

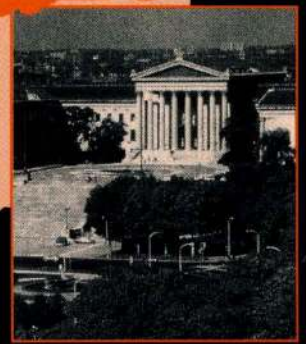
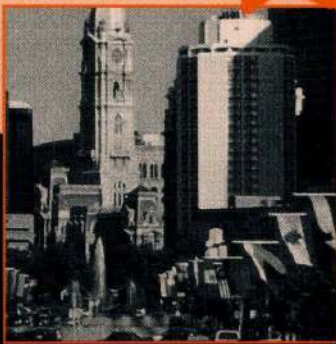
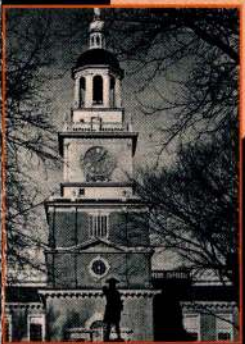
# Philadelphia

OR/MS and the Quality of Life



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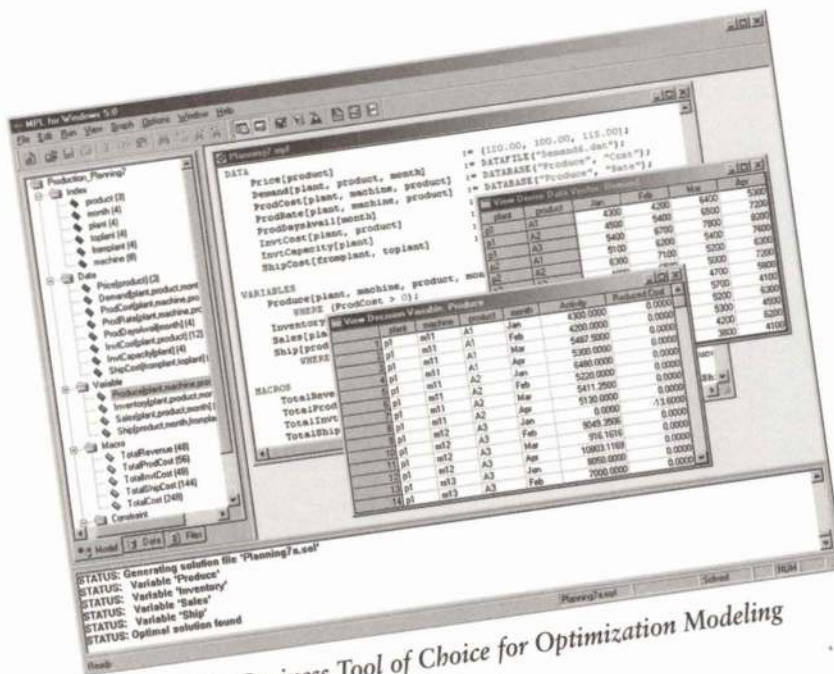
Introducing the Latest Release of

# MPL for Windows 5.0!

with the **OptiMax 2000** Component Library

MPL for Windows 5.0 offers numerous improvements and enhancements to the MPL modeling language - faster processing and increased flexibility in the database connection, for example MS Access, are just a few of the benefits. The graphical model development environment has been completely redesigned to increase the productivity of the model developer. Furthermore, MPL 5.0 now supports many new Windows DLL solvers, including the non-linear solvers CONOPT and LSGRG2, and the recently released CPLEX 6.5.

OptiMax 2000 will revolutionize how optimization modeling is applied to solve business problems. This highly anticipated Component Library (API) can be used to seamlessly call MPL, from both Visual Basic and C/C++, allowing the model developer to create customized end-user applications that solve real-world optimization problems.



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**Download a FREE Student Version of MPL for Windows with CPLEX**

Visit Maximal Software's recently enhanced web-site at [www.maximal-usa.com](http://www.maximal-usa.com) and discover the new MPL On-line Tutorial. This tutorial is specifically designed for teaching optimization modeling the way it is currently being applied in the corporate world. Included is a complete course, featuring MPL, with all the supporting tools needed to teach optimization modeling to your class. Furthermore, all the software required for the course is also available, free of charge, from our web-site allowing you to introduce MPL for Windows into your classroom.

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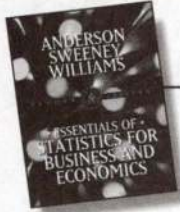
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Copies of papers abstracted in the Conference Program are available only from the authors. Requests for papers should be directed to the authors at the addresses shown in the Program. Published twice a year prior to each meeting by the Institute for Operations Research and the Management Sciences. Individual issues of the Program are available for \$15 US per copy. Orders must be prepaid and sent to INFORMS, PO Box 64794, Baltimore, MD 21264-4794.



## BUSINESS STATISTICS



**Anderson/Sweeney/Williams**

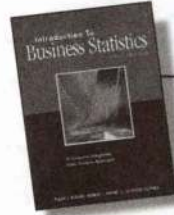
*Essentials of Statistics for Business and Economics, 2e*

**Anderson/Sweeney/Williams**  
*Statistics for Business and Economics, 7e*

**Black**  
*Business Statistics: Contemporary Decision Making, 2e*

**Eldredge**  
*An Excel Companion for Business Statistics*

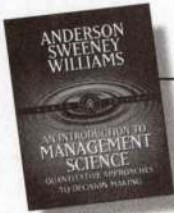
**Gerbing**  
*Relevant Business Statistics Using Microsoft® Excel*



**Kvanli/Pavur/Guynes**

*Introduction to Business Statistics: A Computer Integrated, Data Analysis Approach, 5e*

## MANAGEMENT SCIENCE/QUANTITATIVE METHODS



**Anderson/Sweeney/Williams**

*An Introduction to Management Science: Quantitative Approaches to Decision Making, 9e*

**Anderson/Sweeney/Williams**  
*Contemporary Management Science with Spreadsheets*

**Anderson/Sweeney/Williams**  
*The Management Scientist: Version 5.0 for Windows 95 and Windows 98*

**Anderson/Sweeney/Williams**  
*Quantitative Methods for Business, 7e*

**Bertsimas/Freund**  
*Data, Models and Decisions: Fundamentals of Management Science*



**Bell**

*Management Science/Operations Research: A Strategic Approach*



**Camm/Evans**

*Management Science and Decision Technology*

**Ragsdale**  
*Spreadsheet Modeling and Decision Analysis, 2e*

## PRODUCTION/OPERATIONS MANAGEMENT



**Gaither/Frazier**

*Production and Operations Management, 8e*

**Markland/Vickery/Davis**  
*Operations Management: Concepts in Manufacturing and Services, 2e*

**Morton**  
*Production Operations Management*

## QUALITY MANAGEMENT



**Evans/Dean**

*Total Quality: Management, Organization and Strategy, 2e*

**Evans/Lindsay**  
*Management and Control of Quality, 4e*

**Heizer/Nathan**  
*Cases in Total Quality Management: Manufacturing and Services*

## PROJECT MANAGEMENT

**Gido/Clements**  
*Successful Project Management*

## LOGISTICS

**Coyle/Bardi/Langley**  
*Management of Business Logistics, 6e*

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# CITY OF PHILADELPHIA

OFFICE OF THE MAYOR  
ROOM 215 CITY HALL  
PHILADELPHIA, PENNSYLVANIA 19107-3295  
(215) 686-2181  
FAX (215) 686-2170

EDWARD G. RENDELL  
MAYOR

November 7, 1999

To the members of the  
Institute for Operations Research and the Management Sciences:

As Mayor of the City of Philadelphia, it gives me great pleasure to welcome the members of INFORMS to our city for your national meeting from November 7 through 10, 1999 at the Philadelphia Marriott.

As professionals in mathematical modeling and systems analysis from academia, industry, and consulting, you should find major resources under the conference theme of "Enhancing the Quality of Life," and in the meetings sessions which will be devoted to manufacturing, transportation, and military issues.

I hope that during your stay in Philadelphia – the Place That Loves You Back – you will be able to take some time to enjoy some of our city's unique historical, cultural, and entertainment attractions, and that you will return here at some time in the near future.

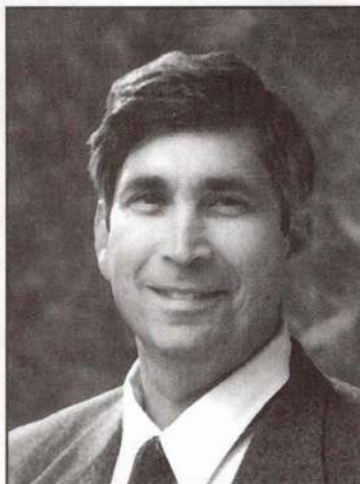
Sincerely,

*Edward G. Rendell*  
EDWARD G. RENDELL

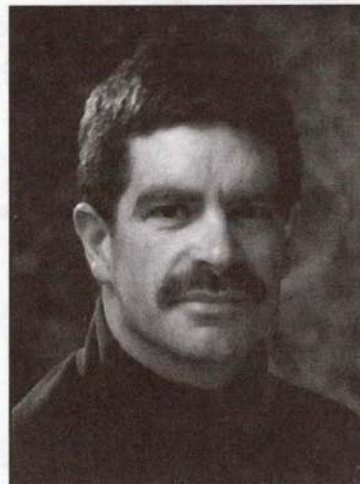
## PHILADELPHIA LOCAL COMMITTEE



G. Anandalingam



Barry G. Silverman



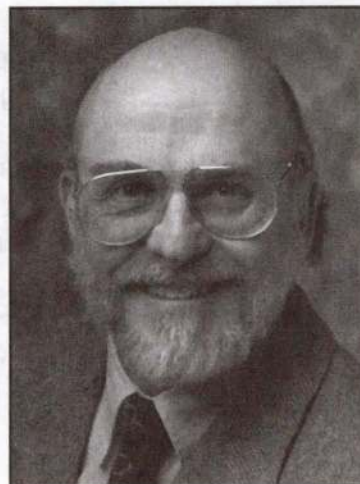
Patrick Harker



Benjamin F. Hobbs



Enver Yucesan



Edward Morlok



C.-H. Chen



Zhi-Long Chen



*Not pictured: Avijit Bannerjee, Scott Malcolm, Noah Gans, Ziv Katalan*

**MESSAGE FROM THE GENERAL CHAIR*****G. Anandalingam (University of Pennsylvania)***

On behalf of the Fall 1999 Organizing Committee of INFORMS, it is our pleasure to welcome you to Philadelphia. This meeting emphasizes the contributions made by OR/MS in enhancing the Quality of Life. In addition to covering the customary spectrum of OR/MS technical topics, we will have tracks on health applications, health care management, telecommunications, service operations management, energy and environment, social science applications, technology management, safety and reliability that address important questions pertaining to the quality of life.

Our Plenary speakers will also focus on the use and potential impact of OR/MS and quantitative techniques to quality of life issues: "Aviation Safety in Numbers" by Arnold Barnett (MIT), on Sunday, November 7<sup>th</sup> from 4:45 to 6:00pm; "OR for Next Generation Telecommunication" by Donald Gips (Level 3 Communications), on Monday, November 8<sup>th</sup> from 11:00am to 12noon and "The Next Era of Medical Education & Health Care" by William Kelley (Medical School, University of Pennsylvania), on Tuesday, November 9<sup>th</sup> from 10:0 to 11:30am.

Additional highlights include the Birthday celebration for George Dantzig on Monday, November 8th, clearly one of the founding fathers of the field. The Fall meeting highlights the reprise of the winners of Franz Edelman Prize, the CPMS Isolated Practitioner Workshop and the Forum on Women in OR/MS. We are also celebrating the 10<sup>th</sup> anniversary of the Teachers Program in the city where it originally started!

I would like to thank all my Local Committee members who have been working hard for almost 18 months putting together this program. If you have any questions during the course of the conference, feel free to either find the Information Booth or any one of the Local Arrangements Committee members for help.

We strongly urge you to also spend some time taking in the historical and culinary pleasures offered by the city of Philadelphia, "the city that loves you back." Guest programs include a visit to Longwood Gardens, the Philadelphia City Tour and a tour to Lancaster and the Amish Country. For cultural enrichment, this city offers the Philadelphia Museum of Art, the second largest Rodin Museum and the world famous Barnes Foundation, with its unique Impressionist art collection. The Philadelphia Zoo, the oldest in the country, is only a short distance away. Philadelphia offers entertainment for all tastes, ranging from the world class Philadelphia Orchestra to jazz groups, rock concerts and folk musicians. Philadelphia boasts of the *top two* restaurants in the country (as rated by Conde Nast), Le Beq Fin and The Fountain.

Finally, I would like to thank two individuals who really made this happen, and who helped me manage the numerous small and large crises that are inevitable in putting together a program of this size. Ginni McGee of the INFORMS office was primarily responsible for putting together the conference program in an efficient and consistent manner. Without the invaluable interventions of Vesselina Panteva, my assistant at Penn, it is not clear that I would have retained my sanity at the end of this process!

**SCHEDULE OF SPECIAL EVENTS**

	<b>Location</b>	<b>From To</b>
<b>FRIDAY, November 5</b>		
CPMS Practice Issues Forum Registration/Reception	Room 305/306	6:30pm 10:00pm
<b>SATURDAY, November 6</b>		
Organization Dissertation Competition	Room 307	8:00am 6:00pm
Meetings Committee Meeting	Meetings Suite	8:30am 5:00pm
CPMS Practice Issues Forum	Room 305/306	8:30am 6:30pm
CPMS Practice Issues Forum Lunch	Room 304	12noon 1:00pm
Registration	Grand Ballroom Lobby, Level 5	4:00pm 8:00pm
INFORMS Membership Meeting	Salon D	5:00pm 6:00pm
Organization Dissertation Reception	Room 310	6:00pm 8:00pm
CPMS Reception/Dinner/Meeting	Room 304	6:30pm 10:00pm
Membership Committee Meeting	TBD	7:00pm 9:00pm
<b>SUNDAY, November 7</b>		
Registration	Grand Ballroom Lobby, Level 5	7:30am 5:00pm
Guest Breakfast	JW's Steakhouse	9:00am 10:00am
INFORMS Executive Committee Meeting	President's Suite	10:30am 1:30pm
E-mail/Exhibits/Job Placement Service	Franklin Hall, Level 4	12noon 5:00pm
Job Fair	Franklin Hall, Level 4	12:30pm 2:30pm
RASIG Roundtable	Room 412	1:00pm 5:00pm
INFORMS Board	Salon B	2:00pm 10:00pm
Omega Rho Distinguished Plenary Lecture	Salon E & F	4:45pm 6:00pm
Section/Society/Fora Officers Meeting/Reception	Room 301	5:00pm 6:00pm
Roundtable Reception/Dinner	Salon C	5:30pm 8:00pm
MSOM Reception	Salon K	6:15pm 7:15pm
Forum on Women in OR/MS Reception	Salon J	7:00pm 9:00pm
Student Reception	Salon H	7:00pm 9:00pm
Electronic Commerce Organization Meeting	Room 304	7:15pm 8:15pm
Roundtable Meeting	Salon A	8:00pm 11:00pm
<b>MONDAY, November 8</b>		
Board/Editors/Committee Chair Breakfast	JW's Steakhouse	7:00am 8:00am
Registration	Grand Ballroom Lobby, Level 5	7:30am 5:00pm
INFORMS Board Meeting	Salon B	8:00am 10:00am
Teacher Program	Room 202B (Convention Center)	8:00am 3:30pm
Roundtable Meeting/Lunch	Room 202A (Convention Center)	8:00am 5:00pm
Guest Breakfast	JW's Steakhouse	9:00am 10:00am
E-mail/Exhibits/Job Placement Service	Franklin Hall, Level 4	9:00am 5:00pm
Welcoming Session & Awards	Salon E & F	10:00am 11:00am
Invited Plenary: Donald Gips	Salon E & F	11:00am 12noon
MSOM Senior Editors Lunch	Salon K	11:45am 12:45pm
Section Subcommittee Lunch	Publications Suite	12noon 1:00pm
Omega Rho Executive Committee Meeting	Allie's Restaurant	12noon 1:00pm
ACORD Lunch	Conference Suite 1	12noon 1:30pm
OR Area Editors Lunch	Conference Suite 3	12noon 1:30pm
Education Committee Meeting	Roundtable Suite	12:30pm 1:30pm
Dantzig Fest	Salon H	1:15pm 5:00pm
Franz Edelman Prize Plenary	Salon E & F	4:45pm 6:00pm
INFORMS Online Meeting/Reception	Conference Suite 1	6:00pm 7:30pm
CPMS Isolated Practitioner Workshop	Room 302	6:15pm 7:15pm
INFORMS General Reception	Grand Salon	7:30pm 9:30pm

**TUESDAY, November 9**

Chapter Officers Breakfast	Conference Suite 3	7:00am 8:00am
Roundtable Continental Breakfast	Roundtable Suite	7:00am 10:00am
Registration	Grand Ballroom Lobby, Level 5	7:30am 5:00pm
Chapter Subcommittee Meeting	Conference Suite 3	8:00am 9:30am
CPMS Council Breakfast/Meeting	Salon B	8:00am 12noon
Meetings Committee Meeting	Meetings Suite	8:00am 6:00pm
Guest Breakfast	JW's Steakhouse	9:00am 10:00am
E-mail/Exhibits/Job Placement Service	Franklin Hall, Level 4	9:00am 5:00pm
INFORMS Plenary: William Kelley	Salon E & F	10:00am 11:30am
Editors & Publications Joint Committee Meeting	Conference Suite 2	10:00am 12noon
Finance Committee Meeting	Publications Suite	10:00am 12noon
Subdivision Committee Meeting	Conference Suite 3	11:30am 5:00pm

**WEDNESDAY, November 10**

Registration	Grand Ballroom Lobby, Level 5	7:30am 2:30pm
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**SCHEDULE OF SUBDIVISION BUSINESS MEETINGS**

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**SUNDAY, November 7**

Railroad Applications SIG	Room 412	5:00pm 6:00pm
Information Systems Society	Salon D	6:15pm 7:15pm
Section on Location Analysis	Room 302	6:15pm 7:15pm
Section on Logistics	Room 305	6:15pm 7:15pm
Management of Medical Technology Section	Room 306	6:15pm 7:15pm
Section on Management Control Systems	Room 307	6:15pm 7:15pm
Minority Forum Organizational Meeting	Room 309	6:15pm 7:15pm
Quality Statistics & Reliability Section	Salon I	6:15pm 7:15pm
Revenue Management Section	Room 403	6:15pm 7:15pm
Technical Section on Telecommunications	Salon G	6:15pm 7:15pm

**MONDAY, November 8**

Forum on Women in OR/MS	Room 307	12noon 1:00pm
Section on Social Science Applications	Conference Suite 2	12noon 1:00pm
Applied Probability Society	Room 413	6:15pm 7:15pm
Section on Aviation Applications	Room 407	6:15pm 7:15pm
Computing Society	Salon C	6:15pm 7:15pm
Decision Analysis Society	Salon D	6:15pm 7:15pm
Financial Services Section	Room 403	6:15pm 7:15pm
Section on Group Decision & Negotiation	Room 306	6:15pm 7:15pm
Health Applications Section	Room 411	6:15pm 7:15pm
Mfg. & Service Operations Mgmt. Society	Salon A	6:15pm 7:15pm
College on Marketing	Room 309	6:15pm 7:15pm
College on Organization Science	Room 402	6:15pm 7:15pm
Section on Mgmt. of Productivity & Technology	Room 401	6:15pm 7:15pm
Technology Management Section	Room 401	6:15pm 7:15pm
Transportation Science Section	Room 408	6:15pm 7:15pm

**TUESDAY, November 9**

Section on Accounting, Auditing & Tax	Room 403	6:15pm 7:15pm
College on Artificial Intelligence	Room 307	6:15pm 7:15pm
Section on Energy, Natural Resources & Environ.	Room 415	6:15pm 7:15pm
INFORM-ED	Salon D	6:15pm 7:15pm
College on Optimization	Room 308	6:15pm 7:15pm
Section on Public Programs & Processes	Room 412	6:15pm 7:15pm
College on Simulation	Room 414	6:15pm 7:15pm

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### **Operations Management: Contemporary Concepts and Cases**

Roger G. Schroeder  
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### **Annual Editions: Production and Operations Management, 00/01**

P. K. Shukla  
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### **Manufacturing Strategy: Text and Cases, Third Edition**

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### **Business Dynamics: Systems Thinking and Modeling for a Complex World**

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### **Introduction to Management Science: A Modeling and Case Studies Approach with Spreadsheets**

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### **Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies**

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The first of its kind, this text provides state-of-the-art models, concepts, and solution methods important in the design, control, operation, and management of supply chain systems.

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### **Basic Statistics for Business and Economics, Third Edition**

Douglas Lind, Robert D. Mason (deceased), and William G. Marchal  
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This two-color comprehensive survey of statistical tools and methods presents step-by-step overviews of concepts with succinct and illustrated solved examples.

### **Practical Business Statistics, Fourth Edition**

Andrew F. Siegel  
ISBN 0072337559

This text de-emphasizes the theoretical approach and presents the material in a well-written, easy style that emphasizes understanding and applications as opposed to mathematical precision and formula detail.



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1-800-338-3987.

**Please Note:** All Special Events are in the Philadelphia Marriott with the exception of 2 events on Monday - the Teacher Program and the Roundtable Meeting & Lunch. These will be in the Pennsylvania Convention Center.

**BASIC MEETING INFORMATION**

**Audio/Visual Equipment:** Every session room will be set up with an overhead projector and screen at no cost. Arrangements for all other A/V equipment must be made **no later than October 15<sup>th</sup>** at the speaker's expense. ON-SITE LCD REQUESTS WILL NOT BE HONORED. For information and pricing, please contact Cheryl Clark at [cheryl.clark@informs.org](mailto:cheryl.clark@informs.org) or 800-343-0062/401-274-2525, ext. 211.

**Book & Literature Display:** Be sure not to miss the book and literature display table in the Exhibit Hall. This is an ideal opportunity to see the latest publications from Baltzer Science Publishers, The Darden Case Collection and Stockton Press.

**Business Meetings & Technical Sessions:** Technical sessions and section business meetings will be held mainly in the Philadelphia Marriott Hotel with a few sessions located in the Pennsylvania Convention Center. Please refer to the Master Track Schedule for track listings. Room assignments will be indicated in the final printed program only.

**Climate:** Philadelphia's fall weather can be cool, with high temperatures in the mid-50s and lows in the 40° range with little precipitation.

**Coffee Breaks:** Coffee breaks will be set up daily for attendees at the following times:

Sunday	10:00am Lobby - Level 5
	2:30pm Franklin Hall - Level 4
Monday	9:45am Franklin Hall - Level 4
	2:45pm Franklin Hall - Level 4
Tuesday	9:45am Franklin Hall - Level 4
	2:30pm Franklin Hall - Level 4
Wednesday	10:00am Lobby - Level 5

**E-mail Center:** E-mail terminals will be set up in Franklin Hall on Level 4 of the Philadelphia Marriott during the following hours:

Sunday, November 7	12noon – 5:00pm
Monday, November 8	9:00am – 5:00pm
Tuesday, November 9	9:00am – 5:00pm

**Exhibit Hall:** Visit the Exhibit Hall to see the latest sophisticated tools necessary to perform your job effectively. Computer hardware and software vendors, publishers and database service firms will

display their current products and provide a lively forum for OR/MS professionals. The Exhibit Hall is located in Franklin Hall on Level 4 of the Philadelphia Marriott during the following hours:

Sunday, November 7	12noon – 5:00pm
Monday, November 8	9:00am – 5:00pm
Tuesday, November 9	9:00am – 5:00pm

**Hotel & Accommodations:** The host hotel is the Philadelphia Marriott, located in the heart of the city at 1201 Market Street. A block of rooms has been reserved for INFORMS attendees – be sure to make your reservations by **October 15<sup>th</sup>**. To ensure availability, call 215-625-2900/800-320-5744 or go to INFORMS Online at <http://www.informs.org> to print out the hotel reservation form. Rates are \$163 - single, \$184 - double, \$204 - triple and \$224 - quad. Rates do not include 14% tax (subject to change without notice). All rooms must be guaranteed with a credit card (American Express, Carte Blanche, Diners Club, MasterCard and VISA).

**INFORMS Online:** The preliminary program is available online ONLY and will be updated regularly until the meeting. This allows us the flexibility of a longer time frame to accept papers and to continuously add to the program. Go to <http://www.informs.org/Conf/Philadelphia99/> and highlight sessions of interest to you, then print your own customized program. Contact authors directly at their addresses as listed online to receive complete copies of any papers abstracted in the program.

**Job Placement Service:** The INFORMS Job Placement Service (JPS) helps OR/MS professionals locate employment opportunities in academia, government and private industry. Employers from a wide variety of professional interest areas participate in the program regularly. JPS runs on a semi-annual basis: January – June and July – December. JPS is now available on INFORMS Online for the Fall Philadelphia meeting at <http://www.informs.org/JPS/>. You can find: online registration for applicants and employers; 24-hour access to job listings and applicant files; on-site interviewing facilities at meetings; hard copy booklets of all active participants; low fees (free for student members). Job Placement will be located in

## INFORMS Philadelphia

Franklin Hall on Level 4 of the Philadelphia Marriott during the following hours:

Sunday, November 7 12noon – 5:00pm  
Monday, November 8 9:00am – 5:00pm  
Tuesday, November 9 9:00am – 5:00pm

**Presentation Withdrawals:** All withdrawals must be received in writing at the Rhode Island office; they may be faxed to 401-274-3189, emailed to [ginni.mcgee@informs.org](mailto:ginni.mcgee@informs.org) or sent to INFORMS, 1 Richmond Square, Suite 215, Providence, RI 02906. If you are unable to make your scheduled presentation, please notify your sponsored or invited session chair and our office to cancel your presentation. Withdrawals received before October 8<sup>th</sup> will be included in the final printed program and all others received after this date will be listed in an addendum to the program.

**Special Services & Assistance:** If you require special accommodations or services for hotel rooms, session rooms or special events, please contact Cheryl Clark at 800-343-0062/402-274-2525, ext. 211 or via email at [cheryl.clark@informs.org](mailto:cheryl.clark@informs.org).

**Transportation:** Philadelphia International Airport is approximately 7 miles from downtown Philadelphia. SEPTA (Southeastern Pennsylvania Transportation Authority) runs between Philadelphia and the airport every half hour - take the R1 train to the Market East Station (the 5<sup>th</sup> stop) and the hotel is connected to Market East Station. The cost is \$5 per person and travel time is

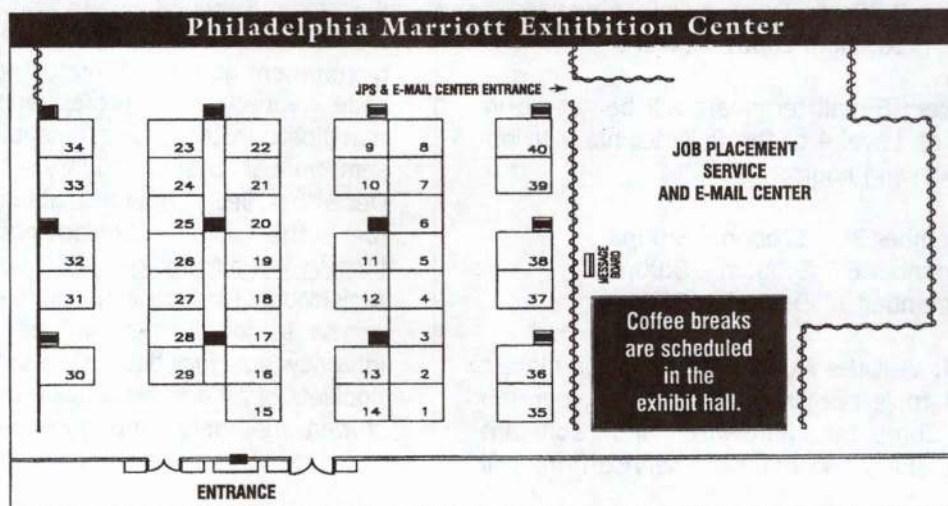
30 minutes. Taxi stands are located outside the baggage claim area. There is a \$20 flat rate and travel time is 20-25 minutes. USA Limo is the official airport shuttle service for the Philadelphia Marriott. Courtesy phones are located in the baggage claim area to schedule a pickup for \$8 per person; travel time is 20-25 minutes. Information phones are available at all baggage claim areas for each of the on-airport car rental agencies: Alamo, Avis, Budget, Dollar, Hertz and National.

**Travel Arrangements:** Travel to Philadelphia for less! Call Conventions in America (CIA) at 800-929-4242 and ask for Group #560 to receive 5% - 10% off the lowest applicable fares on US Airways, or the lowest available fare on any other carrier. Take an additional 10% off if you purchase at least 60 days prior to departure. Travel must be between November 4 - 13, 1999 in order to get discounted fares. All CIA customers will also receive free flight insurance of \$100,000. Reach CIA at 800-929-4242/619-453-3686 and ask for Group #560 or by fax at 619-453-7976. Reservation hours are Monday through Friday, 6:30am – 5:00pm Pacific Time. Visit CIA's website at <http://www.scitravel.com> or email [flycia@scitravel.com](mailto:flycia@scitravel.com). If you call direct or use your own agency, refer to this code: US Airways Gold File #78670926.

Alamo Rent a Car is offering special low rates beginning at \$34 per day or \$155 per week with unlimited free mileage. Call Alamo at 800-732-3232, ID #269720.

## EXHIBITORS

Visit the Exhibit Hall to see the latest sophisticated tools available to perform your job effectively. Computer hardware and software vendors, publishers and database service firms will display their current products and provide a lively forum for OR/MS professionals.



**Applied Decision Analysis LLC**, 2710 Sand Hill Rd., Menlo Park, CA 94025;  
[www.adainc.com](http://www.adainc.com)

*Booth 35*

ADA is a member of the PricewaterhouseCoopers organization.

PricewaterhouseCoopers, the world's largest professional services organization, helps its clients build value, manage risk and improve their performance. ADA publishes DPL, decision analysis software for Windows. DPL integrates influence diagrams, decision trees, spreadsheets and strategy tables for professional decision analysis modeling.

**Dash Optimization Inc.**, 115 River Rd., Ste. 1203, Edgewater, NJ 07020;  
[www.dashopt.com](http://www.dashopt.com)

*Booth 18*

Dash Optimization Inc. provides the most advanced modeling and optimization software. Our products and services allow our clients to significantly enhance their productivity by quickly and reliably solving their hardest optimization problems. The integrated modeling and optimization capabilities of our XPRESS-MP software make it easy for companies to develop, test and solve complex models arising from a wide variety of applications.

**Duxbury Press**, 10 Davis Dr., Belmont, CA 94002;  
[www.duxbury.com](http://www.duxbury.com)

*Booths 1 & 2*

Duxbury, an imprint of Thomson Learning, is an educational publisher focusing exclusively in the fields of statistics and quantitative methods in all disciplines and at all levels of learning. Duxbury publishes student version software and many leading textbooks for OR/MS. Come by

our booth and review recent works by Chris Albright, David Bell, Bob Clemen, Bob Fourer, David Gay, Ed Kao, Craig Kirkwood, Larry Lapin, Sam Savage, Art Schleifer, Linus Schrage, Wayne Winston, Chris Zappe and special student edition software by ADA, ILOG, LINDO Systems, MathSoft, Palisade and SAS Institute.

**Elsevier Science**, 655 Avenue of the Americas, New York, NY 10010;

[www.elsevier.com/locate/orms](http://www.elsevier.com/locate/orms)

*Booths 31 & 32*

The OR/MS publication program by Elsevier Science offers comprehensive international coverage of the latest research and development in the field. Topical handbooks and a wide range of journal publications cover a wide spectrum of topics. Visit us at the booth or see a preview at [www.elsevier.com/locate/orms](http://www.elsevier.com/locate/orms).

**GAMS Development Corp.**, 1217 Potomac St. NW, Washington, DC 20007;  
[www.gams.com](http://www.gams.com)

*Booth 19*

GAMS is the leading tool to develop models for mathematical programming problems. It is currently used in nearly every country in the world for modeling large, complex optimization problems in academia, industry and government. GAMS allows the flexibility to develop several model types and has excellent documentation and debugging features.

**IBM**, 522 South Rd., MSP356, Poughkeepsie, NY 12601;  
[kenruss@us.ibm.com](mailto:kenruss@us.ibm.com)

*Booths 39 & 40*

IBM, a provider of world class optimization software, will demonstrate new product offerings in the Optimization

Solutions and Library (OSL) family. Newly supported platforms will be demonstrated, along with free Academic Licenses, parallel solver support on Windows NT and new programming interfaces.

**ILOG, Inc.**, 1080 Linda Vista Ave., Mountain View, CA 94043; [info@ilog.com](mailto:info@ilog.com)

*Booth 11*

ILOG is the world leader in optimization software. You probably already use ILOG's powerful CPLEX LP, MIP and Parallel optimizers. ILOG also provides the world's leading constraint programming and scheduling tools. New from ILOG: CPLEX 6.5 with stunning MIP innovations and ILOG OPL Studio, the next-generation modeling language and environment bridging both LP/MIP and constraint programming technologies.

**Imagine That, Inc.**, 6830 Via Del Oro, Ste. 230, San Jose, CA 95119;

[www.imaginethatinc.com](http://www.imaginethatinc.com)

*Booth 29*

For exceptional simulation power, use Extend™. With the best hierarchy in the industry, built-in activity-based costing, customizable animation, one-click output analysis, automatic report generation, integrated open source development and authoring environment and hot-links, you'll see why Extend is the acknowledged standard for simulation in top universities and corporations alike.

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**INFORMS Membership**, 901 Elkridge Landing Rd., Ste. 400, Linthicum, MD 21090; [informs@informs.org](mailto:informs@informs.org)  
*Booths 13 & 14*

Created in 1995 through the merger of ORSA and TIMS, INFORMS offers exciting new services to its members. Visit the INFORMS booth and pick up complimentary copies of our 10 prestigious journals and *OR/MS Today*.

## INFORMS-KORMS International Korea

*Booth 23*

We invite you to learn more about this exciting international conference, to be held in Seoul, June 18-21, 2000. The conference theme is *Information & Knowledge Management in the 21<sup>st</sup> Century*.

## INFORMS Salt Lake City Spring 2000

*Booth 24*

The theme of the first INFORMS meeting in the year 2000, *Soaring to New Heights*, explores the challenges the new millennium offers the profession.

## INFORMS San Antonio 2000

*Booth 25*

Introducing the first INFORMS annual conference. An expanded scientific and social program will enhance the educational value of the conference and provide additional opportunities for networking.

**Irwin/McGraw-Hill**, 2 Penn Plaza, 20<sup>th</sup> Fl., New York, NY 10121-2298; [mary.donnelly@mcgraw-hill.com](mailto:mary.donnelly@mcgraw-hill.com)  
*Booths 21 & 22*

Irwin/McGraw-Hill is the leading publisher of higher-education learning materials for operations management,

decision sciences, MIS, IT, economics, finance, business, accounting, management and marketing. We offer a variety of digital solutions including tutorial CD-ROMs, distance-learning software, interactive web site and much more.

**John Wiley & Sons, Inc.**, 605 Third Ave., New York, NY 10158-0012; [www.wiley.com](http://www.wiley.com)  
*Booths 7 & 8*

Founded in 1807, John Wiley & Sons, Inc. is an independent, global publisher of print and electronic products. Wiley specializes in scientific and technical books, journals, textbooks and education materials for colleges and universities and professional and consumer books and subscription services.

**Ketron Management Science**, 1755 Jefferson Davis Hwy. #901, Arlington, VA 22202; <http://www.ketronms.com>  
*Booth #36*

Ketron Management Science concentrates on mathematical programming products and consulting. Products include C-WHIZ, linear and mixed-integer optimizer; OML, callable library of optimization and modeling functions and DATAFORM, modeling language. A user interface supplies access to all stand-alone components including a set of very useful utilities.

**Kluwer Academic Publishers**, 101 Philip Dr., Norwell, MA 02061; [kluwer@wkap.com](mailto:kluwer@wkap.com)  
*Booths 37 & 38*

Kluwer Academic Publishers will exhibit the latest research books and journals in the areas of OR/MS. Titles include *Large Scale & Integer Optimization* by Richard Kipp Martin, *Project Scheduling* by Jan Weglarz and

*Quantitative Models for Supply Chain Management* edited by Sridhar Tayur et al. Also on display will be sample copies of Kluwer's renowned research journals, including the new journal *Information Systems Frontiers*. See you at the booth!

**LINDO Systems Inc.**, 1415 North Dayton St., Chicago, IL 60622; [www.lindo.com](http://www.lindo.com)  
*Booth 15*

LINDO Systems will highlight a new interior point solver as well as speed and feature enhancements to our popular mathematical modeling packages. We will demonstrate LINDO - a powerful linear and integer programming engine, LINGO - an integrated modeling language with linear/nonlinear solvers and What'sBest! - a large scale linear/nonlinear spreadsheet solver.

**Maximal Software, Inc.**, 2111 Wilson Blvd., Ste. 700, Arlington, VA 22201; [www.maximal-usa.com](http://www.maximal-usa.com)  
*Booth 10*

The MPL OptiMax 2000 Component Library for Visual Basic/VBA and C/C++: the OptiMax 2000 is a highly anticipated Component Library (API), designed to take full advantage of the *ActiveX Automation* component software technologies from Microsoft. Optimax 2000 allows the model developer to seamlessly integrate MPL into *VBA for Excel/Access, Visual Basic* and *Visual C++*, thus easily creating customized end-user applications to solve real-world optimization problems. We will also demonstrate the new release of MPL for Windows 5.0.

**Oxford University Press**, 198 Madison Ave., New York, NY 10016; [www.oup-usa.org](http://www.oup-usa.org)

*Booth 26*

Oxford University Press is the oldest publisher in the English language and the largest university press in the world. We publish over 3,000 books a year and have a presence in more than 50 countries. Most books are produced by Oxford's 2 major centers in Oxford, UK and New York. College books are an important part of OUP's list. The New York office has a separate college division that publishes a variety of texts in engineering, business and economics.

**Palisade Corp.**, 31 Decker Rd., Newfield, NY 14867; [www.palisade.com](http://www.palisade.com)

*Booth 30*

Palisade Corporation is a privately-owned software developer specializing in analytical software for risk and decision analysis. Our products enhance any serious decision-maker's capabilities. Our product line features the DecisionTools® Suite: @RISK, TopRank®, PrecisionTree®, BestFit® and RISKview™. Also available are Evolver™, RISKOptimizer™, @RISK for Project and @RISK Developer's Kit.

**Paragon Decision Technology**, PO Box 3277, 2001 DG Haarlem, The Netherlands; [www.paragon.nl](http://www.paragon.nl)

*Booth 17*

Paragon Decision Technology introduces its brand new AIMMS 3.0 system during this meeting. AIMMS 3.0 is an all-around development environment for creating fully functional decision support applications. The unique combination of advanced features and design tools within AIMMS allows you to

build complex applications that are easily maintainable.

**Prentice Hall**, 1 Lake St., Upper Saddle River, NJ 07458; [debbie\\_clare@prenhall.com](mailto:debbie_clare@prenhall.com)

*Booth 28*

Prentice Hall is the premier publisher for decision sciences and business statistics. Interested in well-known author teams? Using technology and the Internet in class? Distance learning? Industry-based software? We've got innovative solutions to offer you. Stop by our booth to learn more about our websites, WebCT courses and our latest texts, by Russell/Taylor, Krajewski/Ritzman, Heizer/Render, Render/Stair, Evans/Olson and Berenson/Levine.

**SIAM**, 3600 University City Science Center, Philadelphia, PA 19104; [www.siam.org](http://www.siam.org)

*Booth 20*

Visit the SIAM booth to check out our new publications. There are new books in almost every SIAM series. Recently published optimization books and information about our newest book series - *MPS-SIAM Series on Optimization* - will be on hand. You will also see sample journal issues of SIAM's renowned journals. Membership information and applications will be available for those individuals interested in becoming SIAM members. Pick up a copy of *SIAM News* for the road.

**Scitor Corporation**, 256 Gibraltar Dr., Sunnyvale, CA 94089; [sales@scitor.com](mailto:sales@scitor.com)

*Booth 27*

Scitor Process v3 is the latest entry in Scitor Corporation's award-winning line of process management products. Scitor Process offers exceptional power, versatility and ease-of-use for process mapping,

process simulation and optimization and web-enabled process publishing. Whether you are engaged in government, manufacturing, finance, information technologies or services, Scitor Process will enable you to produce better goods and services in less time and at lower cost.

**South-Western College Publishing**, 10 Davis Dr., Belmont, CA 94002; [www.swcollege.com](http://www.swcollege.com)

*Booth 3*

Welcome to South-Western College Publishing! Our position as a market leader in decision sciences and business statistics higher education is built on time-tested values and adaptability to changing market needs. Stop by our booth and you'll find a wealth of information on the latest editions by Anderson/Sweeney/Williams, Peter Bell and James Evans! South-Western is part of the Thomson Learning family of publishers.

**Springer-Verlag New York, Inc.**, 175 Fifth Ave., New York, NY 10010; [www.springer-ny.com](http://www.springer-ny.com)

*Booth 12*

For more than 155 years, Springer-Verlag has published high quality scientific books and journals. Please stop by our booth to see our latest titles (discounted 20%) in mathematics, OR, probability and statistics, including the new book by Jorge Nocedal and Stephen Wright, *Numerical Optimization*. Also available will be sample copies of *Mathematical Programming*, a publication of the Mathematical Programming Society, now published with Springer.

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**Visual Decision, Inc.**, 401 Rue Saint-Claude, Montreal, Quebec H2Y 3B6, Canada; [www.visualdecision.com](http://www.visualdecision.com)

### *Booth 9*

Visual Decision is proud to introduce DECISION LAB 1.0, its new decision-making software. Based on the PROMETHEE-GAIA methods, DECISION LAB offers many advanced functionalities to model multicriteria decision problems: multiple DMs support, what-if analysis through scenarios, missing

values acceptance, classification of criteria and actions and sensitivity analysis. Moreover, the SDK version is fully customizable and expandable through add-ins developed with any programming language.

**Wolfram Research, Inc.**, 100 Trade Center Dr., Champaign, IL 61820; [www.wolfram.com](http://www.wolfram.com)

### *Booth 16*

Mathematica is the world's only fully integrated technical computing system, combining

unrivaled computational power with unprecedented ease of use. Used by more than a million scientists, engineers, programmers and students, Mathematica offers unmatched ease of computation (numeric and symbolic), data visualization and programming, fully customizable, cross-platform, publication-quality electronic and printed documents.

## GUEST PROGRAM

The guest program includes a continental breakfast Sunday through Tuesday from 9:00 – 10:00am and the General Reception on Monday evening for a \$25 registration fee. Guests may register using our registration form at <http://www.informs.org/Conf/Philadelphia99/>. Registered guests only may attend the breakfasts and must wear their name badges for admittance. The breakfasts will be held in JW's Restaurant in the Philadelphia Marriott. Guest registration does not include admission to the technical sessions.

Be sure not to miss a special event scheduled for Sunday morning's breakfast! Join us for an armchair tour of Philadelphia's most interesting sites and attractive neighborhoods presented by Marie Alexander, CMP, of Maid to Order. From your seat, explore Philadelphia's public and hidden historic and cultural treasures. Get an "insider's look" at the city which is the Birthplace of the US, a treasure of art and architecture and a lively site for unforgettable adventures for the whole family.

### **Guest Tours:**

#### **• Sunday, November 7 - \$40**

##### ***Longwood Gardens***

Just 30 miles from Philadelphia is America's ultimate garden treasure, Longwood Gardens. Longwood includes 1,050 acres of gardens, woodlands and meadows, sparkling fountains, the historic Peirce-duPont House and 20 indoor gardens. The fall season at Longwood Gardens is a good time to catch the last big rose display before frost sets in. The conservatory has an exhibit of giant chrysanthemums and an indoor orchid room where the display is changed weekly, featuring many rare specimens. The conservatory also have some unusual plants such as the insect-eating plant, the air plant and a 400-year-old bonsai. Directly in front of the conservatories is the main fountain display with dozens of large fountain groups and further away are the Italian Water Gardens, built to resemble the Villa Gamberaia in Florence. The Peirce-duPont House dates back to the early 1700s and was home to the original Quakers who farmed the land, and to Pierre Samuel duPont who turned his estate into a horticultural paradise. Visitors will have the opportunity to

explore the gift shop and have lunch in either the Terrace Restaurant or Longwood Café.

The bus will leave from the Philadelphia Marriott at 10:00am and will return at approximately 3:00pm.

#### **• Monday, November 8 - \$52**

##### ***Lancaster County***

The beautiful farmlands of Lancaster County have been home to the Old Order Amish for 250 years. The tour offers insights into the culture, traditions, language and history of the "plain people" of Pennsylvania. As you travel through Lancaster County, you will become acquainted with their rich heritage and customs that make this lush farming community unique. The first stop will be at Kitchen Kettle Village where you can visit the People's Place, a museum dedicated to understanding the ways of the Amish. Their bookshop houses volumes of information about the Amish, Mennonites and other Anabaptist groups. There are more than 30 shops with local craftsmen and shopkeepers.

The tour includes a full Pennsylvania Dutch family-style lunch at Stolfus Farm, including Lancaster

County dried corn and buttered noodles. Choose from 4 desserts, including homemade ice cream and a Pennsylvania Dutch favorite, wet-bottomed shoofly pie. After the meal, you'll travel the scenic roadways and see the pristine Amish homes, their farms and outbuildings, 1-room schoolhouses and

cemeteries. You'll also have the chance to visit an Amish farm and meet an authentic Amish family.

The bus will leave from the Philadelphia Marriott at 10:00am and will return at approximately 5:00pm.

**PLANT TOURS**

**• Monday, November 8 - \$15**  
**Boeing Plant Tour**

Boeing Philadelphia, a part of the Boeing Military Aircraft and Missile Systems Group, is a world leader in the rotorcraft industry, specializing in designing, developing and manufacturing transport helicopters, combat helicopters and tiltrotor aircraft. The V-22 Osprey tiltrotor and the RAH-66 Comanche helicopter will be highlighted. The V-22 is a multi-service aircraft currently under development for the US Air Force, Navy and Marines. The Army's RAH-66 is a twin-turbine, 2-seat armed reconnaissance helicopter with missions of armed reconnaissance, light attack and air combat. Due to the sensitive nature of the business activities at Boeing Philadelphia, **cameras are not allowed.**

There is a maximum of 40 persons allowed on this tour. The bus will leave from the Philadelphia

Marriott at 8:30am and will return at approximately 12noon.

**• Tuesday, November 9 - \$15**  
**Hospital of the University of Pennsylvania (HUP)**

This tour will include an overview of the history of inventions and innovation by the Pennsylvania Medical School faculty as well as a behind-the-scenes look at technology and procedures created by, purchased for and used at HUP to enhance the quality of operations and health care delivery. A tour of the laboratory areas will be included.

There is a maximum of 30 persons allowed on this tour. The bus will leave from the Philadelphia Marriott at 9:30am and will return at approximately 12noon.

**REGISTRATION**

**• Advance Registration (Deadline October 4):**

Advance registration is less expensive, quicker and easier than on-site registration. Print out the registration form and fax to 401-274-3189 or mail to INFORMS Philadelphia, 1 Richmond Square, Suite 215, Providence RI 02906 by **October 4**. Registration fees can be paid by check or money order made payable to INFORMS Philadelphia '99 or by credit card (American Express, MasterCard or VISA only). It is also possible to register via the Web using your credit card; go to [www.informs.org](http://www.informs.org). The deadline for advance registration will be strictly enforced; all payments postmarked after **October 4** will be charged the full, on-site registration fee. Registration materials will be available at registration in the Grand Ballroom Lobby on Level 5 in the Philadelphia Marriott.

**• On-Site Registration:** Registration will be located in the Grand Ballroom Lobby on Level 5 of the Philadelphia Marriott during the following hours:

Saturday	4:00pm – 8:00pm
Sunday	7:30am – 5:00pm
Monday	7:30am – 5:00pm

Tuesday	7:30am – 5:00pm
Wednesday	7:30am – 2:30pm

The registration fee includes admittance to all technical sessions, to the General Reception on Monday evening and to the exhibit area. Name badges **MUST** be work to all INFORMS sessions, functions and events. Misplaced badges may be replaced at the registration desk; your receipt must be shown for verification. Meals are not included in the registration fee. If you attend special paid events, an additional fee is required. **ALL ATTENDEES, INCLUDING CLUSTER AND SESSION CHAIRS AND SPEAKERS, MUST REGISTER AND PAY THE REGISTRATION FEE.**

**• Rates**

<b>Deadline Dates</b>	<b>On/Before 10/4</b>	<b>After 10/4</b>
INFORMS Members	\$225	\$250
Nonmembers	\$265	\$290
Students/Retired	\$65	\$65
Guests	\$25	\$25

• **Refund & Cancellation Policy:** Registration payments will be refunded only if a written cancellation is received in the RI office no later than

**October 27.** Cancellations may be faxed to 401-274-3189 or emailed to [meetings@informs.org](mailto:meetings@informs.org) and must meet this deadline.

## SPECIAL EVENTS

**CPMS Isolated Practitioner Workshop:** CPMS, the Practice Section of INFORMS, sponsors workshops on topics of interest to isolated practitioners, i.e., the Lone Rangers, of OR/MS. The 15<sup>th</sup> workshop in this series will address timely issues that affect the growing isolated practitioner community. All are welcome to participate in the workshop and discussion to be held Monday evening, 6:15 – 7:15pm in the Room 302. Wine and cheese will be served.

**Dantzig Fest:** Monday, November 8, 1999 is George Dantzig's 85<sup>th</sup> birthday! To honor George, the father of linear programming (and much more!), 2 special paper sessions will be held from 1:15 – 4:30pm in Salon H. Speakers will include Curtis Eaves, Saul Gass, Alan Hoffman, Ellis Johnson, Irv Lustig and Arthur Veinott, among others. Following these sessions, George will address the audience, after which there will be a birthday party. All attendees are invited to come to honor George and sing *Happy Birthday*.

### Forum on Women in OR/MS Events

• **Business Meeting & Luncheon:** Everyone interested in issues related to women professionals in OR/MS is invited to join us in Salon B of the Philadelphia Marriott at lunch on Monday from 12noon – 1:00pm. Bring a bag lunch for a lively discussion at our meeting.

• **Reception:** The Reception for Women in OR/MS will be held on Sunday from 7:00 – 9:00pm in Salon J of the Philadelphia Marriott. This is a chance to meet other women who are practicing, teaching and researching OR/MS. Sponsored by First USA.

## FIRST USA

A BANK ONE Company

**General Reception:** Meeting participants and their registered guests are welcome to attend the General Reception on Monday evening from 7:30 – 9:30pm in the Philadelphia Marriott's Grand Salon. **Please present the ticket included with your registration materials for admittance.**

### INFORMS Membership Meeting:

The INFORMS Membership Meeting will be held on Saturday, November 6 from 5:00 – 6:00pm in Salon D. Please come to meet the newly elected INFORMS members and current Board members and discuss issues of interest to the OR/MS world. Wine and cheese will be served.

**Job Fair:** On Sunday, the INFORMS Job Placement Service will hold its Fall Job Fair from 12:30 - 2:30pm in Franklin Hall on Level 4 of the Philadelphia Marriott. Representatives of major OR/MS employers will be available to meet with job seekers and set up on-site interviews. Bring along copies of your resume.

• **Job Seekers:** The Job Fair is open to all INFORMS members

who have signed up with JPS. JPS provides on-line job listings to read and provides employers with on-line access to your resume. The service is FREE for INFORMS members; there is a nominal charge for non-members. You may sign up via the INFORMS website at [www.informs.org](http://www.informs.org).

• **Employers:** Participation in the Job Fair is open to all employers enrolled in JPS on a first-come, first-served basis. JPS provides an on-line listing of your job opening, on-line access to resumes of job seekers and a downloadable database of these resumes. To sign up with JPS, use the INFORMS website at [www.informs.org](http://www.informs.org) or contact Tina Watkins at 800-446-3676 if you don't have Internet access. There is a charge of \$175 for the first job listing; additional job listings from the same organization are \$75 apiece.

There is a nominal fee of \$20 to participate in the Job Fair. We will provide a table, chairs and a sign with your organization's name. You are encouraged to bring your own recruiting literature and are welcome to bring your own (small) display.

**Student Reception:** The Student Reception will be held in Salon H on Sunday from 7:00 – 9:00pm. Use this opportunity to meet other students and expand your network base. All registered student attendees welcome. **Please present the ticket included with your**

**registration materials for admittance. Name badges must be worn.**

**Teacher Program:** The Mayor of Philadelphia has been invited to help celebrate the 10<sup>th</sup> anniversary of INFORMS' middle/high school/community college math/science teachers program, where it all began! The program, to include presentations to an outstanding area teacher and student, will be composed of introductory OR and computer application presentations, followed by hands-on participation. Probability modeling, computer

simulations, queueing (waiting line) models and Teacher Instruction Modules (TIMs) linear programming models will follow an introduction to OR/MS. Attendees, who are also welcome to attend the general conference, will each receive copies of all program materials: videos, software packages with instructions and teacher/student activity guides and TIMs. The program will be held on Monday from 8:00am – 3:30pm in Room 202B of the Pennsylvania Convention Center.

**Welcoming Session:** Please don't miss the Welcoming Session on Monday from 10:00 – 11:00am in Salon E & F. Anand Anandalingam, General Chair of the Philadelphia Local Committee, will emcee the session and Thomas Magnanti, President of INFORMS, will speak. The INFORMS President's Award, the George E. Kimball Medal, the INFORMS Prize and the INFORMS Expository Writing Award will be presented, and Dr. George B. Dantzig will present the award named in his honor, the George B. Dantzig Dissertation Award, on his 85<sup>th</sup> birthday!

## TECHNICAL PROGRAM

### Plenary Presentations

**Omega Rho Plenary Presentation**  
**Sunday, November 7, 4:45 – 6:00pm**  
**Salon E & F**

*Arnold Barnett, MIT*

#### **Aviation Safety in Numbers**

**Abstract:** We consider the mortality risk of commercial air travel from a multiplicity of perspectives: the objective death risk in different settings, misconceptions of various kinds about observed risk patterns, public perceptions about safety and their effects on actual flying behavior, and not least, such specific threats to air safety as bad weather, collision risk and terrorism.

**Biography:** Arnold Barnett is George Eastman Professor of Management Science at MIT's Sloan School of Management. His specialty is applied mathematical modeling on issues of policy importance. His early work on homicide risk was presented to President Ford at the White House and his 1992 article about Vietnam War casualty patterns was subject of intense attention, including a column by William F. Buckley. Barnett's research papers about aviation safety have been extensively summarized in, among others, The New York Times, The Wall Street Journal, Scientific American,

The Economist and Newsweek. In 1997, he was described by NBC News as "the nation's leading expert" on the safety of air travel. He takes a professional interest in misapplications of statistics (one of the nation's leading growth industries) and wrote the "Misapplications Reviews" column in Interfaces for many years. He has extensive consulting experience and has often served as an expert witness in legal proceedings. Barnett received the 1996 President's Award from INFORMS.

**INFORMS Plenary**  
**Monday, November 8, 11:00am – 12noon**  
**Salon E & F**

*Don Gips, Level 3 Communications*

#### **The New Frontier: OR for Next Generation Telecommunications**

**Abstract:** Both the competitive landscapes in telecommunications industry and the technology utilized in building next generation networks are changing at an unprecedented rate. Few companies today possess the right resources to manage, much less lead, this change. The concept of deploying fixed capacity networks is no

## INFORMS Philadelphia

longer appropriate. In order to profitably capture the huge untapped demand for bandwidth presented by tomorrow's voice, video and data applications, today's telecommunication companies must have highly scalable networks - along with strategically planned moves to higher price performance technology (surpassing Moore's Law). The continuously upgradeable network environment will create unique and complex management challenges. Tackling them successfully will require the development of a new class of cutting edge optimization models. These models will be conceptually related to the current state-of-the-art largely defined by airline applications but will eclipse them in terms of scope and complexity.

**Biography:** Donald Gips is currently Senior Vice President for Corporate Development at Level 3 Communications. He oversees the company's strategic planning, business development, optimization and government relation efforts.

Prior to that, he served in the White House as Chief Domestic Policy Advisor to Vice President Al Gore. Gips advised Vice President Gore on a broad range of economic and social issues, with a focus on technology and communications industries in both domestic and international arenas. In this role, he co-chaired the Administration's task force that developed e-commerce policies and served on the Critical Infrastructure Commission Steering Committee. He also represented the Vice President in National Economic Council and Domestic Policy Council decision making processes.

Before he joined the Vice President's staff, Gips was Chief of the FCC's International Bureau since May of 1996. He oversaw many important international initiatives, including the successful conclusion of the World Trade Organization talks on basic telecommunications, the adoption of the international accounting rates proposal, the creation of satellite communications policy and the signing of DTH/DBS and paging agreements with Mexico. Gips joined the FCC in January 1994 and served as Deputy Chief of the Office of Plans and

Policy until February 1996, where he led the team which designed the Personal Communications Service band plan and auction rules for the FCC's first-ever spectrum auctions.

Prior to working at the FCC, Gips was Executive Manager at McKinsey & Company, the international management consulting firm, where he designed and implemented business strategies for Fortune 500 companies. He helped create the Corporation for National Service and served as Executive Assistant to the Director of the 92nd Street Y, Senior Policy Analyst for the Mayor of New York City's Transportation Office and served as Operations Manager for the 1984 Bill Bradley Senate campaign.

Gips graduated magna cum laude from Harvard University in 1982 and received a Master's degree in Public and Private Management from the Yale School of Organization and Management in 1989. He was awarded a Rockefeller fellowship in 1983 to work on development issues in Asia and a CORO Foundation Public Affairs fellowship in 1984. In 1994 he won a Hammer Award for Reinventing Government and was selected as British American Fellow in 1995. He has served as a Visiting Fellow at the Center for Strategic & International studies. He currently serves on the Boards of the CORO Foundation and the Voice on the Net Coalition.

### Franz Edelman Plenary

**Monday, November 8, 4:45 – 6:00pm**

#### Salon E & F

*Grace Lin, Markus Ettl, Steve Buckley, Sugato Bagchi, David Yao, Bret Naccarato, Rob Allan, Kerry Kim, Lisa Koenig*

The 1999 Franz Edelman Award for Achievement in OR/MS was awarded to IBM at the INFORMS Cincinnati Spring Meeting. This award winning presentation will be reprised in Philadelphia.

### ***Extended Enterprise Supply Chain Management at IBM Personal Systems Group & Other Divisions***

**Abstract:** In 1994, the IBM Corporation started a global supply chain re-engineering effort. The goal was to achieve quick customer responsiveness with minimal inventory in the IBM global supply chain. To support this effort, an extended enterprise supply chain analysis tool, the Asset Management Tool (AMT), was developed and implemented. AMT consists of advanced modeling, simulation and optimization capabilities for quantitative analysis of multi-echelon inventory systems, along with features such as enterprise database connectivity and Internet-based communication. It has been used to study a wide range of issues, including inventory budgets,

turnover objectives, customer service level targets, effects of new product introduction and supply chain scenario analyses. Benefits generated by the tool include \$750M savings in material cost and price protection expenses. AMT has been instrumental in improving the performance of the IBM Personal Systems Group. It has been implemented in a number of IBM business units and their channel partners.

**INFORMS Plenary**

**Tuesday, November 9, 10:00am – 11:30am**

**Salon E & F**

*William N. Kelley, MD, University of Pennsylvania Health System*

***The Next Era of Medical Education & Health Care***

**Abstract:** The dynamic and uncertain health care environment in the US poses particular challenges for academic medical centers entrusted with the critical responsibility to train the nation's future clinicians and physician-scientists. Over the past decade, Dr. William Kelley, CEO of the University of Pennsylvania Health System and Dean of the Pennsylvania School of Medicine, envisioned and built Penn's Health System, which now ranks among the top 3 academic medical centers in the country. Dr. Kelley will discuss how this was accomplished, assess current and future challenges for academic medical centers and describe what he sees as the next era of medical education and health care in America. In sketching the larger vision, he will devote attention to the impact that emerging OR/MS technologies and new modes of electronic communication will have on medical education, research and patient care.



**Biography:** William N. Kelley received his medical degree from Emory University where he was also elected to membership in Alpha Omega Alpha. Following 2 years of Internal Medicine training at the University of Texas Southwestern Medical School and Parkland Memorial Hospital in Dallas, he joined the staff of the National Institutes of Health as a Clinical Associate in the Arthritis and Rheumatism Branch. He finished his clinical training at the Massachusetts General Hospital in Boston. In 1968, Dr. Kelley joined the faculty at Duke University Medical Center where he became Professor of Medicine and Chief of the Division of Rheumatic and Genetic Diseases. From 1975-1989, Dr. Kelley was the John G. Searle Professor and Chair of the Department of Internal Medicine and Professor of Biological Chemistry at the University of Michigan. He then assumed his current position as Executive Vice President of the University of Pennsylvania with responsibilities as CEO for the Medical Center, Dean of the School of Medicine, and the Robert G. Dunlop Professor of Medicine and Biochemistry and Biophysics. He became CEO of the University of Pennsylvania Health System when it was established in 1993.

With a long history of involvement in experimental models of gene therapy, Dr. Kelley and his co-workers at the University of Michigan were the first to propose *in vivo* gene therapy as it is recognized today and the first to directly administer a human

gene *in vivo* and obtain expression in an experimental animal. In 1991, Dr. Kelley co-chaired the first International Symposium sponsored by the NTH on Human Gene Therapy. His patent reflecting the work, "Viral-Mediated Gene Transfer System," submitted in 1987, was issued in late 1997. In 1993, Dr. Kelley received the National Medal Research Award from the National Health Council for this work.

Dr. Kelley has served on the editorial boards of 13 different medical journals, and his bibliography includes more than 260 publications as well as 17 books. He is the founder and senior editor of *The Textbook of Rheumatology*, which is now in its 5<sup>th</sup> edition, and he is the founder and Editor-in-Chief of *The Textbook of Internal Medicine*, published in its 3<sup>rd</sup> edition in 1997. He currently serves as a Director of Merck, Inc., Beckman Coulter, Inc., the Greater Philadelphia First Corporation and the Philadelphia Orchestra Association. Additionally, he serves on the Board of Managers of the Wistar Institute, the Governing Board of the Leonard Davis Institute of Health Economics, as well as the Board of Trustees of Emory University.

In the national leadership arena, he has served as President of the American Federation for Medical Research, President of the American Society for Clinical Investigation, President of the American College of Rheumatology, Chair of the American

## INFORMS Philadelphia

Board of Internal Medicine, and Chair of the Residency Review Committee for Internal Medicine. He was elected to the Institute of Medicine of the National Academy of Sciences, American Academy of Arts and Sciences, Association of American Physicians and the American Philosophical Society. He is a Master of the American College of

Physicians and a recipient of the Distinguished Medical Achievement Award from the Medical Alumni Association of Emory University, the ACP John Phillips Memorial Award and Medal, the Robert H. Williams Award from the Association of Professors of Medicine and the Gold Medal of the American College of Rheumatology.

## SOFTWARE DEMONSTRATIONS

*Sunday, November 7, Exhibit Hall*

**3:00 – 4:30pm**

**ILOG, Inc.**

Irv Lustig; [irv@cplex.com](mailto:irv@cplex.com)

**ILOG OPL Studio**

**Ketron Management Science**

Joe Creegan; [jcreegan@ketronms.com](mailto:jcreegan@ketronms.com)

**Windows MPSIII User's Interface**

*Monday, November 8, Room 502*

**MA29 8:15 – 9:00am**

**Irwin/McGraw Hill**

Marvin Meneeley; [marvin\\_meneeley@mcgraw-hill.com](mailto:marvin_meneeley@mcgraw-hill.com)

**Page Out Course Development Tool**

**MC29 1:15 – 2:45pm**

**Applied Decision Analysis LLC**

Ken Ko; [www.adainc.com](http://www.adainc.com)

**Introducing DPL 4.0, Decision Analysis Software**

**IBM**

Robert Clark; [roclark@us.ibm.com](mailto:roclark@us.ibm.com)

Gyana Parija; [parija@us.ibm.com](mailto:parija@us.ibm.com)

**New Programming Interface**

**MD29 3:00 – 4:30pm**

**Scitor Corp.**

Roger Meade; [rmeade@scitor.com](mailto:rmeade@scitor.com)

**Scitor Process v3**

**Paragon Decision Technology**

Johannes J. Bisschop; [j.bisschop@paragon.nl](mailto:j.bisschop@paragon.nl)

G. de Lange

**The New AIMMS 3.0 Modeling System**

*Tuesday, November 9, Room 502*

**TA29 8:15 – 9:45am**

**Palisade Corporation**

Sam McLafferty; [tgradel@palisade.com](mailto:tgradel@palisade.com)

**Visual Decision, Inc.**

Alexandre

Cvetkovic;

[acvetkovic@visualdecision.com](mailto:acvetkovic@visualdecision.com)

**A Multicriteria, Multi-Scenarios, Multi-Actors Decision-Making Software: Decision Lab 2000**

**TC29 1:00 – 2:30pm**

**LINDO Systems, Inc.**

Mark Wiley; [mwiley@lindo.com](mailto:mwiley@lindo.com)

**Modeling with LINDO, LINGO & What'sBest**

**Dash Optimization, Inc.**

Sebastian Ceria; [sceria@dashopt.com](mailto:sceria@dashopt.com)

**XPRESS-MP for Modeling & Optimization**

**TD29 2:45 – 4:15pm**

**Imagine That, Inc.**

David Krahl; [davek@imaginethatinc.com](mailto:davek@imaginethatinc.com)

**Wolfram Research, Inc.**

Anton Rowe; [anton@episoft.com](mailto:anton@episoft.com)

**Mathematica**

**TE29 4:30 – 6:00pm**

**Maximal Software, Inc.**

Bjarni Kristjansson; [info@maximal-usa.com](mailto:info@maximal-usa.com)

**Tutorial: Using the MPL OptiMax 2000 Component Library with VBA for Excel & Visual Basic**

## TUTORIALS

*Sunday, November 7*

**SA35: Leveraging Internet in Business Applications**

Albert Angehrn, *INSEAD*;  
[albert.angehrn@insead.fr](mailto:albert.angehrn@insead.fr)

Electronic commerce and Internet-related business applications are an exciting field for research as well as for

experimenting with innovative, IT-enhanced learning methods. This tutorial will address the theory and practice of studying and teaching Internet business applications, focusing in particular on issues of high managerial relevance, such as linking IT to a company's

business strategy, identifying and exploiting entrepreneurial opportunities related to the Internet (Cyber-Entrepreneurship) and efficiently facing organizational resistance to the implementation of innovative IT

systems or IT-enabled business processes.

**SB35: Industry Clockspeed**

*Charles H. Fine, MIT; [charley@mit.edu](mailto:charley@mit.edu)*

No abstract supplied.

**SC35: Generalized Hill Climbing Algorithms in Optimization**

*Sheldon Jacobson, University of Illinois; [shj@uiuc.edu](mailto:shj@uiuc.edu)*

Generalized hill climbing (GHC) algorithms have been introduced as a unifying framework for addressing intractable discrete optimization problems. GHC algorithms provide a well-defined structure for classifying and studying a large body of stochastic and deterministic search strategies. Simulated annealing, threshold accepting and tabu search, among others, can all be formulated as particular GHC algorithms. We review the GHC structure and show how many common search strategies can be described using the GHC framework. The advantages and disadvantages of the GHC framework are presented and convergence results for GHC algorithms are discussed. Opportunities for future research with GHC algorithms are presented.

**SD 35: Using Commercial Software & Experiential Learning to Teach the First Management Science Course**

*Matthew J. Liberatore & Robert L. Nydick, Villanova University; [liberator@ucis.vill.edu](mailto:liberator@ucis.vill.edu)*

We offer a proven alternative to spreadsheets that synthesizes MS, commercial software and experiential learning. We illustrate how to apply our integrated approach to 3 modules: mathematical programming (linear, integer and non-linear), decision

analysis (primarily AHP) and simulation (primarily discrete event), using LINGO, Expert Choice and Extend, respectively. We share lessons learned regarding the development of successful student projects that have reached varying stages of implementation. We believe that our approach leads to a paradigm shift: the focus changes from what could and would be done with MS to what students can and will do with MS. This tutorial will be of interest to anyone who wishes to empower ordinary students to produce extraordinary results.

*Monday, November 8*

**MA35: Overview of Medical Informatics: The Key Role of OR/MS**

*Barry Silverman, University of Pennsylvania;*

*[barryq@seas.upenn.edu](mailto:barryq@seas.upenn.edu)*

Medical informatics (MI) is an evolving scientific discipline that deals with the collection, storage, retrieval, communication and optimal use of health-related data, information and knowledge in all basic and applied areas of the biomedical sciences. The discipline utilizes the methods of the information sciences for the purposes of furthering the study of problem solving, decision making, training, communicating and assuring quality related to health care. OR/MS methods play a central role throughout this field. For example, OR/MS methods are widely used in modeling and assisting clinical decision making (Bayesian nets, MAU methods), in workflow analyses and process simulation, in assessing the diagnostic value of new medical interventions (ROC curves), in mining clinical trial result sets for new insights

(regression models, neural nets) and in authoring guidelines and pathway maps for medical practice (decision tree algorithms) among many other applications. OR/MS plays an even more central role in the emerging subfield of bio-informatics and genome modeling. After an introduction to the field of MI, we offer a survey of a number of areas where OR/MS is making important contributions and provide several case studies.

*Tuesday, November 9*

**TA35: Maximizing Shareholder Wealth for Large Financial Companies: Integrated Financial Planning**

*John Mulvey, Princeton University;*

*[mulvey@email.msn.com](mailto:mulvey@email.msn.com)*

We describe recent efforts by financial organizations to render major decisions within a unified planning environment. The integrated financial planning system tracks marginal risk-adjusted returns for all business activities on a real-time basis. It pinpoints the best opportunities for growth and contraction. A dynamic, stochastic optimization model provides the ideal framework for coordinating the company's operations. The system maximizes the growth of shareholder wealth. We illustrate the concepts by means of a large global reinsurance application.

**TC35: An Introduction to SAP R/3**

*F. Robert Jacobs, Indiana University; [jacobs@indiana.edu](mailto:jacobs@indiana.edu)*

SAP's R/3 holds a 30% share of the ERP software market. Hardware and software features will be discussed together with the accelerated SAP implementation approach.

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A demonstration designed to highlight how the sales, operations and accounting functions are integrated in the context of a supply chain example will be conducted. Information will also be discussed concerning 2 courses that use R/3 now being offered at Indiana University.

### **TD35: Management of Technology: What Has Been (& Can Be) Learned from Research in Industrial Organization?**

*Mihkel Tombak, Northwestern University; [m-tombak@nwu.edu](mailto:m-tombak@nwu.edu)*

We will begin with an overview of some issues in MoT, including intellectual property rights, licensing, technology standards, financing (venture capital), organization (joint ventures) and technology policy. We then review what fields, e.g., sociology, OB, history, POM and industrial organization, etc., have contributed to research in MoT. Approaches in industrial organization research will be discussed and the research of MoT issues in industrial organization will be surveyed.

### **TE35: Retail Operations**

*Marshall Fisher, University of Pennsylvania; [fisher@opim.wharton.upenn.edu](mailto:fisher@opim.wharton.upenn.edu)*

*Ananth Raman, Harvard University;*

*[araman@hbs.harvard.edu](mailto:araman@hbs.harvard.edu)*

Retailing is an industry in which we see enormous differences in performance. At one extreme, we have Wal-Mart, which from a standing start in 1962 has grown to become the largest retailer in the world, making Sam Walton the wealthiest man in the US along the way. At the other extreme, about 15% of the largest retailers in the US went bankrupt in the 1980s.

### **WB35: Preference Function Modeling: A New Methodology for Preference Measurement**

*Jonathan Barzilai & Ernst Grundke, Dalhousie University; [barzilai@is.dal.ca](mailto:barzilai@is.dal.ca)*

Preference function modeling (PFM) is a new methodology for the measurement of preferences on interval scales. It has a built-in mechanism for reconciling inconsistent assessment and is a new, intuitive, easy-to-use but powerful decision paradigm based on a rigorous mathematical theory. We will introduce the software implementation of PFM and the underlying theory.

### **WC35: Supply Chain Design & Analysis using the SCOR Model**

*Herbert Heinzl, Siemens Business School & Supply Chain Council;*

*[herbert.heinzl@mch20.sbs.de](mailto:herbert.heinzl@mch20.sbs.de)*

The supply chain operations reference model (SCOR) has been designed and developed for effective communication among supply chain partners and in networks. As a de facto industry standard, it helps management focus across inter-company supply chains. The model can be used to describe, measure and evaluate supply chain configurations. Standard process definitions allow virtually any supply chain to be configured; standard metrics enable measurement and benchmarking of performance. Supply chain configurations can be evaluated to support continuous improvement and strategic planning. SCOR has been developed and endorsed by the Supply-Chain Council, an independent not-for-profit corporation, as the cross-industry standard for supply chain management. The presentation will familiarize the audience with the SCOR methodology and the top-down approach for configuring and implementing SCOR.

**Sunday 08:30-10:00****SA01 Medical Decision Making**

Sponsor: Decision Analysis Society  
Sponsored Session

Chair: Francois Sainfort, University of Wisconsin, Dept. of IE,  
1513 University Ave., Madison, WI 53706,  
sainfort@engr.wisc.edu

1) **Serendipity in Diagnostic Imaging: Magnetic Resonance Imaging of the Breast**, *William F. Lawrence*, Georgetown University Medical Center, Lombardi Cancer Ctr., 2233 Wisconsin Ave., Ste. 430, Washington, DC 20007, lawrencw@gunet.georgetown.edu, *Wenchi Liang, Jeanne S. Mandelblatt, Karen F. Gold, Matthew Freedman, Susan M. Ascher, Bruce J. Trock, Polun Chang*

MRI of the breast has been proposed for evaluation of suspicious lesions noted on mammogram or clinical breast examination. In a preliminary assessment of this new technology, we use decision modeling to determine the probability of cancer in a lesion found by MRI but not by prior diagnostic work.

2) **Time Tradeoff Evaluation of Temporary Health States in Radiology**, *J. Shannon Swan*, University of Wisconsin, Dept. of Radiology E3/311, 600 Highland Ave., Madison, WI 53792, jsswan@facstaff.wisc.edu, *Dennis G. Fryback, William F. Lawrence, Francois Sainfort*

We present a new method for assessing utility for diagnostic tests with a modified time-tradeoffs model. The method compares the patient's desire to have a certain test and have treatment now, vs. waiting for results and treatment after an "ideal" test, with no risk or pain.

3) **What's Really Important? Agreement between Prostate Cancer Patients & their Clinicians**, *Gretchen B. Chapman*, Rutgers University, Psychology Dept., Busch Campus, 152 Frelinghuysen Rd., Piscataway, NJ 08854-8020, gbc@rci.rutgers.edu, <http://www.rci.rutgers.edu/~gbc>, *Arthur S. Elstein, Charles D. Bennett*

Eighty-three patients with newly diagnosed prostate cancer and their clinicians gave time-tradeoff evaluations of 3 multi-attribute health states and the patient's own health state. They also provided attribute importance weights. Patient-clinician agreement was quite low for utilities and weights, but moderate for evaluations of the patient's current health state.

4) **Cost-Effectiveness of Alternative Therapies for Type 1 Diabetes Mellitus**, *Francois Sainfort*, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706, sainfort@engr.wisc.edu, *Russell H. Tomar*

A simulation model of Type 1 diabetes progression, impact on quality of life and associated medical costs is used to analyze the relative cost-effectiveness of alternative treatment strategies. We report the application of the model, the results and their sensitivity to changes in modeling parameters.

**SA02 Issues in Network Optimization**

Cluster: Combinatorial Optimization & Network Flows  
Sponsor: Optimization Section  
Sponsored Session

Chair: S. Thomas McCormick, University of British Columbia, Fac. of Commerce & Bus. Admin., Vancouver, BC, V6T 1Z2, Canada, stmv@adk.commerce.ubc.ca

1) **A Faster Algorithm for Abstract Maximum Flow**, *S. Thomas McCormick*, University of British Columbia, Fac. of Commerce & Bus. Admin., Vancouver, BC, V6T 1Z2, Canada, stmv@adk.commerce.ubc.ca, *James B. Orlin*

Ford & Fulkerson's 1956 max flow/min cut paper formulated max flow in terms of flows on paths, which Hoffman pointed out still works in an abstract setting. A first constructive proof of this result was recently developed; we show how to speed that algorithm by choosing our augmentations more carefully and taking advantage of the near-network structure this creates.

2) **Implementing Generalized Shortest Paths Algorithms**, *Jeffrey D. Oldham*, Stanford University, Dept. of Comp. Sci., Gates 4B, Stanford, CA 94305-9045, oldham@cs.stanford.edu

We implement an algorithm for the generalized shortest paths problem. It guesses the solution's cost and uses a Bellman-Ford algorithm to verify whether the guess is too large, correct, or too small. For some instances, our implementation is asymptotically faster than CPLEX. It also differentiates between different negative-cost detection schemes.

3) **The Gale-Shapley Stable Marriage Problem Revisited: Strategic Issues & Applications**, *Jay Sethuraman*, MIT, 77 Massachusetts Ave., E40-130, Cambridge, MA 02139-3407, jayc@mit.edu, *Chung Piaw Teo, Wee-Peng Tan*

We consider some strategic issues in the stable marriage problem in which each player is required to submit complete preference lists. We describe an optimal cheating strategy for the players under this model.

**SA03 Information, Incentives & Coordination**

Sponsor: Manufacturing & Service Operations Management  
Sponsored Session

Chair: Fangruo Chen, Columbia University, Grad. Sch. of Bus., 3022 Broadway, Uris Hall, New York, NY 10027-6902, fchen@research.gsb.columbia.edu

1) **The Option Value of Subcontracting & Outsourcing in Supply Chains**, *Jan A. Van Mieghem*, Northwestern University, Kellogg Grad. Sch. of Mgmt., 2001 Sheridan Rd., Evanston, IL 60208-2001

We value the option of subcontracting to improve financial performance and system coordination. We analyze and present outsourcing conditions for 3 contract types: price-only contracts; incomplete contracts and state-dependent price-only and incomplete contracts for which we show an equivalence result. We find that sometimes firms may be better off leaving some contract parameters unspecified ex-ante and agreeing to negotiate ex-post.

2) **Analysis of Capacity Reservation & Spot Bidding under Horizontal Competition**, *Sridhar Tayur*, Carnegie Mellon University, Grad. Sch. of Indust. Admin., Pittsburgh, PA 15213, stayur@grobner.gsa.cmu.edu, *Pinar Keskinocak, Feryal Erhun*

An emerging practice that is possible due to Internet-enabled operations, i.e., powder metals industry in the automotive chain, is modeled as a supply chain where 2 outsources may reserve capacity before uncertainty resolution from a common supplier and then bid on spot after while also competing in the same end market.

3) **Order Volatility & Supply Chain Costs**, *Rungson Samroengraja*, Columbia University, Grad. Sch. of Bus., 3022 Broadway, Uris Hall, New York, NY 10027-6902, *Fangruo Chen*

Many industry studies show that there is a great potential for cost savings in the area of supply chain management, and many people blame the bullwhip effect as a major source of supply chain inefficiencies. We use a model to show that a replenishment strategy that reduces order volatility does not necessarily reduce supply chain costs.

4) **Salesforce Incentives & Inventory Management**, *Fangruo Chen*, Columbia University, Grad. Sch. of Bus., 3022 Broadway, Uris Hall, New York, NY 10027-6902, fchen@research.gsb.columbia.edu

We consider a prevalent salesforce compensation plan that pays commissions on annual sales in excess of a quota. We found that this incentive system induces a nonstationary sales pattern detrimental to the firm's operations. An alternative plan is proposed to the salesforce to actually smooth the firm's demand process, generating substantial benefits to the firm.

**SA04 Simulation Applications I**

Contributed Session

Chair: Alpetkin Erkollar, University of Klagenfurt, Dept. of Comp. Sci., Klagenfurt, A-9020, Austria, alp@ifit.uni-klu.ac.at

1) **Learning Simulation on the Web**, *Ingolf Stahl*, Stockholm School of Economics, Box 6501, Stockholm, S-11383, Sweden, ingolf.stahl@hhs.se, <http://www.hhs.se/secc/staff/#iis>

Since there is a demand in colleges and high schools for using simulation in courses and project work, we are putting micro-GPSS, a stream-lined, easy-to-use version of GPSS, on the Web with a GUI for students to use to build up their models by clicking on block symbols.

2) **Web-Based Simulation Modeling using Java**, *Vakulathil Abdurahiman*, CTA-ITA-IEC, Div. of Computer Sci., Sao Jose dos Campos, SP 12228-900, Brazil, rahiman@comp.ita.cta.br, <http://www.comp.ita.cta.br/~rahiman>, *Celso Hirata, Germano Kienbaum*

We discuss the concepts of Web-based simulation modeling. The issues in simulation modeling with adopting this new technique are analyzed. An application example in Java is presented to show how the new simulation environment will help teach simulation.

3) **Maintenance Workforce Optimization in a Cable Factory**, *Mehmet Savsar*, Kuwait University, College of Eng. & Petroleum,

PO Box 5969, Safat, 13060, Kuwait, mehmet@kuc01.kuniv.edu.kw

We describe a simulation modeling procedure to determine the optimum maintenance workforce level in a cable manufacturing factory with 23 machines. The model is experimented with single-skilled and multi-skilled maintenance crews and the optimum number of repairmen is determined in each case. The cost results are then compared.

**4) UML as Domain Specific Language for the Construction & Maintenance of Simulation-Models in the Area of Circuit-Board Production, Alpetkin Erkollar**, University of Klagenfurt, Dept. of Comp. Sci., Klagenfurt, A-9020, Austria, alp@ifit.uni-klu.ac.at, *Alexander Felfernig*

Many domains require the rapid development of highly adaptable simulation-models. In order to accomplish this task, domain specific modeling concepts for building simulation models are employed. We show how modeling concepts of the simulation area can be introduced in UML and be automatically translated into simulation models...

#### SA05 Decision Analysis & Computational Challenges

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Eric Horvitz, Microsoft Research, Decision Theory Group, One Microsoft Way, Redmond, WA 98052-6399, horvitz@microsoft.com

Co-Chair: Ross D. Shachter, Stanford University, Ees & OR Dept., Terman Ctr., Stanford, CA 94305-4023, shachter@stanford.edu

**1) The Value of Control Revisited, Ross D. Shachter**, Stanford University, EES & OR Dept., Terman Ctr., Stanford, CA 94305-4023, shachter@stanford.edu, *David Heckerman*

The value of control is the amount a decision-maker should be willing to pay to transform an uncertainty into a decision, that is, to choose its state. Using recent results in causal modeling, we reexamine the value of control and how to compute and apply it.

**2) Efficient Representations for Aggregate Belief & Compact Securities Markets, David M. Pennock**, University of Michigan, UM AI Lab., 1101 Beal Ave., Ann Arbor, MI 48109-2110, dpennock@umich.edu, *Michael P. Wellman*

Bayesian networks can exploit conditional independence to compactly represent individual belief and efficiently compute decision-theoretic queries over large domains. We report both positive and negative results bearing on the possibility of exploiting conditional independence to achieve similar efficiency in models of consensus belief and general market equilibrium under uncertainty.

**3) One Practitioner's Perspective on Decision Analysis & its Computational Challenges, Kazuo J. Ezawa**, Mondex International Ltd., Atlantic Tech. Ctr., Ste. 109, 100 Campus Dr., PO Box 972, Florham Park, NJ 07932-0972, kazuo.ezawa.mondex@worldnet.att.net

Using some examples, the reality of computational challenge is reviewed. The more computational power/capability doesn't necessarily mean the better DA. We will discuss trade off issues such as framing, model complexity, seeking insights vs. accuracy of prediction, strategic vs. tactical decisions and ease of use of DA software.

**4) Leveraging Probability & Utility in Computational Systems & Applications, Eric Horvitz**, Microsoft Research, Decision Theory Group, One Microsoft Way, Redmond, WA 98052-6399, horvitz@microsoft.com

I will present research on the use of decision-analytic concepts for making automated decisions about the allocation of processing and memory resources in computer systems. The methods highlight challenges and opportunities in the realm of harnessing representations of probability and utility to enhance the behavior of computer systems and applications.

#### SA06 Very Large-Scale Neighborhood Search

Cluster: Discrete Optimization

Invited Session

Chair: James B. Orlin, MIT, Sloan Sch. of Mgmt., E40-147, Cambridge, MA 02139, jorlin@mit.edu

**1) Very Large-Scale Neighborhood Search, James B. Orlin**, MIT, Sloan Sch. of Mgmt., E40-147, Cambridge, MA 02139, jorlin@mit.edu, *Ravindra K. Ahuja, Ozlem Ergun, Abraham P. Punnen*

In neighborhood search techniques, one searches the "neighborhood" of a given solution  $x'$  and replaces  $x'$  by a neighbor that has improved cost. VLSN search refers to neighborhood search techniques in which the number of neighbors of  $x'$  may be exponentially large. We briefly survey VLSN search.

**2) Searching Very Large-Scale Neighborhoods using Improvement Graphs, Ravindra K. Ahuja**, University of Florida, 303 Well Hall, Dept. of ISE, Gainesville, FL 32611, ahuja@ise.ufl.edu, *James B. Orlin*

We review 2 applications of very large-scale neighborhood search in which the key idea is to search neighborhoods using improvement graphs. We illustrate the ideas on partitioning problems, especially to the capacitated minimum spanning tree problem, and on airline fleet assignment.

**3) Large-Scale Neighborhood Search Applied to a Nonbifurcated Network Loading Problem with Multiple Facilities, Bernard Gendron**, Universite de Montreal, DIRO & CRT, CP 7128, succ. Centre-ville, Montreal, Quebec, H3C 3J7, Canada, bernard@crt.umontreal.ca, *Jean-Yves Potvin, Patrick Soriano*

We study a network design problem that arises in the telecommunications industry. We describe large-scale neighborhood search heuristics, which perform k-opt type exchanges in the space of paths. Numerical results are presented on different types of networks with up to 200 vertices.

**4) Domination Analysis of Some Well-Known Construction Heuristics for the Traveling Salesman Problem, Abraham P. Punnen**, University of New Brunswick, Dept. of Math. Stats. & CS, PO Box 5050, Saint John, NB, E2L 4L5, Canada, punnen@unbsj.ca

We review domination results on several well known construction heuristics for the TSP including the Christofides heuristic, patching algorithms, nearest neighbor and other greedy type algorithms, node insertion algorithms, etc. Some new results in this area will also be presented.

#### SA07 Panel: Research Directions in Manufacturing Logistics

Cluster: Manufacturing & Logistics

Invited Session

Chair: S. David Wu, Lehigh University, Dept. of IMSE, 200 West Packer Ave., Bethlehem, PA 18015, david.wu@lehigh.edu

**1) Panel: Research Directions in Manufacturing Logistics, Robin O. Roundy**, Cornell University, Dept. of OR/IE, 203 Rhodes Hall, Ithaca, NY 14853, robin@orie.cornell.edu, *David Simchi-Levi*, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208, levi@iems.nwu.edu, *Guillermo Gallego*, Columbia University, IEOR Dept., Mudd Bldg., 500 West 120th St., Rm. 331, New York, NY 10027, ggallego@ieor.columbia.edu, *Izak Duenyas*, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109, duenyas@umich.edu, *S. David Wu*, Lehigh University, Dept. of IMSE, 200 West Packer Ave., Bethlehem, PA 18015, david.wu@lehigh.edu

Research in manufacturing logistics expands the traditional scope of production and operations management to include issues such as supply chain coordination, information technology, and the integration of manufacturing and other business functions. This panel will discuss recent and future trends for research in this area.

#### SA08 Modeling the Supply Chain at Lucent Technologies: Practitioners View of the Supply Chain Problem

Cluster: Manufacturing & Logistics

Invited Session

Chair: Mary J. Meixell, Bell Labs., Lucent Technologies, PO Box 900, Princeton, NJ 08542-0900, marymeixell@lucent.com

**1) FSPAT: A Tool for Targeting & Reducing Significant Cost Elements in the Supply Chain, Robert R. Svenson**, Bell Labs., Lucent Technologies, PO Box 900, Princeton, NJ 08542-0900, svenson@lucent.com, *Bruce H. Yuan*

Many of the most important decisions affecting a manufacturing firm engaged in international business require a complete understanding of the supply chain and its significant cost elements. To support Lucent Technologies' planning activities, a financial accounting tool was developed to support scenario-based decision analysis. The tool will be described with example applications.

**2) Global Virtual Factory & Supply Chain Modeling in a Build-to-Order Environment, Turgut Aykin**, Bell Laboratories, MSE Dept., Eng. Research Ctr., PO Box 900, Princeton, NJ 08542,

taykin@lucent.com

We describe a supply chain planning model for the management of material flows in a build-to-order environment where performance metrics are specified not in terms of item level fill rates, but in order level fill rates, and order delivery lead time and reliability. We also present a framework for a global virtual factory involving multiple factories, distribution centers, markets and suppliers.

**3) The Integration of Competitive Analysis, Market Information & Reverse Engineering: Methods to Determine Competitor Supply Chain Strategies, Lee L'Esperance, Lucent Technologies, PO Box 900, Princeton, NJ 08081, llesperance@lucent.com**

The supply chain is becoming an increasingly important element of competitive strategy today. Contract manufacturing, third-party logistics, web-based management are among some of the methods used to maximize manufacturing assets while minimizing product delivery intervals. Methods will be described that can lead to insights in how competitor's supply chains link to their overall strategy and financial performance.

**4) Collaborative Planning at Lucent Technologies, Mary J. Meixell, Bell Labs., Lucent Technologies, PO Box 900, Princeton, NJ 08542-0900, marymeixell@lucent.com, Daniel Bilodeau**

Collaborating along the supply chain leads to improvement in both operational and ultimately financial performance of the enterprise. We review how the benefits associated with collaborative planning are estimated.

## SA09 AI Applications

### Contributed Session

**Chair:** Kenneth S. Sims, Cumberland College, 7656 College Station Dr., Williamsburg, KY 40769-1387, kenpc@cc.cumber.edu

**1) Intelligent Data Mining Using Object-Oriented Paradigm, Davinder K. Malhotra, Philadelphia College, Sch. House Ln. & Henry Ave., Philadelphia, PA 19144, malhotrad@philacol.edu, Rashmi Malhotra**

Although many different intelligent techniques, i.e., neural network methods, GAs and neuro-fuzzy models, etc., have been applied for data mining and data warehousing, knowledge-based systems have not been very extensively applied to the DSS data analysis. We illustrate the use of artificially intelligent knowledge-based methods in retrieving information from the morningstar's mutual fund database.

**2) A Geometric Model for Computational Music Analysis, Elaine Chew, MIT, 158 Webster Ave., Cambridge, MA 02141, eniale@mit.edu, http://web.mit.edu/eniale**

Enjoyment of the arts is a defining feature of an enhanced quality of life. The quest for deeper understanding and appreciation naturally follows. Computational tonal analysis is a difficult problem which has been tackled with limited success in music cognition. My new approach utilizes a geometric model which incorporates functional pitch relations.

**3) A Generalized Neural Network Approach to Chemical Oxidation Process Modeling, Sarah S. Lam, Binghamton University, Dept. of Systems Sci. & IE, Binghamton, NY 13902, sslst7@pitt.edu, Alice E. Smith**

An approach that considers multiple feed gas types and reactor types for a chemical oxidation process is presented. In contrast to a more traditional approach, quadratic response surface modeling, our approach requires the construction of one generalized model, which can be used for optimizing the process...

**4) Sensitivity Tests on a Set of Learning Classifier Systems Trained to Play the Iterated Prisoner's Dilemma Problem, Kenneth S. Sims, Cumberland College, 7656 College Station Dr., Williamsburg, KY 40769-1387, kenpc@cc.cumber.edu, Ram Pakath**

We extend prior explorations that use LCS-based agents to generate superior IPD game-playing strategies against opponents playing human-proposed strategies. We provide a "sensitivity analysis" of the LCS by observing its reactions to alterations in some of its parameters and to some opponent parameters.

## SA10 Semidefinite Programming

**Cluster:** Optimization & Applications

**Sponsor:** Optimization Section

**Sponsored Session**

**Chair:** Kurt M. Anstreicher, University of Iowa, Dept. of MS, Iowa City, IA 52242, kurt-anstreicher@uiowa.edu

**1) Interior-Point Methods for Semidefinite Programming, Michael J. Todd, Cornell University, School of OR/IE, 229 Rhodes Hall, Ithaca, NY 14853-3801, miketodd@cs.cornell.edu, www.orie.cornell.edu/~miketodd/todd.html, Kim C. Toh, Reha H. Tutuncu**

We discuss some issues related to interior-point methods for semidefinite programming, including the work involved at each iteration and the ability to exploit sparsity and special structure. We give computational results for the code SDPT3 of Toh, Todd & Tutuncu on problems from SDPLIB-1.1.

**2) A Polynomial-Time Algorithm for Semidefinite Optimization Based on a Scaled Gauss-Newton Direction, Cornelis Roos, Delft University of Technology, Fac. of Info. Tech. & Systems, Mekelweg 4, PO Box 5031, Delft, 2628 CD, The Netherlands, c.roos@its.tudelft.nl, Etienne de Klerk, Jiming Peng, Tamas Terlaky**

Inspired by a paper of Kruk et al., we propose a new primal-dual search direction for solving SDO problems. The search direction is scale invariant, coincides with the primal-dual direction in the linear case and yields a polynomial-time method when subsequent targets on the central path are chosen appropriately.

**3) Using Semidefinite Programming to Obtain a New Quadratic Programming Relaxation of the Quadratic Assignment Problem, Kurt M. Anstreicher, University of Iowa, Dept. of MS, Iowa City, IA 52242, kurt-anstreicher@uiowa.edu**

It has been shown that a simple eigenvalue bound for the QAP has a semidefinite programming representation. We use this SDP representation to construct a new convex qp relaxation of QAP. The lower bound obtained from this QP is stronger than the well-known projected eigenvalue bound for QAP.

## SA11 Discrete & Nonconvex Optimization Applications

**Cluster:** Global Optimization

**Sponsor:** Optimization Section

**Sponsored Session**

**Chair:** Costas D. Maranas, Pennsylvania State University, 112A Fenske Lab., University Park, PA 16802, costas@psu.edu

**1) Reformulation Technique for Nonlinear Generalized Disjunctive Programs, Ignacio E. Grossmann, Carnegie Mellon University, Dept. of Chem. Engineering, Pittsburgh, PA 15213, grossmann@cmu.edu, Sangbum Lee**

We address the solution of generalized disjunctive programs, which involve Boolean and continuous variables, disjunctions containing convex nonlinear inequalities and logic propositions. A reformulation method is proposed based on determining the convex hull of each disjunction, that allows the application of algebraic or logic based MINLP methods.

**2) Reactive Scheduling under Uncertainty Considerations for Multiproduct Batch Plants, Marianthi G. Ierapetritou, Rutgers University, Dept. of Chem. & Biochem. Eng., 98 Brett Rd., Piscataway, NJ 08854-8058, marianth@sol.rutgers.edu**

We address the problem of considering uncertainty into the detail short-term scheduling problem. Uncertainty can be viewed as unexpected deviations in unit availabilities (machine break-down) and/or fluctuations in product demands and raw material availabilities. The approach is based on Ierapetritou & Floudas', 1998 model and determines a new optimal schedule...

**3) Midterm Supply Chain Planning under Demand Uncertainty, Anshuman Gupta, Pennsylvania State University, Dept. of Chem. Engineering, 112 Fenske Lab., University Park, PA 16802, anshuman@santorini.che.psu.edu, Costas D. Maranas**

A 2-stage, stochastic programming approach is proposed for incorporating demand uncertainty in midterm planning problems. Based on duality theory, a closed form solution for the recourse problem is obtained followed by expectation evaluation by analytical integration over the multivariate probability space. The resulting convex MINLP is solved to optimality with the outer approximation algorithm.

## SA12 Decision Making

**Sponsor:** College of Marketing

**Sponsored Session**

**Chair:** Marjorie Adams, University of Virginia, Darden School, PO Box 6550, Charlottesville, VA 22906

**1) "Short-Termism" in New Product Decisions, William T. Ross, Jr., Temple University, Sch. of Bus. & Mgmt., 1810 North 13th St., Philadelphia, PA 19122, Marjorie Adams**

There is evidence that managers will overvalue short-term projects at the expense of longer-term options. We conduct 3 studies. First, we examine, in a

new product situation, whether managers do indeed favor short-term projects. Secondly, we study whether managers who adopt a portfolio management approach to the management of projects are less likely to demonstrate this bias...

**2) Predicting an Uncertain Future to Make a Decision Now: Heuristics & Biases in Assessing Extreme-Value Distributions, Wes Hutchison**, University of Pennsylvania, The Wharton School, Pittsburgh, PA 19104, *Robert J. Meyer*

Central to many dynamic decisions faced by consumers and managers is an intuitive assessment of the expected value of an uncertain future choice. That choice will be the best option available at the time, and it can be represented as the maximum (or sometimes the minimum) of a finite number of draws from some distribution...

**3) Framing Effects of Market Structure in Judgments of Health Risk & Message Processing, Lauren Block**, NYU, 44 West 4th St., New York, NY 10012, *Geeta Menon*

We examine the effects of risk-factor framing and the number of risk factors enumerated in an ad on people's perceptions of risk, attitudes and behavioral intentions toward hepatitis C testing. Results from two studies demonstrate the interactive effects of risk type and number of risk factors on health persuasion.

**4) Coping with Bad Choices: Attribute Value & Emotional Tradeoff Difficulty, Mary Frances Luce**, University of Pennsylvania, The Wharton Sch., Philadelphia, PA 19104, *James R. Bettman, John W. Payne*

We investigate the hypothesis that decision-makers will be motivated to cope with the increasing threat presented by low attribute values by maximizing the relevant attribute in choice. We report 2 studies that use choice patterns and emotion ratings to isolate this coping behavior, controlling for several additional sources of influence on choice (e.g., influence associated with attribute importance weights).

#### SA13 Distribution Channels

**Sponsor:** College of Marketing  
Sponsored Session

**Chair:** Steffen Jorgensen, Odense University, Dept. of Mgmt., Campusvej 55, Odense, DK-5230, Denmark, *stj@sam.sdu.dk*

**1) withdrawn - author request of 10/11, Steffen Jorgensen**, Odense University, Dept. of Mgmt., Campusvej 55, Odense, DK-5230, Denmark, *stj@sam.sdu.dk*, *Georges Zaccour*

**2) Demand Externalities & Interactions on the Quality of Services in Franchise Chains, Janghyuk Lee**, IHEL of ESSEC, Av Bernard Hirsch, BP 105 95021, Cergy Pontoise, France

We focus on the consequences of interactions between 2 franchised outlets on service quality as demand externalities exist in the chain. Using a formal model, we present the form of optimal reaction function and analyze different equilibria of service quality in terms of information availability. Empirical findings from 2 major companies in France will be also presented.

#### SA14 Technology & Networks

**Sponsor:** Technology Management Section/College Organization Science  
Sponsored Session

**Chair:** Lori Rosenkopf, University of Pennsylvania, The Wharton School, 2000 SH-DH, Philadelphia, PA 19104-6302, *rosenkopf@wharton.upenn.edu*

**1) The Quality of Collaboration: Inducements & Opportunities in the Formation of Interfirm Linkages, Gautam Ahuja**, University of Texas, Management Dept., CBA 4.202, Austin, TX 78712, *ahujaebos@texas.edu*

I argue that centrality in an inter-firm network is explained by simultaneously examining both linkage-inducement and linkage-opportunity factors. Firms possessing 3 inducement and opportunity factors accumulated technical, commercial and social capital and become central more easily. However, firms lacking these accumulated resources can also become central by creating radical technological breakthroughs.

**2) Coming From Good Stock: Career Histories & New Venture Formation, M. Diane Burton**, Harvard Business School, Soldiers Field Rd., Boston, MA 02163, *dburton@hbs.edu*, *Jesper B. Sorensen, Christine Beckman*

We argue that entrepreneurs secure informational and reputational benefits from having worked for employers who occupy prominent positions in entrepreneurial networks. Employer centrality increases employee exposure

opportunities and resources. Employer prominence reflects positively on employees, helping to reduce perceived uncertainty of proposed ventures. We find that Silicon Valley founders pursue risky, innovative ventures at a higher rate...

**3) Strategic Participation in Cooperative Technical Organizations: Informal Networks & Alliance Formation, Lori Rosenkopf**, University of Pennsylvania, The Wharton School, 2000 SH-DH, Philadelphia, PA 19104-6302, *rosenkopf@wharton.upenn.edu*, *Anca Turcanu, Varghese George*

We derive an informal inter-firm network firm participation in technical committees in the cellular industry. We show that firm centrality in this network increases subsequent alliance formation rates and that greater joint participation by a pair of firms in this network increases its likelihood of forming subsequent alliances.

**4) The Geography of Opportunity, Toby Stuart**, University of Chicago, Grad. Sch. of Bus., 1101 East 58th St., Chicago, IL 60637, *toby.stuart@gsb.uchicago.edu*, *Olav Sorensen*

We develop a sociological explanation for industry clustering. We present a network and ecological perspective on the determinants of spatial heterogeneity in founding rates and organizational performance in the population of US biotechnology firms. Our analyses investigate the effects of geographic proximity to established biotechnology firms, biotechnology experts and venture capitalists on the location-specific founding rates and performance of startups.

#### SA15 Knowledge Management in the Contemporary Firm

**Sponsor:** Technology Management Section

Sponsored Session

**Chair:** Glenn Dietrich, University of Texas, Div. of Acctng. & Info Sys., 6900 North Loop 1604 West, San Antonio, TX 78249, *gdietrich@utsa.edu*

**1) The Emergence of Leadership in Knowledge Management: A Look at Forms & Functions, Patricia D. Witherspoon**, University of Texas, Dept. of Speech Comm., Austin, TX

Knowledge management in contemporary organizations requires new approaches to the exercise of leadership within these organizations. We look at the characteristics and expectations of those engaged in the process of knowledge management as a process and suggest new forms of leadership that emerge in this process.

**2) Profound Knowledge & Software Systems Engineering: Is there a Link?, Bobby G. Moore**, SAIRC, 4242 Woodcock Dr., Ste. 150, San Antonio, TX 78228, *bmoore@texas.net*

Deming's "profound knowledge" and Checkland's soft system methodology are described and analyzed to determine if a linkage exists between them and if so, what the nature of the linkage is.

**3) Using Technology Transfer's Empirical Research to Inform the Area of Knowledge Management, Kathy L. Wohlert**, University of Texas, Div. of Mgmt. & Mktg., 6900 North Loop 1604 West, San Antonio, TX 78249, *kwohlert@utsa.edu*

Although there is a burgeoning interest in and implementation of knowledge management programs in many of today's firms, limited empirical research exists in knowledge management. Technology transfer is identified as a subset of knowledge management and the research from the field of technology transfer is applied accordingly.

**4) Knowledge Management & Adding Value to an Organization, Glenn Dietrich**, University of Texas, Div. of Acctng. & Info Sys., 6900 North Loop 1604 West, San Antonio, TX 78249, *gdietrich@utsa.edu*

Knowledge management has become an important part of business. We explore ways that knowledge management can add value to an organization. Particular emphasis is placed on creating conditions within the firm that foster knowledge management. Using knowledge management as a technique for developing strategic plans in a rapidly changing technology environment is also discussed.

#### SA16 Portfolio Analysis

Contributed Session

**Chair:** Xun Li, Chinese University of Hong Kong, Dept. of SEEM, Shatin NT Hong Kong, China, *xli@s.cuhk.edu.hk*, <http://www.se.cuhk.edu.hk/~xli/>

**1) Problems of Optimization of an Investment Portfolio, Efim M. Bronshtein**, Ufa State Aviation Technical University, K.Marx Str. 12, Ufa, Bashkortostan, 450000, Russia, *brem@soros.basheda.ru*, *Semjon I. Spivak*

Formulations of problems of formation of optimal investment portfolio are

shown at various definitions of risk of the projects. The interest rates are assumed to be stochastic. Different approaches are applied such as Markov claims, time-depending probabilities of refusals of investments and indexes of a condition.

**2) Index Fund with Mean Square Tracking, Yoshio Tabata,** Osaka University, Grad. School of Econ., Toyonaka, Osaka, 560, Japan, tabata@econ.osaka-u.ac.jp

Some properties of index fund designing problems are shown in discrete time and continuous time. The main property is that if the benchmark is (not) on the efficient frontier, then the index fund with minimum tracking error is (not) on the efficient frontier. More interesting results will be provided.

**3) A Dynamic Asset Allocation Model with Downside Risk Control, Yonggan Zhao,** University of British Columbia, Fac. of Commerce, #419 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, zhao@phdlab.commerce.ubc.ca, **William T. Ziemba**

Assuming lognormality for prices, the strategy that gauges the dynamic portfolio weight by the risk neutral excess rate of return is determined by a stochastic differential equation. A constrained optimization model is established given investors' risk preference and asset price model. Under the risk measure, value at risk, the downside control method is superior to both buy and hold and fixed mix strategies.

**4) Mean-Variance Portfolio Selection with Volatility Degeneracy Case, Xun Li,** Chinese University of Hong Kong, Dept. of SEEM, Shatin NT Hong Kong, China, xli@s.cuhk.edu.hk, <http://www.se.cuhk.edu.hk/~xli/>, **Xunyu Zhou**

The mean-variance portfolio selection model with volatility degeneracy is studied in a financial market containing 1 bond and  $m$  stocks whose prices are associated with a  $d$  dimensional Brownian motion process. The efficient frontier, along with the analytical efficient policies, is obtained via solving an auxiliary stochastic linear-quadratic problem.

#### SA17 The Role of Information in Various Forms of Scheduling

Cluster: Planning & Scheduling  
Invited Session

Chair: Jacob Wijnngaard, University of Groningen, Assen, 9406 CN, Netherlands, winjngaard@bdk.rug.nl

**1) Interaction between Supply Chain Planning & Control & Shopfloor Scheduling in Parallel Flow Shops, A. G. de Kok,** Eindhoven University of Technology, Paviljoen F4, PO Box 513, Eindhoven, 5600 MB, The Netherlands, a.g.d.kok@tm.tue.nl

We present the planning and control of a supply chain where a particular link can be modeled as a parallel flow shop. At the supply chain level, we use a rolling schedule LP model to plan capacity and material availability. At the shop level, we apply a local search algorithm to determine the detailed production plan...

**2) The Use of Foreknowledge in Order Acceptance, Jacob Wijnngaard,** University of Groningen, Assen, 9406 CN, Netherlands, winjngaard@bdk.rug.nl

Order acceptance is an important decision level in production control. One approach is to direct order acceptance by actual detailed production schedules. The strengths and weaknesses of this approach will be discussed and the approach will be compared with a more aggregate approach. The influence of tacit elements in customer preferences will be considered.

**3) Queuing Models for Capacitated Multi-Echelon, Multi-Indenture Repairable Item Systems, W. H. M. Zijm,** Eindhoven University of Technology, PO Box 513, Paviljoen F18, Eindhoven, 5600 MB, The Netherlands, w.h.m.zijm@tm.tue.nl

We discuss the performance analysis of multi-product, multi-echelon, multi-indenture inventory systems for repairable items. At the bases (downstream) and at a central depot, both repair facilities are available to upgrade failed parts for reuse. All repair facilities are subject to capacity constraints. We develop integrated production/inventory models, based on queueing networks and discuss analytical and numerical results.

**4) Using Workload & Routing Information to Reduce Lead Time Uncertainty in A Job Shop Production System, Jan C. Fransoo,** Eindhoven University of Technology, PO Box 513, Pav F12, Eindhoven, NL-5600 MB, The Netherlands, j.c.fransoo@tue.nl, <http://www.tn.tue.nl/vakgr/lbs/fransoo.htm>, **H. P. G. van Ooijen**

We present a statistical model that relates order throughput times to the workload at the work centers on the routing of a job under different shop floor dispatching rules. Based on the statistical model, a prediction model is derived that assigns cost optimal external due dates to jobs per routing class.

#### SA18 Combinatorial Optimization Solutions for Applications in Industry

Cluster: Discrete Optimization  
Invited Session

Chair: Tami Carpenter, Bellcore Room 1A-320B, 445 South St., Morristown, NJ 07960, tcarr@bellcore.com

**1) Integer Knapsack-Cover Polyhedra & Applications, David R. Mazur,** Johns Hopkins University, Dept. of Math. Sci., 220 Maryland Hall, Baltimore, MD 21218, mazur@mts.jhu.edu, **Leslie A. Hall**

We present structural results on polyhedra related to the integer knapsack-cover problem. We then discuss some computational implications of these results and report on their effectiveness in a cutting-plane algorithm for solving a particular telecommunications planning problem.

**2) Optimizing Paint Blocking in an Automobile Assembly Line: An Application of Specialized TSPs, Joel Sokol,** MIT Operations Research Center, 305 Memorial Dr, Cambridge, MA 02139, jsokol@mit.edu, **Thomas L. Magnanti**

In automobile assembly plants, painting similarly-colored cars sequentially saves millions of dollars annually. We model this problem as a time-window TSP. We compare various formulations containing up to 14,000,000 variables for real instances, and exploit the problem's structure to obtain good, fast solutions that allow real-time adjustments.

**3) Inferring Network Topology from Packet Delay Data, David F. Shalldross,** BELLCORE, 445 South St., 1J-306B, Morristown, NJ 07960, davids@bellcore.com

We consider a system of network monitoring by exchanging packets over a period of time between selected points. Using packet delay data, we want to determine the topology of the network, and the routing of the packets. We describe the methods we have tried and their performance on test problems.

**4) Heuristics for Routing & Slotting on Ring Networks, Steven T. Cosares,** Dowling College, Dept. of Math, Oakdale, NY 11769, cosares@dowling.edu, **Tami Carpenter, Iraj Saniee**

We describe the performance of heuristics for a routing and slotting problem that arises in SONET ring sizing. We consider both sequential approaches, wherein the routing of demands precedes their assignment to slots, and more integrated approaches that consider the route and slot assignments simultaneously.

#### SA19 Hybrid Algorithms

Cluster: Constraint Programming  
Invited Session

Chair: Mark G. Wallace, Imperial College, IC-Parc, William Penney Lab., London, SW7-2AZ, England, UK, mgw@icparc.ic.ac.uk

**1) Exact Solutions for Real World Crew Scheduling Problems, Arnaldo V. Moura, Cid C. de Souza, Tallys Hoover Yunes**

We present a hybrid methodology for optimally solving large-scale crew scheduling problems. These are real world instances reaching more than 1.5 billion entries. Our approach integrates constraint programming and integer programming, exploiting their particular strengths for solving specific parts of the problem. Implementation details and computational experiments are discussed.

**2) Hybrid Algorithms for the "Oregon Trail" Knapsack Problem, Jennifer Burg,** Wake Forest University, PO Box 7388, burg@mthsc.wfu.edu, **Sheau-Dong Lang**

The Oregon Trail knapsack problem imposes a cost as well as a weight limit, constraining the values of items by a variety of value functions, possibly depending on the presence or absence of other items. The solution combines dynamic programming, constraint propagation techniques and classic B&B approaches.

**3) Forward Search Hybridization Forms, Hani El Sakkout,** Imperial College, IC-Parc, William Penney Lab., London, SW7 2AZ, England, UK, hhe@icparc.ic.ac.uk

Forward search is an enhancement of backtracking implicit in many hybrid search algorithms, whereby an independent search procedure is applied to a sub-problem to reduce the subsequent backtrack search. The forward search mechanisms in several hybrid algorithms are considered, and two principal forms are identified, namely hierarchical commitment and probe backtracking.

**4) A Hybrid CP-OR Approach to Solve the Traveling Salesman Problem with Time Windows, Filippo Focacci,** Universite di Ferrara, Dipt. di Ingeneria, Via Saragat 1, Ferrara, 44100, Italy,

ffocacci@deis.unibo.it, **Andrea Lodi, M. Milano**

We developed constraints for the TSPTW, integrating OR bounding techniques and dynamic programming, that filter domains to remove inconsistent values and non-optimal ones. Embedding these constraints in constraint programming yields a model that is flexible, and efficient. The behavior of our implementation, using ILOG Solver, is compared with related approaches.

### SA20 Applications for Urban Transit Systems

Sponsor: Transportation Science Section

Sponsored Session

Chair: Mark Hickman, Texas A&M University, Dept. of Civil Eng., College Station, TX 77843, mhickman@tamu.edu

1) **A Method to Adjust Passenger Counts on a Transit Line to Achieve Consistency**, *Shinya Kikuchi*, University of Delaware, Dept. of Civil & Environ. Eng., Newark, DE 19716-3122, kikuchi@ce.udel.edu

Boarding and alighting passenger counts on a transit line is subject to large amount of error. Hence, it is necessary to adjust the original counts at each station so that the conservation of flow (total boarding = totaling alighting) must be satisfied. Traditionally, this task has been done in an ad hoc manner...

2) **Real-Time Scheduling of Demand Responsive Transit Systems**, *Maged Dessouky*, University of Southern California, Dept. of ISE, Los Angeles, CA 90089-0193, maged@rcf.usc.edu, *Randolph W. Hall, Guntram Noeth, Stefan Adam*

With the passage of the ADA Act, which requires that transit agencies provide para-transit or on demand service for the disabled, there has been renewed interest in demand responsive transit. In this talk, we present a heuristic for real-time scheduling of such systems. We evaluate the heuristic using data provided by para-transit service providers in Los Angeles County.

3) **Operations Research in Transit**, *Vukan R. Vuchic*, University of Pennsylvania, Dept. of Sys. Eng., 220 South 33rd St., Rm. 293, Philadelphia, PA 19104-6315, vuchich@seas.upenn.edu

Although urban transit operations are conducive to OR applications, achievements are mixed: some useful work, but many studies without real-world applications. Insufficient contacts between theoreticians and practitioners and unrealistic models are common problems. Critical review will be followed by suggestions for increased OR applications in transit.

4) **Techniques for Scheduling Integrated Transit Service**, *Mark Hickman*, Texas A&M University, Dept. of Civil Eng., College Station, TX 77843, mhickman@tamu.edu, *Kelly Blume*

Demand-responsive transit service may be integrated with fixed route service to carry passengers on longer trips. We present a modified trip itinerary algorithm to schedule these passenger trips. The use of the algorithm and a vehicle scheduling technique are investigated using a case study in Houston.

### SA21 Dynamic Traffic Assignment I

Sponsor: Transportation Science Section

Sponsored Session

Chair: Athanasios Ziliaskopoulos, Northwestern University, 2145 Sheridan Rd., Evanston, IL 60208, a-z@nwu.edu

1) **Computational Experience with Large-Scale Dynamic Traffic Assignment Models**, *S. Travis Waller*, Northwestern University, Dept. of Civ. Eng., 2145 Sheridan Rd., Tech. Inst., Evanston, IL 60208, travis@trans.civil.nwu.edu, *Athanasios Ziliaskopoulos, Yue Irene Li*

A framework for performing large-scale simulation-based DTA on realistically sized networks is presented and discussed. Implementation details for both the simulator and DTA framework are analyzed. Computational results are presented from applying this framework to a 16,000-link network of Columbus, OH.

2) **System Consistency Control for Real-time Dynamic Traffic Assignment Operations**, *Ying Kang*, University of Texas, Dept. of Civil Eng., ECJ 6.2, Austin, TX 78712-1076, yingkang@mail.utexas.edu, *Hani S. Mahmassani*

The developed diagnostic architecture of system consistency control for real time DTA is presented along with a demand prediction feedback adjustment algorithm and a simulator adjustment algorithm. Possible research directions and potential applications of this methodology are also discussed.

3) **A Threshold-Constrained System Optimal Dynamic Assignment for Route Guidance Applications**, *Hossein Tavana*, University of Texas, Dept. of Civ. Eng., ECJ 6.2, Austin, TX 78712, hossein@mail.utexas.edu, *Hani S. Mahmassani*

A formulation and algorithm are presented for a system-optimal assignment of vehicles to paths in a congested network. The results satisfy the requirements of a boundedly-rational user equilibrium by keeping the travel times along the used paths within users' indifference thresholds.

### SA22 Negotiation Fundamentals

Cluster: IT Outsourcing: Integrating Research, Teaching & Practice  
Invited Session

Chair: Rachel Croson, University of Pennsylvania, Wharton Sch. of Bus., Dept. of OPIM, 1322 SH-DH, Philadelphia, PA 19104-6366, crosonr@wharton.upenn.edu

1) **Negotiations Theory for IT Contracting**, *Rachel Croson*, University of Pennsylvania, Wharton Sch. of Bus., Dept. of OPIM, 1322 SH-DH, Philadelphia, PA 19104-6366, crosonr@wharton.upenn.edu

No abstract supplied.

2) **Lessons Learned from Facilitating IT Outsourcing Negotiations**, *Elizabeth Gray*

No abstract supplied.

### SA23 Decomposition Methods & Applications

Sponsor: Energy, Natural Resources & Environment

Sponsored Session

Chair: J. David Fuller, University of Waterloo, Dept. of MS, Waterloo, Ontario, N2L 3G1, Canada, dfuller@engmail.uwaterloo.ca

1) **Extracting Partial Nonlinear Information from Modeling Languages**, *Emmanuel Fragniere*, University of Lausanne, HEC, BFSH1, Dorigny Lausanne, CH-1015, Switzerland, emmanuel.fragniere@hec.unil.ch, *Christian Condevaux-Lanloy*

We will present a tool to access and exploit nonlinear parts of a structured model that is generated from an algebraic modeling language. This feature allows to decompose the convex nonlinear programming problem when too large to be solved frontally.

2) **An Interior-Point Cutting-Plane Algorithm for a Lagrangean Decomposition of the Production-Distribution System Design Problem**, *Samir Elhedhli*, McGill University, Fac. of Mgmt., 1001 Sherbrooke West, Montreal, Quebec, H3A 1G5, Canada, elhedhls@management.mcgill.ca, *Jean-Louis Goffin*

We consider an extension to the analytic centre cutting plane method (ACCPM). We suggest the use of primal, dual and primal-dual interior plant algorithms in the calculation of analytic centers. We explore the motivating theory and discuss the algorithmic issues. We then apply this to a Lagrangean decomposition of the production-distribution system design problem...

3) **Uses of Decomposition Methods in Solving Electric Power Generation Problems**, *John R. Birge*, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, jrbirge@engin.umich.edu

Deregulated electric power markets present new challenges to the optimal generation of power. We will consider models for the optimal coordination of plants with limited capacity and market power and their use in a decomposition of the market equilibrium problem.

4) **Parallel Primal-Dual Decomposition**, *J. David Fuller*, University of Waterloo, Dept. of MS, Waterloo, Ontario, N2L 3G1, Canada, dfuller@engmail.uwaterloo.ca, *H. Jin Park*

We describe the principles of the parallel primal-dual decomposition method, in which the traditional master-subproblem relationship is replaced by a scheme in which every subproblem behaves like either a Dantzig-Wolfe or Benders master problem with respect to the other subproblems. Some computational results are presented.

### SA24 Management Issues in Telemedicine

Cluster: Management of Health Care Technology

Invited Session

Chair: Paul Jen-Hwa Hu, University of South Florida, Dept. of Info. Mgmt. & Dec., Coll. of Bus. Admin., Tampa, FL, paulhu@coba.usf.edu

1) **Assessing Technological Barriers to Telemedicine: Technology Management Implications**, *David L. Paul*, Georgetown University, McDonough School of Bus., Washington, DC 66045, dlp@gusun.georgetown.edu, *Keri E. Pearson, Reuben R. McDaniel*

Drawing on data collected from 3 operational telemedicine projects involving

different clinical telemedicine applications, we examine how technological barriers to telemedicine are impacting its utilization rates.

**2) Organizational Management of Telemedicine Technology: Conquering Time & Space Boundaries in Health Care Services, Olivia R. Liu Sheng, University of Arizona, Dept. of MIS, Tucson, AZ 85721, sheng@bpa.arizona.edu, Paul Jen-Hwa Hu, Chi-Ping Wei**

We address the need for systematic analyses of organizational management of telemedicine. Specifically, concepts of decision making with life-cycle of technologies are combined to investigate important management decisions and their inter-dependencies in organizations adopting such technologies. Important issues across various technologies needed or telemedicine to succeed are identified and examined.

**SA25 Vehicle Scheduling & Routing**

**Contributed Session**

**Chair:** Celso Carnieri, UFPR, Caixa Postal 19002, Curitiba, PR, 81.531-990, Brazil, carnieri@mat.ufpr.br

**1) An Integrated Approach to Bus & Driver Scheduling, Richard Freling, Erasmus University Rotterdam, Econometric Inst., PO Box 1738, Rotterdam, 3000 DR, The Netherlands, freling@few.eur.nl, Dennis Huisman, Albert P. M. Wagelmans**

Our presentation deals with an integrated approach to bus and driver scheduling. The focus is twofold: we discuss the effectiveness of integration as compared to the traditional sequential approach and we present results for an application to the Rotterdam public transport company in the Netherlands.

**2) A Computer-Aided Solution for the Train Scheduling Problem, Chueng-Chiu Huang, Ntl. Yunlin University of Science & Tech., 123 University Rd., Sec. 3, Touliu, Yunlin, Taiwan, 640, ROC, huangcc@pine.yuntech.edu.tw**

We analyze how to generate train schedules for the Taiwan Railroad System. Constraints include the arrival and departure timetables for every train at every station which should be generated within a reasonable time, preferably in under 3 minutes. Thus, if a delay should happen for any scheduled train, an updated timetable can be regenerated quickly to ensure safety for the train system.

**3) A Railway Fleet Assignment Model Based on Multi-Commodity Flow, Mattias Gronkvist, Carmen Systems AB, Odinsgatan 9, Gothenburg, SE-411 03, Sweden, mattias.gronkvist@carmen.se, Sami Gabteni**

We present a model for solving railway fleet assignment problems based on a multi-commodity flow formulation. The model primarily minimizes the number of vehicles used, but other cost and quality criteria can also be considered. The Swedish Railways use this model in production, and computational results indicate savings of 4-10%.

**4) Scheduling of Transportation of Multiple Products in a Forestry Company, Celso Carnieri, UFPR, Caixa Postal 19002, Curitiba, PR, 81.531-990, Brazil, carnieri@mat.ufpr.br, Julio E. Arce, Jefferson Mendes**

We report a model developed for a large forestry company in Southern Brazil, which needs to schedule the transport of their forestry products from several stands to the customers. The model considers distances, road conditions, types of trucks and loading/unloading queues, aiming the minimization of costs.

**SA26 Queueing Systems**

**Sponsor:** Applied Probability Society  
**Sponsored Session**

**Chair:** Mark E. Lewis, University of British Columbia, Faculty of Commerce, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, mlewis@coe.ubc.ca

**1) Expansion Formulae for Characteristics of Sojourn Time in Assembly Systems, Hayriye Ayhan, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, hayhan@isye.gatech.edu, Dong-Won Soe**

We consider a class of assembly-type queueing networks with Poisson input process. The dynamics of the assembly system can be captured via a set of difference equations. We develop a Taylor series expansion for the characteristics of stationary sojourn time using these difference equations.

**2) When You Receive the Reward Matters: Implicit Discounting in "Controlled" Queueing Systems, Martin L. Puterman, University of British Columbia, Fac. of Commerce, 2053 Main Hall, Vancouver, BC, V6T 1Z2, Canada, marty@markov.commerce.ubc.ca, Mark E. Lewis**

In sequential decision models, decision-makers should prefer policies that

generate rewards sooner. In an admission controlled M/M/1 queueing system, we show that bias optimality is consistent with this preference. To accomplish this, we compare the optimal policies in models in which the gatekeeper receives rewards upon job completion and entry.

**3) Join the Queue with the Shortest Expected Waiting Time: Exact Asymptotics, Jerome D. Coombs-Reyes, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, jerome@isye.gatech.edu, Robert D. Foley**

We consider several queues in which the selected arrivals join the queue with the shortest expected waiting time. We obtain exact asymptotics for various rare events such as the probability of having a large number of customers in the system and their distribution among the queues.

**4) Optimal Control of a Nonstationary Queueing System, Mark E. Lewis, University of British Columbia, Faculty of Commerce, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, mlewis@coe.ubc.ca, Hayriye Ayhan, Robert D. Foley**

Consider a finite capacity queueing system with 2 custom classes. Upon arrival, customers offer a reward, which is paid upon acceptance into the system. At known periodic times, the parameters change. Under a conjecture, we show the existence of gain optimal policies that are periodic, monotonic and of threshold form.

**SA27 Scenario Generation for Simulation Inputs**

**Sponsor:** College on Simulation

**Sponsored Session**

**Chair:** Thomas R. Willemain, RPI, Dept. of Dec. Sci./Eng. Syst., 110 8th St., Troy, NY 12180-3590, willet@rpi.edu

**1) A Dynamic Method for Controlling Simulation Model Behavior, Robert Rush, Queues Enforth Development, 432 Columbia St., Ste. 21, Cambridge, MA 02141-1048, rpush@qed.com**

We describe a dynamically adaptive TS procedure for controlling the behavioral characteristics of forecasts generated by simulation models used for stochastic planning. The procedure allows decision-makers to perform customized risk analysis by choosing a pattern of future stochasticities for which they want a well-hedged strategy.

**2) A k-Nearest Neighbor Bootstrap for Generating Weather Scenarios, Balaji Rajagopalan, Intl. Research Institute for Climate Prediction, Lamont-Doherty Earth Observ., PO Box 1000, Rte. 9W, Palisades, NY 10964-8000, rbala@iri.ligo.columbia.edu, Upmanu Lall**

A method is provided to generate random sequences that honor the statistical properties of historical data. A "feature vector" is resampled by conditioning on k nearest neighbors of the vector. This is a nonparametric approximation of a multivariate Markov process. The method is applied to generation of daily weather scenarios.

**3) Adapting the Bootstrap to Generate Realistic Simulation Inputs, Thomas R. Willemain, RPI, Dept. of Dec. Sci./Eng. Syst., 110 8th St., Troy, NY 12180-3590, willet@rpi.edu, Omer F. Demirel**

Built-in input generators make unrealistic assumptions, especially about independence. Alternatively, historical trace data are realistic but provide only a single input stream. The bootstrap can convert one trace into many realistic inputs. We show how to quantify "realistic" and tune the bootstrap to perform well in this new job.

**SA28 Tutorial: Fulbright Scholarships: What are They & How to Get One**

**Sponsor:** Social Science Applications Section  
**Sponsored Session**

**Chair:** Myron Hatcher, California State University, Dept. of IS/DS, Craig Sch. of Bus., Fresno, CA 93740-0007, myron\_hatcher@csufresno.edu

**1) Fulbright Experience in Poland: A Case Study, Thaddeus W. Usowicz, California State University, School of Bus., San Francisco, CA 94127-2716, usowicz@sfsu.edu**

I will discuss how to obtain a Fulbright scholarship, share my experience and answer questions from the audience. The "scholarships" are usually for graduate students doing a dissertation. For faculty, there are research awards, combination research/lectureship and "senior lecturer" awards. The standard award for faculty is for 5 or 10 months...

**SA29 Operations Management I****Contributed Session**

**Chair:** David A. Nembhard, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706-1572, nembhard@engr.wisc.edu

1) **Relaxing Channel Separation - Integrating the Virtual Store**, *Ralf W. Seifert*, Stanford University, Terman Eng. 391, Stanford, CA 94305, seifert@stanford.edu, *Ulrich W. Thonemann*

We characterize the optimal base-stock levels in a distribution system where left-over stock at the retailers can be used to fulfill demand at a virtual store. We quantify the cost savings compared to maintaining strictly separate distribution channels and examine whether dedicated inventory should be used at the virtual store.

2) **Managing Capacity Under Mixed Steady & Random Demand**, *Ananth V. Iyer*, Purdue University, 1310 Krannert Bldg., Krannert Sch. of Mgmt., West Lafayette, IN 47907, aiyer@mgmt.purdue.edu, *Apurva Jain*

We model the use of capacity when demand is a mixture of steady and random orders. We model the lead time and inventory cost impact of the following approaches: pooled capacity, splitting capacity and use of scheduling priorities. We discuss managerial implications of each approach.

3) **Integrated Service Design Research: Issues & Opportunities**, *Rohit Verma*, DePaul University, Kellstadt Grad. Sch. of Bus., 1 East Jackson Blvd., Chicago, IL 60604, rverma@wppost.depaul.edu, <http://www.depaul.edu/~rverma>

While successful marketing offers a product-service package that appeals to the needs and desires of particular segments of customers, this effort is futile without the ability to efficiently manage, control and improve back-end service processes. We provide an overview of research projects in which we attempt to combine market utility models with relevant operating decisions.

4) **Productivity & Quality of Working Life: Human-Factor-Associated System Variation**, *Vivian Yeh*, University of Wisconsin, 1513 University Ave., Madison, WI 53706, yehy@cae.wisc.edu, *David A. Nembhard*

We investigate the system variation associated with human factors such as work schedules of individual workers, variety of the tasks and allocation of the workers in a manufacturing company. Management and workers benefit from the finding for its implications on the improvement of productivity/efficiency and quality of working life.

**SA30 Internet & Supply Chain Management**

**Sponsor:** INFORMS Computing Society

**Sponsored Session**

**Chair:** Hemant Bhargava, Carnegie Mellon University, Heinz Sch. of PP&M, 5000 Forbes Ave., Pittsburgh, PA 152123, bhargava@computer.org

1) **Intelligent Supply Chain Agents**, *Mark E. Nissen*, Naval Postgraduate School, 555 Dyer Rd., Code SM/Ni, Monterey, CA 93943-5000, mnissen@nps.navy.mil

The integration of buyer and seller supply chain processes is critical for enterprise speed and responsiveness. Intelligent agent technology offers good potential to overcome many limitations of current Web and EDI technologies. We discuss intelligent agents that represent and autonomously conduct business on behalf of various supply chain participants.

2) **The Real-Time Total Private Network Enterprise**, *Cosimo Spera*, Soma Research & Technology, 3131 Campbell, CA 95008, cosimo@soma-rt.com

We focus on the theoretical issues and practical challenge that we have faced while implementing part of the real-time private network for a major computer manufacturer. We detail the most relevant phases of such implementation and we report on some of the metrics used to measure the improvements.

3) **Real-World Examples of Internet Enabled Supply Chain Management**, *Chris Jones*, Aspen Technology, 19204 North Creek Parkway, Bothell, WA 98011

We discuss some internet enabled supply chain applications that have been deployed or are in development.

4) **Allocation of Capacity over the Internet**, *Vipul Agrawal*, NYU, Stern Sch. of Bus., 40 West 4th St., Ste. 700, New York, NY 10012, vagrawal@stern.nyu.edu, *Sridhar Seshadri*

We compare different web based mechanisms for the pricing and allocation of capacity to customers with heterogeneous preferences. The mechanisms we study include posting of prices, auctions, and resale. We analyze the effect of

demand uncertainty on the expected profit of the seller.

**SA31 Reliability Research**

**Cluster:** Reliability & Quality Engineering

**Invited Session**

**Chair:** Alice E. Smith, University of Pittsburgh, Dept. of IE, 1031 Benedum Hall, Pittsburgh, PA 15261, aesmith@engr.pitt.edu

**Co-Chair:** David W. Coit, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854-8018, coit@rci.rutgers.edu

1) **Software Reliability Modeling: A Comparative Discussion**, *Jorge L. Romeu*, IIT Research Institute, Ctr. for Information Tech., 201 Mill St., Rome, NY 13440, jromeu@iitri.org

Many different software reliability models have been developed and applied in the field. Such models have attempted to assess and forecast this elusive measure of quality, in a manner akin to what was previously done with hardware reliability. We present a comparative discussion of software reliability models, and of their main problems and limitations...

2) **A Proportional Hazard Degradation Model**, *Gholamhossein Eghbali*, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854-8018, *E. A. Elsayed*

We develop a statistics-based approach for analyzing degradation data obtained at normal operating conditions. The model is a PHDM and it assumes that the degradation criteria at  $t_1$  and  $t_2$  are proportional corresponding values of the degradation path. The degradation paths are nonlinear functions of time and the standard deviation is time-dependent...

3) **System Reliability Estimation with Binomial Sampling & Simulation by Blocks**, *Abdullah Konak*, Auburn University, Dept. of ISE, Dunstan Hall, Auburn, AL 36849, akonak@eng.auburn.edu, *Alice E. Smith*

We propose a Monte Carlo procedure for reliability estimation of a system consisting of highly reliable independent components. This procedure requires less random numbers than the crude Monte Carlo. A negative correlation is introduced among the state vectors, which leads to a smaller sampling variance. The efficiency of the procedure dramatically increases with increasing component reliabilities...

4) **Allocation of Developmental Testing Times for Superimposed Nonhomogeneous Subsystem Failure Intensities**, *David W. Coit*, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854-8018, coit@rci.rutgers.edu, *Tongdan Jin*

In the development of new electronic systems, planning of reliability growth test has become more critical and more difficult as testing budgets diminish. A new method is presented to allocate subsystem reliability growth test time to maximize the system mean time between failure or system reliability for limited testing resources...

**SA32 Telecommunication Topics**

**Contributed Session**

**Chair:** Steven R. Powell, California State Polytech University, CIS Dept., 3801 West Temple Ave., Pomona, CA 91768, srpowell@csupomona.edu

1) **Applied Remote Diagnostics in Paper Machinery: Case Valmet Oyj**, *Anssi Mattila*, University of Jyväskylä, Sch. of Bus. & Economics, PO Box 35, Asemakatu 4, Jyväskylä, 40351, Finland, anmima@tukki.jyu.fi

We evaluate whether the existing technologies in remote diagnostics can be applied to the paper machinery industry. So far, this stream of information technology has been applied, e.g., in medicine. The following issues will be considered: the speed, privacy and creditability of real time data transfer.

2) **Numerical Inversion of Laplace Transform using Piecewise Legendre Polynomials**, *Peter W. den Iseger*, Erasmus University, Econometric Inst., Rm. H11-29, Fac. of Economics, PO Box 1738, Rotterdam, 3000 DR, The Netherlands, iseger@few.eur.nl

Many important characteristics of models used within the field of OR can be represented in terms of Laplace transforms. With the new method, many important quantities of these models can be calculated with attaining the machine precision. One can also obtain piecewise polynomial approximations of these quantities.

3) **Global Consolidation in the Telecommunications Industry**, *Steven R. Powell*, California State Polytech University, CIS Dept.,

3801 West Temple Ave., Pomona, CA 91768, srpowell@csupomona.edu

Merger and acquisition activity among common carriers in the telecommunications industry has become a worldwide phenomenon. We examine the technological, regulatory, organizational and market factors which are driving the industry's consolidation and address the effect that industry consolidation will have on public telecommunications policy.

### SA33 Panel: Emerging Issues & Directions in Quality, Statistics & Reliability - Editors' Point of View

Sponsor: Quality, Statistics & Reliability  
Sponsored Session

Chair: Jianjun Shi, University of Michigan, Dept. of IOE, 1815 IOE Bldg., Ann Arbor, MI 48109-2117, shihang@engin.umich.edu

1) Panel: Emerging Issues & Directions in Quality, Statistics & Reliability - Editor's Point of View, *E. A. Elsayed*, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, elsayed@rci.rutgers.edu, *Hoang Pham*, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854-8018, hopham@rci.rutgers.edu, *Timothy Read*, Dupont Company, *G. Geoffrey Vining*, Virginia Tech, Dept. of Statistics, Blacksburg, VA 24061

This is a special panel to invite journal editors to address their view on the emerging issues & directions in quality, statistics and reliability. Editors from IE Transactions, Journal of Quality Technology, Technometrics and the International Journal of Reliability will contribute. The panel will include short presentations given by each panelist and Q&A discussions.

### SA34 Achieving Efficient Supply Chain Management

Cluster: Manufacturing Systems  
Invited Session

Chair: Amy Z. Zeng, University of North Carolina, Cameron Sch. of Bus., Dept. Production & Dec. Sci., Wilmington, NC 28403-3297, zenga@uncwil.edu

1) Measures of Quality along a Food Supply Chain, *Jack C. Hayya*, Pennsylvania State University, Dept. of MS, 303 Beam Bldg., University Park, PA 16802, jch@psu.edu, *Xin X. He*

The philosophy of supply chain management involves the elimination of organizational boundaries so that the end-customer can be quickly provided with a safe, fresh product. In this context, we examine how the quality measures evolve as go we from the upstream to the downstream end of the supply chain...

2) Analysis of Variability Control Mechanisms in Multi-Echelon Distribution Systems, *Joseph Geunes*, University of Florida, Dept. of ISE, 303 Weil Hall, Gainesville, FL 32611, geunes@ise.ufl.edu

Distribution systems often contain several echelons consisting of different firms that interact only through product ordering and delivery. Chain members observe demand and optimize their own operations without considering the impact on system performance. We investigate practical mechanisms that coordinate operations in distribution systems involving manufacturing, warehousing and retail stages.

3) The Effects of the Shape of Lead-Time Demand Distribution on the Logistics System Costs, *John E. Tyworth*, Pennsylvania State University, 509F Bus. Admin. Bldg., Dept. of Bus. Logistics, University Park, PA 16802, jet@psu.edu, *Amy Z. Zeng*

Service level or shortage cost is frequently used to deal with the LTD when making inventory-logistics decisions in supply chain management. We clarify the discussion of the appropriate form of the total cost function and examine the sensitivity of the decisions to the shape of the distribution of LTD.

4) Minimizing Response Time in a Multi-Product Production System with Significant Changeover Times, *Mark L. Spearman*, University of Alabama, Coll. of Commerce/Bus. Admin., 3000 Alston Hall, Box 870226, Tuscaloosa, AL 35487-0226, mspearman@cba.ua.edu

We consider the problem of determining the batch sizes that minimize total system flow time for a system that makes several different products in which a significant changeover time occurs whenever the product changes. We obtain the counter intuitive result that smaller process batch sizes should accompany longer changeover times.

### SA35 Tutorial: Leveraging the Internet in Business Applications

Invited Session

Chair: Albert Angehrn, INSEAD, Technology Mgmt. Area, Fontainebleau, France, albert.angehrn@insead.fr

1) Tutorial: Leveraging the Internet in Business Applications, *Albert Angehrn*, INSEAD, Technology Mgmt. Area, Fontainebleau, France, albert.angehrn@insead.fr

Electronic commerce and Internet-related business applications are an exciting field for research as well as for experimenting with innovative, IT-enhanced learning methods. This tutorial will address the theory and practice of studying and teaching Internet business applications, focusing in particular on issues of high managerial relevance, i.e., linking IT to a company's business strategy...

### SA36 Data Envelopment Analysis

Cluster: DEA

Invited Session

Chair: Joe Zhu, Worcester Polytechnic Institute, Dept. of Mgmt., 100 Institute Rd., Worcester, MA 01609, jzhu@wpi.edu

1) An Equivalent Model for Solving DEA Models that Excludes the Column(s) being Scored, *Paul P. Rouse*, University of Auckland, Dept. of Acct. & Finance, Private Bag, Auckland, 92019, New Zealand, p.rouse@auckland.ac.nz, *Knox Lovell*

DEA models in which the producers being evaluated are excluded from the envelopment LP technology matrix have been proposed for several purposes: as a tie-breaking technique, as a way of identifying outliers, as a way of overcoming the truncation problem when DEA scores are used as dependent variables in second stage regressions...

2) Indices of Fortune 500 Companies using DEA, *Agha Iqbal Ali*, University of Massachusetts, School of MFOM, Amherst, MA 01003, aiali@som.umass.edu, *Yao Chen*

We use Fortune 500 rankings that are published annually to produce 3 indices of performance that are computed using DEA. By combining the data in 3 different ways, we define a labor efficiency index, an operation leanness index and a resource utilization index. The interpretation of these indices is illustrated for 2 industries: motor vehicle and computer and office equipment.

3) Chance Constrained & Cone Dominance in DEA Models, *Zhimin Huang*, Adelphi University, Sch. of Mgmt. & Business, 1 South Ave., Box 701, Garden City, NY 11530, huang@panther.adelphi.edu, *Susan Li*

We present cone chance constrained models in DEA. Efficiency measure of a decision making unit (DMU) is defined via overall cone probabilistic comparisons of inputs and outputs with other DMUs and can be characterized by solving a chance constrained programming problem.

4) A Unified Additive Model Approach for Evaluating Inefficiency & Congestion with Associated Measures in DEA, *Joe Zhu*, Worcester Polytechnic Institute, Dept. of Mgmt., 100 Institute Rd., Worcester, MA 01609, jzhu@wpi.edu, *William W. Cooper*, *Lawrence M. Seiford*

We develop a necessary and sufficient condition for the presence of (input) congestion. Our approach detects congestion, determines the amount of congestion and identifies factors responsible for congestion and distinguishes congestion amounts from other components of inefficiency. These amounts are all obtainable from non-0 slacks in a slightly altered version of the additive model.

### SA37 Panel: The Art & Tools of Teaching Decision Analysis

Sponsor: INFORM-ED

Sponsored Session

Chair: Jack M. Kloeber, Jr., Air Force Institute of Technology, Dept. of Operational Sci., 2950 P St., Bldg. 640, WP AFB, OH 45433-7765, jack.kloeber@afit.af.mil

1) Panel: The Art & Tools of Teaching Decision Analysis, *Craig W. Kirkwood*, Arizona State University, Dept. of Management, Tempe, AZ 85287-4006, craig.kirkwood@asu.edu, *Gregory S. Parnell*, US Military Academy, Dept. of Systems Eng., Mahan Hall, rm. 432, West Point, NY 10996, fg7526@usma.edu, *Jack M. Kloeber, Jr.*, Air Force Institute of Technology, Dept. of Operational Sci., 2950 P St., Bldg. 640, WP AFB, OH 45433-7765, jack.kloeber@afit.af.mil, *Michael R. Middleton*, University of San Francisco, McLaren Sch. of Business, 2130 Fulton St., San

Francisco, CA 94117-1080, middleton@usfca.edu

There have been several excellent texts published in the past five years which, combined with improved software, have greatly increased our ability to teach relevant decision analysis to undergraduate through graduate students. Our panel will discuss issues regarding methods of teaching DA, with comments on innovative teaching styles and techniques and which software works best for different levels of students interested in DA.

## Sunday 10:15-11:45

### SB01 Insights from Past Lives of Decision Analysis Practitioners

Sponsor: Decision Analysis Society  
Sponsored Session

Chair: Jeff Keisler, Strategic Decision Group, One Boston Place, 39th Floor, Boston, MA 02108-4467, jkeisler@sdg.com

1) **An Interdisciplinary Look at Decision Analysis**, *Todd Anderson*, Strategic Decision Group, One Boston Place, 39th Floor, Boston, MA 02108-4467, tanderson@sdg.com

Decision analysis is especially useful in interdisciplinary problems because different effects and constituencies have to be weighted appropriately in order to obtain a solution. This idea will be highlighted by drawing on the author's academic research in biophysical chemistry and industrial experience.

2) **Using Game Theory in Strategic Decision Analysis**, *Waseem Noor*, Strategic Decision Group, One Boston Place, 39th Floor, Boston, MA 02108-4467, wnoor@sdg.com

For business decision problems with a game theoretic flavor, practical decision analysis tools can be augmented to reintegrate the concepts of decision tree and game tree. We explore when and how this could be useful.

3) **Exploiting Parallelism in Decision Problems**, *Robert P. Hewes*, Strategic Decision Group, One Boston Place, 39th Floor, Boston, MA 02108-4467, bhewes@sdg.com, *Jeff Keisler*

Many decision problems have an inherently parallel nature, but often times the parallelism goes unexploited. Through analogy with parallel computation, we develop a set of constructs to describe this aspect of decision problems. We demonstrate the concepts by applying them to resource allocation problems.

4) **Ideas for Decision Analysis from Model Theory**, *Jeff Keisler*, Strategic Decision Group, One Boston Place, 39th Floor, Boston, MA 02108-4467, jkeisler@sdg.com, *H. Jerome Keisler*

Ideas from model theory, an area within mathematical logic, are explored for potential application in decision analysis. Definitions for concepts such as models, theories, expressibility and decidability may be useful in describing how different people in an organization think and what can happen when they come together.

### SB02 Combinatorial Approaches to Linear Programming Problems

Cluster: Combinatorial Optimization & Network Flows  
Sponsor: Optimization Section  
Sponsored Session

Chair: Daniel Bienstock, Columbia University, Dept. of IEOR, New York, NY 10027, dano@ieor.columbia.edu

1) **A Combinatorial Optimization Approach to Choosing Population Samples for Genetic Mapping**, *Daniel G. Brown*, Cornell University, Dept. of Comp. Sci., 4141 Upson Hall, Ithaca, NY 14853, snowman@cs.cornell.edu, *T.J. Vision*, *S.D. Tanksley*, *David B. Shmoys*, *R.T. Durrett*

Given large populations of test individuals, geneticists seek small samples whose genetic mapping quality is still high. We design LP models for this problem, study its complexity and find samples through randomized rounding and greedy algorithms. While the problem is NP-hard even to approximate, our results are consistently good.

2) **On the Multicommodity-Flow Approach to Low-Congestion Routing**, *Aravind Srinivasan*, Bell Labs, Lucent Technologies, Rm. 2C-302A, 700 Mountain Ave., Murray Hill, NJ 07974-0636, srin@research.bell-labs.com, *F. Thomson Leighton*, *Satish Rao*

Multi-commodity flow provides a natural relaxation for several routing problems. We sketch how it is useful in the context of routing in expander graphs: networks that are well known to have good routability and fault-tolerance properties. We also show certain worst-case relationships between fractional congestion (a bound that is given by a certain multicommodity flow relaxation) and...

3) **Latest Computational Experiments with Approximate LP-Solver**, *Daniel Bienstock*, Columbia University, Dept. of IEOR, New York, NY 10027, dano@ieor.columbia.edu

We present ongoing computational experiments involving our implementation of the epsilon-approximation approach initially developed by Plotkin, Shmoys & Tardos and Grigoriades & Khachiyan, as applied to the approximate solution of large LPs. On instances of practical interest, our code outperforms commercial LP solvers by a factor of 20 or more.

### SB03 Supply Chain Management

Sponsor: Manufacturing & Service Operations Management  
Sponsored Session

Chair: Ravi Anupindi, Northwestern University, MEDS Dept., KGSM, 2001 Sheridan Rd., Evanston, IL 60208, r-anupindi@nwu.edu

1) **Optimal Contracting in Long-Term Supplier Relations**, *Paul R. Kleindorfer*, University of Pennsylvania, The Wharton School, 3620 Locust Walk, Philadelphia, PA 19104-6366, kleindorfer@wharton.upenn.edu, *Moti Levi*

We use a multi-period principal-agent framework to analyze long-term supply relationships in the presence of relationship specific investments. Building on Williamsonian transactions cost theory and case studies, we explore a "middle way" between markets and hierarchies in which suppliers and buyers make specific investments to enable long-term strategic partnerships.

2) **Competitive Analysis of Capacity Options**, *Sridhar Tayur*, Carnegie Mellon University, Grad. Sch. of Indust. Admin., Pittsburgh, PA 15213, stayur@grobner.gsa.cmu.edu

A supplier of capacity, such as natural gas storage, provides multiple manufacturers who compete in the same (recently deregulated) market. Motivated by a CEO request to understand strategic issues, we study the effects of uncertainty and number of manufacturers on channel co-ordination, price (hence quantity) and profitability.

3) **Incentive Alignment in a Supply Chain with Channel Assembly & Component Commonality**, *Lingxiu Dong*, Stanford University, IEEM Dept., Stanford, CA 94305-4024, *Hau Leung Lee*

Due to the risk pooling effect, component commonality is highly desirable to assembly operators. We examine the channel assembly program in the PC industry in which a distributor assembles multiple brand products and orders components from a supplier. We demonstrate that a centralized first best solution in inventory stocking decisions can be achieved...

4) **Informational Effects on Supplier-Retailer Contracting**, *Krishnan S. Anand*, Northwestern University, KGSM, Sheridan Rd., Leverone Hall, 2001, Evanston, IL 60208-2001, anand@nwu.edu, *Ravi Anupindi*, *Yehuda Bassok*

We develop a dynamic model of a supplier and a retailer, with only the retailer having access to demand information. We show that both informational issues and the retailer's inventory-holding costs are key determinants of the supplier-retailer contract. One consequence is that holding-cost subsidies can be an important strategic weapon for the supplier.

### SB04 Simulation Applications II Contributed Session

Chair: Thomas F. Brady, Purdue University North Central, 1401 South US Highway 421, Westville, IN 46391, tbradyjr@purdue.edu

1) **Disease Description: From Worms & Germs to OR/MS**, *Chindripu P. Arun*, Ayr Hospital, Dept. of Urology, Ayr, KA6 6DX, Scotland, UK, arunpeter@yahoo.com

Just as the germ theory of disease helped describe infectious diseases, the concepts of queueing and inventory are helping describe and understand diseases of pathologic physiology. Previous papers have dealt with queueing models; the present paper describes how the concept of inventory control is advancing our understanding.

2) **Use of OR Tools to Evaluate Improved Bio Response Program Templates**, *John D. Walther*, US Department of Defense Army, ECBC, E3330, Rm. 133, AMSSB-REN-DA Walther, Aberdeen Proving Gr., MD 21010, jdwalthe@apea.army.mil, *Freeman F. Marvin*, *Susan A. Hayes*

As part of the Congressionally mandated program to improve our nation's response to chem/bio terrorism, a Response Template has been developed to help cities manage activities required to respond to bio incidents. A comprehensive evaluation methodology, using several OR techniques, has been developed to test and validate the template.

3) **A New Efficient Approach to Genetic Algorithms, Renyou Wang**, Carnegie Mellon University, Dept. of Eng. & Public Policy, 5000 Forbes Ave., Pittsburgh, PA 15213, renyou@andrew.cmu.edu, **Urmila Diwekar**

GAs use random mutation and crossover for generation movement. We will incorporate the constrained and stratified sampling techniques, such as Latin hypercube sampling method, median Latin hypercube sampling method and especially Hammersley sampling method, into a GA to improve its performance.

4) **Computer Simulation, the Bullwhip Effect & Long, Serial Assembly Lines, Thomas F. Brady**, Purdue University North Central, 1401 South US Hwy 421, Westville, IN 46391, tbradyjr@purduenc.edu

We examine the use of a computer simulation model to analyze a long, complex serial assembly line used in making television sets. In particular, we focus on the identification and analysis of critical areas in the line and show empirical evidence of the bullwhip effect. Finally, we show how optimization was used to improve the performance of the line.

## SB05 Decision Analysis I Contributed Session

**Chair:** Lawrence D. Phillips, London School of Economics & Political Science, Dept. of Operational Research, Houghton St., London, WC2A 2AE, UK, larry\_phillips@msn.com

1) **Emerging Roles for Management Science Topics in Strategic Planning, Abe Feinberg**, California State University, MS Dept., MS 8245, Northridge, CA 91330, abe.feinberg@csun.edu, http://www.csun.edu/~hcmgt004/

In strategic planning, issues in finance, marketing and management often capture the greatest attention. Other than principles of operations management, major roles for MS topics are not obvious. Recent software developments for strategy analysis have included significant uses of DA and simulation. Several examples will be presented.

2) **Competence Set Analysis & Multicriteria Decision Making, P. L. Yu**, University of Kansas, Sch. of Business, 350E Summerfield Hall, Lawrence, KS 66045-2003, yupl@cc.nctu.edu.tw, **C. I. Chiang, G. H. Tzeng**

For each significant decision problem, there is a competence set consisting of ideas, knowledge, information and skills for its satisfactory solution. Many nontrivial multicriteria decisions are solved by expanding the competence set, which expands the outcomes of multicriteria (outcome space). We discuss how to effectively expand the competence sets to solve challenging multicriteria decision problems.

3) **withdrawn - author request of 9/21, Jacques Teghem**, Faculte Polytechnique de Mons, 9 rue de Houdain, Mons, B-7000, Belgium, teghem@mathro.fpm.ac.be, **Taicir Loukil**

4) **An Introduction to Decision Conferencing, Lawrence D. Phillips**, London School of Economics & Political Science, Dept. of Operational Research, Houghton St., London, WC2A 2AE, UK, larry\_phillips@msn.com

Decision conferencing is a series of intensive working meetings whose unique feature is the creation, on-the-spot, of a multi-attribute decision analytic model which provides participants with a 'tool for thinking'. The paper presents the latest developments in this 'socio-technical' approach to decision analysis.

## SB06 Yield Management Applications

**Sponsor:** Manufacturing & Service Operations Management  
Sponsored Session

**Chair:** Ziv Katalan, University of Pennsylvania, The Wharton Sch., OPIM Dept., 1314 SH-DH, Philadelphia, PA 19104-6366, katalan@wharton.upenn.edu

1) **A Bid Price Approach to Capacity Expansion in Telecom Services, Garrett J. van Ryzin**, Columbia University, 412 Uris Hall, Grad. School of Bus., New York, NY 10027, gjv1@columbia.edu, **Itir Karaesman**

Telecom service providers must plan the expansion of capacity for inter-office channels (IOCs) and equipment cards based on anticipated demand. Because they have considerable flexibility in provisioning service, determining when and where capacity should be added is complex. We discuss work on a marginal value (bid price) approach to this problem.

2) **Revenue Management with Cancellations, Overbookings & No-Shows, Shaler Sridham, Jr.**, University of North Carolina, Dept.

of OR, CB 3180, 210 Smith Bldg., Chapel Hill, NC 27599-3180, sandy@email.unc.edu, **Conrad J. Lautenbacher**

We report on our continued studies of revenue management with cancellations, overbooking and no-shows, based on formulation as a queuing control problem. New numerical results are presented, along with economic interpretations, approximations and implications for network problems.

3) **Optimal Dynamic Pricing for Perishable Assets with Shifting Customer Reservation Proce, Wen Zhao**, University of Pennsylvania, OPIM Dept., The Wharton Sch., Philadelphia, PA 19104, **Yu-Sheng Zheng**

Price changes are used for 2 reasons: to compensate for statistical demand fluctuations and to adapt to shifts of customers' reservation prices over time. The latter could be more significant. We show the optimal price is decreasing in the inventory, but not necessarily over time if the reservation price shifts.

4) **Managing Rental Services with a Heterogeneous Customer Base, Sergei Savin**, University of Pennsylvania, The Wharton Sch. 1300 SH-DH, 3620 Locust Walk, Philadelphia, PA 19104-6366, **Morris A. Cohen, Noah F. Gans, Ziv Katalan**

Many rental businesses face the problem of managing their service capacity in the presence of both seasonality and demand uncertainty. We develop a modeling framework for this environment that combines long-term, strategic fleet sizing decisions with tactical, yield-management decisions. Structural properties of optimal capacity management policies are derived.

## SB07 Panel: Research Opportunities & New Initiatives at the National Science Foundation

**Cluster:** Manufacturing & Logistics

**Invited Session**

**Chair:** Lawrence M. Seiford, National Science Foundation, OR/Production Systems Program, 4201 Wilson Blvd., Arlington, VA 22230, lsieford@nsf.gov

1) **Panel: Research Opportunities & New Initiatives at the National Science Foundation, Louis A. Martin-Vega**, National Science Foundation, Innovation/Organizational Chng, 4201 Wilson Blvd., Arlington, VA 22230, lmartinv@nsf.gov, **Lawrence M. Seiford**, National Science Foundation, OR/Production Systems Program, 4201 Wilson Blvd., Arlington, VA 22230, lsieford@nsf.gov, **Joseph E. Hennessey**, National Science Foundation, Innovation/Organizational Chng, 4201 Wilson Blvd., Arlington, VA 22230, jhennes@nsf.gov, **Jeryl L. Mumpower**, National Science Foundation, SBER, Rm. 995, 4201 Wilson Blvd., Arlington, VA 22230, jmumpowe@nsf.gov

The National Science Foundation has initiated many research opportunities related to manufacturing, operations research, information technology and logistics. In this panel, these research opportunities and new initiatives at NSF will be discussed.

## SB08 Improving the Provisioning Process at Lucent Technologies

**Cluster:** Manufacturing & Logistics

**Invited Session**

**Chair:** Kedar S. Naphade, Lucent Technologies, PO Box 900, Princeton, NJ 08542-0900, knaphade@lucent.com

1) **Applying Target-Costing Methods & Tools to New Products, H. M. B. Bird**, Bell Labs., Lucent Technologies, PO Box 900, Princeton, NJ 08542-0900, hbird@lucent.com, **M. B. Clifton, W. P. Townsend**

Target costing is a market-driven process for developing competitive products. We have applied target costing to a large number of new families of manufactured telecommunications products, with excellent results. We describe our approaches and processes and some of the analytical tools and methods that we have used.

2) **TopOff: A New Pull Manufacturing Link in Factory Supply Chains: Description, Practice & Analysis, David S. Mohoric**, Lucent Technologies, Optical Networking Group, 1600 Osgood St., North Andover, MA 01845-1043, mohoric@lucent.com, **Geoffrey C. Scott**

At the factory level, pull manufacturing is an important link in flexible, responsive corporate supply chains. Recently, a new pull manufacturing paradigm, TopOff, was developed within Lucent. This offers several advantages over traditional pull systems. We describe TopOff, our experiences with implementing it in a large Lucent factory and on-going operations modeling and

analysis that promote it.

**3) Risk Analysis helps Lucent Transition to New Technologies, Kedar S. Naphade**, Lucent Technologies, PO Box 900, Princeton, NJ 08542-0900, knaphade@lucent.com

When product technology changes, timing the cut off of materials purchasing for the old generation and the initial purchasing of materials for the new technology is a critical and high dollar risk decision. We describe the problem and a quick and dirty model that assists decision making for such transitions.

### SB09 Panel: New Directions in Group Decision & Negotiation I

**Sponsor:** Group Decision & Negotiation Section  
Sponsored Session

**Chair:** Melvin F. Shakun, NYU, Stern Sch. of Bus., 44 West 4th St., New York, NY 10012-1126, mshakun@stern.nyu.edu

**1) New Directions in Group Decision & Negotiation I, Melvin F. Shakun**, NYU, Stern Sch. of Bus., 44 West 4th St., New York, NY 10012-1126, mshakun@stern.nyu.edu, **Kalyan Chatterjee, Rachel Croson, Peri H. Iz, D. Marc Kilgour, Brenda Zimmerman**

This double panel session will discuss new research and application directions in group decision and negotiation. Panel members will make opening remarks followed by panel discussion with audience participation.

### SB10 Semidefinite Programming & its Applications I

**Cluster:** Optimization & Applications

**Sponsor:** Optimization Section  
Sponsored Session

**Chair:** Masakazu Kojima, Tokyo Institute of Technology, Dept. of Math. & Comp. Sci., 2-12-1 Oh-Okayama Meguro-ku, Tokyo, 152, Japan, kojima@is.titech.ac.jp, www.is.titech.ac.jp/labs/kojimalab/kojima/

**1) A QQP-Minimization Method for Nonconvex Semidefinite Programs, Florian Jarre**, University of Wuerzburg, Angewandte Mathematik, Am Hubland, Wuerzburg, D-97074, Germany, jarre@mathematik.uni-wuerzburg.de

We discuss a method for smooth unconstrained nonconvex minimization. Here, the usual linear systems of the Newton step are replaced by simple quadratically constrained quadratic programs. This method is then used within a barrier method for solving nonconvex semidefinite programs. Some global convergence results are given along with numerical examples.

**2) Preconditioned Conjugate Gradient Methods for Large Scale & Dense Linear Systems in Semidefinite Programming, Kazuhide Nakata**, Tokyo Institute of Technology, Dept. of Math. & Comp. Sci., 2-12-1 Oh-Okayama Meguro-ku, Tokyo, 152, Japan, nakata@is.titech.ac.jp, **Shao-Liang Zhang, Masakazu Kojima**

To solve large scale and dense linear systems arising in each iteration of primal-dual interior-point method for semidefinite programming, we incorporated the conjugate gradient method into the semidefinite programming algorithm. We present some preconditioners for the conjugate gradient method and their numerical comparison.

**3) A .699-Approximation Algorithm for Max-Bisection, Yinyu Ye**, University of Iowa, Dept. of MS, S384 Pappajohn Bldg., Iowa City, IA 52242-1000, yinyu-ye@uiowa.edu

We present a .699-approximation algorithm for max-bisection, i.e., partitioning the nodes of a weighted graph into two blocks of equal cardinality so as to maximize the weights of crossing edges. This is an improved result from the .651-approximation algorithm of Frieze & Jerrum and the semidefinite programming relaxation of Goemans & Williamson.

**4) Global Optimization of General Nonlinear Programs via Successive Convex Relaxation, Masakazu Kojima**, Tokyo Institute of Technology, Dept. of Math. & Comp. Sci., 2-12-1 Oh-Okayama Meguro-ku, Tokyo, 152, Japan, kojima@is.titech.ac.jp, www.is.titech.ac.jp/labs/kojimalab/kojima/

We present how we extend the successive convex relaxation methods developed by Kojima and Tuncel for nonconvex quadratic programs to general nonlinear programs.

### SB11 Verified Global Optimization

**Cluster:** Global Optimization

**Sponsor:** Optimization Section  
Sponsored Session

**Chair:** R. Baker Kearfott, University of Southwestern Louisiana, Dept. of Math., Box 4-1010, Lafayette, LA 70504-1010, rbk@usl.edu

**1) Numerica: An Overview & Examples, Pascal Van Hentenryck**, Universite Catholique de Louvain, Dept. of Comp. Science & Eng., 2 Place Sainte-Barbe, Louvain la Neuve, B-1348, Belgium, pvh@info.ucl.ac.be

No abstract supplied.

**2) An Overview of the GlobSol Package, R. Baker Kearfott**, University of Southwestern Louisiana, Dept. of Math., Box 4-1010, Lafayette, LA 70504-1010, rbk@usl.edu

With hardware and software advances, verified global optimization is becoming increasingly practical. The GlobSol package, initially a research code, has evolved into a general package for rigorous bounds on solutions to a number of practical NLP problems. The capabilities, use and installation of GlobSol will be outlined and illustrated.

**3) Application of the GlobSol Package, George F. Corliss**, Marquette University, Dept. of Math, Stats. & CS, Milwaukee, WI 53233, georgec@mscs.mu.edu

Engineers often must optimize designs of physical or electronic devices by minimizing an objective, e.g., stress or fit to a design curve, that is computed by extensive finite element computations. We apply the "all-together" method of Dennis & Williamson and use Kearfott's GlobSol to solve the resulting constrained optimization problem.

**4) Compiler & Programming Language Support for Verified Global Optimization, G. William Walster**, Sun Microsystems, MTV12-40, 2550 Garcia Ave., Mountain View, CA 94043, bill.walster@eng.sun.com

Computing verified solutions to constrained and unconstrained nonlinear global optimization problems is one of the most important practical results of interval arithmetic and analysis. Routine practical commercial applications of interval global optimization require both commercial compiler and programming language support of interval data types. The form of this support and the steps required to produce it are described.

### SB12 Sales Force Models

**Sponsor:** College of Marketing

Sponsored Session

**Chair:** Pradeep P. Bhardwaj, UCLA, Los Angeles, CA

**1) On the Optimality of Delegating Pricing Authority to the Salesforce, Kissan Joseph**, University of Kansas, 345J Summerfield Hall, Lawrence, KS 66045

Marketing theory prescribes that delegating pricing authority to the salesforce will improve profits. Surprisingly, the available empirical evidence reveals just the opposite to be true. Thus, we develop a model that re-examines the optimality of the price delegation decision.

**2) Adjusting for Controllable vs Uncontrollable Performance Variables in Performance Evaluation: Effects on Ratings & Fairness, Cynthia Huffman**, University of Delaware, Lisa Cain

We report on 2 experiments examining the effects on fairness and performance ratings of making adjustments for controllable vs. uncontrollable intermediate variables in performance evaluation. Results show that, as expected, performance ratings are adjusted for intermediate variables, here selling price and course difficulty. Results support predictions that performance ratings are more extreme...

**3) Delegating the Promotion Function to the Salesforce under Conditions of Moral Hazard & Adverse Selection, Sanjog Misra**, University of Rochester, Simon Sch. of Business, Rochester, NY

The issue of moral hazard in the compensation of salespeople has been researched in some detail (Basu et al. 1985, Lal & Srinivasan, 1993). However, most of these models assume that marketing mix elements do not interact with the design of a compensation plan. We discuss the issue of delegating the promotion function to the salesforce...

**4) Compensation Schemes for National Account & Field Representatives, Pradeep P. Bhardwaj**, UCLA, Los Angeles, CA

Previous research argues that heterogeneity in the salesforce is the main reason why firms offer different contracts to different members of the salesforce. We propose a model to understand why do firms offer different contracts to ex ante homogeneous sales reps?

**SB13 Measurement & Modeling Issues in Consumer Behavior**

**Sponsor:** College of Marketing  
Sponsored Session

**Chair:** Eric Greenleaf, NYU, Stern Sch. of Business, 44 West 4th St., Rm. 8-94, New York, NY 10012-1126

1) **The Evolution of Preferences & Choice Behaviors of Consumers in a New Market**, *Carrie M. Heilman*, Washington University, Olin Sch. of Bus., Box 1133, 1 Brookings Dr., St. Louis, MO 63130, *Douglas Bowman*, *Gordon P. Wright*

We examine how customer loyalty, price sensitivity and brand preferences evolve over purchases made by consumers who are new to a category. Our theory is based on the notion that the desire to collect information about alternatives and risk aversion to lesser known brands (i.e., private labels) drive initial brand choices. Once information search is completed, subsequent choices reveal loyalty to a preferred brand(s).

2) **When & Why does Consumer Stockpiling Accelerate Consumption Volume?**, *Pierre Chandon*, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, England, UK, *pchandon@lbs.ac.uk*, *Brian Wansink*

Managers and researchers often assume that each individual has a fixed level of consumption from which different brands can draw. We show how the household stockpiling that can result from sales promotions can accelerate consumption and increase primary demand. By integrating the psychological and economic antecedents of product consumption, a framework is developed...

3) **The Fault is Not in Our Scales but in Ourselves: How Response Styles Weaken Correlations from Surveys**, *Eric Greenleaf*, NYU, Stern Sch. of Business, 44 West 4th St., Rm. 8-94, New York, NY 10012-1126, *Geeta Menon*, *Barbara Bickart*

We examine how response styles weaken true correlations between marketing variables measured with rating scales, which adds to weakening already caused by scale discreteness. We find empirically that the former often exceeds the latter and assess how it reduces statistical power and distorts market research.

4) **Comparison between Pre- & Post-Purchase Product Evaluation Processes: Exploring Nature of Enduring, Receding & Emerging Evaluative Criteria**, *Kimberly Taylor*, Florida International University, Mktg. Dept., University Park, Miami, FL 33199, *Mary Jane Burns*

Little previous research specifically links consumers' pre-purchase and post-purchase evaluations. We propose a descriptive framework of the ways in which these 2 sets of criteria might differ, i.e. some types of criteria endure in importance, while others recede or emerge, and test this framework in a laboratory study. Implications of these results for both academic researchers and marketing practitioners are given.

**SB14 Technology & Organizational Economics**

**Sponsor:** Technology Management Section/College on Organization Science  
Sponsored Session

**Chair:** Brian S. Silverman, Harvard Business School, Soldiers Field, Boston, MA 02163, *bsilverman@hbs.edu*

1) **Learning & Leakage: Implications for Alliance Organization**, *Joanne E. Oxley*, University of Michigan, Sch. of Bus. Admin., 701 Tappan St., Ann Arbor, MI 48109-1234, *oxley@o.imap.itd.umich.edu*

Inter-firm alliance participants frequently face a dilemma: how do we promote knowledge transfer and learning while safeguarding valuable intangible assets? We synthesize insights from transaction cost economics and organization theory to explore this, examining relationships between project characteristics, "knowledge transfer mechanisms" and governance safeguards adopted by alliance participants.

2) **Complementary Capabilities & the Adoption of New Technology: The Case of the Three-Strip Technicolor Process**, *Douglas R. Johnson*, University of Illinois, 350 Commerce West Bldg., 1206 South 6th St., Champaign, IL 61820, *drjohn@cba.uiuc.edu*, *Stephen Bowden*

We investigate adoption of the 3-strip technicolor process by directors/cinematographers in the Hollywood studio system. We argue that adoption by these individuals is influenced by their capabilities, their employers' strategic objectives, and most importantly, their access to necessary complementary skills. We use network analysis to assess such access.

3) **Core Technologies, Peripheral Technologies & Corporate Diversification**, *Brian S. Silverman*, Harvard Business School,

Soldiers Field, Boston, MA 02163, *bsilverman@hbs.edu*

We consider how a firm's technological resources affect its diversification pattern. It integrates elements of TCE and the RBV to explore how a firm's decision to exploit technological resources through diversification, rather than licensing, is affected by the degree to which the technological resources comprise the firm's "core technology."

4) **Does it Pay to Let Scientists Do Good Science? Evidence from R&D Job Offers**, *Scott Stern*, MIT, Sloan Sch. of Mgmt., 50 Memorial Dr., Cambridge, MA 02144

We evaluate the impact of organizational design on the labor market for scientists/engineers - notably, how "science-friendly" practices are related to wages. Two theories, "productivity" and "preference," offer conflicting hypotheses concerning this relationship. We introduce a novel field-based approach to evaluate this relationship and consequently distinguish between theories.

**SB15 International Aspects of Technological Development**

**Sponsor:** Technology Management Section  
Sponsored Session

**Chair:** William T. Flannery, University of Texas, Mgmt. of Technology Program, 6900 North Loop, 1604 West, San Antonio, TX 78249-0634, *wflannery@utsa.edu*

1) **Technology Transfer in the International Area: Exploring Technology Transfer Differences**, *William T. Flannery*, University of Texas, Mgmt. of Technology Program, 6900 North Loop, 1604 West, San Antonio, TX 78249-0634, *wflannery@utsa.edu*

With the rapid globalization of technology-based economies brought on by advances in IT, international technology transfer is best understood as a dynamic dependent upon geographic and industry specifics. We will examine aspects of the technology transfer process that appear to be interdependent upon these specifics.

2) **Incubating & Sustaining Learning & Innovation Poles in Latin America & the Caribbean**, *David L. Gibson*, University of Texas, IC2 Institute, 2815 San Gabriel, Austin, TX 78705, *davidg@icc.utexas.edu*, *Sunil Tankha*, *Julie Nordskog*, *Jennifer Burner*, *Pedro Conceigo*

We present the logic, conceptual framework and elements of an initial action plan for leveraging codified knowledge and tacit know-how through Web-based networks and face-to-face training programs to accelerate technology-based economic developments in Latin America and the Caribbean.

3) **Contribution of the Technology Asset to the Competitive Advantage in the Chemical Industrial Sectors in a Developing Country**, *Rocio Cassaigne-Hernandez*, Universidad Nacional Autonoma de Mexico, Fac. of Chemistry, Circuito Institutos Edif D, Mexico, 04510, Mexico, *cassaigl@servidor.unam.mx*, *Carlos Escobar-Toledo*

Technological development is not an easily quantifiable concept. Yet, such determination is necessary in order to identify the stage of development of a technology and to define the starting point for further technological and strategic planning. We present a tested methodology to determine the value of this asset.

4) **Global New Product Development in International Brazilian Firms**, *Sergio Takahashi*, University of Sao Paulo, Fac. of Economy, Bus. Admin. & Acctg., Ribeirao Preto, 14040-900, Brazil, *sergiota@usp.br*, *Vania Passarini Takahashi*

We compare the strategies of product development in international firms in Brazil with similar strategies in a global context. This analysis includes aspects of competencies and knowledge management in an organization design perspective and relates to mergers, acquisitions and partnerships.

**SB16 Finance Applications**

Contributed Session

**Chair:** Mustafa Pinar, Bilkent University, Dept. of IE, Ankara, 06533, Turkey, *mustafap@bilkent.edu.tr*, *pascal.ie.bilkent.edu.tr/~mustafap*

1) **An Evaluation of Brazilian Currency Policy**, *David Benaroch*, Rua Uruguai 413, Apt. 1208, Rio de Janeiro, 20510-000, Brazil, *Silvio R. Badenes de Gouveia*, *Nelson F. Maculan*

We analyze the evolution of the trajectory of the currency policy. An emphasis is adopted with respect to main sectors: financial, production and international trade. A framework of risk is also approached. The foreign investments are mentioned as protection of exchange flotations. Target inflation and Tobin tax are shown as for and against.

2) **Financial Statement Estimation through Entropy**, *Thomas R.*

*Jefferson*, Sultan Qaboos University, Coll. of Commerce, PO Box 20, Al-Khod, Muscat, 123, Sultanate of Oman, tjeffers@squ.edu.om, *Waymond Rodgers, Carlton H. Scott*

Entropy is used to find the most probable estimates satisfying accounting relationships. Geometric programming provides a fast solution method. The method estimates actual accounts.

3) **A Priori, Ex Post & Market Variances**, *Peter C. Anselmo*, New Mexico Tech., Dept. of Mgmt., Box 3, Speare Hall, Socorro, NM 87801, anselmo@nmt.edu, *Erquan Li, James S. Dyer*

We discuss the connection between a priori risk (usually variance) used in asset allocation and the actual measurement of asset risk via analysis of historical return distributions.

4) **Some Optimization Problems from Time Series Analysis in Finance**, *Mustafa Pinar*, Bilkent University, Dept. of IE, Ankara, 06533, Turkey, mustafap@bilkent.edu.tr, pascal.ie.bilkent.edu.tr/~mustafap, *Aslihan Salih-Altay, Aharon Ben-Tal*

Volatility estimation is an important and challenging problem in finance. We review the autoregressive conditional heteroskedastic variance-covariance model and related maximum likelihood estimation problems. Emphasis is on numerical solution of the resulting optimization models. Preliminary results will be given depending on progress.

## SB17 Workload Control in Job Shops

Cluster: Planning & Scheduling

Invited Session

Chair: Gerard Gaalman, University of Groningen, gmj.c.gaalman@bdk.rug.nl

1) **Work Load Management under MRP**, *Silvanus T. Enns*, University of Calgary, Dept. of MME, Fac. of Eng., Calgary, Alberta, T2N 1N4, Canada, enns@enme.ucalgary.ca

In an MRP environment, planned lead times dictate work-in-process inventory levels while the MPS dictates throughput rates. We investigate how shop load feed back and/or queuing relationships can be used in setting planned lead times to reduce shop inventory while maintaining due date performance and throughput rates.

2) **Workload Control in the Semiconductor Industry**, *John W. Fowler*, Arizona State University, Dept. of IE, Tempe, AZ 85287-5906, john.fowler@asu.edu, *Gary L. Hogg, Scott J. Mason*

We describe the state-of-the-art in workload control as applied to the semiconductor industry. The focus is on examining the concepts behind workload control heuristics and evaluating their effectiveness, overhead requirements and implementability. We provide an overview of the distinctive elements in a semiconductor manufacturing environment, general dispatching methods, order release strategies and future directions.

3) **Comparing Work Load Control Theory & Industrial Practice: A Survey in Italy**, *R. Cigolini*, Polytechnico Milano, Milan, Italy, roberto.cigolini@polimi.it

Our objective is to understand the reasons for the existing distance between the WLC research and the PP&C procedures used by most companies, and how this gap can be reduced. An empirical survey was carried out and interviews were conducted with 30 shop floor managers. Empirical data were collected and compared...

4) **Robustness of Workload Concepts**, *M. Land*, University of Groningen, m.j.land@bdk.rug.nl

With the help of controlled release methods, WLCs buffer the shop floor against the dynamics of the incoming flow of jobs. This should provide a lean and stable shop floor environment. To handle a wide spectrum of dynamics, the concepts must guarantee a certain level of robustness...

## SB18 Network Design & Applications

Cluster: Discrete Optimization

Invited Session

Chair: Bernard Gendron, Universite de Montreal, DIRO & CRT, CP 7128, succ. Centre-ville, Montreal, Quebec, H3C 3J7, Canada, bernard@crt.umontreal.ca

1) **withdrawn - chair request of 9/21**, *Mervat Chouman*, Universite de Montreal, CRT, CP 7128, succ. Centre-ville, Montreal, Quebec, H3C 3J7, Canada, mervat@crt.umontreal.ca, *Teodor Gabriel Crainic, Bernard Gendron*

2) **Adaptive Approximation Methods for Dynamic Service Network Design**, *Katerina Papadaki*, Princeton University, CASTLE Lab., Dept. of Civil Eng. & OR, Princeton, NJ 08544,

powell@princeton.edu, *Warren Powell*

Dynamic service network design problems produce intractably large integer programs. Engineering practice uses simulations with relatively simple dispatch rules. We are developing a class of dynamic programming approximations which produce simulations with optimization behavior which exploit structural results in the value function. Numerical results will be presented.

3) **Airline Network Design**, *Cynthia Barnhart*, MIT, Ctr. for Transport Studies, Dept. of Civil Eng & OR, Cambridge, MA 02139-4307, *Andrew P. Armacost, Monoj Lohatepanont*

We consider the problem of determining the profit maximizing airline flight schedule given a fixed fleet of aircraft. The flight schedule specifies the flight legs to be flown and their associated scheduled departure times. We pose alternative models and algorithms for this problem and present results using data provided by major airlines.

4) **Dual-Ascent Procedures for Multicommodity Capacitated Fixed-Charge Network Design Problems**, *Bernard Gendron*, Universite de Montreal, DIRO & CRT, CP 7128, succ. Centre-ville, Montreal, Quebec, H3C 3J7, Canada, bernard@crt.umontreal.ca, *Teodor Gabriel Crainic, Antonio Frangioni*

We present a dual-ascent approach for computing lower bounds on the optimal value of fixed-charge multicommodity capacitated network design problems. The approach is an extension of previous procedures for particular cases, such as the fixed-charge multicommodity uncapacitated network design problem (Balakrishnan, Magnanti, Wong 1989) and the capacitated plant location problem (Guignard, Spielberg 1977)...

## SB19 Constraint-Based Scheduling

Cluster: Constraint Programming

Invited Session

Chair: Wim Nuijten, ILOG, 9 rue de Verdun, Gently Cedex, 94532, France, nuijten@ilog.fr

1) **An Investigation into Two Approaches for Constraint Directed Resource Allocation & Scheduling**, *Andrew J. Davenport*, University of Toronto, 97 Dovercourt Rd., Toronto, Ontario, M6J 3C2, Canada, andrewd@eil.utoronto.ca, *J. Christopher Beck*

We investigate new techniques for scheduling with resource alternatives based on the complete decomposition prior to scheduling (CDPS) approach and the multiple alternative decomposition (MAD) approach. We investigate experimentally whether the higher computational cost of decision making in the MAD approach results in better scheduling performance than the CDPS approach.

2) **Incorporating New Scheduling Criteria in Constraint-Based Tools**, *Philippe Baptiste*, University of Technology of Compiègne, UMR CNRS 6599 HEUDIASYC, Ctr. Recherches de Royallieu, Compiègne Cedex, 60205, France, philippe.baptiste@hds.utc.fr, *Wim Nuijten*

Most of the constraint based tools offer efficient primitives to solve scheduling problems where the goal is to minimize the makespan. Such is not the case for other criteria, e.g., weighted sum of completion times. We propose several research directions that could enable constraint based systems to handle various criteria.

3) **A Constraint Programming Approach for Supply Chain Scheduling**, *Mark J. Ringer*, JD Edwards World Source Company, 1 Technology Way, U9, Denver, CO 80237, mark\_ringer@jdedwards.com

J.D. Edwards, a leading ERP and supply chain software vendor, is developing an advanced planning and scheduling system. A constraint programming approach is used to model, solve and optimize a large and complex manufacturing planning and scheduling problem. We will give an overview of the technical and implementation details encountered using the development of this new system.

4) **Constraint Propagation Techniques for Reservoirs**, *Jerome Rogerie*, ILOG, 9 rue de Verdun, Gently Cedex, 94532, France, rogerie@ilog.fr, *Wim Nuijten*

Reservoirs are resources that allow the definition of both capacity consuming and capacity producing activities on them. Commonly found examples of reservoirs are storage tanks and inventory. We will present some powerful constraint propagation techniques for reservoirs, a subject that despite its practical importance has received relatively little theoretical attention.

## SB20 Using Bus Location Information in Public Transit

Sponsor: Transportation Science Section

Sponsored Session

**Chair:** Rabi Mishalani, Ohio State University, Dept. of Civil & Environ. Eng., 2070 Neil Ave., 470 Hitchcock, Columbus, OH 43210

1) **Use of Current Traffic Conditions for Paratransit Dispatching**, *Mark Hickman*, Texas A&M University, Dept. of Civil Eng., College Station, TX 77843, mhickman@tamu.edu, *Cristina Slabic*

We have modified an existing algorithm for the paratransit scheduling problem to account for real-time changes in road traffic conditions. The resulting algorithm can be used to support real-time dispatching decisions. A case study in Houston describes the utility of traffic information in paratransit vehicle dispatching.

2) **Irregularly Sampled Probe Vehicles as a Traffic Sensor**, *Daniel J. Dailey*, Department of Electrical Engineering, M322 EE/CS Bldg., Box 352500, Seattle, WA 98195, dailey@ee.washington.edu, *C. Elango*

3) **A Markov Chains Model for Bus Arrival Time Estimation with GPS Data**, *Wei Lin*, Virginia Tech, Dept. of Civil Eng., Blacksburg, VA 24061, whlin@ctr.vt.edu

We observed that delays at neighboring bus stops are correlated. Proper utilization of this correlation information will improve the accuracy of bus arrival time estimation. We discuss the formulation of a Markov chains model for bus arrival time estimation in which the behavior of bus drivers and delays in previous bus stops are incorporated.

4) **A Methodology for Evaluating Real-Time Passenger Information Systems**, *Rabi Mishalani*, Ohio State University, Dept. of Civil & Environ. Eng., 2070 Neil Ave., 470 Hitchcock, Columbus, OH 43210, *Mark R. McCord*, *Sungjoon Lee*

A probabilistic modeling methodology for evaluating real-time bus arrival information systems is developed. Information is assumed to be provided at bus stops where passengers arrive randomly. Sensitivity to passenger utility functions, operational characteristics, real-time vehicle location data, and bus arrival prediction methods is captured. Analytical and simulation-based results are presented.

**SB21 Dynamic Traffic Assignment II**

**Sponsor:** Transportation Science Section  
Sponsored Session

**Chair:** Srinivas Peeta, Purdue University, Sch. of Civil Eng., West Lafayette, IN 47907

1) **Real-Time Schedulability of a Distributed Dynamic Traffic Assignment System**, *Nhan Huynh*, University of Texas, Dept. of Civ. Eng., ECJ 6.2, Austin, TX 78712, *Hani S. Mahmassani*, *Yi-Chang Chiu*, *Khaled F. Abdelghany*

A real-time scheduling policy is developed to manage the execution of a distributed DTA system for a large-scale network. The essence of the framework is to ensure the system will meet its required timing and precedence constraints in addition to performing its intended functions. The methodology is validated through use of DYNASMART-X, an established DTA system.

2) **Decomposition Approaches for Dynamic Traffic Assignments**, *S. Travis Waller*, Northwestern University, Dept. of Civ. Eng., 2145 Sheridan Rd., Tech. Inst., Evanston, IL 60208, travis@trans.civil.nwu.edu, *Yue Irene Li*, *Athanasios Ziliaskopoulos*

Various strategies for DTA are analyzed with regard to the possibility of decomposing them into more manageable sub-problems. Both analytical and heuristic approaches are analyzed. Computational results will be presented and discussed.

3) **A Hybrid A Priori & Online Reoptimization Framework for Real-Time Route Guidance Applications**, *Yi-Chang Chiu*, University of Texas, Dept. of Civil Eng., ECJ 6.2, Austin, TX 78712, *Hani S. Mahmassani*

A hybrid DTA framework that incorporates a priori routing policies and online re-optimization is presented. It introduces a collaborative architecture between the centralized and decentralized DTA controllers which generates robust a priori routing policies and performs quick online re-optimization for real-time route guidance in urban network.

4) **Stable Online Solutions for Route Guidance under Information Systems**, *Srinivas Peeta*, Purdue University, Sch. of Civil Eng., West Lafayette, IN 47907, *Ta-Hui Yang*

Issues vis-a-vis stable regions for on-line traffic assignment solutions are explored. Analysis is performed using simulation and analytic models.

**SB22 Current Developments in IT Outsourcing**

**Cluster:** IT Outsourcing: Integrating Research, Teaching & Practice  
Invited Session

**Chair:** Lorin Hitt, University of Pennsylvania, The Wharton Sch., 1318 SH-DH, Philadelphia, PA 19104

1) **Information Systems Outsourcing Contracts: Theory & Evidence**, *Vijay Gurbaxani*, University of California, Grad. School of Mgmt., Irvine, CA 92717-3125

No abstract supplied.

2) **Balance Between Insourcing & Outsourcing: A Survey**, *Eric K. Clemons*, University of Pennsylvania, The Wharton Sch., 1315 Locust Walk, SH-DH 6366, Philadelphia, PA 19104, *Lorin Hitt*, *Eli M. Snir*

No abstract supplied.

3) **The State of the IT Outsourcing Market: A View from the Field**

No abstract supplied.

**SB23 Valuation of Real Options in Competitive Electricity Markets**

**Sponsor:** Energy, Natural Resources & Environment  
Sponsored Session

**Chair:** Shmuel S. Oren, University of California, Dept. of IE/OR, 4172 Etcheverry Hall, Berkeley, CA 94720-1777, oren@ieor.berkeley.edu

1) **A Real Option Model for Power Investments**, *Yves Smeers*, Universite Catholique de Louvain, CORE, 34 Voie du Roman Pays, Louvain la Neuve, 1348, Belgium, smeers@core.ucl.ac.be, *Kadjo Bedin Kouassi*

We consider an investment in a new generation plant when several risk factors are described by affine jump processes. We derive the partial differential equation characterizing the value of the plant and explore the possibilities of solving the associated real option problem by complementary problems.

2) **Exercising Real Operation Options under Price Uncertainty**, *Chung-Li Tseng*, University of Maryland, Dept. of Civil Engineering, College Park, MD 20742, chungli@eng.umd.edu, <http://www.eng.umd.edu/~chungli>, *Graydon L. Barz*

A power plant converts a particular fuel to electricity. This conversion process involves 2 commodities with different market prices. The operation of a power plant associated with intertemporal constraints is formulated as real options. We present optimal exercising strategy for the real option at each time period.

3) **Dispatchability under Uncertainty: A Real Options Approach**, *Todd Strauss*, PHB Hagler Bailly Inc., 1776 Eye St. NW, Washington, DC 20006, tstrauss@haglerbailly.com

Operating flexibility at an electric power plant is valued as a real option. The real option approach is contrasted with the standard discounted cash flow approach and with a pure financial option valuation approach.

4) **Incorporating Physical Constraints & Startup Costs in Option-Based Valuation of Generation Capacity**, *Shijie Deng*, Georgia Institute of Technology, School of ISyE, Atlanta, GA 30332-0205, deng@ieor.berkeley.edu, *Shmuel S. Oren*

We describe a stochastic DP approach for valuing electricity generation capacity with physical constraints and startup costs. Generators are modeled as a strip of cross commodity call options with a delay and cost imposed on each option exercise. Stochastic prices of electricity and fuel are represented by a recombining trinomial tree.

**SB24 Management Issues in Health Care Technology Management I**

**Cluster:** Management of Health Care Technology  
Invited Session

**Chair:** Paula E. Bobrowski, SUNY, Dept. of Mktg., Oswego, NY 13126, bobrowsk@oswego.edu

1) **Organizational Integration, Product Development Proficiency & Market Success in the Medical Device Industry**, *Murray Millson*, Syracuse University, Innovation Mgmt. Prog., Sch. of Mgmt., Syracuse, NY 13244, *David Wilemon*

What are the relationships between organization integration, product development process proficiency and market success for medical device products? Based on an empirical investigation, we examine these relationships

and offer several managerial and research implications for those concerned with product development in the medical device industry.

**2) Women in Medicine: Perceptions of Technological Competence, Pamela L. Cox,** Cazenovia College, 304 Eddy Hall, Cazenovia, NY 13035, pcox@cazcollege.edu

As more women enter a profession, decreases in salary, prestige and promotional opportunities often follow. One of the reasons these changes seem to occur is that perceptions of technological competence tend to decrease with the increase in the proportion of women. We examine the perceptions of technological competence associated with women in medicine.

**3) Defining & Managing Error Reduction Technologies in the Blood Transfusion Processes, John R. Grout,** Berry College, Campbell Sch. of Bus., Mount Berry, GA 30149, jgrout@campbell.berry.edu

Transfusion operations require matching individual-specific materials and tasks with patients. Human errors occur relatively frequently. Jigs, fixtures and more advanced technologies are possible counter-measures. Extended fault tree analysis is used to provide a set theoretic definition of mistake-proofing and a system for managing mistake-proofing so process efficiency is not impaired.

**4) Bio-Medical Models: A Theoretical Leap for Management Science, Paula E. Bobrowski,** SUNY, Dept. of Mktg., Oswego, NY 13126, bobrowsk@oswego.edu, **Arun Ranchod**

According to Drucker, current management models have become outdated in an information age. The information revolution is redefining the business enterprise as a creator of value and wealth based on innovation. We demonstrate how information theory has been mathematically modeled and applied in the field of biomedical research and illustrate how these theories can be applied in creating management models...

## SB25 Routing

Contributed Session

**Chair:** Alan L. Erera, University of California, 109 McLaughlin Hall #1720, Berkeley, CA 94720-1720, alerera@ieor.berkeley.edu

**1) Solving Vehicle Routing Problems with Soft Time Windows, Robert A. Russell,** University of Tulsa, Finance & OM Dept., 600 South College Ave., Tulsa, OK 74104-3189, rrussell@utulsa.edu, **Wen-Chyuan Chiang**

We examine VRPs with soft time windows. We compare the effectiveness of classic ejection chain techniques with a TS metaheuristic employing advanced recovery strategies. We also explore the applicability of smoothing transformations to time window problems.

**2) A Heuristic Approach to the Period Vehicle Routing Problem, Burcin Bozkaya,** ESRI, 380 New York St., Redlands, CA 92373, bbozkaya@esri.com, **Buyang Cao**

We present a model and a heuristic algorithm for solving the period vehicle routing problem. We develop a two-phase cluster-and-schedule where we implement TS in both phases. We integrate this algorithm with a client-server DSS and develop visit schedules for a major elevator manufacturer.

**3) Capacity-Sharing Strategies for Stochastic Vehicle Routing Problems, Alan L. Erera,** University of California, 109 McLaughlin Hall #1720, Berkeley, CA 94720-1720, alerera@ieor.berkeley.edu

A new family of operating strategies for single-period stochastic VRPs based on capacity sharing is proposed and preliminary analysis is reported. The estimation of expected operating costs and near-optimal configuration of systems is discussed.

**4) withdrawn - author request of 10/8, Anulark Pinnoi,** Asian Institute of Technology, ISE Program, PO Box 4, Klongluang, Patumtani, 12120, Thailand, anulark@ait.ac.th, **Ha Dang Son**

## SB26 Fluid & Queuing Networks

Sponsor: Applied Probability Society

Sponsored Session

**Chair:** John J. Hasenbein, University of Texas, OR Group, Dept. of Mechanical Eng., Austin, TX 78712, jhas@mail.utexas.edu

**1) Stochastic Networks with Quality of Service Specifications, Costis Maglaras,** Columbia University, Columbia Business Sch., 409 Uris Hall, 3022 Broadway, New York, NY 10027-6902, c.maglaras@columbia.edu, **Jan A. Van Mieghem**

We consider multiclass queueing networks that offer probabilistic QoS guarantees on end-to-end delay and blocking that are differentiated for each exogenous arrival stream. We model these constraints using fluid

approximations and then proceed to describe scheduling and admission control policies that guarantee the desired specifications.

**2) Bounds for Multiclass Queueing Networks: From Stability to Performance, Dimitris Bertsimas,** MIT, Sloan Sch. of Mgmt., 50 Memorial Dr., Bldg. E53-363, Cambridge, MA 02142, dbertsim@aris.mit.edu, **David Gamarnik, John N. Tsitsiklis**

Given a piecewise linear Liapunov function that is a witness of stability for a particular policy in a multiclass queueing network, we derive explicit upper and lower bounds on the performance of this policy.

**3) A Necessary & Sufficient Condition for Stability of Fluid Networks, Hengqing Ye,** HKUST, Dept. of IE/EM, Clear Water Bay, Kowloon, Hong Kong, ieyehq@stu.ust.hk, **Hong Chen**

We study the stability of fluid networks, which implies the stability of queueing networks. We prove that a necessary and sufficient condition for the stability of a fluid network (under either a priority service discipline or a FIFO discipline) is that there exists a Lyapunov function for its fluid level processes...

**4) On the Stability Gap between Fluid & Queueing Networks, John J. Hasenbein,** University of Texas, OR Group, Dept. of Mechanical Eng., Austin, TX 78712, jhas@mail.utexas.edu, **Jim G. Dai, John Vande Vate**

In earlier research, Dai & VandeVate demonstrated conditions that completely characterize the global stability region for 2-station multi-type fluid networks. An outstanding question is the relationship between such fluid networks and their queueing counterparts. We demonstrate that the stability region under static buffer priority disciplines may depend on the entire distributions of the service and arrival processes...

## SB27 Perturbation Analysis & Simulation I

Sponsor: College on Simulation

Sponsored Session

**Chair:** Weibo Gong, University of Massachusetts, Dept. of Elec. & Comp. Eng., Amherst, MA 01003, gong@golf.ecs.umass.edu; <http://www-unix.ecs.umass.edu/~gong>

**1) Perturbation Analysis via Coupling, Liyi Dai,** Washington University, Dept. of Systems Sci. & Math., CB 1040, St. Louis, MO 63130, liyi@zach.wustl.edu

Coupling is a method of generating multiple random samples. We are concerned with perturbation analysis via coupling. This approach offers a great versatility of the form of gradient estimators, which is potentially useful for variance reduction and for efficient implementation. Several known perturbation analysis techniques can be reviewed as special ways of coupling...

**2) A Comparison of Perturbation Analysis Techniques, Michael C. Fu,** University of Maryland, Smith School of Bus., Van Munching Hall, College Park, MD 20742-1815, mfu@rshsmith.umd.edu, **Jian-Qiang Hu**

We will give an overview on several different perturbation analysis techniques and their relationships, as well as their connection to other derivative estimation methods, such as the likelihood ratio method.

**3) Perturbation Analysis for Stochastic Fluid Queueing Systems, Weibo Gong,** University of Massachusetts, Dept. of Elec. & Comp. Eng., Amherst, MA 01003, gong@golf.ecs.umass.edu; <http://www-unix.ecs.umass.edu/~gong>, **Yong Liu, Yujing Wu**

We discuss perturbation analysis and related rational approximation results for stochastic fluid queueing systems and their application in communication networks.

## SB28 Mathematical Applications Applied to a Social Agenda

Sponsor: Social Science Applications Section

Sponsored Session

**Chair:** Rafael Solis, California State University, Dept. of IS/DS, Craig Sch. of Bus., Fresno, CA 93720, rafael@csufresno.edu

**1) Simulating Group Responses to Non-Traditional Survey Instruments, K. Scott Alberts,** St. Olaf College, Dept. of Mathematics, 1520 St. Olaf Ave., Northfield, MN 55057, alberts@stolaf.edu

While statistical simulation is now routine in many areas, social scientists still avoid such techniques. During a larger study, a measure of item agreement was developed as part of a forced-distribution Q-sort instrument. This measure was sufficiently complicated that simulation was used to get reliable estimates for the

moments.

2) **Portfolio Selection: A Comparison between Cluster Analysis & the Analytic Hierarchy Process**, *Rafael Solis*, California State University, Dept. of IS/DS, Craig Sch. of Bus., Fresno, CA 93720, rafael@csufresno.edu

Portfolio selection based on historical performance of stocks is conducted utilizing 2 quantitative techniques: cluster analysis and AHP. The portfolios created using the 2 methodologies contain stocks that have performed differently so as to minimize the overall risk (the same idea as diversification). The 2 portfolios will be observed for 6 months prior to INFORMS Philadelphia...

## SB29 Operations Management II Contributed Session

**Chair:** Jan C. Fransoo, Eindhoven University of Technology, PO Box 513, Pav F12, Eindhoven, NL-5600 MB, The Netherlands, j.c.fransoo@tue.nl, <http://www.tm.tue.nl/vakgr/lbs/fransoo.htm>

1) **Contracting Over Multiple Parameters: Capacity Allocation in Semiconductor Manufacturing**, *Suman Mallik*, General Electric Company, Bldg. K1, Rm. 5B32A, PO Box 8, Schenectady, NY 12301, suman.mallik@crd.ge.com

Motivated by the experiences of a major US-based semiconductor manufacturer, we will present an integrated model of incentive problems arising in forecasting and capacity allocation. The model involves multiple product managers and multiple manufacturing managers. This is a generalization of our previous work. The summary of models and results of both the works will be discussed.

2) **Multi-Period Capacity Allocation with Machine Duplication in Semiconductor Manufacturing**, *Bulent Catay*, University of Florida, DIS Dept., 351 Stuzin Hall, Gainesville, FL 32611, catay@grove.ufl.edu, *Selcuk S. Erenguc*, *Asoo J. Vakharia*

We address the problem of assigning batches of wafers to different machines by recognizing capacity limitations of the individual machines as well as reducing operating and investment costs related to the machines and inventory holding costs. A mixed-integer mathematical model is proposed and lower bounding and heuristic methods are developed.

3) **Production Planning & Order Assignment for Space Launch Vehicles**, *Leslie O. Morgan*, University of Utah, 1645 Campus Ctr. Dr. #106, Salt Lake City, UT 84112-9304, mgltm@business.utah.edu, *Alysse R. Morton*, *Richard L. Daniels*

An aerospace firm produces launch vehicles to shoot payloads of different sizes into space. Vehicles can be built in varying sizes, each with known capacity and cost. We consider the problem of jointly determining the optimal mix of launch vehicles to produce and the optimal assignment of satellites to vehicles.

4) **Using Aggregate Estimation Models for Order Acceptance in a Decentralized Production Control Structure for Batch Chemical Mfg.**, *Jan C. Fransoo*, Eindhoven University of Technology, PO Box 513, Pav F12, Eindhoven, NL-5600 MB, The Netherlands, j.c.fransoo@tue.nl, <http://www.tm.tue.nl/vakgr/lbs/fransoo.htm>, *Wenny Raaymakers*, *J. W. M. Bertrand*

We explore the performance of various aggregate models for order acceptance and loading in no-wait job shops. Simulation results show that a linear regression-based model outperforms a workload-based model on capacity utilization and decentralized replanning effort, specifically under increased capacity utilization and/or high variety in the job mix.

## SB30 Agents, Brokers & Intermediaries

**Sponsor:** INFORMS Computing Society

**Sponsored Session**

**Chair:** Kaushal Chari, University of South Florida, College of Bus., 4202 E Fowler Ave., CIS 1040, Tampa, FL 33620-7800, kchari@coba.usf.edu

1) **Designing Artificial Agents for Electronic Commerce: Results & Prospects**, *James Laing*, University of Pennsylvania, Wharton Sch. of Bus., Dept. of OPIM, 1322 SH-DH, Philadelphia, PA 19104-6366, laing@wharton.upenn.edu, *Steven Kimbrough*

We address design of adaptive artificial agents for automated negotiations. Such agents would be useful in electronic commerce. Our previous work evolved populations of negotiation strategies that rival human performance. The new results reported here apply to designing single (i.e., deployable) agents to negotiate in these difficult contexts.

2) **Evolving the Electronic Market with Trusted Third Parties**, *Sulin Ba*, University of Southern California, Marshall Sch. of Business, Los Angeles, CA 90089-1421, sulin@usc.edu, *Andrew B.*

## Winston, Han Zhang

Fear of security breaches and mistrust in the products offered online remain major obstacles to the growth of electronic commerce. The issue of trust has arisen recently with the creation of TTP. Will people use their services? How does the electronic market evolve? The paper studies the role of TTPs in the electronic market.

3) **Designing Behaviors for Information Agents**, *Keith S. Decker*, University of Delaware, Dept. of Computer & IS, 103 Smith Hall, Newark, DE 19716, [decker@cis.udel.edu](mailto:decker@cis.udel.edu), <http://www.cis.udel.edu/~decker/>

We will discuss the behaviors and architecture of WWW-based autonomous software agents that gather information in groups for humans and other computational agents. We will also report on organizational "middle-agents" for use in such systems. Examples are drawn from the WARREN project for open multi-agent financial portfolio management, and our current DECAF agent-building toolkit.

4) **On Designing a Multi-Agent System for Distributed Information Filtering**, *Rajeev Raje*, Indiana University, Dept of CIS, 723 West Michigan St., SL 280, Indianapolis, IN 46202-5132, [rraje@cs.iupui.edu](mailto:rraje@cs.iupui.edu), *Snehasis Mukhopadhyay*, *Mathew Palakal*, *Javed Mostafa*

Due to heterogeneity and geographical distribution, the design of global-scale systems is a major challenge. Such systems can be efficiently realized using cooperation between smart, autonomous objects (or agents). We will discuss the design of a multi-agent distributed information filtering system, an example of a global-scale information system.

## SB31 Quality & Reliability Engineering Applications

**Cluster:** Reliability & Quality Engineering

**Invited Session**

**Chair:** Hoang Pham, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854-8018, [hopham@rci.rutgers.edu](mailto:hopham@rci.rutgers.edu)

**Co-Chair:** E. A. Elsayed, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, [elsayed@rci.rutgers.edu](mailto:elsayed@rci.rutgers.edu)

1) **Integrating PID Controllers into Statistical Process Control Applications**, *Melike Baykal-Gursoy*, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, [gursoy@rci.rutgers.edu](mailto:gursoy@rci.rutgers.edu), *Edward T. Nugent*

We consider pure-gain and first-order processes subject to white noise disturbances and random mean shifts. These processes are monitored using SPC techniques. We demonstrate that performance improvements could be achieved using off-the-shelf PID controllers. The addition of PID control requires modification of the statistical process monitoring scheme. We consider three types of mean shifts...

2) **Design of Accelerated Life Testing Plans with Multiple Stresses**, *E. A. Elsayed*, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, [elsayed@rci.rutgers.edu](mailto:elsayed@rci.rutgers.edu), *Lixia Jiao*

ALT is a widely used approach that estimates reliability of components or systems at normal operating conditions using data obtained at accelerated conditions. The accuracy of reliability estimates depends on the stress levels and the corresponding sample sizes. We present an efficient and practical approach for determining the appropriate stress levels...

3) **Bringing Quality Awareness to Policing**, *Alok Baveja*, Rutgers University, School of Bus., Camden, NJ 08102, [baveja@crab.rutgers.edu](mailto:baveja@crab.rutgers.edu), *Michael A. Redmond*

Much use of technology for law enforcement has been for operational and tactical purposes. We argue quality awareness can be created using proactive tools that foster relationships among enforcement agencies, community groups and city officials. We present examples of how such an awareness-centered police department can be better equipped to take on the challenges of law enforcement in the future.

4) **Analysis of Purchasing Contracts for an Imperfect Process with Time-Dependent Product Value**, *Linguo Gong*, Louisiana State University, Dept. of ISDS, Baton Rouge, LA 70803-6316, *Kwei Tang*, *Jen Tang*

We study the contractual relationship in a single period manufacturing and distribution supply chain when the value of the product decreases over time and the manufacturer's process is subject to random failure. Two contractual relationships are considered. In the first, the 2 parties share the revenue...

### SB32 Distributed Computing & Network Design Problems in Telecommunications

Sponsor: Technical Section on Telecommunications  
Sponsored Session

Chair: Ishwar K. Murthy, Louisiana State University, 3178 CEBA Bldg., Nicholson Ext, Dept. of IS & Dec. Sci., Baton Rouge, LA 70803-6316, imurthy@unix1.sncc.lsu.edu

1) **Exact Algorithms for Tree Topologies in Telecom Network Design**, *Trilochan Sastry*, Indian Institute of Management, Vastrapur, Ahmedabad, 380015, India, sastry@iimahd.ernet.in

We study exact algorithms for several variations of the capacitated network design problem, all of which are known to be NP-hard. We describe a tree enumeration algorithm and a dynamic programming path-based algorithm. The worst case running times of the 2 is faster for problem instances where the capacity constraint on edges is very tight...

2) **Examining the Diffusion of Distributed Database Technology**, *Balaji Rajagopalan*, Illinois State University, 5520 Dept. of Acctng., Normal, IL 61790-5520, brajag@ilstu.edu, *Rathindra Sarathy*

Our objective is to use established diffusion models to study the extent of DDB technology in organizations. Swanson's (1994) tri-core model of IS innovation, as well as research by Grover et al. (1997) will be used in the study of DDB diffusion.

3) **Client Server Network Design: Formulations & Algorithms**, *Sabyasachi Mitra*, George Institute of Technology, DuPree Sch. of Mgmt., Atlanta, GA 30332-0520, saby.mitra@mgt.gatech.edu, *Sridhar Narasimhan*

We will focus on the design of 3-tier router based client server networks using current communication technologies such as ATM and frame relay. Several alternate formulations of the problem with varying levels of complexity will be discussed. Solution methodologies and computational results will also be discussed.

### SB33 Panel: Quality Improvement & Reliability - Emerging Trends

Sponsor: Quality, Statistics & Reliability  
Sponsored Session

Chair: Darek Ceglarek, University of Michigan, 1031 H.H. Dow Bldg., Dept. of Mech. Eng., Ann Arbor, MI 48109-2136, darek@engin.umich.edu

1) **Panel: Quality Improvement & Reliability - Emerging Trends**, *Douglas C. Montgomery*, Arizona State University, Dept. of IMSE, Tucson, AZ 85721, doug.montgomery@asu.edu, *Soren Bisgaard*, University of Wisconsin, Ctr. for Qual. & Prod. Improv., Dept. of IE, 610 Walnut St., Madison, WI 53705-2397, bisgaard@engr.wisc.edu, *Way Kuo*, Texas A&M University, Dept. of IE, College Station, TX 77843, way@acs.tamu.edu

This is a panel discussion by distinguished researchers in the areas of quality and reliability. The panel will discuss emerging trends shaping current and future research in quality improvement and reliability. The panel will include presentations and discussions by leading researchers.

### SB34 Tutorial: Electronic Business Process Optimization: Enabling a New Era of Business Intelligence

Cluster: Manufacturing Systems  
Invited Session

Chair: Richard G. Mathieu, University of North Carolina, Cameron School of Bus., Dept. of PDS, Wilmington, NC 28403, mathieur@uncwil.edu, <http://www.uncwil.edu/people/mathieur>

1) **Tutorial: Electronic Business Process Optimization: Enabling a New Era of Business Intelligence**, *Irfan M. Ovacik*, i2 Technologies, 909 East Las Colinas Blvd., 16th Fl., Irving, TX 75039, ovacik@i2.com, *Willie Weng*

eBPO is a new initiative launched by i2 Technologies to provide decision support solutions that optimize and integrate core business processes across a company while intelligently connecting the enterprise to its trading partners. We are going to focus on supply chain management, which is one of the eBPO processes.

### SB35 Tutorial: Industry Clockspeed Invited Session

Chair: Charles H. Fine, MIT, Sloan Sch. of Mgmt., 30 Wadsworth St., E53-390, Cambridge, MA 02139, charley@mit.edu

1) **Tutorial: Industry Clockspeed**, *Charles H. Fine*, MIT, Sloan Sch. of Mgmt., 30 Wadsworth St., E53-390, Cambridge, MA 02139, charley@mit.edu

No abstract supplied.

### SB36 DEA I

Contributed Session

Chair: Anthony D. Ross, Texas A&M University, Mays Coll. of Business, College Station, TX 77840, aross@acs.tamu.edu

1) **DEA with Reverse Inputs: Measuring the Relative Efficiencies of Major League Baseball Teams**, *Herbert F. Lewis*, SUNY, Harriman Sch. of Mgmt & Policy, Stony Brook, NY 11794-3775, hlewis@notes.cc.sunysb.edu, *Thomas R. Sexton*

We develop a model in which measurement scales for certain inputs are such that larger values indicate lower input consumption. Properties and interpretations of this model are discussed. The model is applied to measure the relative efficiencies of major league baseball teams.

2) **Intertemporal Productivity Analysis & Model Invariance in DEA**, *Anthony D. Ross*, Texas A&M University, Mays Coll. of Business, College Station, TX 77840, aross@acs.tamu.edu

We present an approach for identifying best practice decision making units in a multiproduct supply network operation. Using incomplete operational data presents many challenges when used by researchers and analysts. An invariant DEA model and some procedures for handling such empirical realities are specified. The model examines the productive efficiency of DMUs over multiple planning horizons.

3) **On Returns to Scale under Weight Restrictions in DEA**, *Kaoru Tone*, National Graduate Institute for Policy Studies, 2-2 Wakamatsu-cho, Shinjuku-ku, Tokyo, 162-8677, Japan, tone@grips.ac.jp

We extend the concept of returns to scale in DEA to the weight restriction environments. The definition and computational procedure will be presented. It is demonstrated that the most productive scale size will usually narrow by this addition of weight restrictions. An empirical study will follow.

4) **Overcoming the Inherent Dependency of Data Envelopment Analysis Efficiency Scores: A Bootstrap Approach**, *Mei Xue*, University of Pennsylvania, Dept. of OPIM, The Wharton Sch., Philadelphia, PA 19104-6366, xuem@wharton.upenn.edu, *Patrick T. Harker*

The efficiency scores generated by DEA models are clearly dependent on each other in the statistical sense. Hence, the conventional procedure of regression analysis generally followed in the DEA literature is invalid. We provide a bootstrap method to overcome this dependency problem.

### SB37 Panel: Integrative Cases for Teaching OR/MS in the MBA Curricula

Sponsor: INFORM-ED  
Sponsored Session

Chair: Janet M. Wagner, University of Massachusetts, Dept. of MSIS, 100 Morrissey Blvd., Boston, MA 02125, profwagner@aol.com, wagner@umbusky.cc.umb.edu

1) **Panel: Integrative Cases for Teaching OR/MS in the MBA Curricula**, *Salwa Ammar*, Le Moyne College, Dept. of Bus. Admin., Syracuse, NY 13214, ammars@palm.lemoyne.edu, *Kenneth Baker*, Dartmouth College, Tuck School of Bus. Admin., 100 Tuck Hall, Hanover, NH 03755, kenneth.r.baker@dartmouth.edu, *Dana R. Clyman*, University of Virginia, Darden Grad Sch. of Bus. Adm., Charlottesville, VA 22906-6550, clymand@darden.gbus.virginia.edu, *Stephen G. Powell*, Dartmouth College, Tuck Sch. of Bus. Admin., 100 Tuck Hall, Hanover, NH 03755, sgp@dartmouth.edu, *Janet M. Wagner*, University of Massachusetts, Dept. of MSIS, 100 Morrissey Blvd., Boston, MA 02125, profwagner@aol.com, wagner@umbusky.cc.umb.edu, *Wayne L. Winston*, Indiana University, Kelley School of Bus., Bloomington, IN 47405, winston@indiana.edu, *Ronald H. Wright*, Le Moyne College, Dept. of Bus. Admin., Syracuse, NY 13214-1399, wright@palm.lemoyne.edu

Participants will discuss and share cases which support the learning of OR/MS concepts and another area in the MBA curriculum. Applications include OR/MS

and economics, organizational behavior, MIS and more. Discussion to follow on ways to foster integration within the MBA curriculum.

## Sunday 13:15-14:45

### SC01 Asking the Right Questions: Experiences Teaching & Learning about Decision Analysis Practice

Sponsor: Decision Analysis Society  
Sponsored Session

Chair: David G. Lowell, Santa Clara University, OMIS Dept., 323 Kenna Hall, Santa Clara, CA 95053, davelowell@earthlink.net

1) **Developing Corporate Decision Analysis Capability, Marcy B. Conn**, Strategic Decisions Group, 2440 Sand Hill Rd., Menlo Park, CA 94025, mconn@sdg.com

Experience with hundreds of executives and professionals provides insight into the following aspects of teaching decision analysis in a corporate setting: Which concepts are readily transferable in a classroom setting? What skills require substantial hands-on experience and coaching? What are typical timetables for various levels of skill acquisition?

2) **Building Decision Analysis Capability: An Instructional Framework Tested by Student Experience, Stephen L. Derby, David G. Lowell**, 2075 Tasso St., Palo Alto, CA 94301, sgderby@pacbell.net, David G. Lowell

Decision analysis learned in a classroom does not prepare the student to conduct a decision analysis in practice. We discuss a framework for teaching the practice of decision analysis that evolved from student experiences in a projects course at Stanford's EES&OR Department.

3) **Teaching & Learning about Decision Analysis Practice, David G. Lowell, Stephen L. Derby**, Santa Clara University, OMIS Dept., 323 Kenna Hall, Santa Clara, CA 95053, davelowell@earthlink.net, Stephen L. Derby

In our experience teaching decision analysis practice to executives and graduate students in business and engineering, we have found the most important lessons are listening well, communicating clearly, modeling concisely and taking an iterative approach. We discuss approaches to facilitate students learning these skills.

### SC02 Approximation Algorithms for Problems in Combinatorial Optimization

Cluster: Combinatorial Optimization & Network Flows

Sponsor: Optimization Section  
Sponsored Session

Chair: Vardges Melkonian, Cornell University, 290 Rhodes Hall, Ithaca, NY 14853, vardges@orie.cornell.edu

1) **Approximation Algorithms for Facility Location Problems, Fabian Chudak, David B. Shmoys, Karen Aardal**, IBM TJ Watson Research Center, Rt. 134, Yorktown Heights, NY 10598, chudak@watson.ibm.com, David B. Shmoys, David Williamson, Karen Aardal

We describe some recent results on approximation algorithms for several variants of facility location problems.

2) **withdrawn - chair request of 8/30, Kamal Jain**, Georgia Institute of Technology, 330492 Georgia Tech Station, Atlanta, GA 30332-1325, kjain@cc.gatech.edu, Vijay Vazirani

3) **Approximation Algorithms for a Directed Network Design Problem, Vardges Melkonian, Eva Tardos**, Cornell University, 290 Rhodes Hall, Ithaca, NY 14853, vardges@orie.cornell.edu, Eva Tardos

We consider the problem of finding a minimum cost subgraph in a digraph such that for each vertex set  $S$  there are at least  $f(S)$  arcs leaving  $S$ . A 2-approximation algorithm is presented for the case when  $f(S)$  is crossing supermodular. We also describe the basic solutions of the LP-relaxation.

### SC03 Coordination Issues in Design & Development

Sponsor: Manufacturing & Service Operations Management  
Sponsored Session

Chair: Karl Ulrich, University of Pennsylvania, The Wharton School, 1317 SH-DH, Philadelphia, PA 19104, ulrich@wharton.upenn.edu

1) **The Role of Suppliers in Product Development: An Empirical Investigation in the Auto Industry, Tim Laseter**, University of Virginia, Darden Grad. Sch. of Bus., PO Box 6550, Charlottesville,

VA 22906-6550, **Kamalini Ramdas**

We develop a classification of automobile components and of different types of supplier roles in product development. We then investigate the relationship between the nature of specific components and the role played by their suppliers in product development, through an empirical study in the automobile industry.

2) **Managing the Marketing-Manufacturing Interface during Production Ramp-Up, Christian Terwiesch**, University of Pennsylvania, The Wharton Sch., Dept. of OPIM, SH-DH 1300, Philadelphia, PA 19104, terwiesch@wharton.upenn.edu, **Teck-Hua Ho**

In many high-tech industries, learning and process improvement during production ramp-up are driven by engineering experimentation rather than operator experience. Experiments lead to process improvements, but they also reduce capacity in the short run. We present a formal model of this trade-off raising interesting problems at the marketing-manufacturing interface.

3) **Understanding the Communication Process in Product Development Organizations, Manuel E. Sosa, Steven D. Eppinger, Michael T. Pich**, MIT, Sloan Sch. of Mgmt., Cambridge, MA 02139, msosa@mit.edu, Steven D. Eppinger, Michael T. Pich

To better understand how product development teams communicate, we propose a framework consisting of 4 elements: communication drivers, communication barriers, communication media, and message. We will present several hypotheses and empirical evidence to explore how these 4 elements are related.

4) **Mediating Marketing, Manufacturing & Supply Chain Decisions during Product Development, Karl Ulrich**, University of Pennsylvania, The Wharton School, 1317 SH-DH, Philadelphia, PA 19104, ulrich@wharton.upenn.edu

During new product development, decisions about features and market segments must be made. These decisions are linked to decisions about supply chain configuration, product architecture, and component commonality. This talk reports on progress in developing decision support tools to mediate these decisions.

### SC04 Price Formations in Auctions

Cluster: Economics & Game Theory

Invited Session

Chair: Richard Engelbrecht-Wiggans, University of Illinois, Dept. of Bus. Admin., 1206 South 6th St., Champaign, IL 61820, epuls17@uiuc.edu

1) **High Bids & Broke Winners, Charles Zheng**, Northwestern University, Dept. of Economics, 2003 Sheridan Rd., Evanston, IL 60208, czheng@nwu.edu

We provide a new auction theory where bidders have budget constraints and they can default. We precisely predict equilibrium bidding behavior and explain the "high bids and broke winners" anomaly in the C-block FCC spectrum auction. We also advise the seller on how to raise his expected profit by appropriately subsidizing the bidders.

2) **Asymmetric Mergers in Second-Price Common Value Auction Problems, Vladimir Mares**, Rutgers University, Dept. of Economics, New Brunswick, NJ 08903-5062, mares@economics.rutgers.edu

We will identify the equilibria in asymmetric common value auctions. Results contradict the common intuitions about the anti-competitive effects of mergers and joint bidding. We identify an informational externality that leads to a higher confidence in the private signals, alleviates the winner's curse and allows bidders to pursue more aggressive bidding strategies and increase revenues.

3) **Low Revenue Equilibria in Simultaneous Ascending Price Auctions, Richard Engelbrecht-Wiggans, Charles M. Kahn**, University of Illinois, Dept. of Bus. Admin., 1206 South 6th St., Champaign, IL 61820, epuls17@uiuc.edu, Charles M. Kahn

The outcomes of some recent FCC auctions look similar to those that one might expect if the bidders colluded. We show that such outcomes can be generated as perfect equilibria of simultaneous ascending-price auctions without relying on future auctions, signals, or outside agreements to sustain collusion.

### SC05 Decision Analysis II

Contributed Session

Chair: Scott T. Serich, George Washington University, 1603 Kirby Rd., McLean, VA 22101-3207, serich@acm.org

1) **The Beneficiary Factor & Consistency on Decision-Making, Pedro J. Steiner Neto**, CEPPAD-UFPR/FAE, Rua Padre Anchieta, 1231 Ap. 31, Curitiba, PR, 80730-000, Brazil, pedro.steiner@avalon.

sul.com.br, *Luciane G. Silva, Paulo H. Prado*

According to prospect theory, decision makers don't have a consistent behavior, as opposed to rationality theories like the expected utility. We discuss a new reason for such inconsistency, the decision beneficiary. Depending on who will benefit from the decision - capital market, product market or organization - the behavior will differ. Furthermore we identify more consistency for older decision makers and for those occupying top positions as well.

**2) Decision Analysis & the Operationalization of the Precautionary Principle, Ahti A. Salo**, helsinki University of Technology, Systems Analysis Lab., PO Box 1100, Espoo, 02015, Finland, ahti.salo@hut.fi, <http://www.sal.hut.fi>

The precautionary principle provides a guideline for managing risks associated with considerable scientific uncertainties, e.g., GMOs. Drawing on a recent joint project for the European Commission, we suggest that the management of such risks can be supported by considering several decision analytic framings and strategic qualitative factors such as reversibility and resilience.

**3) Using Mathematical Models in Negotiation & Auction Processes, Rafael Epstein**, University of Chile, Dept. of IE, PO Box 2777, Republica 701, Santiago, Chile, repstein@di.uchile.cl, **Jaime Catalan**

We show how mathematical models help to successfully implement auction processes. We stress quantitative and qualitative benefits of these tools during the negotiation. We show 2 experiences, an auction process for providing meals to half of the public schools in Chile and a negotiation process to provide transportation service to a private pulp company.

**4) A Measure of Decision Making Performance Grounded in Information Physics, Scott T. Serich**, George Washington University, 1603 Kirby Rd., McLean, VA 22101-3207, serich@acm.org

Traditional micro-economic models can be plagued by market imperfections that preclude reliable demand or factor forecasts, particularly in information-intensive industries such as software or consulting. We introduce a new measure of managerial decision-making performance based on optimal energy utilization and leveraging recent theoretical developments in information physics.

## SC06 Supply Chain Economics

**Sponsor: Manufacturing & Service Operations Management**  
Sponsored Session

**Chair: Martin Lariviere**, Duke University, Fuqua Sch. of Business, Durham, NC 27708, larivier@mail.duke.edu

**1) Modeling Information Flows in Supply Chains, Krishnan S. Anand**, Northwestern University, KGSM, Sheridan Rd., Leverone Hall, 2001, Evanston, IL 60208-2001, anand@nwu.edu

We argue that comprehensive models of supply chains need to incorporate both material and information flows and their interaction. The key attributes of ISs are illustrated in the context of a specific model. Using inventories as an example, we show that different informational assumptions could lead to very different operational implications.

**2) Information Economics: The Value of Learning in a Supply Chain, Dawn Barnes-Schuster**, University of Chicago, Kellogg Grad. Sch. of Bus., 1101 East 58th St., Chicago, IL 60637, dawn.barnes-schuster@gsb.uchicago.edu

Using the constructs of IT, we consider the problem of capacity reservation and pricing in a simple 2-stage supply chain. We provide a mechanism for valuing market information under this scenario and relate it to expected system profits.

**3) Multiple Source Procurement Arrangements, Wedad Elmaghraby**, NYU, Stern School of Bus., New York, NY 10012, welmaghr@stern.nyu.edu

As companies find it beneficial to outsource certain parts of their production process, the optimal types of outsourcing arrangements must be considered. The benefits of multiple sourcing vs. sole sourcing are considered under various market conditions.

**4) Restricted Capacity & Choosing Breadth of Distribution, Martin Lariviere**, Duke University, Fuqua Sch. of Business, Durham, NC 27708, larivier@mail.duke.edu, **Gerard Cachon**

A supplier with limited capacity may simply decide not to sell to some retailers. While potentially lowering sales, limiting distribution allows for better service to participating retailers. We consider how restricting distribution affects supply chain performance and retailer market actions.

## SC07 Scheduling, Logistics & Facilities Design I

**Cluster: Manufacturing & Logistics**  
Invited Session

**Chair: Alice E. Smith**, University of Pittsburgh, Dept. of IE, 1031 Benedum Hall, Pittsburgh, PA 15261, aesmith@engrng.pitt.edu

**Co-Chair: Bryan A. Norman**, University of Pittsburgh, 1048 Benedum Hall, Dept. of IE, Pittsburgh, PA 15232, banorman@engrng.pitt.edu

**1) A Column Generation Approach for Integrated Scheduling & Logistics of Assemblies, Rakesh Nagi**, SUNY, Dept. of IE, 342 Bell Hall, Buffalo, NY 14260, nagie@eng.buffalo.edu, **Muhammad Farooq Anwar**

We address the integrated problem of scheduling machines and logistic activities to minimize the production makespan of complex assemblies. For industrial-sized problems, a column generation approach is developed. The master problem selects from a set of choices, the best sequence of operations, while the subproblem generates new beneficial sequences.

**2) Evaluating Rescheduling Strategies, Jeffrey W. Herrmann**, University of Maryland, Inst. for Systems Research, College Park, MD 20742, jwh2@eng.umd.edu, **Guilherme E. Vieira, Edward Lin**

Simulation-based factory scheduling is a powerful tool. However, it must be used properly to attain maximum effectiveness, especially in a dynamic environment that requires rescheduling. We will discuss the influence of rescheduling methods on the performance of discrete-parts manufacturing systems.

**3) A Linear Model for Scheduling Commercial Advertisements on Cable TV, Jayant Rajgopal**, University of Pittsburgh, Dept. of IE, 1048 Benedum Hall, Pittsburgh, PA 15261, rajgopal@engrng.pitt.edu, <http://www.pitt.edu/~rajgopal>

We overview the dynamics of TV commercial scheduling and introduce the notion of an audience loss function. A simple, yet robust linear model is described for optimizing this loss function, subject to the constraints that are typically inherent in the process. A numerical illustration is also provided.

**4) AMPOWER: Advanced Manpower Planning System, Mehmet Gulsen**, United Airlines, World Headquarters WHQKB, PO Box 66100, Chicago, IL 66100, mehmet.gulsen@ual.com

AMPOWER is a combined forecasting/optimization system that provides optimal pilot staffing for both short term operational needs and long term strategically planning needs of the airline. The model initially generates forecasts for various absenteeism factors, i.e. sick leave, military duty, etc., that contribute to manpower loss...

## SC08 Supply Chain Management in the Semiconductor Industry

**Cluster: Manufacturing & Logistics**  
Invited Session

**Chair: John W. Fowler**, Arizona State University, Dept. of IE, Tempe, AZ 85287-5906, john.fowler@asu.edu

**1) Supply Chain Management in the Semiconductor Industry: A Software Supplier Perspective, Y. S. Chang**, i2 Technologies USA, 303 Twin Dolphin Rd., Ste. 210, Redwood City, CA 94065, ys\_chang@i2.com

Given the complexity of a typical supply chain, supply chain software systems should help companies to intelligently manage the activities of the supply chain. The solution provided by this system enables each company to identify and focus on key business drivers that determine success in its particular portion of the industry. We introduce a new industry-focused supply chain solution.

**2) Supply Chain Management in the Semiconductor Industry: An Equipment Supplier Perspective, David Anderson**, SEMI/SEMATECH, 2706 Montopolis Dr., Austin, TX 78748, dave.anderson@asu.edu

The semiconductor industry is projected to double in size by the year 2005. It is important that the value chain infrastructure (suppliers of equipment, materials, and services) grow along with the semiconductor manufacturers as the industry expands. Developing a strong infrastructure of suppliers is necessary to achieve and maintain manufacturing technology leadership...

**3) Supply Chain Management in the Semiconductor Industry: An IC Manufacturer Perspective, John Konopka**, IBM, Raleigh, NC

The semiconductor industry is projected to grow to an estimated 300 billion

dollars (US) by the year 2005. This paper presents a review of the theories and strategies that have been developed and implemented through various industry wide initiatives to establish globally competitive semiconductor supply chains.

**4) Supply Chain Management in the Semiconductor Industry: Survey Results, John W. Fowler**, Arizona State University, Dept. of IE, Tempe, AZ 85287-5906, john.fowler@asu.edu

We will share results from a recent survey of SEMATECH and SEMI/SEMATECH member companies to gain information on supply chain management within the semiconductor industry. The survey specifically asks about customer relationships, supplier relationships and IT. The survey was to develop a better understanding of customer and supplier relationships within the semiconductor industry...

#### SC09 Panel: New Directions in Group Decision & Negotiation II

Sponsor: Group Decision & Negotiation Section  
Sponsored Session

Chair: Melvin F. Shakun, NYU, Stern Sch. of Bus., 44 West 4th St., New York, NY 10012-1126, mshakun@stern.nyu.edu

1) New Directions in Group Decision & Negotiation II, *Melvin F. Shakun*, NYU, Stern Sch. of Bus., 44 West 4th St., New York, NY 10012-1126, mshakun@stern.nyu.edu, *Kalyan Chatterjee*, *Rachel Croson*, *Peri H. Iz*, *D. Marc Kilgour*, *Brenda Zimmerman*

This double panel session will discuss new research and application directions in group decision and negotiation. Panel members will make opening remarks followed by panel discussion with audience participation.

#### SC10 Eigenvalue Optimization

Cluster: Optimization & Applications

Sponsor: Optimization Section  
Sponsored Session

Chair: Michael L. Overton, New York University, Courant Inst. of Math. Sci., 251 Mercer St., New York, NY 10012, overton@cs.nyu.edu

1) Semidefinite Relaxation of the Hartree-Fock Approximation in Quantum Chemistry, *Francois Oustry*, INRIA Rhone Alpes, ZIRST, 655 av de l'Europe, Montbonnot St Martin, 38330, France, francois.oustry@inria.fr, francois.oustry@inrialpes.fr, *Bastiaan J. Braams*, *Michael L. Overton*, *Madhu Nayakkankuppam*

The most common and important variational technique used in many-particle calculations on fermions systems is the Hartree-Fock Approximation. We start here from a quadratic formulation given in the space of density matrices by Garrod & Percus (1954). Then we use Lagrangian duality to obtain a semidefinite relaxation of the problem.

2) Semistable Programming, *Michael L. Overton*, New York University, Courant Inst. of Math. Sci., 251 Mercer St., New York, NY 10012, overton@cs.nyu.edu, *James V. Burke*

In semistable programming, the key constraint is that the eigenvalues of a matrix must lie on or to the right of the imaginary axis, generalizing semidefinite programming to non-Hermitian matrices. We give a necessary condition for local minimizers, and give a generalization of the complementarity condition familiar from semidefinite programming.

3) Optimizing Matrix Stability, *Adrian Lewis*, University of Waterloo, Dept. of Combinatorics & Opt., Fac. of Mathematics, Waterloo, Ontario, N2L 3G1, Canada, aslewis@orion.math.uwaterloo.ca, *James V. Burke*, *Michael L. Overton*

A variation on semistable programming is minimizing the spectral abscissa (largest real part of the eigenvalues) over a given affine set of matrices. We show that the optimal solution often has a large Jordan block, making even small problems quite challenging. The spectral abscissa determines system stability in control theory.

#### SC11 Recent Developments in Global Optimization

Cluster: Global Optimization

Sponsor: Optimization Section  
Sponsored Session

Chair: Hong Seo Ryoo, Towson University, Dept. of Math, 8000 York Rd., Towson, MD 21252-0001, hryoo@towson.edu

1) Supervised Clustering using Genetic Algorithms, *Ayhan Demiriz*, RPI, Decision & Eng. Systems Dept., 110 8th St., Troy,

NY 12180-3590, demira@rpi.edu, *Kristin P. Bennett*

In supervised clustering, the objective function of an unsupervised technique, k-means clustering, is modified to minimize both the within cluster variance of the input attributes and a measure of cluster impurity based on the class labels. A GA optimizes this complex objective function to produce clusters. Strong experimental results support the approach.

2) Feature Selection in Clustering, *W. Nick Street*, University of Iowa, MS Dept., 108 Pappajohn Bldg., Iowa City, IA 52242, nickstreet@uiowa.edu

In many unsupervised learning applications it is important not only to find good clusters but also to identify the subset of predictive features that most strongly influences the cluster formation. We present a mathematical programming formulation for this task, and apply it to disease diagnosis from genetic markers.

3) Portfolio Selection with Skewness Preference, *Laila Haerian*, Towson University, Dept. of Math, 8000 York Rd., Towson, MD 21252-0001, lhaeri1@tiger.towson.edu, *Hong Seo Ryoo*

Markowitz' seminal mean-variance model for portfolio selection is based upon the assumption that an investor's utility can be well-approximated by the first 2 moments of the rate of the return of the portfolio. It is well known, however, that the rate of stocks usually does not satisfy normality assumption...

4) DC Programming, Global Optimality Conditions & Global Optimality Algorithms, *Alexander Strekalovsky*, Irkutsk State University, Lab. of Global Opt. Methods, Lermontov str. 134, Irkutsk, 6640033, Russia, strekal@icc.ru

No abstract supplied.

#### SC12 Marketing on the Internet

Sponsor: College of Marketing

Sponsored Session

Chair: Steven M. Shugan, University of Florida, 2030 NW 24th Ave., Gainesville, FL 32605, shugan@dale.cba.ufl.edu

1) Product Evaluations on the Internet, *Steven M. Shugan*, University of Florida, 2030 NW 24th Ave., Gainesville, FL 32605, shugan@dale.cba.ufl.edu, *Larry Winer*

With the growth of new channels of distribution, such as the Internet, buyers enjoy a wide range of both products and product information. Some suppliers of product information and evaluations, however, have potential conflicts of interest that may cause biased evaluations. We provide an empirical analysis showing that a bias does exist...

2) Mass Customized Services on the Internet: An Empirical Approach for Pricing & Demand Assessment, *John Liechty*, University of Michigan, *Venkatram Ramaswamy*, *Steven Cohen*

We discuss a menu-based, Bayesian approach for assessing customers' price sensitivities and preferences for the variety of features that can be offered by a firm engaged in mass customization. The proposed approach provides valuable guidance in setting prices for a customized portfolio of features and services, so as to increase customer value and revenues...

3) An Approach to Identify Effective Locations for the Placement of Banner Ads, *Amit Bhatnagar*, University of Wisconsin, Milwaukee, WI, amit@uwm.edu, *Purushottam Papalla*

Advertising on the internet involves placing banners and/or buttons at other web sites. Unlike traditional advertising that is pushed onto consumers, however, internet ads have to pull consumers in. It is, therefore, important for online businesses to precisely target their ads at locations are likely to attract the type of customers who might be interested in the message...

#### SC13 Product Assortments

Sponsor: College of Marketing

Sponsored Session

Chair: Barbara E. Kahn, University of Pennsylvania, The Wharton School, Dept. of Mktg., Philadelphia, PA 19104

1) How Variety in Product Assortment can Affect Consumption Quantity, *Barbara E. Kahn*, University of Pennsylvania, The Wharton School, Dept. of Mktg., Philadelphia, PA 19104, *Brian Wansink*

We examine the influence of variety on consumption. It is hypothesized that, up to a limit, larger sets will result in more items consumed, as consumers may feel that they want to "complete the set," or reach closure by trying all available items. Experiments conducted on 1st and 4th grade students support the hypotheses. Other experiments conducted on adults identify some limiting conditions when the effects are not likely to hold.

2) Consumer Strategies for Filling the Shopping Basket, *Joel*

*Steckel*, New York University, Mgmt. Ed. Ctr., Stern School, 44 West 4th St., New York, NY 10012-1126, *Jack K. H. Lee*

Different uses, users and usage occasions for a given product category give rise to the possibility of multiple preference contexts within individuals and households. Each preference context is assumed to have a unique preference structure, hence, utility for a given alternative. Context dependence drives the need for consumers to fill their "shopping baskets" with assortments of goods...

**3) The "Combo Meal" Effect: How to Increase Variety without Really Trying**, *Andrea Morales*, University of Pennsylvania, The Wharton School, Philadelphia, PA 19104, *Barbara E. Kahn*

We present experimental results that indicate that if items already present a menu are repeated in the form of a special "combo meal," the perceived variety of the menu, and ultimately the satisfaction with the choice process and the desire to return to the restaurant, are increased. This increase in perceived variety only occurs if the "combo meal" is priced differently (higher/lower) than the sum of the individual items in the combination.

#### SC14 Coping with Complexity & Interdependence

**Sponsor:** Technology Management Section/College on Organization Science

**Sponsored Session**

**Chair:** Nancy A. Staudenmayer, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, *nstauden@mail.duke.edu*

**1) Too Much of a Good Thing? Product Proliferation & Organizational Failure**, *William Barnett*, Stanford University, Grad. Sch. of Bus., L-306, Palo Alto, CA 94305-5015, *barnett\_william@gsb.stanford.edu*, *John Freeman*

When organizations make important changes, such as introducing new products, they may gain strategic advantages but also experience disruptions. We argue that these disruptions are especially strong when organizations introduce multiple products simultaneously. To test this hypothesis, we study the effects of new product introductions on the survival of US semiconductor manufacturers.

**2) The Virtue of Simplicity: Navigating Complex Environments with Practices, Norms & Heuristics that Balance Change & Stability**, *Anjali Sastry*, University of Michigan, Business School, 701 Tappan St., Ann Arbor, MI 48109-1234, *masastry@umich.edu*, *Fiona Lee*

To investigate how successful organizations pair change in some domains with stability in others, we investigate the lifetime evolution of the Financial Women's Association, a non-profit organization for Wall Street women. FWA operations in a volatile environment but its mission, culture and leadership approach have persisted. Interdependent rules and practices maintain continuity while allowing some contradiction and change.

**3) Organizational Decay: How Innovation Stresses Organizations**, *Michael W. Lawless*, Duke University, Fuqua Sch. of Bus., Durham, NC 27708-0120, *lawless@mail.duke.edu*, *Nancy A. Staudenmayer*

When new technology generations emerge faster than older decline, strategies to pace technology and cut development cycles may return less profit than expected because relationships among products, units and functions become more complex. Organizational decay is the condition where marginal costs of adopting technology increase with technology generations and interdependence.

**4) Not Only by Strategic Partnerships Alone: Managing a Portfolio of Relationships**, *Ben Bensaou*, Harvard University, Dept. of Bus. Admin., Soldiers Field, Boston, MA 02163, *bbensaou@hbs.edu*

Using original data on 447 supplier relationships in the US and Japanese auto industries, we examine whether strategic partnerships are the best way to manage supply. Contrary to popular belief, auto manufacturers in both countries seem to rather manage a portfolio of relationships determined by technological and market factors.

#### SC15 Technology & Innovation Management I

**Contributed Session**

**Chair:** Eran Liron, Stanford University, Grad. School of Bus., Stanford, CA 94305, *liron@leland.stanford.edu*

**1) Performance in New Technology Introductions: A Comparison of Firm Structure**, *Jeffrey T. Macher*, University of California, F534 Haas Sch. of Business, Berkeley, CA 94720, *macher@haas.berkeley.edu*, <http://www.haas.berkeley.edu/~macher>

We examine the introduction of new manufacturing processes into semiconductor firms' wafer fabrication facilities. Two research questions are posed: Are performance differences discernable by firm structure? Can intrafirm

capabilities explain these differences? Two measures of performance are tested: rate of improvement in manufacturing yield following introduction of a new process and the length of time of new process development...

**2) Managerial Antecedents of Technological Opportunism in Firm Response to Technologies**, *Raji Srinivasan*, Pennsylvania State University, 701 CBAB, University Park, PA 16802, *rxs213@psu.edu*

Firms, sometimes even within a given industry, respond differentially to technology developments. We propose that the extent to which organizations differ in their ability to exercise strategic choice is reflected in their technological opportunism: defined as the ability of a firm to sense technological developments in the environment and to proactively respond to these developments to further its business objectives...

**3) A Model to Guide Product Platform Development for a Global Value Chain**, *B. Joon Park*, Georgia Institute of Technology, DuPree Coll. of Mgmt., 755 Ferst Dr., Atlanta, GA 30332-0520, *gt7104d@prism.gatech.edu*, *Soumen Ghosh*, *Nagesh N. Murthy*

Recently, several studies on product development have focused on the interface of marketing, manufacturing and engineering design. However, there is limited work that has considered integrating product development decisions with supply chain management issues. We develop a model for guiding product platform development to support a global value-chain.

**4) Efficient Joint R&D Efforts by Having the Option to Switch Contractual Terms**, *Eran Liron*, Stanford University, Grad. School of Bus., Stanford, CA 94305, *liron@leland.stanford.edu*, *Evan L. Porteus*

We examine a 2-party, joint R&D problem; one developing the product and the other the custom process, each acting in its self-interest but with possible future transactions. Yields depend on respective investments. We give conditions under which system optimal performance is achieved by an option to switch the sharing rule.

#### SC16 Credit Customers

**Contributed Session**

**Chair:** Suresh K. Nair, University of Connecticut, Sch. of Bus. Admin., Storrs, CT 06269-0241, *suresh@sba.uconn.edu*

**1) Expert Probabilistic Systems & Neural Networks in Credit Scoring Analysis**, *Maria Arns Steiner*, UFPR, Rua Padre Anchieta, 1231 Ap. 31, Curitiba, PR, 80730-000, Brazil, *tere@mat.ufpr.br*, *Celso Carnieri*, *Pedro J. Steiner Neto*

With about 2,500 historical data from a German bank, we studied the probabilistic expert systems and neural networks techniques in order to recognize and foresee which credit customers will be "good or bad payers". These techniques were used comparatively, using the shell SPIRIT and MatLab-Neural Networks Toolbox to do the computational tests...

**2) Credit Scoring & Evaluation: A Review of Practices & Theories**, *Joel K. Jolayemi*, University of Zululand, Private Bag X1001, Kwadlangezwa, KwaZulu-Natal, 3886, South Africa, *jkjolayemi@pan.uzulu.ac.za*

We present a survey and critical review of the procedures and models developed/applied for credit scoring and evaluation. The presentation is divided into 2 parts: the first reviews the procedures applied in some financial institutions while the second surveys and reviews the techniques and models developed in the literature.

**3) Issues in Modeling Lifetime Value of Customer in Credit Card Firms**, *Suresh K. Nair*, University of Connecticut, Sch. of Bus. Admin., Storrs, CT 06269-0241, *suresh@sba.uconn.edu*

Modeling is increasingly being used in financial services for risk, marketing and back room operations. We discuss the issues involved in modeling the lifetime value of customer to credit card companies using a Markov decision process approach. Such models may be used for credit line management and other proactive strategies for influencing customer behavior...

#### SC17 Methodological Issues of Planning

**Cluster: Planning & Scheduling**

**Invited Session**

**Chair:** Alex Meystel, Drexel University, Dept. of ECE, Philadelphia, PA 19104, *alex@cerebrum.impact.drexel.edu*

**1) Planning & Control with Multi-Resolutional Search, Decomposition & Filtering**, *Alex Meystel*, Drexel University, Dept. of ECE, Philadelphia, PA 19104, *alex@cerebrum.impact.drexel.edu*

We focus on the inter-relatedness of the stages of planning and control in the

functioning of complex systems depending on dealing with large amounts of potentially incomplete and frequently uncertain information. Operators of search, decomposition and filtering function as a package of mutually supportive goal-oriented computational algorithms called GFS-operator...

2) **Linguistic Geometry for Solving Air Combat Games**, *Boris Stilman*, University of Colorado, Dept. of Comp. Sci. & Eng., CB 109, Denver, CO 80217-3364, [bstilman@carbon.cudenver.edu](mailto:bstilman@carbon.cudenver.edu)

This method of planning has evolved from the research in computer chess. I was involved in a joint research with the well-known chess-player and engineer M. Botvinnik. Two fundamental steps were undertaken: creation of a planning language that fits within the law of space tessellation and discovery of game horizons that fit into the concept of multi-resolutional control.

3) **Multi-Site Scheduling using Soft Computing Techniques**, *Marcello Frixione*, DIST - University of Genova, via Opera Pia 13, Genova, I-16145, Italy, [frix@dist.unige.it](mailto:frix@dist.unige.it), *G. Vercelli*, *Renato Zaccaria*

Multi-site scheduling deals with the scheduling problems of an enterprise with several distributed production sites, where sites use the intermediate products of the other sites to manufacture the products of the enterprise, e.g., in car or airplane manufacturing. In the multi-site scheduling scenario we differentiate between a global and a local scheduling level...

4) **An Open Architecture for Flexible Scheduling Productio & Revision**, *Amadeo Cesta*, Italian National Research Council, Viale Marx 15, Rome, I-00137, Italy, [amadeo@pscs1.irmkant.rm.cnr.it](mailto:amadeo@pscs1.irmkant.rm.cnr.it), *Angelo Oddi*

5) **Propagating Search Envelopes in Multi-Resolutional Behavior Planning**, *Alex Meystel*, Drexel University, Dept. of ECE, Philadelphia, PA 19104, [alex@cerebrum.impact.drexel.edu](mailto:alex@cerebrum.impact.drexel.edu), *J. Albus*, *A. Lacaze*, *C. Tasoluk*

## SC18 Innovations & Applications of Integer Programming

Cluster: **Discrete Optimization**

Invited Session

Chair: *Renato de Matta*, University of Iowa, 108 Pappajohn Bus. Admin. Bldg, Iowa City, IA 52242-1000, [renato-dematta@uiowa.edu](mailto:renato-dematta@uiowa.edu)

1) **An Integrated Production & Transportation Scheduling Problem on a Two-Echelon Manufacturing Network**, *Renato de Matta*, University of Iowa, 108 Pappajohn Bus. Admin. Bldg, Iowa City, IA 52242-1000, [renato-dematta@uiowa.edu](mailto:renato-dematta@uiowa.edu), *Tan Miller*

We find the most efficient use of production facilities of a supplier and a manufacturing plant by coordinating their production and shipping schedules. We solve a MIP model that minimizes the total of production, inventory, setup and transportation costs subject to demand and capacity constraints at both facilities.

2) **Short-Term Scheduling in Batch Processing**, *Monique Guignard-Spielberg*, University of Pennsylvania, The Wharton Sch., 1320 SH-DH, Philadelphia, PA 19104-6366, [guignard@grace.wharton.upenn.edu](mailto:guignard@grace.wharton.upenn.edu)

Production of multiple products on multiple machines is done in batches. We consider identical as well as different batch lengths. We describe a representation similar to STN and algorithmic tools used to improve the solution process. We present computational results on data sets similar to those of Westenberger & Kallrath.

3) **Just-in-Time Scheduling with a Common Due Window**, *Zhi-Long Chen*, University of Pennsylvania, Dept. of Systems Eng., 220 S 33rd St., Philadelphia, PA 19104-6315, [zchen@seas.upenn.edu](mailto:zchen@seas.upenn.edu), *Chung-Yee Lee*

We propose a column generation based B&B algorithm for the parallel machine JT scheduling problem where all jobs have a common due date and earliness and tardiness penalty weights are job dependent. The algorithm can solve medium size problems within a reasonable CPU time.

4) **Developing Driver Work Schedules for an Inter-City Bus Service Company with Multiple Fleets**, *Emmanuel Peters*, University of Iowa, Dept of Mgmt Sci, Coll of Bus, 108 Pappajohn BAB, Iowa City, IA 52242, [emmanuel-peters@uiowa.edu](mailto:emmanuel-peters@uiowa.edu), *Renato de Matta*

A company that operates multiple fleets and employs drivers with different skills must decide the mix of fleets to be driven in the driver work schedules. We model this decision as an integer programming problem and propose a column generation approach to solve the problem. Computational results are presented.

## SC19 Constraint Programming Languages

Cluster: **Constraint Programming**

Invited Session

Chair: *Pascal Van Hentenryck*, Universite Catholique de Louvain, Dept. of Comp. Science & Eng., 2 Place Sainte-Barbe, Louvain la Neuve, B-1348, Belgium, [pvh@info.ucl.ac.be](mailto:pvh@info.ucl.ac.be)

1) **An Algebra for Producing Routing Algorithms from Simple Insertion Heuristics**, *Yves Caseau*, Bouygues, 1 ave. Eugene Freyssinet, St. Quentin Yvelines, 78061, France, [yes@challenger.bouygues.fr](mailto:yes@challenger.bouygues.fr), *Francois Laburthe*, *Glenn Silverstein*

We show how to implement and combine a set of metaheuristics that can be applied on top of a constraint-based insertion heuristic. These heuristics include limited discrepancy search, large neighborhood search and the search for displacement trees or chains. These metaheuristics only use 2 operations (push/pull) on the existing solution that are implemented using a constraint-based approach...

2) **Localizer: A Modeling Language for Local Search**, *Laurent Michel*, ILOG, 12 rue Charles Bouvier, Bouge, B5004, Belgium, [ldm@ilog.fr](mailto:ldm@ilog.fr)

Local search is a traditional technique to solve combinatorial search problems and has raised much interest in recent years. The design and implementation of local search algorithms is not an easy task in general and may require considerable experimentation and programming effort. However, little support is available to assist the design and implementation of local search algorithms...

3) **OPL Script: Composing & Controlling Models**, *Pascal Van Hentenryck*, Universite Catholique de Louvain, Dept. of Comp. Science & Eng., 2 Place Sainte-Barbe, Louvain la Neuve, B-1348, Belgium, [pvh@info.ucl.ac.be](mailto:pvh@info.ucl.ac.be)

We give a brief introduction to OPL Script, a script language for composing and controlling optimization models. OPL Script makes it possible to concisely state many applications that require solving several instances of the same model, e.g., to perform some sensitivity analysis, a sequence of models or a combination of both as in column-generation applications...

## SC20 Traffic Detection & Management Algorithms

Sponsor: **Transportation Science Section**

Sponsored Session

Chair: *Carlos Sun*, Rowan University, Glassboro, NJ 08028

1) **An Integer Formulation for SO-DTA to Derive Optimal Control Strategies for Incident Traffic Management**, *Omar Sawaya*, Northwestern University, Dept. of Civil Eng., 2145 Sheridan Rd., Evanston, IL 60208, [o-sawaya@nwu.edu](mailto:o-sawaya@nwu.edu), *Athanasios Ziliaskopoulos*

We present an approach that computes optimal control strategies in the form of alternate routes around freeway incident and in response to the prevailing traffic conditions. An integer programming formulation for SO-DTA is introduced, that accounts for the discrete nature of location specific information provided by a VMS.

2) **Optimal Content of Messages on Variable Message Signs for Incident Management**, *Srinivas Peeta*, Purdue University, Sch. of Civil Eng., West Lafayette, IN 47907, *Shyam Gedela*

Heuristic techniques are analyzed to determine the optimal time-dependent messages to be displayed on Variable Message Signs on-line. A case study involving an ATMS on the Borman Expressway is discussed.

3) **Automatic Incident Detection Algorithms: Calibration & Evaluation**, *Josh Peterman*, University of Texas, Dept. of Civ. Eng., ECJ 6.2, Austin, TX 78712, *Hani S. Mahmassani*, *Carl Haas*

The objective of this research is to develop and apply a formal calibration procedure to several incident detection algorithms to determine trade-offs between incident detection ability and false alarm rate. The algorithms are calibrated and tested using traffic data and incident reports generated by the TransGuide Traffic Management System in San Antonio, Texas.

4) **Detection of Traffic & Section-Based Measures**, *Carlos Sun*, Rowan University, Glassboro, NJ 08028, *Stephen G. Ritchie*, *R. Jayakrishnan*

We present intelligent surveillance technology based on detection of vehicle signatures from point to point in traffic flow, and associated algorithms based on lexicographic pattern matching concepts. We describe the benefits in measuring section variables such as density and travel times, and provide results from a field study.

**SC21 Path Algorithms & Routing****Sponsor:** Transportation Science Section**Sponsored Session****Chair:** Elise D. Miller-Hooks, Pennsylvania State University, 212 Sackett Bldg., Dept. of Civil & Environ. Eng., University Park, PA 16802

1) **Properties of Online Shortest Path Problems**, *S. Travis Waller*, Northwestern University, Dept. of Civ. Eng., 2145 Sheridan Rd., Tech. Inst., Evanston, IL 60208, travis@trans.civil.nwu.edu, *Athanasis Ziliaskopoulos, Julie Sara Mobley*

We discuss shortest path problems where the travel times on links are random variables and vehicles transversing the network acquire information as they progress. We present system properties and specific examples with solution algorithms. Computational results are presented and discussed.

2) **A Multi-Objective Shortest Path Algorithm for Large-Scale Intermodal Transportation Networks**, *Khaled F. Abdelghany*, University of Texas, Dept. of Civil Eng., ECJ 6.2, Austin, TX 78712, *Hani S. Mahmassani*

A multi-objective shortest path algorithm for large scale intermodal transportation networks is presented. The algorithm searches all modes' networks to determine Pareto optimal paths from every node in the network to a single destination. Computational results for 2 different implementations are presented.

3) **Snowplow Districting & Routing**, *Xu Jun Eberlein*, Caliper Corporation, 1172 Beacon St., Newton, MA 02161

We present effective heuristic algorithms for designing snowplow districts and routes. Given locations and capacities of plow truck stations, the objectives are to design districts and routes with balanced worktime and minimal deadhead time. Because a route can be plowed either by a single truck or tandem trucks, the algorithm also determines the best truck assignment to each route.

4) **A Real-Time Routing Algorithm for use in Stochastic, Time-Varying Networks**, *Elise D. Miller-Hooks*, Pennsylvania State University, 212 Sackett Bldg., Dept. of Civil & Environ. Eng., University Park, PA 16802, *Baiyu Yang*

One of the primary goals of intelligent transportation systems is to provide travelers with en-route routing suggestions in response to real-time information. An efficient real-time routing algorithm is presented for determining en-route least expected time paths given current and predicted travel conditions, where inherent dynamic and probabilistic characteristics of future conditions are considered.

**SC22 Negotiating a Y2K Outsourcing Agreement Case****Cluster:** IT Outsourcing: Integrating Research, Teaching & Practice  
**Invited Session****Chair:** David C. Croson, University of Pennsylvania, The Wharton School, Philadelphia, PA 19104

1) **Case 1: Vendor Perspectives**, *Michael Jacobides*, University of Pennsylvania, The Wharton Sch., Mgmt. Dept., 2055 SH-DH, 3620 Locust Walk, Philadelphia, PA 19104

No abstract supplied.

2) **Case Two: Client Perspectives**, *David C. Croson*, University of Pennsylvania, The Wharton School, Philadelphia, PA 19104

No abstract supplied.

**SC23 Longer-Run Issues in Electricity Restructuring****Sponsor:** Energy, Natural Resources & Environment  
**Sponsored Session****Chair:** Yves Smeers, Universite Catholique de Louvain, CORE, 34 Voie du Roman Pays, Louvain la Neuve, 1348, Belgium, smeers@core.ucl.ac.be

1) **LCP Models of Nash-Cournot Competition in the England & Wales Electricity Market**, *Christopher J. Day*, London Business School, Sussex Place, Regents Park, London, NW1 4SA, England, UK, cday@lbs.ac.uk, *Benjamin F. Hobbs*

An LCP formulation of competition between producers of electricity in England and Wales is considered. We investigate issues relating to the reform of this market, from its present poolco mechanism to bi-lateral trading.

2) **Ensuring Generation Capacity Adequacy in Competitive Electricity Markets**, *Shmuel S. Oren*, University of California, Dept. of IE/OR, 4172 Etcheverry Hall, Berkeley, CA 94720-1777, oren@ieor.berkeley.edu

I will discuss alternative approaches that have been adopted around the world for guaranteeing the appropriate level of investment in electric generation capacity. I argue that "capacity payment" is the least desirable approach and it undermines the long-term efficiency objectives of the electric industry restructuring.

3) **A Generation Planning Model in Electricity Markets Based on the Complementary Problem**, *Michel Rivier*, Universidad Pontificia Comillas, Inst. de Investigacion Tec., Alberto Aguilera 23, Madrid, 28015, Spain, michel.rivier@iit.upco.es, *Mariano Ventosa, Andres Ramos*

The electricity market behavior will depend on companies' production cost profiles, on companies' technical operation constraints, and on the market equilibria resulting from the interaction of all participants. This presentation proposes a new methodology for long term operation planning models, fully adapted to represent an annual or hyperannual generation scheduling in a competitive framework...

4) **The Long-Term Effect of Imperfect Competition in Electricity Generation**, *Frederic H. Murphy*, Temple University, 2402 Pine St., School of Bus. & Mgmt., Philadelphia, PA 19122, v5256e@vm.temple.edu, *Yves Smeers*

We discuss the consequences of capacity expansion in oligopolistic electricity markets. We look at different games, discuss their adequacy for capturing interactions in the market place and derive properties of their solution.

**SC24 Management Issues in Health Care Technology Management II****Cluster:** Management of Health Care Technology**Invited Session****Chair:** Eliezer Geisler, Illinois Institute of Technology, Stuart Grad. School of Bus., 565 West Adams St., Chicago, IL 60661, geisler@stuart.iit.edu

1) **A Six-Dimensional Meta-Analysis of the Management of Health Care Technology Literature (1979-97)**, *Ashok Kumar*, Grand Valley State University, 510 Eberhard Ctr., 301 West Fulton, Grand Rapids, MI 49504, kumara@gvsu.edu, *Jaideep G. Motwani, Arnold Reisman*

We take a retrospective look at trends, patterns and directions taken by researchers in Management of Health Care Technology during the period 1979-97. Three hundred and thirty three publications are each classified in 6 distinct categories.

2) **Embeddedness Matrix, the Notion of Technology-Based Assets & a Test of Alternative Theories of Boundary Choices in Medical Technologies**, *Eliezer Geisler*, Illinois Institute of Technology, Stuart Grad. School of Bus., 565 West Adams St., Chicago, IL 60661, geisler@stuart.iit.edu

Health care organizations have a choice in deciding on acquisition of assets in which medical technology is embedded. We report on preliminary results from a study that tested the transaction cost, knowledge-based and resources-based theories of the firm to explain decisions by health care organizations in their consideration of medical technology...

**SC26 Queueing Networks****Sponsor:** Applied Probability Society**Sponsored Session****Chair:** Xiuli Chao, NJIT, Dept. of IE, University Heights, Newark, NJ 07102, chao@admin.njit.edu, chao@megahertz.njit.edu

1) **Strong Approximations for a Feedforward Multiclass Queueing Network**, *Xinyang Shen*, University of British Columbia, Fac. of Commerce & Bus. Admin., 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, xshen@hong.commerce.ubc.ca, *Hong Chen*

We obtain a strong approximation for a feedforward multiclass queueing network that provides a refinement to the diffusion approximation and doesn't require a heavy traffic condition. We propose some specific approximations that lead to numeric approximations to the workload, the queue length and the sojourn time processes of the queueing network.

2) **Scheduling Multiclass Networks in Heavy Traffic: Asymptotic Optimality via Discrete-Review Policies**, *Costis Maglaras*, Columbia University, Columbia Business Sch., 409 Uris Hall, 3022 Broadway, New York, NY 10027-6902, c.maglaras@columbia.edu

For a multiclass network under heavy loading, an approximating Brownian control problem is formulated and solved. An implementable discrete-review

policy is defined based on the optimal Brownian solution. Using the Bramson-Williams framework, we establish asymptotic optimality in the heavy-traffic sense by analyzing the fluid behavior under this policy.

**3) Queueing Networks with State Dependent Transitions, Masakiyo Miyazawa**, Science University of Tokyo, Dept. of Info. Sciences, Noda-City Chiba, 278, Japan, miyazawa@is.noda.sut.ac.jp, **Xiuli Chao**

We give a procedure to construct a queueing network with network-state dependent local transitions from a quasi-reversible queueing network state independent local transitions. We show that under some conditions of additional departures, the state-dependent queueing network has a tractable stationary distribution. This stationary distribution, under some conditions, is a stochastic upper bound of the original network.

**SC27 Perturbation Analysis & Simulation II**

**Sponsor:** College on Simulation

**Sponsored Session**

**Chair:** Weibo Gong, University of Massachusetts, Dept. of Elec. & Comp. Eng., Amherst, MA 01003, gong@golf.ecs.umass.edu; <http://www-unix.ecs.umass.edu/~gong>

**1) A Perturbation Analysis-Based Solution to the Ground-Holding Problem in Air Traffic Control, Christos G. Panayiotou**, University of Massachusetts, Dept. of Elect. & Comp. Eng., Amherst, MA 01003, panayiot@ecs.umass.edu, **Christos G. Cassandras**

We propose an efficient, real-time approach for determining the optimal ground-holding delay (GHD) for every aircraft. Using finite perturbation analysis, we predict the effect of adding a new aircraft to an existing schedule of arriving flights and hence determine the GHD that minimizes some cost function.

**2) IPA Derivative Estimation for a Queueing System, Pirooz Vakili**, Boston University, Dept. of Mfg. Eng., 15 Saint Mary's St., Boston, MA 02215, vakili@bu.edu

We propose an algorithm for estimating performance derivatives with respect to routing parameters in a queueing system and discuss the statistical properties of the estimators. We give a review of other algorithms that have been used to solve the same problem.

**3) A Global Approach for Large-Scale Buffer Allocation Problems, Leyuan Shi**, University of Wisconsin, Dept. of IE, Madison, WI 53706, leyuan@ie.engr.wisc.edu

We present a hybrid approach that combines perturbation analysis techniques with the nested partition method for a large scale buffer allocation problem. The effectiveness of the hybrid algorithm will be demonstrated through a numerical example.

**SC28 Rigorous Qualitative Analysis**

**Sponsor:** Social Science Applications Section

**Sponsored Session**

**Chair:** Gerald Jones, California State University, Dept. of IS/DS, Craig Sch. of Bus., Fresno, CA 93740-8001, geraldj@csufresno.edu

**1) Y2K: Death of Simulations Visions of the Future, Gerald Jones**, California State University, Dept. of IS/DS, Craig Sch. of Bus., Fresno, CA 93740-8001, geraldj@csufresno.edu

While much has been heard about the problems created by the Y2K bug, most academics expect it to have little, if any, impact on their normal activities. Unfortunately, that is not always the case. We report on the impact the bug will have on batch-processed simulations and alternatives to be developed.

**2) Tutorial/Workshop in Leadership, Gerald Jones**, California State University, Dept. of IS/DS, Craig Sch. of Bus., Fresno, CA 93740-8001, geraldj@csufresno.edu

This workshop allows participants to experience the use of a management ethics survey in exploring differences in responses to ethical situations as a function of generation and various other demographic variables. Participants will find the material and process employed useful in leadership, ethics, management research and in the classroom for generating discussion and learning.

**SC29 Public Policy Applications**

**Contributed Session**

**Chair:** Yun Wang, Mercy College, Math/CIS Dept., 555 Broadway, Dobbs Ferry, NY 10522, ywang@mercynet.edu

**1) Crime Displacement Phenomenon & Enforcement Allocation Policies, Shouu-Jiun Wang**, SUNY, 342 Bell Hall, Dept. of IE, Buffalo, NY 14260, sw@eng.buffalo.edu, **Rajan Batta, Christopher M. Rump**

Criminal displacement is the phenomenon when offenders of certain types of crimes shift the incidence of crime to other types of crimes, times or locations. We develop rules of thumb aimed at effective policy design through an understanding of how criminal displacement occurs and improving enforcement operations.

**2) Workflow Modeling for Inter-Organizational Virtual Information Dissemination, Siva R. Sankaran**, California State University, Dept. of Acct. & MIS, 18111 Nordhoff St., Northridge, CA 91330-8372, siva@pacbell.net, **Tung X. Bui**

We propose the concept of virtual information dissemination and advocate a domain-independent architecture for a system that, when implemented on the Internet, can serve as a decision support tool for those managing a humanitarian crisis. Expectations in terms of accuracy, response time and reduction of human suffering were met.

**3) Blacklisting Social Science Institutions: A Revisit, Richard A. Colombo**, Fordham University, 113 West 60th St., New York, NY 10023, rcolombo@pipeline.com, **Don G. Morrison, Robin Wensley**

We examine the effect of the ESRC's policy of denying PhD studentships to institutions whose submission rates fall below a threshold. We use a beta-binomial model with time-varying parameters to investigate how submission rates from over 80 UK social science institutions have changed over the past 10 years.

**4) Implementing Cost-Effective Technology Training Programs at Public Schools, Yun Wang**, Mercy College, Math/CIS Dept., 555 Broadway, Dobbs Ferry, NY 10522, ywang@mercynet.edu

A better technological environment for this nation's public education relies on many factors. Technology training is one factor, playing a critical role in improving district's education standards in our current high-tech world. We provide various ways to implement cost-effective technology training processes within a district's existing tight budget.

**SC31 Aviation System Safety & Risk Analysis**

**Cluster:** Reliability & Quality Engineering

**Invited Session**

**Chair:** James Luxhoj, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, luxhoj@princess.rutgers.edu

**1) System Safety & Risk Analysis for Air Carrier Oversight, Donald Arendt**, Federal Aviation Administration, Flight Standards Certification, AFS 900, 45005 Aviation Dr., Dallas, VA 20166, don.arendt@faa.dot.gov

We focus on the rule of system safety principles and risk analysis techniques in the development of surveillance and oversight programs for aircraft carriers.

**2) withdrawn - author request of 10/11, Kathleen V. Diegert**, Sandia National Lab., Stats. & Human Factors Dept., PO Box 5800, Albuquerque, NM 87185-0829, kvdiege@sandia.gov, **Karen S. Marlman, Alice J. Johnson**

**3) Monitoring Multiple Aviation Safety Data by Data Depth: Control Charts & Threshold Systems, Regina Liu**, Rutgers University, Dept. of Statistics, Hill 453, Piscataway, NJ 08854, liu@stat.rutgers.edu, **James Luxhoj, Andrew Cheng**

We present an application of a nonparametric methodology based on data depth for monitoring multivariate safety observations. The control chart is combined here with threshold levels for evaluating the performance of aircraft operators and provides clear guidelines for identifying unexpected performances and for aligning appropriate corrective actions.

**4) Applying Hilbert-Space Methods to Multivariate Quality Control & Risk Monitoring, Lars Nordmann**, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, **James Luxhoj**

We explore the utility of Hilbert-Space methods for the statistical analysis of multivariate data clouds. Applications can be found in aviation safety and general risk assessment.

**SC32 High-Speed Networks**

**Sponsor:** Technical Section on Telecommunications

**Sponsored Session**

**Chair:** Eli V. Olinick, University of California, Department of IEOR, 4135 Etcheverry Hall, Berkeley, CA 94720-1777, olinick@ieor.berkeley.edu  
http://www.ieor.berkeley.edu/~olinick

1) **Routing in ATM Networks, Pascal R. Chanas**, France Telecom CNET, 905 rue Albert Einstein, Sophia-Antipolis, 06921, France, **Olivier Goldschmidt, Michel Burlet**

We consider the arc-disjoint path problem where demands in an ATM network must be routed on a unique path. We present new theoretical results for the problem in symmetric digraphs and heuristics to solve routing problem for VP network design. We present empirical results from real world cases.

2) **Virtual Path Layout in ATM Networks, Olivier Goldschmidt**, Make Systems, 4000 Regency Park, Cary, NC 27511, olivier@makesys.com, **Michel Burlet, Pascal R. Chanas**

We present a mathematical model and algorithmic techniques for optimizing the layout of virtual paths in an ATM network with the general objective of minimizing the number of VPs between nodes in the network. Specifically, we design a virtual path network that minimizes the diameter of the VP network.

3) **The Path Restoration Version of the Spare Capacity Allocation Problem with Modularity Restrictions, Jeffery L. Kennington**, SMU, Dept. of Comp. Sci. & Eng., Dallas, TX 75275-0122, jlk@seas.smu.edu, **Mark W. Lewis**

We present an efficient algorithm for the path restoration version of the spare capacity allocation problem with modularity restrictions. The algorithm is a special implementation of B&B that exploits modularity. Special cuts are used to obtain a tighter LP relaxation. An empirical analysis is presented.

4) **The SONET Edge Partition Problem, Eli V. Olinick**, University of California, Department of IEOR, 4135 Etcheverry Hall, Berkeley, CA 94720-1777, olinick@ieor.berkeley.edu http://www.ieor.berkeley.edu/~olinick, **Olivier Goldschmidt, Dorit S. Hochbaum**

Given pairwise bandwidth demands, we wish to connect customer sites with a network of unidirectional SONET rings. Sites may be assigned to multiple rings; however, traffic between 2 sites cannot be split between rings. The objective is to minimize the total number of ADMs required for the network.

### SC33 Predictive & Proactive Maintenance: Models & Methods

**Sponsor:** Quality, Statistics & Reliability  
Sponsored Session

**Chair:** Stephen M. Pollock, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, pollock@umich.edu

1) **Predictive Maintenance using a Precursor Window, Lisa M. Maillart**, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, maillart@umich.edu, **Stephen M. Pollock**

If condition monitoring of a machine occurs within a precursor window, preventive maintenance can be performed that time. However, if failure occurs before monitoring, reactive maintenance must be performed. We find optimal monitoring intervals that balance between costs of monitoring and maintenance. The results suggest a practical method for allocating monitoring resources among many machines.

2) **PM-Expert: A Decision Support System for Profit-Driven Maintenance, Daniel J. Reaume**, General Motors R&D Center, 30500 Mound Rd., Warren, MI 48090-9055, daniel\_reaume@gmnotes3.gmr.com, **Jeffrey M. Alden**

Balancing increased profit against the cost of maintenance is a critical problem for managers of production systems. A DSS is needed to analyze the effects of maintenance planning decisions on safety, quality, throughput and profit. We present such an application, PM-Expert, for the user-friendly preparation, analysis and graphical presentation of maintenance related business cases.

3) **Coordinating Quality Control & Maintenance, Kevin W. Linderman**, University of Minnesota, 3-235 Carlson Sch. of Mgmt., Minneapolis, MN 55455, klinderman@csom.umn.edu, **Kathleen E. McKone**

Process variation is tightly linked to the condition of the production equipment. Therefore, control of the process may be improved if quality control methods are supplemented with equipment maintenance policies. In particular, we recommend that maintenance costs...

### SC34 The Theory & Applications of Supply Chain Management

**Cluster:** Manufacturing Systems  
Invited Session

**Chair:** Susan Li, Adelphi University, School of Business, 1 South Ave., Box 701, Garden City, NY 11530, susan@panther.adelphi.edu

1) **Selection of Suppliers Considering the Learning Effect & Technology Improvement, Shanling Li**, McGill University, Faculty of Management, 1001 Sherbrooke St. West, Montreal, Quebec, H3A 1G5, Canada, li@management.mcgill.ca, **Wendy Huang, Devanath Tirupati**

We examine the impact of supplier learning and technology improvement and compare long-term and short-term suppliers. Signing a long-term contract will be benefited from learning effect. Periodically searching the best market price may take the advantage of technology breakthroughs. We developed models to describe the supplier selection problems and derive analytical results.

2) **System Cooperation with Quantity Discount Consideration, Zhimin Huang**, Adelphi University, Sch. of Mgmt. & Business, 1 South Ave., Box 701, Garden City, NY 11530, huang@panther.adelphi.edu, **Susan Li**

This study deals with a situation where the buyer has a monopolistic position, and examines the issues and advantages of cooperation in a buyer-seller inventory control system. Game theory concepts form the foundation for our analysis of these issues. The similarity and differences between our model and those in the literature are discussed.

3) **Approaches to a Mail Transportation Network Problem, Wen-Chyuan Chiang**, University of Tulsa, Finance & OM Dept., 600 South College Ave., Tulsa, OK 74104-3189, wen-chyuan-chiang@utulsa.edu, **Panagiotis Kouvelis**

We consider a mail network problem with different transportation modes. We propose intelligent heuristics to solve the problem. The quality of computational results is demonstrated.

### SC35 Tutorial: Generalized Hill Climbing Algorithms in Optimization

Invited Session

**Chair:** Sheldon H. Jacobson, University of Illinois, Dept. of MIE, 1206 West Green St., MEB 226, Urbana, IL 61801-2906, shj@uiuc.edu, http://www.staff.uiuc.edu/~shj/shj.html

1) **Tutorial: Generalized Hill Climbing Algorithms in Optimization, Sheldon H. Jacobson**, University of Illinois, Dept. of MIE, 1206 West Green St., MEB 226, Urbana, IL 61801-2906, shj@uiuc.edu, http://www.staff.uiuc.edu/~shj/shj.html

GHC algorithms have been introduced as a unifying framework for addressing intractable discrete optimization problems. GHC algorithms provide a well-defined structure for classifying and studying a large body of stochastic and deterministic search strategies. Simulated annealing, threshold accepting and TS, among others, can all be formulated as particular GHC algorithms. We review the GHC structure...

### SC36 DEA II

Contributed Session

**Chair:** David W. Moore, University of California, 4135 Etcheverry Hall, Dept. of IEOR, Berkeley, CA 94720, davidm@ieor.berkeley.edu

1) **Determining Academic Departments Productivity & Quality with a Fuzzy Data Envelopment Analysis Model, Ana Lucia Lopes**, Universidade do Sul de Santa Catarina, Rua do Guapuruvu, 155, Florianopolis, SC, 88062-240, Brazil, ana@eps.ufsc.br, **Edgar Augusto Lanzer, Ricardo M. Barcia**

A model to evaluate the performance productivity and quality of academic departments is proposed, based on DEA that was applied to sets of teaching, research, service and quality indicators resulting in 4 frequency distributions that can be interpreted as fuzzy productivities measures. The fuzzy measures were integrated through an optimum (simulated) department choice of an ordered weighted aggregator...

2) **Estimation of Efficiency Score under Uncertainty, Hideo Michida**, Kobe University, Dept. of CSE, Rokkodai-cho, Nada, Kobe, Hyogo, 657-8501, Japan, michida@kaede.seg.kobe-u.ac.jp, **Hiroshi Morita, Noriyoshi Nakayama**

The efficiency score calculated using uncertain data is also uncertain, and the

inefficiency should be included the inefficiency from uncertainty. We propose an interval of efficiency score to estimate the true efficiency score which is not spoiled by uncertainty. The uncertain data are given as repeated observations in this study.

**3) An Interactive Approach to Improve Estimates of Value Efficiency in Data Envelopment Analysis, Tarja Joro**, University of Alberta, 3-04F Business Bldg., Edmonton, Alberta, T6G 2R6, Canada, tjoro@ualberta.ca, <http://www.bus.ualberta.ca/tjoro>, **Pekka J. Korhonen, Stanley Zionts**

Value efficiency analysis is an approach to incorporate preference information in DEA. Some related concepts to value efficiency analysis are developed in order to obtain more precise estimates. DEA, value efficiency analysis and the proposed refinements are then applied to estimate the efficiency of university research units.

**4) Non-Parametric Analysis of Productive Efficiency using Engineering Knowledge & Detailed Data, David W. Moore**, University of California, 4135 Etcheverry Hall, Dept. of IEOR, Berkeley, CA 94720, davidm@ieor.berkeley.edu

We develop a non-parametric theory of productive efficiency for detailed engineering data, as opposed to aggregate economic data. We endow the input and output correspondences with additional structure compared to those of traditional DEA models. This additional structure leads to new modes of efficiency analysis and generalizes the DEA approach.

### SC37 Integrating OR/MS & Finance in the Classroom

Sponsor: INFORM-ED

Sponsored Session

Chair: James J. Cochran, University of Cincinnati, QAOM Dept., PO Box 210130, Coll. of Bus. Admin., Cincinnati, OH 45221-0130, cochraj@econqa.cba.uc.edu

**1) Teaching Finance-Related Decision Modeling, Samuel E. Bodily**, University of Virginia, Darden Grad. Sch. of Bus. Adm., Box 6550, Charlottesville, VA 22906-6550, bodilys@darden.gbus.virginia.edu

Teaching finance-related decision modeling in the MBA quantitative required course, in MBA electives, and in executive education is discussed. Topics include appraisal of capital projects in uncertainty, risk management and preference, how to create value and reduce risk, staged investing, and hedging. The approach uses cases and spreadsheets with simulation and other aids.

**2) A Program in Investment Science, David G. Luenberger**, Stanford University, EES&OR Dept., 314 Terman Eng. Ctr., Stanford, CA 94305-4023, luen@leland.stanford.edu

I shall describe an integrated educational program consisting of several courses beginning at the MS level and progressing through the PhD. The series begins with the three most important analytic techniques and builds a solid foundation of theory and computation methods, applied to both securities and real projects.

**3) Integrating Finance & MS in an MBA Program, Wayne L. Winston**, Indiana University, Kelley School of Bus., Bloomington, IN 47405, winston@indiana.edu

We will discuss how finance and management science are integrated in the IU MBA program. This fall I am giving eight lectures in the second year finance electives which integrate finance and MS. The content of these courses will be discussed.

## Sunday 15:00-16:30

### SD01 Utilities for Groups & Corporations

Sponsor: Decision Analysis Society

Sponsored Session

Chair: James E. Smith, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, jes9@mail.duke.edu

**1) Multiperson Utility, Manel Baucells**, UCLA, The Anderson School, 655 Levering Ave., Los Angeles, CA 90024, mbaucell@anderson.ucla.edu, **Lloyd Shapley**

We set the problem of preference aggregation in a context of incomplete preferences. The main result is that a hierarchy (formally, a spanning tree) of bilateral agreements along with the extended Pareto rule is sufficient to build a complete preference for groups.

**2) The Corporate Contractual System & Normative Corporate Risk Attitude, J. Eric Bickel**, Stanford University, 300 Granada Dr. #4, Mountain View, CA 94043, bickel@stanford.edu

Based on the view that the corporation is a contractual system, we show how

what can be thought of as "corporate risk attitude" is induced. In so doing, we provide a normative argument for the existence of corporate utility and suggest ways in which this utility function may be determined.

**3) The Impact of Risk Attitude Approximations on Decision Analysis Results, Craig W. Kirkwood**, Arizona State University, Dept. of Management, Tempe, AZ 85287-4006, craig.kirkwood@asu.edu

There is a "folk theorem" in decision analysis practice that says risk aversion doesn't matter in many practical decisions, and that when risk attitude does matter it is often adequate to use an exponential utility function. We report the results of an extensive simulation test of this conjecture.

**4) Risk-Sharing & Corporate Risk Attitudes, James E. Smith**, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, jes9@mail.duke.edu

We consider the problem of deriving a corporate utility function from the risk preferences of the company's shareholders. Though we cannot uniquely determine the corporate utility function (except under very special circumstances), we can place bounds on corporate risk tolerances and certainty equivalents based on the preferences of the shareholders.

### SD02 Dynamic Routing

Cluster: Combinatorial Optimization & Network Flows

Sponsor: Optimization Section

Sponsored Session

Chair: Sarah Stock Patterson, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, sara.sp@duke.edu

**1) A New Model for Dynamic Route Guidance, Andreas S. Schulz**, MIT, Sloan Sch. of Management, E53-361, Cambridge, MA 02139, **Olaf Jahn, Rolf H. Moehring**

The design of route-guidance algorithms faces a dilemma. The approach that theoretically yields the optimum system performance may discriminate against some users. Proposed alternate methods, however, do not directly address the system optimum and may result in inferior performance. We propose a novel model and algorithms to resolve this dilemma.

**2) Fluid Analysis of Arrival Routing, Dimitris Bertsimas**, MIT, Sloan Sch. of Mgmt., 50 Memorial Dr., Bldg. E53-363, Cambridge, MA 02142, dbertsim@aris.mit.edu, **Michael H. Veatch**

Arrivals are routed to one of  $n$  queues to minimize average holding cost. Analysis using fluid limits shows that, when queues are large, routing only switches to queues with larger holding cost. The optimal fluid policy is compared with the optimal policy for exponential interarrival and service times.

**3) The Time-Dependent Quickest Transshipment Problem, Sarah Stock Patterson**, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, sara.sp@duke.edu, **Elise D. Miller-Hooks**

We present a pseudopolynomial time algorithm to solve the time-dependent integral quickest transshipment problem. This algorithm determines the minimum time paths along which to send supply between multiple sources and sinks in a time-dependent (w.r.t. travel times, arc and node capacities and supply) and dynamic (w.r.t. flow) network.

### SD03 Learning & Testing in Product Development

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Christoph H. Loch, INSEAD, Blvd. de Constance, Fontainebleau, 77305, France, christoph.loch@insead.fr

**1) A Dynamic Project Prioritization Policy, Stylianos Kavadias**, INSEAD, Blvd. de Constance, Fontainebleau, 77305, France, stylianos.kavadias@insead.fr, **Christoph H. Loch**

Scarce resources present a typical problem in firms pursuing multiple product development projects in parallel. Once projects are under way and compete for resources, how should priorities be dynamically assigned to maximize total project value? We develop a multi-armed bandit formulation of the problem and derive simple prioritization policies that are continuously updated.

**2) Learning & Process Improvement during Production Ramp-Up, Christian Terwiesch**, University of Pennsylvania, The Wharton Sch., Dept. of OPIM, SH-DH 1300, Philadelphia, PA 19104, terwiesch@wharton.upenn.edu, **Roger Bohn**

We analyze the interactions among production speed, capacity utilization, yields and process improvement (learning) during production ramp-up of a new product. We model learning in the form of deliberate experimentation. Experiments such as engineering trials lead to process improvements, but they

also reduce capacity in the short run.

**3) Optimal Testing in Product Development, Stefan Thomke,** Harvard Business School, Morgan Hall T63, Soldiers Field, Boston, MA 02163, sthomke@hbs.edu, **David Bell**

A fundamental problem in managing product development is the optimal timing, frequency and fidelity of testing activities that are carried out to evaluate novel product concepts and designs. We will present several important findings on optimal testing strategies that are the result of a formal mathematical model on testing.

**4) Preliminary Information, Testing & Communication in Product Development, Christoph H. Loch,** INSEAD, Blvd. de Constance, Fountainebleau, 77305, France, christoph.loch@insead.fr, **Christian Terwiesch, Stefan Thomke**

We model a product design activity as search in a problem tree, where multiple tests are used to identify a design solution. The problem structure determines the best search policy. It is common in concurrent engineering that a dependent "downstream" activity must make commitments before the design solution is known...

#### SD04 Multi-Unit Auctions

Cluster: Economics & Game Theory  
Invited Session

Chair: Michael H. Rothkopf, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854-8003, rothkopf@rucor.rutgers.edu

**1) Trading Portfolios: An Experimental Evaluation, Sayee Srinivasan,** OptiMark Technologies Inc., 530 Main Ave., Durango, CO 81301, ssrinivasan@maileroptimark-tech.com, **Jan Stallaert, Andrew B. Whinston**

Investors prefer to hold diversified portfolios of assets. We take this dictum seriously and propose a double auction model that would allow investors to trade non-standard combinations of assets. Preliminary results from laboratory experiments indicate that the model can be improved along numerous dimensions. The proposed framework is an initial effort to design markets that reflect true needs of investors.

**2) Auctions & Subsidies, Indranil Chakraborty,** Instituto Tecnológico Autónomo de México, Dept. of Bus. Admin., Rio Hondo 1 Col. Tizapan-Angel, Mexico DF, 01000, Mexico, indranil@eniatic.rhon.itam.mx

We demonstrate the effect of a subsidy and quantity discount in a multi-unit auction under the (Friedman) uniform price rule. When there are 2 units on sale, a sufficiently large lump-sum subsidy to a bidder who wins both units makes bidders more aggressively on the second unit. This increases the expected revenue to the seller...

**3) Demand Reduction in Multi-Unit Auctions: Evidence from a Sportscard Field Experiment, David Lucking-Reiley,** Vanderbilt University, Nashville, TN, reiley@vanderbilt.edu, **John A. List**

Auction theory suggests that multi-unit uniform-price auctions entail demand reduction incentives which may cause inefficient allocations and reduced revenue. We present the results of an experiment with multi-unit auctions for \$10,000 worth of sportscards. As predicted theoretically, we find significant demand reduction. The bid differences are large enough to affect the allocation of goods...

#### SD05 Knowledge Representation in DA

Contributed Session

Chair: Fei Qin, Duquesne University, 353 Gross St., Apt. 2, Pittsburgh, PA 15224, qin6313@duq.edu

**1) A Causal Mapping Approach to Constructing Bayesian Networks, Sucheta S. Nadkarni,** University of Kansas, School of Business, Lawrence, KS 66045, snadkarni@bschool.wpo.ukans.edu, **Prakash P. Shenoy**

We describe a systematic procedure to construct Bayesian networks based on expert knowledge using the causal mapping approach. We outline how causal beliefs of experts in specific domains can be represented as graphical structures and how probability encoding techniques can be used to derive the parameters of the structure.

**2) Sensitivity of Correlations for Expert Probability Distributions, Christopher J. Lacke,** Rowan University, Math Dept., Glassboro, NJ 08028, lacke@rowan.edu, www.rowan.edu/mars/depts/math/lacke/lacke1.html, **Robert T. Clemen**

Using a copula to combine expert probability distributions requires assessing dependence among the experts' opinions. In the context of a colorectal cancer

screening model, we study the sensitivity of experts' combined distributions to subjectively assessed correlations. We also study the sensitivity of the choice of the optimal screening regimen.

**3) withdrawn - author request of 9/6, Roberto Ley-Borras,** Instituto Tecnológico de Orizaba, Oriente 13 A No. 1122, Entre Norte 28 y 28 A, Orizaba, Veracruz, 94300, Mexico

**4) A Sample Preparation Expert-Database System for Microwave Digestion III, Object-Oriented Programming & Online Database, Fei Qin,** Duquesne University, 353 Gross St., Apt. 2, Pittsburgh, PA 15224, qin6313@duq.edu, **Howard M. Kingston**

We describe the architecture of a hybrid expert-database system for microwave sample preparation: MWDXpert from a programming point of view. Microsoft Access database tables are used for storing both analytical data and inference rules. Microsoft Excel is used for statistical calculation. Structured query language and active data objects are used to achieve database software independence...

#### SD06 Financial Decision Making in Health Care

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Stefanos Zenios, Stanford University, Grad. Sch. of Business, Stanford, CA 94305-5015, stefzen@leland.stanford.edu

**1) The Role of Provider Financial Incentives in Health Care, Mark Pauly,** University of Pennsylvania, The Wharton School, Pennsylvania, PA 19104, pauly@wharton.upenn.edu

This talk will provide an overview of our current knowledge about the role of provider financial incentives in health care.

**2) A Budget Allocation Model for Non-Profit Hospitals Based on DEA, Jens Muller, Stefan Scholtes**

We consider  $n$  DMUs with corresponding output vectors  $A_1, \dots, A_n$ . We wish to allocate a given Budget  $B$  to the DMUs, i.e. to find a budget allocation vector  $b$  with  $b_1 + \dots + b_n = B$ . We present a fixed point method for the calculation of this allocation and give some preliminary numerical results.

**3) Modeling the Impact of Reimbursement Policy on Clinics, Patients & Pharmaceutical Firms, Kut C. So,** University of California, Grad. School of Mgmt., Irvine, CA, rso@gsm.uci.edu, **Chris Tang**

We present a mathematical model that enables us to examine the impact of a drug reimbursement policy. Despite the simplistic structure of our model, the analysis helps our understanding of the joint impact of such a policy on the patients, the clinic and pharmaceutical firm, and thus can provide valuable information for evaluating the effectiveness of implementing such a reimbursement policy.

**4) Incentive Compatibility in the Delivery of Dialysis Therapy, Stefanos Zenios,** Stanford University, Grad. Sch. of Business, Stanford, CA 94305-5015, stefzen@leland.stanford.edu, **Prashant C. Fuloria**

We develop a multi-task principal-agent model that can be used to investigate the impact of different reimbursement policies on the delivery of dialysis therapy. The model assumes that the agent controls the departure rates in a multiclass M/M/infinity queue and the principal reimburses the agent based on the performance of the queue.

#### SD07 Scheduling, Logistics & Facilities Design II

Cluster: Manufacturing & Logistics

Invited Session

Chair: Alice E. Smith, University of Pittsburgh, Dept. of IE, 1031 Benedum Hall, Pittsburgh, PA 15261, aesmith@engrng.pitt.edu

Co-Chair: Bryan A. Norman, University of Pittsburgh, 1048 Benedum Hall, Dept. of IE, Pittsburgh, PA 15232, banorman@engrng.pitt.edu

**1) Manufacturing Offshore: What Changes it Brings to your Logistics System, Russell D. Meller,** Auburn University, 308 Dunstan Hall, Dept. of ISE, Auburn, AL 36849-5346, rmeller@eng.auburn.edu, **Pamela H. Vance**

Offshore manufacturing is being utilized or considered by many companies today. A transition to offshore manufacturing has dramatic implications for the logistics system. We discuss a preliminary model for determining which operations should be performed offshore. We also discuss one company's

experience with this transition.

**2) Responsibility-Based Design of Networked Production Systems, Benoit Monreuil, Université Laval, Operations et Systèmes Dec., Pavillon de Seve, Bureau 1152, Sainte-Foy, Québec, G1K 7P4, Canada, benoit@osd.ulaval.ca, Marc Poulin, Alain Beaulieu**

We present a conceptual framework for developing an integrated design of the operational strategy, the manufacturing organization, the facilities configuration and the manufacturing information architecture of a manufacturing enterprise in terms of a networked production system. We provide an illustrative industrial application.

**3) Integrated Design & Operation of Dual Resource Constrained Flow Shops, Ronald G. Askin, University of Arizona, Dept. of SIE, PO Box 210020, Tucson, AZ 85721-0020, ron@sie.arizona.edu**

Manufacturing cells and flow shops often have more workstations than workers. Cross-trained workers perform multiple operations either with a deterministic orbit for each worker or a more flexible, real-time control strategy. We examine the impact of transfer batch sizes, buffer inventory levels and worker control strategies across a variety of parameterizations of this environment.

**4) Developing Effective Placement Solutions for Indoor Wireless Communications Networks, Bryan A. Norman, University of Pittsburgh, 1048 Benedum Hall, Dept. of IE, Pittsburgh, PA 15232, banorman@engr.pitt.edu, Marty Adickes, Rick Billo**

Successful installation of indoor wireless communications depends on transceiver placement such that effective radio communication can take place. We present a computerized layout simulation system incorporating Genetic Algorithms as the placement engine for transceivers, coupled with circle covering heuristics to determine initial numbers of transceivers and coverage characteristics.

**SD08 Game Theoretic Models in OM**

Cluster: Manufacturing & Logistics  
Invited Session

Chair: Izak Duenyas, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109, duenyas@umich.edu

**1) A Competitive Modeling of Electricity Pricing, Chonawee Supatgiat, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48105-2119, chonawee@umich.edu, John R. Birge, Rachel Q. Zhang**

We consider an open electricity market with uniform pricing rule. The market is modeled as a multi-round auction, which represents a large-scale problem in game theory. The generators face a large decision space and have different generation costs and capacities. We derive their optimal operating policies and the resulting electricity spot prices.

**2) A Stackelberg Game of Pricing, Hyun-Soo Ahn, University of Michigan, Dept. of IOE, 205 Beal Ave., Ann Arbor, MI 48109-2117, hsahn@umich.edu, Izak Duenyas, Rachel Q. Zhang**

We consider a pricing problem faced by a manufacturer who sells his goods at a retail outlet and at its own store. There are 3 pricing decisions to be made: the manufacturer determines the price to sell the product to the retail outlet, the outlet determines its sale price and the manufacturer determines its sale price...

**3) Price Competition under Stochastic Capacity, Scott Carr, UCLA, Anderson Sch. of Mgmt., Los Angeles, CA, Izak Duenyas, William S. Lovejoy**

We consider price competition between 2 companies under stochastic capacity. The firms first set their prices which result in orders. They then attempt to produce the products ordered using the (random) capacity they have. There is a penalty for unfilled orders. We model the pricing problem using a game-theoretic model and present structural results.

**SD09 Group Decision & Negotiation**

Contributed Session

Chair: Donald N. Stengel, California State University, 5245 North Backer Ave., MS PB07, Fresno, CA 93740-8001, don\_stengel@csufresno.edu

**1) Electre-GA: A GDSS Based on a Fuzzy Outranking Relation, Juan C. Leyva-Lopez, Autonomous University of Sinaloa, Facultad de Ingeniería, Ciudad Universitaria, Culiacan, Sinaloa, 80040, Mexico, jleyva@uas.uasnet.mx**

An extension and modification of the ELECTRE III multicriteria outranking methodology is developed to assist a group of decision makers to achieve a

consensus on a set of possible alternatives. The procedure is proposed to take place in a specially computer-equipped GDSS room and be conducted by an analyst-facilitator.

**2) An Intelligent Employee Performance Appraisal Writer: An Illustration of Knowledge-Based Group Decision-Making, Elmore Alexander, Philadelphia College, Sch. House Ln. & Henry Ave., Philadelphia, PA 19144, alexandere@philacol.edu, Rashmi Malhotra, Davinder K. Malhotra**

We illustrate the design and development of a GDSS that uses the capability of knowledge-based expert systems. Although DSS and GDSS are very extensively used by managers, the knowledge management subsystems of current DSSs are not very well developed. To validate and illustrate the usefulness of the MS, we illustrate the development of an intelligent employee appraisal writer...

**3) Joint Gains: Global Negotiation Support in the Internet, Eero Kettunen, Helsinki University of Technology, Systems Analysis Lab., PO Box 1100, Espoo, HUT, 02015, Finland, systems.analysis@hut.fi, http://www.sai.hut.fi, Raimo P. Hamalainen**

Joint Gains (www.jointgains.hut.fi) supports negotiations in the Web using the method of improving directions for multi-party negotiations over multiple continuous issues. All the participants will gain at every iteration. Our other Web-DSS tools and negotiation agents in e-commerce are also discussed.

**4) Division of a Merit Pay Pool by Peers, Donald N. Stengel, California State University, 5245 North Backer Ave., MS PB07, Fresno, CA 93740-8001, don\_stengel@csufresno.edu**

A merit pay pool will be divided among members of a department. Departmental peers are the best judges of a colleague's deservedness of merit pay but such an arrangement encourages opportunism by generally underrating others. We propose a mathematically-based procedure for fair division which removes the underrating bias.

**SD10 Semidefinite Programming & its Applications II**

Cluster: Optimization & Applications

Sponsor: Optimization Section  
Sponsored Session

Chair: Renato D. C. Monteiro, Georgia Institute of Technology, School of ISyE, Atlanta, GA 30332, monteiro@isye.gatech.edu

**1) Using SDP for Min-Bisection, Cris Choi, University of Iowa, Dept. of MS, Tippie Coll. of Business, Iowa City, IA 52242, cchoi@dollar.biz.uiowa.edu, Yinyu Ye**

We present computational results for solving graph min-bisection, i.e., partitioning the nodes of a (nonnegative) weighted graph into two blocks of equal cardinality so as to minimize the weights of crossing edges. In particular, we report computational results on solving a set of circuit partition problems arising in the chip design industry.

**2) A General Framework for Establishing Polynomial Convergence of Long-Step Methods for SDP, Sam Burer, Georgia Institute of Technology, School of ISyE, Atlanta, GA 30332, burer@math.gatech.edu, Renato D. C. Monteiro**

We present a general framework for establishing polynomial convergence of long-step methods for SDP. This framework unifies previous polynomial long-step convergence results and is used to establish new polynomial convergence results for long-step methods based on several symmetric central path equations.

**3) An Efficient Algorithm for Solving the Maximum Cut Relaxation SDP Problem, Renato D. C. Monteiro, Georgia Institute of Technology, School of ISyE, Atlanta, GA 30332, monteiro@isye.gatech.edu, Sam Burer**

We present an algorithm for solving the positive semidefinite relaxation of the maximum cut problem and compare it to the dual-scaling interior-point algorithm of Benson et al. We present computational experiments to show that our method is quite fast on large scale problems.

**SD11 Advances in Global Optimization**

Cluster: Global Optimization

Sponsor: Optimization Section  
Sponsored Session

Chair: Nick Sahinidis, University of Illinois, Dept. of Chem. Eng., 600 South Mathews Ave., Urbana, IL 61801, nikos@uiuc.edu

**1) Global Optimization of Two-Stage Stochastic Mixed Integer Programs, Shabbir Ahmed, University of Illinois, Dept. of Chemical Eng., 600 South Mathews Ave., Urbana, IL 61801, s-ahmed1@uiuc.edu**

edu, *Mohit Tawarmalani, Nick Sahinidis*

We develop a B&B-based global optimization algorithm for solving 2-stage stochastic MIPs with discretely distributed parameters. We devise specialized lower bounding and branching strategies and discuss finiteness issues. Computational experience with the algorithm is provided.

2) **Portfolio Optimization via Global Nonconvex Quadratic Programming**, *J. P. Shectman*, University of Illinois, Dept. of Chemical Eng., 600 South Mathews Ave., Urbana, IL 61801, jshectma@uiuc.edu, *Nick Sahinidis*

Markowitz's Nobel-prize-winning oeuvre introduced portfolio optimization with a simple QP model. Empirical evidence mandates a more complicated approach, but computational issues riddle many alternatives. While still quadratic, the proposed method accounts for the qualitative statistical behavior of security returns and investor preferences beyond second order.

3) **Convexification Tools in Integer Programming**, *Mohit Tawarmalani*, University of Illinois, Dept. of Chemical Eng., 600 South Mathews Ave., Urbana, IL 61801, tawarmal@uiuc.edu, *Nick Sahinidis*

We develop the theory of convex extensions for lower semi-continuous functions and characterize their generating sets through Fenchel transforms. The generating sets are employed to derive tight relaxations for integer programming problems.

4) **An Approach to Parallelize Global Optimization**, *Zelda B. Zabinsky*, University of Washington, Dept. of IE, Box 352650, Seattle, WA 98195, zelda@u.washington.edu, *Wen Luo, Mark E. Tuttle*

Advances in parallel computing offer tremendous opportunities in global optimization and raise questions on how to design parallel algorithms in order to make the best use of multiple processors. We will present various implementations of random search methods, with some theoretical bounds and computational experiments on test functions.

## SD12 Promotion Strategy

Sponsor: College of Marketing  
Sponsored Session

Chair: Atanu R. Sinha, UCLA, The Anderson Sch., 110 Westwood Plaza, Los Angeles, CA 90095-1481, atanu.sinha@anderson.ucla.edu

1) **Loyalty Rewards Programs: Own or Partnering?**, *Atanu R. Sinha*, UCLA, The Anderson Sch., 110 Westwood Plaza, Los Angeles, CA 90095-1481, atanu.sinha@anderson.ucla.edu, *Sanjay K. Dhar*

Firms in an industry often award rewards on loyalty programs of firms in other industries. Our objective is to examine this phenomenon, both theoretically and empirically, and to determine the conditions under which firms engage in such arrangements and the type of arrangements they use.

2) **Sources & Consequences of Customer Value & Customer Loyalty: Empirical Evidence from the Field**, *Indrajit Sinha*, Temple University, Fox School of Bus. & Mgmt., Philadelphia, PA, jsinha@sbm.temple.edu, *Wayne S. DeSarbo, Stephanie Young-Helou*

While customer value and loyalty programs are becoming increasingly pervasive in many industries and in many countries, empirical evidence linking these constructs in a nomological, behavioral framework to actual consumer purchase behavior is surprisingly scarce. We develop an integrative model of customer value and loyalty involving both their theoretical antecedents and consequences.

3) **Marketing Decisions to Maximize Customer Equity: Application to Promotion Budget Allocation**, *Paul D. Berger*, Boston University, 595 Commonwealth Ave., Boston, MA 02215, pdberger@bu.edu, *Nada I. Nasr*

We offer a general approach to the promotional budget allocation decision, where the goal is to maximize customer equity. We use decision calculus in which managers' judgments serve as some inputs to formal modeling. A series of applications are offered under different market conditions, including those with synergy, or interaction, between promotional vehicles.

4) **Product Trial & the Disconfirmation Model: A New Perspective**, *Gary H. Kritz*, Drexel University, gkritz@drexel.edu, *Paul Arsenaault*

Direct product experience has already been shown to lead to stronger attitude formation. Yet, the marketing literature has very limited research to explain under what conditions product trial works best. We incorporate a well-established model within a product trial framework to begin to help marketers make better promotional dollar allocation decisions.

## SD13 Marketing Applications of Statistical Models

Sponsor: College of Marketing  
Sponsored Session

Chair: Eric T. Bradlow, University of Pennsylvania, Wharton Sch., Ste. 1400 SH-DH, 3620 Locust Walk, Philadelphia, PA 19104

1) **Crossing the Chasm for High Technology Products: Traditional Diffusion of Innovations or Bi-Logistic Growth**, *Lee G. Cooper*, UCLA, 330 23rd St., Santa Monica, CA 90402-2514, *Koen Pauwels, Gary J. Russell, Wagner A. Kamakura*

Technology adoption life cycles have traditionally been modeled by the Bass (1969) model of diffusion of innovation. Recently, however, Moore (1994, 1995, and 1998) articulates a different theory of the market adoption of high-technology products. We translate Moore's approach into a model-based framework and estimate it on market data.

2) **A Latent-Class Autologistic Model for Market Based Data**, *Anand V. Bodapati*, Northwestern University, Kellogg Sch., 2001 Sheridan Rd., Evanston, IL 60208, *Gary J. Russell*

No abstract supplied.

3) **Predicting & Estimating for the Bayesian NBD Model**, *Eric T. Bradlow*, University of Pennsylvania, Wharton Sch., Ste. 1400 SH-DH, 3620 Locust Walk, Philadelphia, PA 19104, *Pete Fader, Bruce G. S. Hardie*

No abstract supplied.

## SD14 Organization Science

Sponsor: College on Organization Science  
Sponsored Session

Chair: Todd R. Zenger, Washington University, Olin School of Bus., 1 Brookings Dr., St. Louis, MO 63130-4899, zenger@mail.olin.wustl.edu

## SD15 Technology & Innovation Management II

Contributed Session

Chair: George E. Monahan, University of Illinois, Dept. of Business Admin., 1206 South 6th St., Champaign, IL 61820, gmonahan@uiuc.edu

1) **How Do Supplier-Buyer Relationships Impact Modularization in NPD?**, *Juliana Hsuan Mikkola*, Copenhagen Business School, Nansensgade 19, 6, Copenhagen, 1366, Denmark, jh.ivs@cbs.dk

The degree of modularization, or the opportunity for mixing-and-matching, inherent in a system is dependent upon the number of components and interface constraints shared among the components, modules and sub-systems. A mathematical modeling approach is used to explain such relationships in addition to how supplier-buyer relationships can impact opportunities for modularization.

2) **Managing the Paradox between Individual Career & Collective Research in Japan: An Organizational Approach**, *Jiang Wen*, University of Electro-Communications, MS Program, Grad. Sch. of IS, Chofu-ga-oka 1-5-1, Chofu-shi, Tokyo, 182-8585, Japan, wen@kob.is.uec.ac.jp, *Shinichi Kobayashi*

We provide new observations on managing the paradox between collective research and individual careers in Japan. The evidence, based on university-firm and inter-firm collaborations, shows that such a paradox does not exist in Japan due to the widely existed life-long employment customs and various adopted fluid organizations.

3) **Using Aggregate Process Models to Guide Research & Development Strategy in the Pharmaceutical Industry**, *Paul R. Bunch*, Eli Lilly & Company, Lilly Corporate Ctr., Indianapolis, IN 46077, bunch@lilly.com, *Aaron L. Schacht*

We consider the use of aggregate steady-state and dynamic process models to guide R&D strategy in the pharmaceutical industry. The role of models in linking desired R&D output to budgeting, resource allocation and setting performance objectives will be discussed. A case study will be presented that considers resource planning under uncertainty.

4) **Pollution Prevention or Control? A Model of Green Technology Acquisition**, *Chialin Chen*, University of Illinois, Dept. of Business Admin., 1206 South 6th St., Champaign, IL 61820, cchen3@uiuc.edu, <http://www.students.uiuc.edu/~cchen3>, *George E. Monahan*

A firm's strategic decision concerning green technology acquisition is modeled

as a Markov decision process. The focus is on the choice between pollution prevention and control technologies. Key elements of the analysis are the nature of green technology, the decision maker's risk perception and the competitive and regulatory environments.

### SD16 The Stochastic Programming Approach to Hedge Fund Disaster Protection

Sponsor: Financial Services Section  
Sponsored Session

Chair: William T. Ziemba, University of British Columbia, Fac. of Commerce, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, [ziemba@interchange.ubc.ca](mailto:ziemba@interchange.ubc.ca)

1) The Stochastic Programming Approach to Hedge Fund Disaster Protection, *William T. Ziemba*, University of British Columbia, Fac. of Commerce, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, [ziemba@interchange.ubc.ca](mailto:ziemba@interchange.ubc.ca)

Hedge funds are pooled investments for wealthy investors. Macro-funds make directional bets using derivatives. Others take less risk using long and short positions in mis-priced securities. These funds influence I markets with occasionally massive losses and possible bankruptcy. How can such losses be mitigated and prevented using stochastic programming models?

2) Integrated Financial Risk Management: Capital Allocation Issues, *John M. Mulvey*, Princeton University, Program in Financial Eng., Sch. of Eng. & Applied Sci., Princeton, NJ 08544, [mulvey@princeton.edu](mailto:mulvey@princeton.edu)

Optimization models provide the setting for allocating the capital of financial intermediaries. Allocation serves 3 purposes: compares performance across business units, provides a risk-indicator for regulators, develops a basis for major decisions. We show that allocation rules can be retrieved from the solution to a dynamic model of the firm.

3) Scenario Generation for Multistage Stochastic Programming Portfolio Models in Sequential Sampling Algorithms, *Michael H. Dempster*, University of Cambridge, Judge Inst. of Mgmt. Studies, Trumpington St., Cambridge, CB2 1AG, England, UK, [mahd2@cam.ac.uk](mailto:mahd2@cam.ac.uk)

Sequential sampling procedures for strategic financial portfolio problems relies on the definition of complex scenario generation procedures in which the random behaviour of the considered financial variables is taken into account. We describe a conditional scenario generator, which is interfaced with a recursive model generator and EVPI-importance sampling algorithm.

### SD17 Cognitive Aspects of Planning & Scheduling Support I

Cluster: Planning & Scheduling  
Invited Session

Chair: Rene Jorna, University of Groningen

1) Planning in Dynamic Situations: Some Experience in Process Control & Transportation, *J. M. Hoc*, Université de Valenciennes, Valenciennes, France, [jean-michel.hoc@univ-valenciennes.fr](mailto:jean-michel.hoc@univ-valenciennes.fr)

In cognitive psychology as in AI, studies of planning have been mostly devoted to static situations where the (human) planner fully controls the environment. Consequently, such studies have focused on action plans such as scheduling a series of actions to perform, although integrating hierarchical representations of plans...

2) Planning in Food Processing Industries, *Wout van Wezel*, University of Groningen, Groningen, The Netherlands, [w.m.c.van.wezel@bdk.rug.nl](mailto:w.m.c.van.wezel@bdk.rug.nl)

Market dynamics increasingly pose problems to small- and medium-sized organizations in food processing industries. In particular, customer requirements concerning quality, flexibility and price tend to increase continually. The internal flexibility of food processing organizations must increase in order to respond adequately to market demands. We discuss a planning concept for food processing industries...

3) Support for Engineering Planning Systems, *Leliane Nunes de Barros*

Literature on planning is overwhelming and no clear synthesis of the various planning methods exists that can be used to construct a planner for a particular application. We propose an approach to provide support for engineering planning systems by using a library of problem solving methods. We show how planners can be described in terms of this framework and how they can be conceived as being built from the library conceptual constituents...

4) Cognitive Aspect of Plan Execution & Lessons for Overall Planning, *Rene Jorna*, University of Groningen

Supporting the planning task with the help of computers requires extensive knowledge of the execution of this planning task by planners and schedulers. Hayes-Roth & Hayes-Roth (1979) and Garling (1994) studied the cognitive aspects of planning, but only did it with errand-planning tasks. We develop planning and scheduling support systems (Mietus, 1994; van Wezel, Jorna & Mietus, 1996)...

### SD18 Industrial Applications of Integer Programming

Cluster: Discrete Optimization  
Invited Session

Chair: Arthur Fenaroli, IBM, 522 South Rd., MSP356, Poughkeepsie, NY 12601, [artf@us.ibm.com](mailto:artf@us.ibm.com)

1) Integer Programming for Scheduling Petroleum Product Distribution, *Steve Welch*, Maritrans Management Services Inc., 1818 Market St., Ste. 3540, Philadelphia, PA 19103, [swelch@maritrans.com](mailto:swelch@maritrans.com), *Emmanuel D. Chajakis*

We have been using integer programming to schedule petroleum product deliveries across the Gulf of Mexico. As part of a suite of modeling tools, our fleet scheduling MIPs have enabled us to better integrate into our customer's supply chain and optimize the tradeoffs between customer service and fleet utilization.

2) Complex Industrial (0,1) MIP Problems: Controlling the BB Tree via OSL User Exits, *Kurt Spielberg*, 38 Knollwood Dr., Cherry Hill, NJ 80002, [kurtspie@us.ibm.com](mailto:kurtspie@us.ibm.com)

We describe a system based on OSL user exits that control the choice of nodes, branch variables and direction. Users can bring their knowledge of the problem, e.g. what variable values are important, to bear directly on the solution process. System design and results will be presented.

3) Location of Emergency Cleanup Equipment for Oil Spill Response Management, *Lefteris Lakovou*, University of Miami, Dept. of Indust. Eng., PO Box 248294, Coral Gables, FL 33124, [lefteris@eng.miami.edu](mailto:lefteris@eng.miami.edu), *Chi Ip*, *Christos Douligeris*, *Ashutosh Korde*

Myopic planning and tactical decision-making with regard to oil spill events result in severely inefficient cleanup efforts with high fixed, operating and cleanup/damage costs. We propose an integrated framework that addresses some important strategic issues such as determining the optimal location and capacity of cleanup equipment, taking into account their post-event complications...

4) The Use of Parallel OSL for Refinery Scheduling, *Rob Clark*, IBM, 522 South Rd., MSP356, Poughkeepsie, NY 12601, [roclark@us.ibm.com](mailto:roclark@us.ibm.com), *Gyana Parija*, *Sriram Vasantharajan*, *Ramesh Raman*

We will discuss our experiences with solving a difficult problem of planning the development and operation of oil fields over a specified time horizon. Several MIP strategies were developed in the GAMS/OSL integrated solver and applied to the GAMS model. Results from the parallel GAMS/OSL solver will be given.

### SD19 Telecommunications

Cluster: Constraint Programming  
Invited Session

Chair: Gilles Pesant, University of Montreal, CRT, CP 6128, Succ. Centre-ville, Montreal, Quebec, H3C 3J7, Canada, [pesant@crt.umontreal.ca](mailto:pesant@crt.umontreal.ca)

1) Planning Cordless Business Communication Systems, *Pascal Brisset*, University for Civil Aviation, 7 ave. Édouard Belin, Toulouse Cedex, 31055, France, [brisset@recherche.enac.fr](mailto:brisset@recherche.enac.fr), *Thom Fruehwirth*

We describe a new tool to optimize the placement and minimize the number of base stations for local wireless communications at company sites. It uses high-level constraint-based technology on top of a logic programming language. This example shows that efficiency is not incompatible with concise and elegant programming.

2) Radio Link Frequency Assignment Benchmark, *Thomas Schiex*, INRA, Biometry & AI Dept., Chemin de Borde Rouge BP27, Castanet-Tolosan, 31326, France, [tschiex@toulouse.inra.fr](mailto:tschiex@toulouse.inra.fr), *Bertrand Cabon*, *S. de Givry*, *L. Lobjois*, *Joost P. Warners*

The problem of radio frequency assignment is to provide communication channels from limited spectral resources while keeping to a minimum the interference suffered by those wishing to communicate in a given radio communication network. We will present a set of RLFAP benchmark with some results, including how constraint satisfaction techniques can cope with these problems.

3) Analyzing & Planning Traffic Flows for IP Service, *Robert*

**Rodosek**, Imperial College, IC-PARC, William Penney Lab., London, SW7 2AZ, England, UK, r.rodosek@icparc.ic.ac.uk

The task of efficiently managing spare bandwidth capacity in the network is imperative for ISPs. We present a constraint-based approach to analyze and plan traffic flows in case of changes, e.g., peering. The existing flows are recognized up to a required precision by reasoning on minimum network data.

**4) An Optimal Strategy for the Constrained Cycle Cover Problem**, *Patrick Soriano*, University of Montreal, HEC, CP 6128, succ. Centre-ville, Montreal, Quebec, H3C 3J7, Canada, partick@crt.umontreal.ca, *Gilles Pesant*

We propose a constraint programming algorithm for the decomposition of a telecommunications network into a set of rings in order to protect it against failures. Optimal solutions are obtained efficiently on networks of realistic size.

## SD20 Traveler Behavior Models

Sponsor: Transportation Science Section

Sponsored Session

Chair: Kara Kockelman, University of Texas, Dept. of Civ. Eng., ECJ 6.9, Austin, TX 78712, kcockelm@mail.utexas.edu

**1) Temporal-Spatial Micro-Assignment of Travel Demand with Activity Chains**, *Ahmed F. Abdelghany*, University of Texas, Dept. of Civ. Eng., ECJ 6.2, Austin, TX 78712, *Hani S. Mahmassani*

The assignment problem of travel demand with activity chains is presented. A stochastic dynamic user equilibrium solution algorithm is developed and implemented incorporating a traffic simulation model within an iterative search framework. Experiments conducted on a test network provide insight on system performance under travel demand with activity chains.

**2) A Utility-Theory-Consistent System-of-Demand Equations Approach to Household Travel Choice**, *Kara Kockelman*, University of Texas, Dept. of Civ. Eng., ECJ 6.9, Austin, TX 78712, kcockelm@mail.utexas.edu

A utility-theory-consistent system of demands for activity participation in a time-price setting is derived. A time budget, not just a financial one, and the discrete nature of many travel-related demands are incorporated explicitly. A multivariate negative binomial stochastic specification produces closed-form observation likelihoods and permits unobserved heterogeneity across households, along with correlation within a single household's set of demands.

**3) Investigation of Processes Underlying Commuters Dynamic Route & Departure Time Choices under Real-Time Information**, *Karthik Srinivasan*, University of Texas, Civil Eng., ECJ 6.2, Austin, TX 78712, *Hani S. Mahmassani*

Mechanisms underlying commuter behavior dynamics including learning and adjustment processes are investigated. This research has important implications for accurate traffic modeling and network state prediction and design of effective control strategies.

**4) User Behavior under Variable Message Signs**, *Srinivas Peeta*, Purdue University, Sch. of Civil Eng., West Lafayette, IN 47907, *Jorge Ramos*

Models are developed to predict diversion rates on highways based on the content of messages displayed. The Borman Expressway in Northern Indiana is used as a case study.

## SD21 Flows on Dynamic & Probabilistic Networks

Sponsor: Transportation Science Section

Sponsored Session

Chair: Amelia C. Regan, University of California, Engineering Gateway 4151, Dept. of CEE, Irvine, CA 92697-2175, aregan@uci.edu

**1) A Probabilistic Inventory/Routing Problem Heuristic**, *Oded Berman*, University of Toronto, Rotman Sch. of Mgt., 105 St. George St., Toronto, Ontario, M5S 3E6, Canada, berman@mgmt.utoronto.ca, <http://mgmt.utoronto.ca/bios/berman/>, *Richard C. Larson*, *Jon Jolliffe*

We consider a savings algorithm over time and space. Using an N-day horizon, the proposed the "3-D flower petal algorithm" for industrial gases applications combines tours to customers originally planned for different days. Customer product usage is a random process, typically a Wiener process. The cost function includes travel cost and the expected...

**2) Dynamic Programming Approximations for Discrete Multicommodity Network Flow Problems over State-Time Networks**, *Huseyin Topaloglu*, Princeton University, Prog. in Stats.

& OR, Dept. of Civ. Eng. & OR, Princeton, NJ 08540, topalglu@princeton.edu, *Warren Powell*

We propose an adaptive dynamic programming approximation algorithm that provides integer solutions to a version of multicommodity flow problem over a dynamic graph. The methodology can be applied to both deterministic and stochastic problems. We show that it produces solutions that are close to LP relaxation for deterministic problems.

**3) Online Algorithms for the Dynamic Traveling Repair Problem with Deadlines**, *Amelia C. Regan*, University of California, Engineering Gateway 4151, Dept. of CEE, Irvine, CA 92697-2175, aregan@uci.edu, *Xiangwen Lu*, *Sandra Irani*

We examine extensions of a classical online problem in computer science, the k-server problem, to include the characteristics of fleet management problems. Beginning from the k-server problem, we develop and examine several on-line algorithms for the dynamic traveling repair problem in which customers must be served within pre-specified deadlines.

**4) Heuristics in Column Generation for Vehicle Routing & Crew Scheduling Problems**, *Jacques Desrosiers*, GERAD, Ecole des HEC, 3000 ch. Cote-Ste-Catherine, Montreal, Quebec, H3T 2A7, Canada, jacques@crt.umontreal.ca, *Marius M. Solomon*, *Guy Desaulniers*

We present several heuristics used in conjunction with column generation to solve vehicle routing and crew scheduling problems. In practical applications, these approximate methods have often been key elements for the viability of this optimization research.

## SD22 Moderated IT Outsourcing Negotiation

Cluster: IT Outsourcing: Integrating Research, Teaching & Practice  
Invited Session

Chair: To be announced

## SD23 Long-Term Aspects of Power Industry Performance under Competition

Sponsor: Energy, Natural Resources & Environment  
Sponsored Session

Chair: Marija Ilic, MIT, Dept. of EECS, Bldg. 10-059, 77 Massachusetts Ave., Cambridge, MA 02139, ilic@mit.edu

**1) Dynamic Transmission Provision under Competition**, *Marija Ilic*, MIT, Dept. of EECS, Bldg. 10-059, 77 Massachusetts Ave., Cambridge, MA 02139, ilic@mit.edu

**2) Long-Term Transmission Contracting & Ownership**, *Paul R. Kleindorfer*, University of Pennsylvania, The Wharton School, 3620 Locust Walk, Philadelphia, PA 19104-6366, kleindorfer@wharton.upenn.edu

**3) Market Power Analysis in the Presence of Transmission Constraints**, *Assef Zebian*, TCA Inc.

**4) Stochastic Modeling of Electric Power Prices in a Multi-Market Environment & Gaming**, *Petter Skantze*, MIT, Cambridge, MA 02139, *Poonsaeng Visudhiphan*

## SD24 Organization Science

Contributed Session

Chair: Mihnea C. Moldoveanu, University of Toronto, Rotman Sch. of Mgmt., 105 St. George, Toronto, Ontario, M5S 3E6, Canada, mmoldoveanu@hbs.edu

**1) Time Efficiency in Organizations & Markets**, *Manuel A. Nunez*, Chapman University, Argyros Sch. of Bus., 333 North Glassell St., Orange, CA 92866, mnunez@chapman.edu, *Alexander Talalayevsky*

Given a market coordination structure, we propose a queuing network model to study the time and cost of sending messages through the structure. When the structure corresponds to a functional hierarchy, we provide formulas in terms of system costs and utilization factors to determine the optimal design of the structure.

**2) The Impact of Purchasing Managers' Ethical Perceptions on their Evaluation of Suppliers: A Cross-Cultural Empirical Investigation**, *Abel A. Moreno*, Metropolitan State College of Denver, Campus Box 45, PO Box 173362, Denver, CO 80217-3362, morenoa@mscd.edu, *Raghu Tadepalli*

While there have been a few studies comparing the ethical perceptions of

purchasing managers in different countries, there have been no studies that have sought to compare the relationship between purchasing managers' ethical perceptions and their evaluations of suppliers. We show the results of a US-Mexico empirical investigation.

**3) Development, Use & Diffusion of a Web-Based Workflow System for the Comment-Response Phase of a Federal Environmental Impact Statement, David J. LePoire, Argonne National Lab., 9700 South Cass Ave., Argonne, IL 60439, dlepoire@anl.gov, http://www.ead.anl.gov, Fred A. Monette, Georgia Anast, E. Stull, H. Avci, H. Hartmann, M. Goldberg**

The Comment Response Management System is an Internet workflow system for collecting and processing information from the public. This information was processed until final resolution was achieved among a distributed team. Awareness, ease-of-use, benefits and diffusion in 3 affected groups: public participants, organization staff and technical developers are discussed.

**4) The Production of Knowledge, Mihnea C. Moldoveanu, University of Toronto, Rotman Sch. of Mgmt., 105 St. George, Toronto, Ontario, M5S 3E6, Canada, mmoldoveanu@hbs.edu**

We draw on new results from information-based complexity theory and OR in order to advance a new model for the production of knowledge-intensive products, such as large-scale software programs, therapeutic algorithms for psychiatric interventions and the codification of "intellectual capital" for consulting businesses...

## SD26 Queueing Models

**Sponsor: Applied Probability Society  
Sponsored Session**

**Chair: Susan H. Xu, Pennsylvania State University, 335 Beam Bldg., Dept. of MSIS, University Park, PA 16802, shx@psu.edu**

**1) Quasi-Stationary Decompositions of the Multi-Sever Retrial Queue with Server Vacations, Quan-Lin Li, Chinese Academy of Sciences, Eng. Lab of Complex Systems, Inst. of Automations, Beijing, 100080, PR China, liql@compsys.ia.ac.cn, Min Tan, Jinhua Cao**

We consider a multi-server retrial queue with server vacations which is described as a level dependent QBD process (i.e., quasi-birth-and-death process). The decay parameter of the level dependent QBD process is shown to be independent of server vacations. The iterative expressions of quasi-stationary distribution of the level dependent QBD process is derived...

**2) Control of Queues & the Management of Call Centers, Michael L. Pinedo, NYU, Operations Mgmt. Dept., Stern Sch. of Bus., New York, NY 10012, mpinedo@stern.nyu.edu, Sridhar Seshadri, J. George Shanthikumar**

We apply well known results in the control of queues to the management of call centers. Call centers are subject to non-stationary arrival processes and there are constraints with regard to the deployment of operators. We determine operational rules for the assignment of operators and the scheduling of breaks.

**3) Structural Analysis on Polling Systems with Correlated Arrivals, Haijun Li, Washington State University, Dept. of Pure & Applied Math, Pullman, WA 99164, lih@haijun.math.wsu.edu, Susan H. Xu**

Various polling models arise naturally in several areas, such as communication systems, computer networks, and some traditional fields of engineering such as maintenance, manufacturing and transportation. We present a dependence analysis on a general polling system with correlated arrivals. Using stochastic comparison methods, we provide bounds for some joint system performance measures...

**4) On the Stationary Distribution of Semi-Martingale Reflected Brownian Motion in Non-Negative Orthant: Numeric Method/Queueing Network Apps., Hong Chen, HKUST, Dept. of IE/EM, Clear Water Bay, Kowloon, Hong Kong, hongchen@uxmail.ust.hk, Xinyang Shen**

The SRBM in the nonnegative orthant may arise as the approximation to multiclass queueing networks. We develop a numerical algorithm QNET+ to compute the stationary distribution of the SRBM. The algorithm is based on an algorithm by Chen, Dai & Shen (1999) for an SRBM in a hypercube...

## SD27 Simulation & Decision Making I

**Sponsor: College on Simulation  
Sponsored Session**

**Chair: Chun-Hung Chen, University of Pennsylvania, Dept. of Systems Eng., Towne Bldg., Rm. 270, Philadelphia, PA 19104-6315, chchen@seas.upenn.edu**

**Co-Chair: Enver Yucesan, INSEAD, Boulevard de Constance, Technology Mgmt. Area, Fontainebleau Cedex, 77305, France, yucesan@insead.fr**

**1) A Heuristic Algorithm for Resource Allocation Problems, Leyuan Shi, University of Wisconsin, Dept. of IE, Madison, WI 53706, leyuan@ie.engr.wisc.edu**

A general search procedure is proposed for resource allocation problems, which develops the concepts of the nested partitions method and TS. By incorporating the TS into the NP framework, we show that the algorithm can be very efficient for searching near optimal solutions.

**2) Optimal Control of a Multi-State Manufacturing System: Control of Production Rate & Temporary Increase in Capacity, Lei Huang, Boston University, Dept. of Mfg. Eng., 15 Saint Mary's St., Boston, MA 02215, leihuang@enga.bu.edu, Jian-Qiang Hu, Pirooz Vakili**

In planning and scheduling of production systems manufacturers have 2 main strategies for responding to uncertainty: they build inventory or they temporarily increase the production capacity. We discuss how they can be achieved based on a hedging point policy and its optimality.

**3) An Application of Simultaneous Ranking, Selection & Multiple Comparisons to a Simulation Model of an Outpatient Clinic, James R. Swisher, Biological & Popular Culture, Inc., 7335 Lee Hwy, Radford, VA 24141, jswisher@biopop.com, Sheldon H. Jacobson**

An application of simultaneous ranking, selection and multiple comparisons with the best is presented for a simulation model of an outpatient family-practice clinic. Model development, factor screening and experimental design will be discussed. Experimental results for the selection of the best system given a particular patient population will be given.

**4) Online Lot Size Optimization in Manufacturing Systems, Christos G. Cassandras, Boston University, Dept. of Mfg. Eng., 15 Saint Mary's St., Boston, MA 02215, cgc@bu.edu, Rui Yu**

The selection of lot sizes in multi-product manufacturing systems with setup times is critical for the purpose of expected system time minimization. We address this stochastic optimization problem using a combination of concurrent estimation and stochastic comparison algorithms driven by observed actual system data.

## SD28 Impact of Social Variables on Organizations Productivity

**Sponsor: Social Science Applications Section  
Sponsored Session**

**Chair: Diane Bandow, Organizational Consulting, OTC, Rm 6W, Promenade II, 1200 Peachtree St., Atlanta, GA 30309, dbandow@att.com**

**1) What Entrepreneurs Need to Know about Finance, Amir A. Jassim, California State University, Dept. of IS/DS, Craig Sch. of Bus., Fresno, CA 93740-0007, amirj@csufresno.edu**

Most new entrepreneurs are very enthusiastic about their new ventures. They are very knowledgeable about the product or service they want to sell and their target market; however, many lack the necessary skills to make sound financial decisions. We discuss the pros and cons of several strategies to raise needed capital and how to manage it efficiently.

**2) Internet Usage & Potential Productivity in Acute Care Hospitals, Myron Hatcher, California State University, Dept. of IS/DS, Craig Sch. of Bus., Fresno, CA 93740-0007, myron\_hatcher@csufresno.edu**

A random sample of 813 hospitals was selected for a national survey of acute care hospitals with 115 responses and 33 incorrect addresses resulting in a 15% response rate. Internet usage, including homepages and advertising, was measured. The literature supports the survey results of tremendous potential of improved productivity for hospitals...

**3) Group-as-a-Whole-Esteem: Critical Elements for Team Working, John Herr**

We examine the concept of self-esteem at the group level by applying individual theories and the concept of self-esteem to the group-as-a-whole. Fourteen expert group facilitators, with an average experience level of 33.4 years, were interviewed to establish the elements that comprise a group-as-a-whole-esteem.

Nineteen critical elements were identified and a contemporary model of group dynamics was developed.

### SD30 Tutorial: New Advances Combining Optimization & Simulation

Sponsor: INFORMS Computing Society  
Sponsored Session

Chair: Fred W. Glover, University of Colorado, School of Bus.,  
CB 419, Boulder, CO 80309-0419

1) Tutorial: New Advances Combining Optimization & Simulation, *Fred W. Glover*, University of Colorado, School of Bus.,  
CB 419, Boulder, CO 80309-0419, *James P. Kelly*, *Manuel Laguna*

Many real world problems in optimization are too complex to be given tractable mathematical formulations. Nonlinearities, combinatorial relationships and uncertainties often render challenging practical problems inaccessible to modeling except by resorting to simulation, an outcome that poses grave difficulties for classic optimization methods. In such situations, recourse is commonly made to itemizing a series of scenarios...

### SD31 System Reliability Engineering

Cluster: Reliability & Quality Engineering  
Invited Session

Chair: Hongzhou Wang, Lucent Technologies, 101 Crawfords  
Corner Rd., Holmdel, NJ 07733, Chair

Co-Chair: Hoang Pham, Rutgers University,  
Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ  
08854-8018, hopham@rci.rutgers.edu

1) SRGM for Fault-Tolerant Software Systems, *Xiaolin Teng*,  
Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway,  
NJ 07960, *Hoang Pham*

Fault-tolerant programming methods improve software reliability by using the principles of design diversity and redundancy. In this paper, we propose a new software fault tolerant reliability model based on the NHPP for the N-version programming systems.

2) A New SPC Monitoring Method: The ARMA Chart, *Wei Jiang*,  
HKUST, Dept. of IEEM, Clear Water Bay, Kowloon, Hong  
Kong, jiangwei@ust.hk, *Kwok-Leung Tsui*, *W. H. Woodall*

A new control chart, the ARMA chart, is proposed based on monitoring the autoregressive moving average statistic of the original observations. An ad hoc procedure is developed to determine the appropriate parameter values of the proposed chart. It is shown that the SCC chart in Wardell et al. (1994) and the EWMAST chart in Zhang (1998) are special cases of the ARMA chart.

3) A Software Reliability Model with Testing Coverage, *Hoang Pham*,  
Rutgers University, Dept. of IE, 96 Frelinghuysen Rd.,  
Piscataway, NJ 08854-8018, hopham@rci.rutgers.edu, *Xuemei Zhang*

We present a software reliability model addressing the testing coverage function and the imperfect debugging using the nonhomogenous Poisson process. Model results are presented.

4) Optimal Opportunistic Maintenance Scheduling of Multi-Unit  
Systems with Assured Reliability, *Hongzhou Wang*, Lucent  
Technologies, 101 Crawfords Corner Rd., Holmdel, NJ 07733,  
Chair, *Anthony Izundu*, *Hoang Pham*

The optimal preventive maintenance of a multi-system is studied in this paper. The system availability, system maintenance cost rate, and other operating characteristics of the system are derived. The optimum system maintenance policies to optimize the operating performance are presented.

### SD32 Topological Network Design Problems in Telecommunications

Sponsor: Technical Section on Telecommunications  
Sponsored Session

Chair: James MacGregor Smith, University of Massachusetts,  
Dept. of MIE, Amherst, MA 01003,  
jmsmith@ecs.umass.edu

1) Greedy Randomized Adaptive Search Procedures for the  
Steiner Problem in Graphs, *Mauricio G. C. Resende*, AT&T Labs  
Research, Shannon Laboratory, 180 Park Ave., Rm. C241, Florham  
Park, NJ 079732, mgcr@research.att.com http://www.research.att.com/~mgcr, *Simone L. Martins*, *Celso Ribeiro*, *Panos M. Pardalos*

The SPG has many applications, one of which is telecommunications network design. We describe and compare greedy randomized adaptive search procedures for the SPG. We focus on implementation issues and on experimental evaluation of the heuristics on real-world telecommunications network design problems.

2) On the Structure & Complexity of the 2-Connected Steiner Network Problem in the Plane, *Emily Larson Luebke*, University of North Carolina, Dept. of OR, Chapel Hill, NC 27599-3180, *J. Scott Provan*

2SNPP finds the minimum Euclidean length network connecting a set of points in the plane and whose connectivity is invulnerable to destruction of any 1 edge. We show that 2SNPP is NP-hard, give a complete solution for nxm grids and find a geometric solution for 2SNPP from its combinatorial description.

3) Performance & Reliability of RAID Disk Arrays, *Charles J. Colbourn*, University of Vermont, Dept. of Comp. Sci., Burlington, VT 05405, colbourn@emba.uvm.edu http://www.emba.uvm.edu/~colbourn/, *Myra B. Cohen*

In a RAID disk array, catastrophic failures of individual disks are expected to degrade rather than suspend system operation. We examine the use of erasure-resilient codes for enabling the tolerance of a large number of individual disk failures, and consider optimization issues in the practical use of such codes.

4) Multi-Period Network Design Problem with Diversity & Capacity Constraints, *Peter Kubat*, GTE Laboratories, 40 Sylvan Rd., Waltham, MA 02254, pkOO@gte.com, *James MacGregor Smith*

Mathematical programming models for multi-period network design problems, which arise in cellular telecommunication systems, are presented. The underlying network topologies range from a simple star to complex multi-layer Steiner-like networks. LP-based heuristics are developed and their performance are compared with B&B algorithms.

### SD33 Reliability & Quality Improvement

Sponsor: Quality, Statistics & Reliability  
Sponsored Session

Chair: Kai Yang, Wayne State University, 4815 Fourth St.,  
#2151, Detroit, MI 48201, kyang@mie.eng.wayne.edu

1) A Software Reliability Model With Environmental Factors, *Hoang Pham*, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd.,  
Piscataway, NJ 08854-8018, hopham@rci.rutgers.edu

We present a new software reliability model that incorporates environmental factors. Some of the error environmental factors that we suggest are briefly discussed.

2) Automobile BIW Manufacturing Analysis By Using Variation Simulation Techniques, *Kai Yang*, Wayne State University, 4815  
Fourth St., #2151, Detroit, MI 48201, kyang@mie.eng.wayne.edu

Variation simulation techniques and 3D process data animation techniques have been integrated in order to conduct a manufacturing analysis of BIW during the launch stage to improve dimensional quality and reduce prototype build.

3) Estimation of Network Reliability Using a Neural Network, *Alice E. Smith*, University of Pittsburgh, Dept. of IE, 1031 Benedum  
Hall, Pittsburgh, PA 15261, aesmith@engr.pitt.edu, *Chat Srivareeratana*

We discuss the estimation of all-terminal network reliability using a neural network trained on a small set of networks with different topologies and link reliabilities. Since the calculation of network reliability is an NP-hard problem, computationally efficient surrogates must be found. A neural network approximator is such a method that is shown to be more precise than bounds...

4) Multiple Faults Diagnosis in Compliant Assemblies for Dimensional Process Control, *John Rong*, University of Michigan,  
Ann Arbor, MI 48109-2136, *Darek Ceglarek*, *Jianjun Shi*

A model-based fault diagnosis methodology is developed for dimensional control in the sheet metal assembly process. The proposed methodology is able to detect and isolate multiple faults of compliant assembly structures. Model-based diagnosis procedure using parameter estimation and statistical decision theory is developed for the proposed assembly system.

### SD34 Convex Optimization & Network Flows

Cluster: Combinatorial Optimization & Network Flows  
Sponsor: Optimization Section  
Sponsored Session

**Chair:** Dorit S. Hochbaum, University of California, Haas Sch. of Bus., Dept. of IEOR, 4135 Etchverry, Berkeley, CA 94720-1777, dorit@hochbaum.berkeley.edu  
http://www.ieor.berkeley.edu/~hochbaum/

**1) Characterizing the Flow Equivalent Trees of a Network, David B. Hartvigsen, University of Notre Dame, Coll. of Business Admin., PO Box 399, Notre Dame, IN 46556-0399, hartvigsen.1@nd.edu**

Gomory & Hu showed that every edge-capacitated graph is "flow equivalent" to an edge-capacitated tree on the same node set. Our main result is a compact characterization of all the flow equivalent trees of a given edge-capacitated graph.

**2) Conjugate Scaling Technique for Fenchel-Type Duality in Discrete Convex Optimization, Satoru Iwata, Osaka University, Div. of Systems Sci., Machikaneyama-cho 1-3, Toyonaka, Osaka, 560-8531, Japan, iwata@sys.es.osaka-u.ac.jp, Maiko Shigeno**

We present a polynomial time algorithm for solving submodular flow problems with a class of discrete convex cost functions. The algorithm adopts a new scaling technique that scales the discrete convex cost functions via the conjugacy relation.

**3) Efficient Convex Optimization over Partial Order Constraints, Dorit S. Hochbaum, University of California, Haas Sch. of Bus., Dept. of IEOR, 4135 Etchverry, Berkeley, CA 94720-1777, dorit@hochbaum.berkeley.edu http://www.ieor.berkeley.edu/~hochbaum/, Maurice Queyranne**

We consider the problem of separable convex minimization (or concave maximization) over a set of constraints of the type  $x_i \leq x_j$ . We propose very efficient algorithms that use only a minimum cut procedure and binary search to solve the problem.

**SD35 Tutorial: Using Commercial Software & Experiential Learning to Teach the First MS Course**  
Invited Session

**Chair:** Matthew J. Liberatore, Villanova University, Coll. of Commerce & Finance, 800 Lancaster Ave., Villanova, PA 19085, liberatore@cf\_faculty.fin.vill.edu, liberator@ucis.vill.edu

**Co-Chair:** Robert L. Nydick, Villanova

University, Coll. of Commerce & Finance, Dept. of Decision & It, Villanova, PA 19085

**1) Tutorial: Using Commercial Software & Experiential Learning to Teach the First Management Science Course, Matthew J. Liberatore, Villanova University, Coll. of Commerce & Finance, 800 Lancaster Ave., Villanova, PA 19085, liberatore@cf\_faculty.fin.vill.edu, liberator@ucis.vill.edu, Robert L. Nydick**

We offer a proven alternative to spreadsheets that synthesizes MS modeling, commercial software and experiential learning. We illustrate how to apply our integrated approach to 3 modules: mathematical programming (linear, integer and non-linear), decision analysis (primarily AHP) and simulation (primarily discrete event), using LINGO, Expert Choice and Extend, respectively...

**SD36 Panel: OR/MS Women on their Way to Administrative Roles**

**Sponsor:** Forum on Women in OR/MS  
Sponsored Session

**Chair:** Yasemin Aksoy, Tulane University, Cnsrtm. for Supply Chain Mgmt., Freeman Sch. of Bus., New Orleans, LA 70118, yaksoy@mailhost.tcs.tulane.edu

**1) Panel: OR/MS Women on their Way to Administrative Roles, Yasemin Aksoy, Tulane University, Cnsrtm. for Supply Chain Mgmt., Freeman Sch. of Bus., New Orleans, LA 70118, yaksoy@mailhost.tcs.tulane.edu, Joyce J. Elam, Florida International University, College of Bus. Admin., University Park, Miami, FL 33199, elamj@fiu.edu, Judith S. Liebman, University of Illinois, 110 Whitehall Ct., Urbana, IL 61801, jliebman@uiuc.edu**

This panel will inspire young women (aren't we all?) in OR/MS to pursue administrative roles in academia. We will discuss the difficulties and the challenges along the way, emphasize the importance of having women in administrative roles and provide tips to make the journey as much fun as possible.

**SD37 Soft OR & Education**

**Sponsor:** INFORM-ED

**Sponsored Session**

**Chair:** James J. Cochran, University of Cincinnati, QAOM Dept., PO Box 210130, Coll. of Bus. Admin., Cincinnati, OH 45221-0130, cochraj@econqa.cba.uc.edu

**1) Soft OR in the MBA Curriculum, Michael Pidd, Lancaster University, Dept. of MS, Lancaster, LA1 47X, England, UK, m.pidd@lancaster.ac.uk**

Soft OR methods, such as Soft Systems Methodology and Cognitive Mapping are widely used in the UK. A number of British universities include soft OR in their MBA curricula. At Lancaster we teach an optional course called 'The problems of managing complexity.' This paper will discuss the development, rationale and delivery of this course.

**2) Using the Web to Teach Soft OR, Michael Pidd, Lancaster University, Dept. of MS, Lancaster, LA1 47X, England, UK, m.pidd@lancaster.ac.uk**

Soft OR methods, such as Soft Systems Methodology and Cognitive Mapping are widely used in the UK. The UK OR Society funded the development of web-based teaching material on soft OR for use around the world, especially for use on MBA programs. This paper discusses the background to this project and will demonstrate the web-based material.

**3) An Application of Juran's Triprol & Trilogy Quality Methodologies to Improve the Educational Process, Frederick B. Buoni, Florida Institute of Technology, College of Eng., 150 W University Blvd., Melbourne, FL 32901-6988, buoni@zach.fit.edu, John Hadjiligiou, Gredy Garrido**

We discuss the use of Juran's Triprol quality methodology to model the educational process in a technical university, and then apply Juran's Trilogy quality methodology to improve the educational process. We will present initial results from applying these concepts at the Florida Institute of Technology.

**SD40 Software Demonstration I**  
Software Demo Session

**Chair:** To be announced

**1) ILOG OPL Studio, Irv Lustig, ILOG CPLEX Division, 889 Alder Ave., Ste. 200, Incline Village, NV 89451, irv@ilog.com**

ILOG OPL Studio is a new product from ILOG based on the OPL Optimization Programming Language, a new modeling language supporting linear and integer programming, constraint programming and scheduling, with database connectivity, automatic C++ code generation and a GUI. Come hear about the new revolution in optimization!

**2) Windows MPSIII User's Interface, Joe Creegan, Ketrion Management Sciences, 1755 Jefferson Davis Hwy, Ste. 901, Arlington, VA 22202, jcreegan@ketrionms.com**

We will demonstrate the Windows MPSIII User's Interface, a powerful set of front-end drivers for the C-WHIZ linear and mixed integer optimizer and for other MPSIII components. Additionally, you'll see the new optimal solution viewer, SOLVIEW.

**Sunday 16:45-18:00**

**SO41 Omega Rho Distinguished Plenary: Aviation Safety in Numbers**

**Plenary Session**

**Chair:** David F. Rogers, University of Cincinnati, Dept. of QAOM, CBA, PO Box 210130, Cincinnati, OH 45221-0130, david.rogers@uc.edu, http://www.cba.uc.edu/dept/qa/faculty/rogers.htm

**1) Omega Rho Distinguished Plenary: Aviation Safety in Numbers, Arnold I. Barnett, MIT, Sloan Sch. of Mgmt., OR Ctr., E53-379, Cambridge, MA 02139-4307, abarnett@mit.edu**

We consider the mortality risk of commercial air travel from a multiplicity of perspectives: the objective death risk in different settings, misconceptions of various kinds about observed risk patterns, public perceptions about safety and their effects on actual flying behavior, and, not least, such specific threats to air safety as bad weather, collision risk and terrorism...

**Monday 08:15-09:45****MA01 Decision Analysis Society Practice Award Finalist Presentations**

Sponsor: Decision Analysis Society  
Sponsored Session

Chair: Donald L. Keefer, Arizona State University, Dept. of Mgmt., 945 East Leeward Lane, Tempe, AZ 85283-1939, don.keefe@asu.edu

**1) Decision Analysis Society Practice Award Finalist Presentations****MA02 Combinatorial Optimization & Integer Programming**

Cluster: Combinatorial Optimization & Network Flows

Sponsor: Optimization Section  
Sponsored Session

Chair: Robert Carr, Sandia National Labs, PO Box 5800, MS 1110, Albuquerque, NM 87185-1110, bobcarr@cs.sandia.gov

**1) On Minimum Ratio Cancelling, or, What Hath Wallacher Wrought?, Andreas S. Schulz, MIT, Sloan Sch. of Management, E53-361, Cambridge, MA 02139**

In 1992, Claus Wallacher proposed a certain polynomial-time minimum ratio rule for the min-cost flow problem. In the last years, this concept has been much elaborated. It is now applied to generalized flows, linear programming and integer programming. We provide a unified and self-contained exposition of these results.

**2) Mixing Mixed-Integer Inequalities, Oktay Gunluk, AT&T, 120 Laurel Ave., Rm. D5 3D-21, Middletown, NJ 07748, oktay@att.com, Yves Pochet**

Mixed-integer rounding (MIR) inequalities play a central role in the development of strong cutting planes for mixed-integer programs. We describe a "mixing" procedure that generates new valid inequalities by combining MIR inequalities. These new inequalities fully describe the convex hull of a certain mixed-integer region. We also present some preliminary computational results obtained by mixing Gomory's mixed-integer cuts.

**3) Towards A 4/3 Approximation for the Asymmetric Traveling Salesman Problem, Robert Carr, Sandia National Labs, PO Box 5800, MS 1110, Albuquerque, NM 87185-1110, bobcarr@cs.sandia.gov, Santosh Vempala**

The integrality gap of the Held-Karp relaxation of the symmetric TSP has long been conjectured to be 4/3. We show that a slight strengthening of this conjecture implies a tight 4/3 integrality gap for a LP relaxation of the asymmetric TSP, for which no constant factor approximation is known. Our tools are a new characterization of the integrality gap, and the isolation of "hard-to-round" solutions of the relaxations.

**MA03 Supply Chain Games**

Sponsor: Manufacturing & Service Operations Management  
Sponsored Session

Chair: Lawrence M. Wein, MIT, Sloan Sch. of Mgmt., Rm. E53-343, Cambridge, MA 02139, lwein@mit.edu

**1) Protection in the Personal Computer Industry, Terry A. Taylor, Stanford University, Dept. of IE/EM, Stanford, CA 94305, Hau Leung Lee, V. Padmanabhan, Seungjin Whang**

Price protection policies are frequently observed in industries where prices are declining, e.g., technology related industries. We explore the effects of declining prices and price protection policies on the behavior and performance of the members of the supply chain. The potential of price protection as a mechanism for achieving channel coordination is investigated.

**2) Inventory & Price Competition: Theory & Supply Chain Implications, Siddharth Mahajan, University of Pennsylvania, Wharton Sch., Dept. of OPIM, 1300 SH-DH, Philadelphia, PA 19104, Garrett J. van Ryzin**

We analyze a model where consumers choose products based on both availability and price. This sets up a competition among providers in which the strategic variables are inventory levels and price. We examine the structure of equilibria of this game and resulting supply chain implications.

**3) Channel Stuffing, Gerard Cachon, Duke University, Fuqua Sch. of Business, Box 90120, Durham, NC 27708-0120**

Channel stuffing is when a supplier encourages a retailer to increase its inventory. One technique is a temporary wholesale price discount that creates an incentive for the retailer to forward buy. Recent literature strongly admonishes this practice. This work explains why channel stuffing is not always wasteful; in fact, it is sometimes quite savvy.

**4) Bid Convergence in Smart Markets, Jeremie Gallien, MIT, OR Ctr., Rm. E40-149, Cambridge, MA 02139, jgallien@mit.edu, Lawrence M. Wein**

We analyze an optimization-based procurement auction mechanism, "smart market," used by a manufacturer to select suppliers (bidders) competitively when capacity constraints are stringent. Assuming a best response behavioral model for the suppliers, we show that this novel e-commerce mechanism is highly efficient from the manufacturer's viewpoint.

**MA04 Economic Theory**

Contributed Session

Chair: Ash Dhir, Francis Marion University, Sch. of Business, Florence, SC 29501-0547, adhir@fmarion.edu

**1) Modeling the Optimal Savings-Consumption Allocation, Sheng-Pen Wang, Chang Gung University, Dept. of Bus. Admin., Kwei-San, Taoyuan, 33302, Taiwan, wangsp@mail.cgu.edu.tw**

We describe 2 savings-consumption allocation problems and present their dynamic programming formulation. Numerical solutions of the first problem reveal rich economic information on savings and consumption policies. With the complication of investment strategies and tax effects, the second problem becomes more realistic and interesting.

**2) Strategy & Transaction Costs in Organization Theory, Josef Windsperger, University of Vienna, Mgmt. Ctr., Brunner Str. 72, Vienna, A-1210, Austria, josef.windsperger@univie.ac.at**

We show that strategy influences the transaction cost determinants such as uncertainty and asset specificity that further results in a certain organization design. Under a strategy/transaction costs approach, the organization design is efficient if the difference between strategic rents (consisting of monopolistic, Schumpeterian and Ricardian rents) and coordination costs are minimized.

**3) withdrawn - author request of 10/11, Devavrat Purohit, Duke University, Fuqua School of Bus., Durham, NC 27708, purohit@mail.duke.edu, Preyas Desai****4) Contribution of Resources, Capabilities & Organization to a Firm's Competitive Performance, Ash Dhir, Francis Marion University, Sch. of Business, Florence, SC 29501-0547, adhir@fmarion.edu**

An empirical verification of Barney's (1991) resource-based proposition is made. Results support the hypothesis that higher quality resources, capabilities and organization tend to produce higher levels of competitive performance. However, conventional, off-the-shelf properties of resources have but a limited effect on competitive outcome. Rather, performance is predominantly influenced by the teamworthiness and change-worthiness of resources...

**MA05 MCDM I**

Contributed Session

Chair: Richard M. Schooff, US Air Force Academy, 4514-B East Juniper Dr. F Academy, CO 80840-1130, rschooff.dfms@usafa.af.mil

**1) A New Perspective for Performance Measurements, Celik Parkan, City University of Hong Kong, MS Dept., 83 Tat Chee Av, Kowloon, Hong Kong, China, mscecelik@cityu.edu.hk**

A unified model is introduced for performance measurement problems. The model involves entities, outcomes, a set of events and the relative importance of the outcomes. Outcomes are examined from a loss or gain perspective and defined in 2 different ways leading to the models of DEA and operational competitiveness rating analysis.

**2) A Comparison Between the Processes of AHP & Soft Systems Methodology, T. Nepal, ML Sultan Technikon, Comp. Studies Dept., PO Box 1334, Durban, KZ-Natal, 4000, South Africa, nepal@wpogate.mlsultan.ac.za, Don Petkov, Olga Petkova**

We describe practical and theoretical observations on the processes of using AHP and SSM. The assumption that AHP can be viewed as a descriptive approach to decision making is explored on the background of the interpretivist features of SSM. Recommendations for their complementary usage are given in conclusion.

**3) Technical & General Management Skills: Recruiter vs. Student Perceptions, Kathleen L. McFadden, Northern Illinois University, OMIS Dept., Wirtz 209, DeKalb, IL 60115-2854,**

kmcfadden@niu.edu, *Daniela Gabric*

This study will determine whether OM students' perceptions of marketable skills match actual recruiter preference. We explore the relative importance of 15 general skills, 15 technical skills and 34 personality characteristics. We also compare mean scores to determine whether recruiters value general skills significantly more than technical skills.

**4) Athena Alternative Launch Site Selection, Richard M. Schooff**, US Air Force Academy, 4514-B East Juniper Dr., USAF Academy, CO 80840-1130, rschooff.dfms@usafa.af.mil, *Stein Cass*

Due to circumstances beyond its control, Lockheed Martin's Athena Small Launch Vehicle program is being forced to relocate from its current site at Vandenberg AFB, CA to an alternative location. We develop and use a hierarchical, multiobjective model to analyze and evaluate alternative launch sites.

## MA06 Managing Supply Chain Inventory under Demand Uncertainty

**Sponsor:** Manufacturing & Service Operations Management  
Sponsored Session

**Chair:** Charles R. Sox, Auburn University, Dept. of ISE, 207 Dunstan Hall, Auburn, AL 36849, crsox@eng.auburn.edu

**1) Sharing Inventory & Information between Markets, Nicholas C. Petrucci**, University of Illinois, 350 Commerce West Bldg., 1206 South 6th St., Champaign, IL 61820, petrucci@uiuc.edu, *Maqbool Dada*

We determine how inventory and pricing decisions in one retail market can improve decision making in another, related retail market that is separated from the first in either time, space, or both. The model extends the newsvendor problem with pricing by allowing multiple supplies and more general informational dynamics.

**2) Inventory Levels in Capacitated Production Systems with Cyclic, Non-Stationary Uncertain Demand, James A. Rappold**, University of Wisconsin, 975 University Ave., Madison, WI 53706, jrappold@bus.wisc.edu, *John A. Muckstadt*

We consider a capacitated manufacturing system which produces a single item. Demand is highly variable, cyclic, and non-stationary. This problem was encountered in the automotive spare parts industry. We present a computationally efficient solution method, the results of a computational study, and an extension for the production of multiple items.

**3) An Efficient Procedure for Computing Optimal Order-up-to Levels for Non-Stationary Inventory Control, Srinagesh Gavirneni**, Schlumberger, Research Dept., Austin Product Ctr., Austin, TX 78726, nagesh@sib.com, *Sridhar Tayur*

We present an efficient procedure for computing optimal up-to levels for a discrete time non-stationary inventory model that generalizes models arising from forecast updates, seasonality, information sharing and exchange rate fluctuations. It handles a variety of fluctuations in the problem parameters and is considerably faster than DP and IPA.

**4) An Approximation Scheme for Adaptive Inventory Control with Non-Stationary Demand & Partial Information, James T. Trehanne**, Auburn University, ISE Dept., 207 Dunstan Hall, Auburn, AL 36849, trehajt@eng.auburn.edu, *Charles R. Sox*

Demand is typically uncertain and nonstationary, so the distribution is often estimated and then assumed known with certainty. We take advantage of properties of the cost function to develop an effective approximation scheme and present computational results for a suboptimal policy based on this approximation.

## MA07 Forecasting & Logistics Efficiency

**Cluster:** Manufacturing & Logistics  
Invited Session

**Chair:** Ana Muriel, University of Massachusetts, MIE Dept., Amherst, MA 01089, ollieatassi@worldnet.att.net

**1) Evolution of Semiconductor Demand Forecast, Metin Cakanyildirim**, Cornell University, School of OR, 294 Rhodes Hall, Ithaca, NY 14853, metin@orie.cornell.edu, *Robin O. Roundy*

In the semiconductor industry, many critical decisions are based on demand forecasts. However, these forecasts contain random error. We lay out a scheme estimating variance and correlation of forecast errors (without altering given forecasts) and modeling the evolution of forecasts over time. Our scheme allows correlation's both across time and across adjacent line-widths...

**2) Accounting for Forecast Evolution in Capacitated Production**

**Planning, Philip M. Kaminsky**, University of California, Dept. of IE/OR, Berkeley, CA 94720-1777, kaminsky@ieor.berkeley.edu, *Jayashankar Swaminathan*

In many industrial settings, marketing personnel can make more accurate demand estimates for a particular period as the period gets closer. We consider a model for a single product under limited production capacity and develop exact and heuristic approaches for production planning which account for successive forecast evolution.

**3) Analysis of Fixed Partition Policies for the Inventory Routing Problem, Julien D. Bramel**, Columbia University, 406 Uris Hall, Grad. Sch. of Business, New York, NY 10027, jdb8@columbia.edu, <http://www.columbia.edu/~jdb8>, *Shoshana Anily*

A number of retailers are supplied from a facility by capacitated vehicles. The retailers experience deterministic demand and incur holding costs. The objective is to minimize the average transportation and inventory costs over the infinite horizon. We consider fixed partition policies and develop a 98.5%-effective lower bound and an asymptotically near-optimal region partitioning scheme.

**4) Coordinating Transportation & Inventory Decisions in the Automotive Industry, Ana Muriel**, University of Massachusetts, MIE Dept., Amherst, MA 01089, ollieatassi@worldnet.att.net, *Rachel Q. Zhang, Ufuk Kula*

Over the year, the rates of production and sales in the automotive industry exhibit very different trends. The consequent time lag between production and sales of vehicles translates into great amounts of inventory throughout the supply chain. Our objective is to determine the optimal amounts of inventory and timing of shipments in the distribution network.

## MA08 Optimization of Freight & Fleet Management I

**Sponsor:** Section on Logistics  
Sponsored Session

**Chair:** Alexandra M. Newman, Naval Postgraduate School, OR Dept., Monterey, CA 93943, newman@nps.navy.mil

**1) Deployment Scheduling for Aircraft Carriers, Siriphong Lawphongpanich**, Naval Postgraduate School, OR Dept., Monterey, CA 93943, slawpon@nps.navy.mil, *Ronald L. Brown, David A. Schrady*

We describe scheduling aircraft carriers for deployment. Although similar scenarios have been modeled as set covering problems, this approach is not suitable here. We propose a multi-commodity flow with side constraints framework which reduces to a shortest path problem with side constraints when carriers are deployed to the same area.

**2) Optimizing Intermodal Rail Operations, Alexandra M. Newman**, Naval Postgraduate School, OR Dept., Monterey, CA 93943, newman@nps.navy.mil, *Candace A. Yano*

We propose a model to increase the operational efficiency of intermodal trains using specialized optimization procedures. We extend previous work to incorporate general rail network structures, compare centralized and decentralized decision-making approaches, and via heuristics designed to mimic current operational procedures, show that substantial service improvements can be realized.

**3) Integrated Market Planning at Federal Express, Michael S. Umlauf**, Federal Express Corp., OR Dept., 2831 Airways Blvd, Memphis, TN 38132, msumlau@fedex.com

At Federal Express, morning delivery is managed by 3 divisions with responsibility, respectively, for operating the company's air, trucking and courier fleets. The integrated market planning tool provides a common analytical framework by which the availability of freight to the customer is improved via more efficient allocation of resources.

## MA09 Inventory Management I Contributed Session

**Chair:** Nezhil Altay, Texas A&M University, INFO Dept., 322 Wehner Bldg., College Station, TX 77843-4217, naltay@cgsb.tamu.edu, <http://people.tamu.edu/~n0a8872>

**1) Inventory Control for the Stochastic Assembly System, Wenjie Li**, Chinese University of Hong Kong, Dept. of SE&EM, Sha Tin NT, Hong Kong, China, wjli@se.cuhk.edu.hk

We consider an assembly network through which products are to be assembled from components. It takes as input the bill of materials, the lead times, the stochastic demand and cost. The model implements the lot-size reorder point policy for each component. We precisely evaluate the cost for the supplies of components.

- 2) **Modeling of Inventory Control with Regenerative Processes, Eموke M. Bazsa**, Erasmus University, Econometric Inst., Rm. H11-30, PO Box 1738, Rotterdam, 3000 DR, The Netherlands, bazsa@few.eur.nl, **Hans B. Frenk, Peter W. den Iseger**

Since so many different situations can be analyzed in the theory of inventory control, there is a need to develop a general framework which helps to improve the understanding of the models appearing in the literature. The average cost and service measures will be derived and calculated using this framework.

- 3) **The Effectiveness of Zero Inventory Ordering Policies for a One-Warehouse Multi-Retailer Problem with Piecewise Linear Costs, Zuo-Jun Shen**, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208, zjshen@nwu.edu, **Lap Mui Ann Chan, Ana Muriel, David Simchi-Levi, Chung Piaw Teo**

We consider a problem faced by companies that rely on truckload and carriers for the distribution of products across their supply chain. We develop approximation algorithms which satisfy the ZIO property with fixed worst-case bounds.

- 4) **Solution Approaches to the Coordinated Replenishment Problem With Time-Varying Demand, Nezh Altay**, Texas A&M University, INFO Dept., 322 Wehner Bldg., College Station, TX 77843-4217, naltay@cgsb.tamu.edu, http://people.tamu.edu/~n0a8872, **Powell E. Robinson, Jr.**

With the beginning of 1980s, 2 distinctive research streams seemed to come out of the literature. One stream tries to decompose the multi-product structure into several single item dynamic demand problems and solve with Wagner-Whitin approaches. The other stream utilizes tight MIP formulations of arborescent networks.

#### MA10 Using Metacomputing Environments to Solve Optimization Problems

Cluster: Optimization & Applications

Sponsor: Optimization Section  
Sponsored Session

Chair: Michael C. Ferris, University of Wisconsin, Comp. Sci. Dept., 1210 West Dayton St., Madison, WI 53706-1685, ferris@cs.wisc.edu

- 1) **FATCOP, Qun Chen**, University of Wisconsin, Dept. of IE, Madison, WI 53706, chenq@cae.wisc.edu, **Michael C. Ferris**

We introduce FATCOP, a new parallel mixed integer program solver running on distributed privately owned computers. The implementation uses Condor to greedily provide a virtual machine composed of otherwise idle computers. We detail issues of fault tolerance in this environment and give results on some hard MIP problems.

- 2) **A Problem-Solving Environment for Large Mixed-Integer Nonlinear Programs, Jean-Pierre Goux**, Northwestern University, ECE Dept., 2145 Sheridan Rd., Evanston, IL 60208-3119, goux@ece.nwu.edu, **Jorge Nocedal, Sven Leyffer**

We present an integrated environment to solve large MINLPs on metacomputing platforms. This environment combines the power of modeling language, AMPL, web-based interfaces, CORBA/Java, to manage remote distributed computations and nonlinear B&B algorithm. Results on specific applications will be presented.

- 3) **Modeling Languages & Condor, Michael C. Ferris**, University of Wisconsin, Comp. Sci. Dept., 1210 West Dayton St., Madison, WI 53706-1685, ferris@cs.wisc.edu, **Todd S. Munson**

We develop a tool for utilizing the computational resources provided by Condor from within the AMPL and GAMS modeling languages. We gain the ability to easily perform data parallel processing and demonstrate the capabilities of framework through several applications.

- 4) **A Cutting Plane Algorithm for Stochastic Programming on Metacomputers, Jeffrey T. Linderoth**, Argonne National Laboratory, MCS Division, 9700 South Cass St., Argonne, IL 60439, linderoth@mcs.anl.gov, **Stephen J. Wright**

We describe a cutting plane algorithm for solving stochastic linear programs that is tailored to metacomputing environments. Details of an implementation based on the Condor system are given and computational results are reported.

#### MA11 Tutorial: Stochastic Methods for Practical Global Optimization

Cluster: Global Optimization  
Sponsor: Optimization Section  
Sponsored Session

Chair: Zeld B. Zabinsky, University of Washington, Dept. of IE, Box 352650, Seattle, WA 98195, zelda@u.washington.edu

- 1) **Tutorial: Stochastic Methods for Practical Global Optimization, Zeld B. Zabinsky**, University of Washington, Dept. of IE, Box 352650, Seattle, WA 98195, zelda@u.washington.edu

Stochastic methods, including SA and GAs, are finding many applications to practical global optimization problems. These problems include discrete and continuous variables and the functions have many local optima. This tutorial will discuss theoretical results on stochastic search methods, as well as practical experience on engineering design problems.

#### MA12 Modeling Repeat Purchases

Sponsor: College of Marketing  
Sponsored Session

Chair: Pete Fader, University of Pennsylvania, Dept. of Mktg., 3620 Locust Walk, Philadelphia, PA 19104-6371

- 1) **The Emergence of Market Structure in New Repeat-Purchase Categories: A Dynamic Approach & an Empirical Application, Bart J. Bronnenberg**, UCLA, **Vijay Mahajan, Wilfried R. Vanhonacker**

We study the dynamics of market-shares of competing brands in new repeat-purchase categories. Because retailer distribution-decisions are distributed over time, a manufacturer's success in obtaining distribution from adopting retailers may positively depend on its brand's share to date. Manufacturer's push and pull effects are evaluated taking this feedback into account.

- 2) **Investigating the Properties of the Eskin/Kalwani & Silk Model of Repeat Buying for New Products, Pete Fader**, University of Pennsylvania, Dept. of Mktg., 3620 Locust Walk, Philadelphia, PA 19104-6371, **Bruce G. S. Hardie**

We examine the empirical properties of the well-known model of repeat purchasing proposed by Eskin (1973) and further developed by Kalwani & Silk (1980). We show that the model's parameters are not readily interpretable, even within a stationary environment. In contrast, we show that the model's forecasting performance, even under conditions of extreme nonstationarity, is quite impressive...

- 3) **Repeat Buying in Cyberspace, Bruce G. S. Hardie**, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, England, UK, **Pete Fader**

We develop a model of repeat buying behavior for customers of an internet retailer, and illustrate how the model can be used to forecast future purchasing (with obvious customer valuation implications), as well as to profile customers with a view to developing customer retention programs.

#### MA13 Corporate Image & Social Responsibility

Sponsor: College of Marketing  
Sponsored Session

Chair: Vicki G. Morwitz, NYU, Stern Sch. of Bus., 44 West 4th St., MEC 8-89, New York, NY 10012-1126, vmorwitz@stern.nyu.edu

- 1) **Consumer Reactions to Corporate Social Responsibility, Sankar Sen**, Temple University, **C. B. Bhattacharya**

We examine when, how and for whom specific CSR strategies work. Our findings implicate both company-specific and individual-specific factors as key moderators of consumers' responses to CSR and highlight the mediating role played by their perceptions of congruence between their own characters and those of the company.

- 2) **The Customer, the Salesman & the Company: The Role of Identification, C. B. Bhattacharya**, Boston University, 15 Saint Mary's St., Boston, MA 02215, **Mike Ahearne**

Organizational researchers theorize that organizational identification among employees leads to desirable outcomes. We examine whether customers identify with organizations. We posit that perceived organizational identity, construed external image and perceived sales representative identity are antecedents. We expect identification to impact both in-role behavior, i.e., product choice, and extra-role behavior, i.e., citizenship.

- 3) **Withholding Consumption: A Social Dilemma Perspective on Consumer Boycotts, Vicki G. Morwitz**, NYU, Stern Sch. of Bus., 44 West 4th St., MEC 8-89, New York, NY 10012-1126, vmorwitz@stern.nyu.edu, **Sankar Sen, Zeynep Gurhan-Canli**

We examine consumers' boycott decisions. We propose that for most consumers, the decision to boycott can be conceptualized as a social dilemma. We experimentally test predictions from social dilemma research regarding the

effects of consumers' expectations about overall participation, individual efficacy and the framing of pro-boycott communications on their likelihood to boycott.

#### MA14 Technological Disruption, Destruction & Dislocation

Sponsor: Technology Management Section/College on Organization Science

Sponsored Session

Chair: Christopher Tucci, NYU, Stern Sch. of Bus., 40 West 4th St., Tisch 7-10, New York, NY 10012-1118, [tucci@stern.nyu.edu](mailto:tucci@stern.nyu.edu)

1) **A Matter of Perspective: Understanding the Sources & Timing of Discontinuous Technological Change**, *Mary Tripsas*, University of Pennsylvania, Wharton School, 2000 SH-DH, Philadelphia, PA 19104-6370, [tripsas@wharton.upenn.edu](mailto:tripsas@wharton.upenn.edu)

We suggest that discontinuous technologies from the perspective of one industry are often incrementally developing technologies imported from other industries. Rather than invading the new industry when existing technology has reached its technological limits, the new technology is often precipitated by radical shifts in customer needs called need discontinuities.

2) **Role of the Institutional Environment on the Impact of Innovation: Comparative Analysis of US/Japanese Firms in the Worldwide Hard Disk**, *Henry Chesbrough*, Harvard Business School, Soldiers Field Rd., T-61 Morgan Hall, Boston, MA 02163, [hchesbrough@hbs.edu](mailto:hchesbrough@hbs.edu)

Evidence if building that firms in different institutional environments organize differently, even in similar industries undergoing similar technical changes. I conduct an empirical examination in the worldwide hard disk drive industry to test whether institutional effects of labor markets, venture formation capital markets and prevailing supply chain linkages influence firm longevity.

3) **Disruptive Technologies & Technological Modularity**, *Clayton Christensen*, Harvard Business School, Soldiers Field Rd., T-43 Morgan Hall, Boston, MA 02163, [cchristensen@hbs.edu](mailto:cchristensen@hbs.edu)

I review evidence linking concepts of disruptive technologies and technological modularity. The basis of competition in an industry changes when the functionality of available products overshoots what the market can absorb. Competitive advantage then rests on time-to-market, ability to customize products to needs of ever-smaller niches, forcing firms to adopt modular product architectures.

4) **New Product Development & Technological Change**, *Christopher Tucci*, NYU, Stern Sch. of Bus., 40 West 4th St., Tisch 7-10, New York, NY 10012-1118, [tucci@stern.nyu.edu](mailto:tucci@stern.nyu.edu), *Andrew A. King*

Previous research has emphasized the role that managers play in creating capabilities that allow the firm to survive technological changes. We investigate how managers respond to technological changes given that when they learn of a new technology, they often do not have sufficient lead time to change their corporation's capabilities to match.

#### MA15 Best Dissertation Award Winners

Sponsor: Technology Management Section

Sponsored Session

Chair: Jeffrey Liker, University of Michigan, Dept. of IOE, 1520 McIntyre Dr., Ann Arbor, MI 48105, [liker@engin.umich.edu](mailto:liker@engin.umich.edu)

1) **Best Dissertation Award Winners**, *Moren Levesque*, University of British Columbia, Canada, *Karen Beekman Eden*

#### MA16 No Title Supplied

Sponsor: Financial Services Section

Sponsored Session

Chair: Farid Ait-Sahlia, Hewlett Packard Labs., 1501 Page Mill Rd., MS 4V-1, Palo Alto, CA 94304

1) **Value-at-Risk-Based Risk Management: Optimal Policies & Asset Prices**, *Suleyman Basak*, University of Pennsylvania, The Wharton Sch., Finance Dept., Philadelphia, PA 19104-6367

We analyze optimal portfolio and wealth/consumption policies of utility maximizing investors who must manage market exposure using a given risk model. We focus on value-at-risk managers who often choose larger exposures than non-risk managers, consequently incur larger losses, when losses occur. We suggest an alternative model, based on expectation-of-loss.

2) **Conditioning on One-Step Survival for Barrier Option Simulations**, *Paul Glasserman*, Columbia University, 403 Uris Hall,

New York, NY 10027, *Jeremy Staum*

In Monte Carlo simulations for discretely monitored barrier options, conditioning on survival over each time-step reduces the variance of estimates. We detail the theoretical underpinnings of this method in order to relate it to other variance reduction techniques. We evaluate implementations when exact conditional distributions are available and when unavailable.

3) **Valuation & Exercise of American Barrier Options**, *Farid Ait-Sahlia*, Hewlett Packard Labs., 1501 Page Mill Rd., MS 4V-1, Palo Alto, CA 94304, *Tze Leung Lai*

A fast and accurate method to price American barrier options by reducing American valuation problems to a single (canonical) optimal stopping problem for standard Brownian motion. In the canonical scale the time horizon is significantly reduced and optimal stopping boundaries are well approximated by piecewise linear functions.

#### MA17 Job Scheduling

Contributed Session

Chair: Fatih M. Tasgetiren, Auburn University, IE Dept., 207 Dunstan Hall, Auburn, AL 36849-5346, [mfatih@pitt.edu](mailto:mfatih@pitt.edu)

1) **An Improved Priority Rule for Dynamic Job Shop Scheduling**, *Michael X. Weng*, University of South Florida, 4202 East Fowler Ave., Tampa, FL 33620, [weng@eng.usf.edu](mailto:weng@eng.usf.edu), *Haiying Ren*

We discuss a new priority rule for dynamic job shop scheduling so as to minimize mean job tardiness. The new rule is developed based on the characteristics of some existing dispatching rules. The numerical results will be presented.

2) **A Branch & Bound to Solve the Just-in-Time Scheduling Problem**, *Ghaith Rabadi*, University of Central Florida, 1617 Cricket Club Cir., #303, Orlando, FL 32828, [grabadi@mail.ucf.edu](mailto:grabadi@mail.ucf.edu), <http://pegasus.cc.ucf.edu/~gar31503>, *Mansoor Mollaghasemi*

The JIT manufacturing concept can mathematically be modeled by minimizing the total earliness and tardiness around a due date. A new B&B algorithm is presented to solve the single machine JIT scheduling problem when sequence-dependent setup times are involved.

3) **Job Selection for Workload Planning: Deterministic & Stochastic Models**, *Susan Slotnick*, Arizona State University West, 4701 West Thunderbird Rd., PO Box 37100, Phoenix, AZ 85069-7100, [slotnick@pegasus.west.asu.edu](mailto:slotnick@pegasus.west.asu.edu), *Herbert F. Lewis*

We develop both a deterministic and stochastic multi-period model of job selection that maximizes profit. The managerial decision is whether to accept or reject a given job, based on its immediate profitability, the customer's past history and/or the customer's future business. A dynamic program and heuristics are proposed for each model.

4) **Job Shop Scheduling by Genetic Algorithms: Product Type-Based Representation**, *Fatih M. Tasgetiren*, Auburn University, IE Dept., 207 Dunstan Hall, Auburn, AL 36849-5346, [mfatih@pitt.edu](mailto:mfatih@pitt.edu)

Product type-based representation is presented to solve the general job-shop-scheduling problem under the measure of mean tardiness. With this representation, jobs are scheduled according to the type of products instead of priority rules. Results are compared with the well-known priority rules from the literature such as SPTT, EDD and SLK.

#### MA18 Discrete Optimization

Cluster: Discrete Optimization

Invited Session

Chair: Monique Guignard-Spielberg, University of Pennsylvania, The Wharton Sch., 1320 SH-DH, Philadelphia, PA 19104-6366, [guignard@grace.wharton.upenn.edu](mailto:guignard@grace.wharton.upenn.edu)

1) **Tree Elaboration Strategies in Branch & Bound Algorithms for Solving the Quadratic Assignment Problem**, *Peter M. Hahn*, University of Pennsylvania, Dept. of Systems Eng., 220 South 33 St., Philadelphia, PA 19104-6315, [peter\\_hahn@compuserve.com](mailto:peter_hahn@compuserve.com), *William L. Hightower*, *Terri Anne Johnson*, *Monique Guignard-Spielberg*, *Catherine Roucairol*

The particular elaboration of the B&B search tree has major impact on a particular bound's pruning effectiveness. In the process of pruning, weak bounds are frequently used to guide the tree. We relate our experience using higher quality bounds to guide tree elaboration in solving Nugent and Krarup instances.

2) **Properties & Classes of Omega Functions**, *Lee Papayanopoulos*, Rutgers University, Fac. of Mgmt., 180 University

Ave., Newark, NJ 07102, papayano@andromeda.rutgers.edu

The polymorphic omega function has no general closed form but can be graphed/computed with all of its parameters. It maps a discrete primal lattice into a dual space and can provide insight into the structure of integer linear models. Relevant results and a classification of omega morphology are presented.

3) **Crew Planning for a Petroleum Products Marine Fleet**, *Murthy V. Mudrageda*, Maritrans Management Services Inc., 1818 Market St., Ste. 3540, Philadelphia, PA 19103, mmudrageda@maritrans.com, *Emmanuel D. Chajakis, Steve Welch, Frederic H. Murphy*

Crewing for US marine vessels is now a major problem. We have developed an MIP crew planning model for a petroleum fleet. The model was used by crew planners at Maritrans Inc. and helped alleviate the effects of a tight labor market.

4) **Solving the Design Problem of Telecommunication Network Using Column Generation**, *Nelson F. Maculan*, Federal University of Rio de Janeiro, COPPE-Sistemas, PO Box 68511, Rio de Janeiro, 21945-970, Brazil, maculan@cos.ufrj.br, *Marcos Passini, Abdel Lisser*

Telecom network design and survivability have been treated last years with ring and meshed architectures and these 2 models have always been dealt separately. However, rings were recently introduced in meshed networks to improve capacity. It yielded the 2-architecture problem, which we model and solve using column generation.

### MA19 New Developments in Discrete Optimization

Cluster: Discrete Optimization

Invited Session

Chair: Timothy L. Jacobs, SABRE Technology Solutions, 1 East Kirkwood Blvd., MD 7390, Southlake, TX 76092

1) **Facets for Cyclic Group & Knapsack Polyhedra**, *Ellis L. Johnson*, Georgia Institute of Technology, School of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, ellis.johnson@isye.gatech.edu

No abstract supplied.

2) **Several Approaches to a Specially Structured Nonlinear IP Problem**, *Charles H. Rosa*, SABRE Technology Solutions, 1 East Kirkwood Blvd., MD 7390, Southlake, TX 76092, charles\_rosa@sabre.com

No abstract supplied.

3) **No Title Supplied**, *Gregory Glockner*, ILOG, 1901 Landings Dr., Mountain View, CA 94043

No abstract supplied.

### MA20 Traffic Flow Theory & Prediction

Sponsor: Transportation Science Section

Sponsored Session

Chair: Carlos Sun, Rowan University, Glassboro, NJ 08028

1) **Modeling Traffic's Flow Density Relation: Accommodation of Multiple Flow Regimes & Traveler Types**, *Kara Kockelman*, University of Texas, Dept. of Civ. Eng., ECJ 6.9, Austin, TX 78712, kcockelm@mail.utexas.edu

We explore the idea that weather conditions and driver- and vehicle-population characteristics affect a homogenous roadway segment's flow- vs. density-relationship. Switching regression models across uncongested and congested flow regimes account for 2 hypothesized behaviors for different driver/vehicle/environment classes.

2) **Real-Time Estimation & Prediction of Dynamic Origin-Destination Demand**, *Ying Kang*, University of Texas, Dept. of Civil Eng., ECJ 6.2, Austin, TX 78712-1076, yingkang@mail.utexas.edu, *Hani S. Mahmassani*

A dynamic O-D demand problem formulation based on a general transformation with Kalman filtering process is presented for real-time large network applications. Large network experiments and results under simulated real-time operation are presented.

3) **Analysis of Sensitivity of Origin-Destination Demand Estimation Algorithms**, *Carlos Sun*, Rowan University, Glassboro, NJ 08028, *Himanshu Porwal, R. Jayakrishnan*

We present results from the analysis of sensitivity of four different O-D estimation algorithms towards changes in traffic conditions. The algorithms are based on least squares estimation, Kalman filtering, each operating with

assignment matrices found by simulation-based and analytic assignment based techniques.

### MA21 Dynamic Traffic Assignment III

Sponsor: Transportation Science Section

Sponsored Session

Chair: Athanasios Ziliaskopoulos, Northwestern University, 2145 Sheridan Rd., Evanston, IL 60208, a-z@nwu.edu

1) **Dynamic Network Loading: Models & Algorithms**, *Ismail Chabini*, MIT, 77 Massachusetts Ave., Rm. 1-263, Cambridge, MA 02139-4307, *Soulaymane Kachani*

We examine the dynamic network loading models where departure flow rates are models using Lebesgue integrable functions. We establish analytical properties of these models. Multiple classes of solution algorithms and computer implementations are shown. Numerical results using real-networks are presented.

2) **Algorithms for the Shortest Path Problems in Continuous Dynamic Networks**, *Ismail Chabini*, MIT, 77 Massachusetts Ave., Rm. 1-263, Cambridge, MA 02139-4307, *Brian Dean*

We present a novel algorithm for computing shortest paths in continuous-time dynamic networks. We analyze the theoretical complexity of the algorithm, which is polynomial in FIFO networks. Computational results are shown.

3) **Distribution-Based Dynamic Network Loading Models & Algorithms**, *Ismail Chabini*, MIT, 77 Massachusetts Ave., Rm. 1-263, Cambridge, MA 02139-4307, *Soulaymane Kachani*

We present and analyze dynamic network loading models where traffic flow rates are modeled as Dirac distributions. We establish analytical properties of these models. Multiple classes of solution algorithms and computer implementations are shown. Numerical results using real-networks are presented.

### MA22 IT Outsourcing Negotiation Debrief

Cluster: IT Outsourcing: Integrating Research, Teaching & Practice

Invited Session

Chair: David C. Croson, University of Pennsylvania, The Wharton School, Philadelphia, PA 19104

1) **Vendor Perspective**, *Lorin Hitt*, University of Pennsylvania, The Wharton Sch., 1318 SH-DH, Philadelphia, PA 19104

No abstract supplied.

2) **Client Perspective**, *David C. Croson*, University of Pennsylvania, The Wharton School, Philadelphia, PA 19104

No abstract supplied.

3) **Experimental Evidence on Vendor & Client Performance in IT Negotiations**, *Rachel Croson*, University of Pennsylvania, Wharton Sch. of Bus., Dept. of OPIM, 1322 SH-DH, Philadelphia, PA 19104-6366, crosonr@wharton.upenn.edu

No abstract supplied.

### MA23 Issues in Natural Gas

Sponsor: Energy, Natural Resources & Environment

Sponsored Session

Chair: Steven A. Gabriel, ICF Consulting Group, 9300 Lee Highway, Fairfax, VA 22031-1207, sgabriel@icfkaiser.com

1) **Natural Gas Issues in a High Natural Gas Demand World**, *Steven A. Gabriel*, ICF Consulting Group, 9300 Lee Hwy, Fairfax, VA 22031-1207, sgabriel@icfkaiser.com, *Shree Vikas, David Ribar*

The demand for natural gas in the US is projected to increase substantially in the near future. We consider 3 energy sector issues that could affect the natural gas industry for meeting the increased demand: rapid buildup in gas exploration and production activities, Canadian gas exports to the US and increasing pipeline load factors...

2) **An Analytic Resource Assessment Method for Conventional Oil & Gas Accumulations**, *Robert A. Crovelli*, US Geological Survey, Denver Federal Ctr., PO Box 25046, MS 939, Denver, CO 80225, crovelli@usgs.gov

The analytic spreadsheet energy software system (ASSESS) petroleum resource assessment method was developed from analytic probabilistic methodology to calculate estimates of technically recoverable crude oil and natural gas resources for conventional petroleum accumulations in assessment units that will comprise a new national oil and gas assessment of the US.

**3) Challenges in Realizing a 30 Trillion Cubic Feet Natural Gas Market, Joe Benneche**, Energy Information Administration, 1000 Independence Ave. SW, EI-83, 2H026, Washington, DC 20585, joseph.benneche@eia.doe.gov

EIA projects that demand for natural gas, with increases principally from the electric generation sector, will reach almost 30 tcf in 2013. Is there enough gas to meet demand? Can we produce the gas fast enough? Can we build pipelines fast enough? How high will prices go? We will address these questions...

## MA24 Health Care Management

### Contributed Session

**Chair:** N. K. Kwak, St. Louis University, Dept. of Decision Sci., 3674 Lindell Blvd., St. Louis, MO 63108, kwakn@slu.edu

**1) Simulation of an Outpatient Department at CMC Hospital, K. V. Ramani**, Cornell University, Johnson Grad. Sch. of Mgmt., Ithaca, NY 14853, jgsm-temp3@cornell.edu

CMC Hospital, Vellore, India is a large hospital with 1500 beds and 4000 employees and receives 2500 outpatients every day in more than 40 clinics. We have developed a simulation model to analyze the working of the medicine outpatient department and suggest alternate systems to reduce the turnaround time of outpatients by 30%.

**2) How Can Intensive Care Provision in the National Health Service Be Managed Effectively?, Ruth Kowalczyk**, Lancaster University, 21 Parliament St., Morecambe Lancashire, LA3 1RQ, UK, r.kowalczyk@lancaster.ac.uk

As an expensive service in great demand, the provision of intensive care can benefit from an analysis of how it is managed. ICUs are extremely diverse and there are many factors which influence a patient's treatment or unit's success. This study aims to contribute to improving the effectiveness of this service.

**3) The Efficacy & Efficiency of the Focused Hospital, David J. Brailer**, Health Care Systems, 204 Colonial Penn Ctr., 3641 Locust Walk, Wharton Sch., Philadelphia, PA 19104-6218, brailer@wharton.upenn.edu, <http://www.wharton.upenn.edu>, **Eugene A. Kroch**, **William P. Pierskalla**

We developed an analytical model for redeploying inpatient capacity to measure the efficacy of "factory-within-a-factory" operating techniques to determine what was revealed about diseconomies of scope in acute care hospitals. Before-and-after comparisons showed that focused hospitals significantly reduced complications and costs proportionate to their compliance with the focused hospital model.

**4) Periodic Screening for Type 2 Diabetes Mellitus, Stephen W. Sorensen**, Centers for Disease Control, 4770 Buford Hwy. NE, MS K-68, Atlanta, GA 30341, zuc7@cdc.gov, **Theodore J. Thompson**

Recent papers indicate that opportunistic screening for Diabetes Mellitus may be cost-effective for high risk groups. We develop a strategy for periodic screening based on a stochastic model of the disease. We test the strategy using incidence and prevalence from the National Health Interview Survey.

**5) An Integrated Decision Support Model for Resource Allocations in a Health Care System, N. K. Kwak**, St. Louis University, Dept. of Decision Sci., 3674 Lindell Blvd., St. Louis, MO 63108, kwakn@slu.edu, **Chang Won Lee**

We present an application of an integrated decision support model to aid for efficient resource allocations in a health care system. An integer goal programming model is developed and analyzed using the AHP technique. The IGP model enhances the health care system's capability for meeting its strategic resource allocation planning.

## MA25 Optimization Theory I

### Contributed Session

**Chair:** Kwang-Soo Lee, Indiana State University, Analytic Dept., Terre Haute, IN 47809, sdkwang@befac.indstate.edu

**1) Sensitivity Analysis using Interior-Point Methods, Emre A. Yildirim**, Cornell University, 292 Rhodes Hall, Ithaca, NY 14853, yildirim@orie.cornell.edu, <http://www.orie.cornell.edu/~yildirim>, **Michael J. Todd**

We study perturbations of right-hand side and cost in LP and SDP. We obtain tight bounds on the norm of perturbations using interior-point methods for LP and SDP. For LP, we show that these bounds compare nicely with bounds arising from the simplex method.

**2) Interior Point Methods in Engineering Optimization Problems & a New Approach to the Parameterization of the**

**Central Trajectory, Suat Kasap**, University of Oklahoma, Dept. of IE, 202 West Boyd, Rm. 124, Norman, OK 73019, suat@ou.edu, **Theodore B. Trafalis**

A new approach to the parameterization of the central trajectory will be presented. Currently, the central trajectory is parameterized by the barrier parameter. In this study, it is parameterized by time. Specifically, a new update rule based on the solution of an ordinary differential equation for the barrier parameter is introduced.

**3) The Combined Random-Gradient Method of Examination: A Function of Conditional Extremums, Yuriy M. Pochtman**, Dnepropetrovsk State University, Financial/Economic Institute, Guseenko tr.4/6, ap. 30, Dnepropetrovsk, 320005, Ukraine, yuriy@ump.dp.ua, <http://ump.virtualave.net/>, **Sergey L. Lodyagin**

We suggest the effective method of a local conditional extremums set searching for multivariable functions with estimation of results reliance no based on apriori knowledges about the function and the restrictions. The method uses speed advantages of deterministic method as much as possible.

**4) Degenerate Optimal Solution & the Range of Feasibility, Kwang-Soo Lee**, Indiana State University, Analytic Dept., Terre Haute, IN 47809, sdkwang@befac.indstate.edu

Due to the primal-dual relationship of LP, if an optimal solution to an LP problem is degenerate, the problem has multiple optimal bases. We discuss a way of generating alternative optimal bases using an optimal simplex tableau and its implications on the range of feasibility.

## MA26 Web Server Performance

**Sponsor:** Applied Probability Society

### Sponsored Session

**Chair:** Rema Hariharan, AT&T Labs., 200 Laurel Ave., D5-3D17, Middletown, NJ 07740, rhariharan@att.com

**1) A Performance Model for Web Servers in Distributed Network Architectures, R. D. van der Mei**, AT&T Labs., Advanced Tech., Middletown, NJ 07740, **P. K. Reeser**, **W. K. Ehrlich**, **J. P. Francisco**

Web technologies are currently being employed to provide end user interfaces in diverse computing environments. The core element of these Web solutions is a Web server based on the Hypertext Transfer Protocol running over TCP/IP. Web servers are required to respond to millions of transaction requests per day at an "acceptable" QoS level...

**2) Workload & Performance Models for HTTP Servers, Kavitha Chandra**, University of Massachusetts, Ctr. for Advanced Comp. & Tel., Lowell, MA 01854, kavitha\_chandra@uml.edu, **M. Raspapovic**, **B. J. Yoo**

Web servers experience a time-varying load that is a function of both user access patterns and transport control protocol dynamics. We propose workload models for HTTP servers based on the analysis of traffic measurements made at several campus and backbone sites on the Internet. The proposed model is hierarchical and allows specification at several levels of client domain aggregation.

**3) A Model of a Web Server with Dynamic Server-side Processing, Varsha Mainkar**, AT&T Labs., Advanced Tech., Middletown, NJ 07740

Increasing numbers of Web servers now serve HTML files that are dynamically generated by the server, after the HTTP request reaches the server. This is implemented by CGI scripts, or Java servlets or by Active Server Page technology. The implication of server-side processing is that you can no longer size your Web server by using "hits per second" capacity...

**4) An Overload Control Model for Phoneweb Servers, Rema Hariharan**, AT&T Labs., 200 Laurel Ave., D5-3D17, Middletown, NJ 07740, rhariharan@att.com

Phoneweb servers are used in web services to retrieve e-mail/web pages using a phone interface. Text-to-Speech engines that go with the Phoneweb may be shared among several Phoneweb servers. We present a traffic model to engineer the number of TTS engines that may be shared by Phoneweb servers at a given location...

## MA27 Simulation & Decision Making II

**Sponsor:** College on Simulation

### Sponsored Session

**Chair:** Chun-Hung Chen, University of Pennsylvania, Dept. of Systems Eng., Towne Bldg., Rm. 270, Philadelphia, PA 19104-6315, chchen@seas.upenn.edu

**Co-Chair:** Enver Yucesan, INSEAD,  
Boulevard de Constance, Technology Mgmt. Area,  
Fontainebleau Cedex, 77305, France, yucesan@insead.fr

1) **Revisiting Comparison of Alternatives, Pirooz Vakili**, Boston University, Dept. of Mfg. Eng., 15 Saint Mary's St., Boston, MA 02215, vakili@bu.edu

We present some recent results on the well-known problem of comparing alternatives. The basis for comparison is the expected value of some sample performance; the comparison is performed using a number of samples from each alternative. We comment on the implications of these results for simulation.

2) **Simulation Planning for Ordinal Comparison in Discrete Event Dynamic Systems, Liyi Dai**, Washington University, Dept. of Systems Sci. & Math., CB 1040, St. Louis, MO 63130, liyi@zach.wustl.edu, **Chun-Hung Chen**

Based on a rate expression in terms of large deviation principles, we investigate the effect of simulation planning on the convergence of ordinal comparison. We derive bounds on the rate of convergence of ordinal comparison and discuss sample path generation schemes that maximize the convergence rate of ordinal comparison.

3) **Sensitivity Analysis for an Approach to Ranking & Selection with Multiple Performance Measures, Douglas J. Morrice**, University of Texas, MSIS Dept. CBA 5.202, Austin, TX 78712-1175, morrice@mail.utexas.edu, **John Butler, Peter W. Mullarkey**

In previous work, we developed a ranking and selection procedure for comparing systems that have multiple performance measures. The procedure combines MAU theory with ranking and selection to select the best of K configurations using the indifference zone approach. We perform sensitivity analysis on the MAU weights and other parameters used in the procedure.

4) **Applications of Ordinal Optimization Ideas in Simulation, Yi-Chi Ho**, Harvard University, Pierce Hall, Cambridge, MA 02138, ho@arcadia.harvard.edu, hrl.harvard.edu/people/faculty/ho

We review the various successful applications of the ideas of ordinal optimization to computationally intensive simulation problems in various fields known to the author as of 1999.

## MA28 The Operations Research Paradigm & Social Sciences

**Sponsor:** Social Science Applications Section  
Sponsored Session

**Chair:** Carl M. Harris, George Mason University, Sch. of Info. Tech. & Eng., Fairfax, VA 22030, charris@gmu.edu

**Co-Chair:** Myron Hatcher, California State University, Dept. of Is/Ds, Craig Sch. of Bus., Fresno, CA 93740-0007, myron\_hatcher@csufresno.edu

1) **The Role of Analysis in Forging Racial Equality in the US Army, Carl M. Harris**, George Mason University, Sch. of Info. Tech. & Eng., Fairfax, VA 22030, charris@gmu.edu, **Edward Rattner**

Early in 1948, President Truman directed the US military to cease racial discrimination. In 1951, the OR Office was asked by the Army to help determine whether this was truly feasible, then to assess the means by which could be rapidly effected. An examination of the history of this effort (Project CLEAR) is instructive in understanding the social history of the US in the twentieth century...

2) **Panel, Frederic H. Murphy**, Temple University, 2402 Pine St., School of Bus. & Mgmt., Philadelphia, PA 19122, v5256e@vm.temple.edu, **Michael H. Rothkopf, Wray Smith**

The panel will discuss the situation as developed in the paper.

## MA29 Software Demonstration II

Software Demo Session

**Chair:** To be announced

1) **Page Out Course Development Tool, Marvin Meneeley**, Irwin/McGraw Hill, marvin\_meneeley@mcgraw-hill.com

Interested in providing strong Web support for your courses? Explore McGraw-Hill's Page Out course development tool focusing on technology resources in the new Hillier/Hillier/Lieberman Management Science text. With no HTML or server constraints, instructors can integrate valuable resources into

a customized website in just minutes. Best of all, it's free!

## MA30 Theoretical & Experimental Analysis of Scheduling Problems

**Sponsor:** INFORMS Computing Society  
Sponsored Session

**Chair:** Robert Goldberg, Queens College, Comp. Sci. Dept., CUNY, 65-30 Kissena Blvd., Flushing, NY 11367-0904, goldberg@qcunix1.acc.qc.edu

1) **Remarks on Classic Scheduling, Robert Goldberg**, Queens College, Comp. Sci. Dept., CUNY, 65-30 Kissena Blvd., Flushing, NY 11367-0904, goldberg@qcunix1.acc.qc.edu

This research deals with the well-known set partitioning problem which is closely related to load balancing and scheduling problems. This problem is stated as follows: given a set of positive numbers S, partition the set into k subsets such that a measure of the dispersion of elements is minimized under a given norm...

2) **Error Analysis of Scheduling in an Ideal Situation, Isak Taksa**, Queens College, Graduate Center, CUNY, 65-30 Kissena Blvd., Flushing, NY 11367-0904

Since the scheduling problem is known to be NP-hard, general optimal solutions cannot be obtained in polynomial time. The only input sets for which the norm of the optimal solutions can be easily computed are ideal sets which have a partition such that the sum of the elements of each subset is equal to the average distribution...

3) **New Results in Worst-Case Analysis of Scheduling, Jacob Shapiro**, Baruch College, CUNY, 65-30 Kissena Blvd., Flushing, NY 11367-0904

In Graham's original paper on the offline scheduling problem, a heuristic was provided that minimizes local variance of the subset sums: namely, place the current element into the subset with the smallest sum. We analyze the performance of a variant of this heuristic. Instead, the current element is placed into the subset with the largest sum...

4) **Experimental Analysis of Schedule Algorithms, Jerry Waxman**, Queens College, CUNY, 65-30 Kissena Blvd., Flushing, NY 11367-0904

While previous research has provided tight error bounds under various metrics for the classic scheduling problem, an area of current interest is the expected performance of these algorithms on real sets of data. Extensive testing has been conducted on 4 algorithms, first fit, best-fit, greedy-fit, random-fit and graphs indicating their average performance using a Monte-Carlo approach are presented...

## MA31 Software Reliability Research

**Cluster:** Reliability & Quality Engineering  
Invited Session

**Chair:** Hoang Pham, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854-8018, hopham@rci.rutgers.edu

1) **Architecture-Based Software Reliability Prediction, Eric Wong**, BELLCORE, 445 South St., MCC-IB31OR, Morristown, NJ 07960, ewong@bellcore.com

We present an approach to predict the reliability of a heterogeneous software system based on its architecture and the failure behavior of its components. The novelty of this approach lies in the idea of parameterizing the analytic model of the software using measurements obtained from testing.

2) **A Software Reliability Model with Error Removal Efficiency, Xuemei Zhang**, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 07960, **Xiaolin Teng, Hoang Pham**

A general software reliability growth model is presented addressing error removal efficiency and error introduction rate, based on NHPP. We discuss the proposed model using data collected from some real-world applications. The results show that this model performs very well in both fit and prediction and it provides more information about the undergoing software development process.

3) **Software Reliability & Cost Modeling by a Quasi Renewal Process, Hongzhou Wang**, Lucent Technologies, 101 Crawfords Corner Rd., Holmdel, NJ 07733, Chair, **Hoang Pham**

We present a software reliability model using a quasi renewal process. Based on this process, the expected software testing and debugging cost and the mean error-free time after testing are developed. Computational results are presented.

4) **A Software Model with Time Dependent Failure Rates based on Bayesian Approach, Loan Pham**, Rutgers University, Dept. of

IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854-8018, **Hoang Pham**

A model predicting MTTF based on Bayes approach is presented. We apply the proposed model to actual software failure data and show it gives better results under various criteria. In addition, model prediction can be improved by introducing failure-free intervals.

### MA32 Pricing Telecommunications Networks

Cluster: Telecommunications Pricing & Control

Invited Session

Chair: Stephen D. Patek, University of Virginia

1) Pricing Noncooperative Networks: Users with Elastic Demands, **Yannis Korilis**, Lucent Technologies, 101 Crawfords Corner Rd., Rm. 44-602, Holmdel, NJ 07733

No abstract supplied.

2) A Flow Control Scheme for the Internet using Congestion Pricing, **Steven Low**, University of Melbourne, Dept. of EEE, Parkville, Vic, 3052, Australia

We propose an optimization approach to reactive flow control, where the objective of the control is to maximize the total utility of all sources over their transmission rates. The source utility functions model their valuation of bandwidth and can be different for different sources. The key is to consider the dual problem whose structure suggests treating network links and sources...

3) On the Estimation of Effective Bandwidths from Measurements, **Ioannis Paschalidis**, Boston University, Dept. of Mfg. Engineering, 15 Saint Mary's St., Boston, MA 02215, **Spyridon Vassilaras**

We consider the process of estimating the loss probability (due to buffer overflows) in a communication switch to be used for admission control purposes. One approach of doing this is to estimate a traffic model from measurements and use analytical large deviations asymptotics. We quantify the estimation error in such an approach and assess its effects on the large deviations asymptotics...

4) Pricing in a Large Loss System, **Martin Reiman**, Bell Labs, Lucent Technologies, 600-700 Mountain Ave., Rm. 2C-315, Murray Hill, NJ 07974-0636, **marty@lucent.com**, **Costas Courcoubetis**

We consider a multiresource loss system that handles several classes of customers. Arrival rates are determined in response to prices. We examine two economic models, one where prices are set to maximize revenue, and the other where prices are set to maximize social welfare. We focus on the asymptotic regime where the resource capacities are large.

### MA33 Statistical Experimental Design for Industrial Applications

Sponsor: Quality, Statistics & Reliability

Sponsored Session

Chair: Bruce A. Ankenman, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, **ankenman@iems.nwu.edu**

1) Sequential Experimental Designs for Binary-Response Experiments, **Joseph O. Voelkel**, Rochester Institute of Technology, 98 Lomb Memorial Dr., Rochester, NY 14623, **jgvcqa@ritvax.isc.rit.edu**

We explore designs for 1-factor binary-response sequential experiments, e.g., sequential explosive testing where the factor is drop height and the material may or may not explode. Bayesian methods are used to incorporate the vague information at the study's outset and to update information. We illustrate the method.

2) Experiment Design Strategies Under the No-Change, Change Scenario, **Bruce A. Ankenman**, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, **ankenman@iems.nwu.edu**

No abstract supplied.

3) Comparing Experimental Designs for Estimating Certain Mixed Effect Models, **Ana I. Aviles**, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, **Bruce A. Ankenman**

In many experiments, the response is affected by the experimental factors and by random effects of sampling procedures. The random effects of sampling procedures are variance components. We compare various experimental designs for estimating both response surface effects and variance components.

4) Optimal Design of Experiments for Modeling Processes with

Feedback Control Variables, **Li-an Xu**, University of Michigan, Dept. of Statistics, Ann Arbor, MI 48109, **xlian@umich.edu**

In many experiments, the response is affected by the experimental factors and by random effects of sampling procedures. The random effects of sampling procedures are variance components. We compare various experimental designs for estimating both response surface effects and variance components.

### MA34 No Title Supplied

Sponsor: College on Information Systems

Sponsored Session

Chair: Prabhudev Konana, University of Texas, Dept. of MSIS, CBA 5.202, Austin, TX 78712-1176, **pkonana@icf.bus.utexas.edu**

1) Intermediation in Electronic Market for Interactive Software Services, **Atip Asvanund**, Carnegie Mellon University, Heinz Sch. of PP&M, 5000 Forbes Ave., Pittsburgh, PA 15213, **atip@computer.org**, **Hemant Bhargava**, **Danny Fernandes**, **Ramayya Krishnan**

We discuss distinctive features that arise in brokering distributed repositories of interactive software services. A broker must support both discovery of software resources and composition and subsequent execution of the software components. We focus on enabling features of the broker, including formal metadata models, supporting algorithms and software architectures.

2) Complementarity in Electronic Data Interchange Linkages, **Sury Ravindran**, University of Texas at Dallas, Info. Networking Inst., 2601 North Floyd Rd., Richardson, TX 75080, **suryan@utdallas.edu**

Organizations that wish to improve performance measures using electronic linkages with their suppliers generally see an increase in risk due to increased dependence on the trading partner. This study attempts to lay a theoretical foundation to analyze the required changes in processes to improve performance and empirically test the model.

3) Development of Personalization Technologies for e-Commerce Applications, **Alex Tuzhilin**, NYU, Stern Sch. of Bus., 44 West 4th St., Rm. 9-78, New York, NY 10012, **atuzhili@stern.nyu.edu**

In many e-commerce applications, including the dynamic Web content presentation and personalized ads, it is important to understand the behavior of individual customers. To do this, it is crucial to build accurate individual profiles of these customers. I present my work on developing technologies facilitating the construction of such profiles.

4) Agent-Based Consumer Marketing, **Abhay Nath Mishra**, University of Texas, Dept. of MSIS, CBA 5.202, Austin, TX 78712-1176, **abhay@icf.bus.utexas.edu**, **Sridhar Balasubramanian**, **Prabhudev Konana**

We analyze the implications of electronic markets and online information search agents for consumer choice and market performance. We introduce a mean-variance model of consumer utility that allows us to explore how electronic markets can influence both consumer expectations and uncertainty in the context of different brands.

### MA35 Tutorial: Medical Informatics

Invited Session

Chair: Barry G. Silverman, University of Pennsylvania, Dept. of Systems Eng., Philadelphia, PA 19104, **barryg@seas.upenn.edu**

1) Tutorial: Overview of Medical Informatics: The Key Role of OR/MS, **Barry G. Silverman**, University of Pennsylvania, Dept. of Systems Eng., Philadelphia, PA 19104, **barryg@seas.upenn.edu**

MI is an evolving scientific discipline that deals with the collection, storage, retrieval, communication and optimal use of health related data, information and knowledge in all basic and applied areas of the biomedical sciences. The discipline utilizes the methods of the information sciences for the purposes of furthering the study of problem solving, decision making, training, communicating and assuring quality related to health care...

### MA36 Operations Management III

Contributed Session

Chair: Donald E. Simmons, Binghamton University, School of Mgmt., Binghamton, NY 13902-6015, **br00513@binghamton.edu**

1) Contracting Strategies in Uncertain Environments, **Anand A. Paul**, University of Texas, 2501 Lake Austin Blvd., Apt. L101, Austin, TX 78703, **abraham@uts.cc.utexas.edu**, **Genaro J. Gutierrez**

We examine, in an analytical framework, the pros and cons of different contracting strategies for managing projects and procurement in environments characterized by severe information asymmetries.

**2) Managing Competition in the Channel through a Staggered Product Rollout, *Viswanath Cysa***, Case Western Reserve University, Weatherhead Sch. of Mgmt., 24451 Lakeshore Blvd. 600W, Euclid, OH 44123, vxc10@po.cwru.edu, *Stephen M. Gilbert*

We examine ways in which a monopolistic manufacturer can use his pricing policies to change the timing of ordering decisions of competing retailers. We show that by influencing the timing decisions, which we refer to as staggering the product rollout, the manufacturer can encourage favorable forms of competition downstream.

**3) Collaborative Planning Forecasting & Replenishment in Supply Chains, *Yossi Aviv***, Washington University, Olin Sch. of Bus., One Brookings Dr., CB 1133, St. Louis, MO 63130-4899, aviv@mail.olin.wustl.edu, <http://www.olin.wustl.edu/faculty/aviv>

I will discuss CPFR partnerships in supply chain management, using a set of quantitative models. Results from 2 recent research papers will be presented: one deals with collaborative forecasting issues whereas the second deals with planning aspects of CPFR initiatives.

**4) Server Flexibility in Field Service Operations, *Donald E. Simmons***, Binghamton University, School of Mgmt., Binghamton, NY 13902-6015, br00513@binghamton.edu, *Sal R. Agnihotri*

We present a conceptual model of a field-based service environment where a heterogeneous workforce provides after-sales support for a heterogeneous product set that is subject to random failures. A simulation experiment examines tradeoffs involving the use of dedicated and/or flexible workers and provides insights for effectively managing the skill mix.

**MA37 A Roundtable Discussion on Academic Centers for Applied OR/MS**

Sponsor: INFORM-ED

Sponsored Session

Chair: Susan M. Sanchez, Naval Postgraduate School, OR Dept., 227 Glasgow Hall, Monterey, CA 93943, susan\_sanchez@umsl.edu

**1) The Centre for Operations Excellence, *Martin L. Puterman***, University of British Columbia, Fac. of Commerce, 2053 Main Hall, Vancouver, BC, V6T 1Z2, Canada, marty@markov.commerce.ubc.ca

The COE (<http://coe.ubc.ca/>) provides a focus for education and applied research in operations at UBC. I will describe the structure and achievements of the COE emphasizing our innovative Msc and industrial partnership programs. I will also provide some guidelines for success for institutions seeking to expand applied research activities through industrial collaboration.

**2) The MIT Leaders for Manufacturing Program, *Stephen C. Graves***, MIT, 77 Massachusetts Ave., Rm. E40-439, Cambridge, MA 02139-4307, sgraves@mit.edu, *Donald B. Rosenfield*

The Leaders for Manufacturing Program is a partnership between MIT and industry and is engaged in education, research and knowledge transfer activities. The mission of the program is to identify the principles of world class manufacturing and disseminate them to produce world-class leaders for our manufacturing enterprises.

**3) The Vision of the Logistics Institute, *H. Donald Ratliff***, Georgia Institute of Technology, School of ISyE, The Logistics Inst., Atlanta, GA 30327, don.ratliff@isye.gatech.edu

TLI at Georgia Institute of Technology provides comprehensive research and educational programs focused on the logistics value chain. TLI works with more than 25 corporations and government agencies known as TLI\*Os "Leaders in Logistics". We have recently initiated TLI Asia Pacific in Singapore which is a joint program with the National University of Singapore...

**MA39 Modal Perspectives on Transportation Logistics**

Sponsor: RASIG

Sponsored Session

Chair: Dharma R. Acharya, CSX Transportation, 500 Water St., J-300, Jacksonville, FL 32082, dharma\_acharya@csx.com

**1) Railroad Perspective on Transportation Logistics, *Noel Perry***, CSX Transportation, 500 Water St., J-300, Jacksonville, FL 32082

No abstract supplied.

**2) Trucking Perspective on Transportation Logistics**

No abstract supplied.

**3) Shipper Perspective on Transportation Logistics**

No abstract supplied.

**MA42 Dantzig Dissertation Award Finalist Presentations Invited Session**

Chair: Collette R. Coullard, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, coullard@iems.nwu.edu

**1) Search & Selection for Large-Scale Stochastic Optimization, *Justin Boesel***, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119

No abstract supplied.

**2) Efficient Capacity Allocation in a Collaborative Air Transportation System, *William D. Hall***, Charles Stark Draper Laboratory/MIT, 555 Technology Square, MS 3F, Cambridge, MA 02139

No abstract supplied.

**3) Bias Optimality in a Two-Class Nonstationary Queueing System, *Mark Lewis***, Georgia Institute of Technology, 415 Cumberland Sq., Smyrna, GA 30080

No abstract supplied.

**Monday 10:45-11:45**

**MP41 Plenary: The New Frontier: OR for Next Generation Telecommunications**

Plenary Session

Chair: To be announced

**1) Invited Plenary: The New Frontier: OR for Next Generation Telecommunications, *Donald Gips***, Level 3 Communications, 1025 Eldorado Boulevard, Broomfield, CO 80021, don.gips@level3.com

Both the competitive landscape in the telecom industry and the technology utilized in building next generation networks are changing at an unprecedented rate. Few companies today possess the right resources to manage, much less lead, this change. The concept of deploying fixed capacity networks is no longer appropriate. In order to profitably capture the huge untapped demand for bandwidth presented by tomorrow's voice, video and data applications, today's telecom companies must have highly scalable networks along with strategically planned moves to higher price performance technology (surpassing Moore's Law)...

**Monday 13:15-14:45**

**MC01 Risk & Preferences in Space Missions**

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Robin Dillon, Virginia Tech., Dept. of MS & Info. Tech., Pamplin Coll. of Bus., dillon@vt.edu

**1) Decision Analysis of Space Projects, *James E. Matheson***, Strategic Decisions Group, 2440 Sand Hill Rd., Menlo Park, CA 94025-6900, jmatheson@sdg.com

Many of the current research topics, including valuing space missions and determining the appropriate level of quantitative analysis, are not new. Decision analysis research first examined these topics in the late 1960s. We will provide some historical perspective on these topics with recommendations for the future of the research.

**2) Valuing Space Missions, *David Reiter***, Stanford University, Dept. of EES & OR, Stanford, CA 94305, reiter@leland.stanford.edu, *Elisabeth Pate-Cornell, Robin Dillon*

Space missions confront a range of engineering and scientific uncertainties. They provide value via scientific advances, public excitement, and application potential. We suggest a formal framework for incorporating these factors to quantify the value of a proposed mission. This approach could prove useful for a wide variety of NASA decisions.

**3) Strategic Technology Portfolio Selection: An Option Pricing Approach for NASA, *Robert Shishko***, California Institute of Technology, Jet Propulsion Lab., 4800 Oak Grove Dr., Pasadena, CA 91109-8099, robert.shishko@jpl.nasa.gov

We examine the use of a formal option-pricing approach for NASA technology.

The approach must consider the public goods aspects of the ultimate products and must treat the underlying uncertainties of both the costs and benefits. We offer a computational method that quantifies the option value of a technology.

**4) A Method for Advanced Programmatic Risk Analysis with an Unmanned Space Mission Illustration, Robin Dillon**, Virginia Tech., Dept. of MS & Info. Tech., Pamplin Coll. of Bus., dillon@vt.edu, *Elisabeth Pate-Cornell*

Currently, risk modeling tools focus on quantifying either technical or management risks. These tools, while beneficial, are often used in isolation. Since it is difficult to simultaneously balance cost, schedule and performance and dependencies among projects, managers who face these problems can benefit from an integrated programmatic risk analysis approach.

## MC02 Deterministic Machine Scheduling

Cluster: Combinatorial Optimization & Network Flows

Sponsor: Optimization Section

Sponsored Session

Chair: Chung Lun Li, Washington University, Olin Sch. of Bus., One Brookings Dr., St. Louis, MO 63130, lichung@mail.olin.wustl.edu

**1) Cluster Tool Scheduling, Jeffrey W. Herrmann**, University of Maryland, Inst. for Systems Research, College Park, MD 20742, jwh2@eng.umd.edu, *Manh-Quan Nguyen*

Cluster tools are highly integrated machines that can perform a sequence of semiconductor manufacturing processes. A typical cluster tool has a wafer handler that moves wafers between chambers. We will discuss the performance of different wafer handler dispatching rules and the impact of tool configuration on total processing time and cost of ownership.

**2) Polynomial Solvability & NP-Completeness for Gilmore-Gomory's Traveling Salesman & Related Problems, George L. Vairaktarakis**, Case Western Reserve University, Dept. of OR/OM, Weatherhead Sch. of Mgmt., Cleveland, OH 44106-7235, gxv5@po.cwru.edu, gxv5@guinness.som.cwru.edu

We reconsider the TSP first studied in the (now famous) paper of Gilmore & Gomory, 1964. This problem finds important applications in machine scheduling, workforce planning, etc. We solve this TSP variant by a new  $O(n \log n)$  algorithm and resolve the complexity of the bottleneck version of Gilmore-Gomory's TSP that was left as an open question...

**3) A Fast Algorithm to Minimize the Maximum Lateness in the Two-Machine Flow Shop with Release Times, George Steiner**, McMaster University, MS & IS Dept., MGD-415, Hamilton, Ontario, L8S 4M4, Canada, steinver@mcmaster.ca, *Paul Stephenson*

We present a new B&B algorithm for the 2-machine flow-shop problem with release times where the objective is to minimize the maximum lateness. The algorithm employs an adaptive branching scheme together with new dominance properties that are used for scheduling and searching.

## MC03 Emerging Research on Environment & Operations

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Charles J. Corbett, UCLA, AGSM, 110 Westwood Plaza, Box 951481, Los Angeles, CA 90095-1481

**1) Reverse Logistics with Component Commonality, Gregory A. DeCroix**, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, decroix@mail.duke.edu

In response to regulatory requirements and consumer pressures, many companies are considering end-of-life recovery of their products. The variability of the resulting reverse material flow may complicate the inventory and production operations at the manufacturer. We investigate the use of common reusable components across multiple product lines as a way of mitigating this impact.

**2) Accident Epidemiology: Understanding the Drivers of Major Accident Risk, Paul R. Kleindorfer**, University of Pennsylvania, The Wharton School, 3620 Locust Walk, Philadelphia, PA 19104-6366, kleindorfer@wharton.upenn.edu

Data on accident histories in the chemical and process industries in the US has become available as mandated by the Clean Air Act Amendments of 1990. The tools of epidemiology are used to investigate drivers of severity and frequency of accidents, and trends in these years, over the past 5 years.

**3) The Effect of Environmental Standards on Supply Chain Performance, Andrew A. King**, NYU, Stern School of Business, 40 West 4th St., Tisch 7-10, New York, NY 10012-1118, aking@stern.nyu.edu, *Michael J. Lenox*

Many proponents of industrial ecology argue that to protect the natural environment, firms must manage the performance of their entire supply chain. One proposed method is the use of industry standards for supply chain management. We investigate if such standards improve the environmental performance of supply-chains and how such standards diffuse through industries.

**4) The Impact of ISO 9000 & ISO 14000 Certification on Firm Performance, Charles J. Corbett**, UCLA, AGSM, 110 Westwood Plaza, Box 951481, Los Angeles, CA 90095-1481, *David A. Kirsch*

The ISO 14000 environmental management systems standards were recently introduced following the widespread global acceptance of the earlier ISO 9000 quality management standards. The impact of these standards on quality, environment and financial performance is still disputed, though. We investigate whether ISO 9000 and ISO 14000 certification affects firms' financial performance and by which mechanisms.

## MC04 Game Theory

Contributed Session

Chair: Ercan Tirtiroglu, University of Massachusetts, Dept. of Management, 285 Old Westport Rd., North Dartmouth, MA 02747-0993, etirtiroglu@umassd.edu

**1) Discount Pricing Decisions in Distribution Channels, Qinan Wang**, Nanyang Technological University, Business School, Rm. S3-B2A-31, Singapore, 639798, Singapore, aqnwang@ntu.edu.sg, *S. Viswanathan*

We conduct an analytical study of quantity discounts vis-a-vis volume discounts in a 1-vendor, 1-retailer system. The inventory and pricing policies of the vendor and the retailer are discussed in a Stackelberg game framework. Results of a computational study that compares the 2 types of discount policies are presented.

**2) Product & Process Development under Competition, Atrayee Bhattacharjee**, Case Western Reserve University, Dept. of Economics, Wick 400, 10900 Euclid Ave., Cleveland Heights, OH 44106, axb89@po.cwru.edu, *Matthew J. Sobel*

We characterize optimal product and process development policies in a dynamic monopoly model of a technology driven firm. The monopoly results are utilized in characterizing an equilibrium of a leader-follower sequential game model of a technology driven industry. Firms choose prices and the amounts to spend on product development and production process renovation.

**3) Duality for Equilibrium Problems under Generalized Monotonicity, Siegfried Schaible**, University of California, Grad. School of Mgmt., Riverside, CA 92521, siegfried.schaible@ucr.edu, *Igor V. Konnov*

Duality is studied for an abstract equilibrium problem which includes mathematical programs and variational inequality problems. Various duals are proposed and primal-dual relationships are established under certain generalized convexity and generalized monotonicity assumptions. Furthermore, existence results for a solution are derived for different generalized monotone equilibrium problems.

**4) Practical Considerations in Interpreting a Mixed Strategy Solution, Ercan Tirtiroglu**, University of Massachusetts, Dept. of Management, 285 Old Westport Rd., North Dartmouth, MA 02747-0993, etirtiroglu@umassd.edu, *Dogan Tirtiroglu*

We consider mixed strategy solutions in the context of 2-person, 0-sum games. From a practical point of view, we raise 2 issues concerning the interpretation of such a solution. One issue has to do with unfair frequencies and the other, which is inter-related to the first, has to do with degrees of freedom.

## MC05 MCDM II

Contributed Session

Chair: Raimo P. Hamalainen, Helsinki University of Technology, Systems Analysis Lab., PO Box 1100, Espoo, 02015, Finland, raimo@hut.fi, <http://www.sal.hut.fi>

**1) Multi-Attribute Cost-Effectiveness in Software Development, Gary W. Garden**, West Virginia University, 1008 Ridgeway Ave., Morgantown, WV 26505, ggarden@labyrinth.net, *Michael C. Carr*

Cost-effectiveness analysis (CEA) is a common analysis tool that relates physical performance parameters to economic parameters. However, the multi-attribute nature of performance makes CEA implementation problematic. We demonstrate an alternative method for dealing with multiple attributes in CEA and present results from an application to software development projects.

**2) A Multicriteria Decision Making Problem with a Monotone Utility Function, Esra Kokter Karasakal**, Middle East Technical

University, Dept. of IE, Ankara, Bilkent, 06531, Turkey, esra@ie.metu.edu.tr, **Murat Koksalan**

We consider the continuous solution space MCDM problem, assuming that the decision maker has an implicit general monotone utility function. We present an approach for finding the decision maker's most preferred solution based on solution space reduction and investigate the issues in the representation of the reduced solution space.

3) **Prospect-Theory, Mental Accounting & Differences in Aggregated & Segregated Evaluation of Lottery Portfolios**, **Thomas Langer**, University of Mannheim, Lehrstuhl für ABWL, Finanzwirtschaft Bankbetrieb., Mannheim, D-68131, Germany, langer@bank.bwl.uni-mannheim.de, **Martin Weber**

Empirical research demonstrates lottery portfolios to look more attractive to individuals if the overall portfolio distribution is displayed only. We provide a theoretical explanation, based on prospect-theory, predicting the effect not to be general, but to depend on the risk profiles of the lotteries. Our own experimental tests confirm our hypotheses.

4) **Preference Ratios in Multiattribute Evaluation**, **Raimo P. Hamalainen**, Helsinki University of Technology, Systems Analysis Lab., PO Box 1100, Espoo, 02015, Finland, raimo@hut.fi, http://www.sal.hut.fi, **Ahti A. Salo**

The PRIME method is based on the elicitation of possibly imprecise ratio statements. Simulation studies indicate that PRIME rapidly reduces the set of nondominated alternatives and provides a flexible and user-friendly approach to value tree analysis. The method is illustrated with a reanalysis of a classic case study on international oil tanker negotiations.

#### MC06 Research Related to Telephone Call Centers

Sponsor: **Manufacturing & Service Operations Management**  
Sponsored Session

Chair: **Noah F. Gans**, University of Pennsylvania, OPIM Dept., The Wharton School, Philadelphia, PA 19104-6366, gans@wharton.upenn.edu

1) **Improving the Stationary Independent Period by Period Approach for Staffing Call centers with Limited Hours of Operation**, **Linda V. Green**, Columbia Business School, Grad. School of Bus., 423 Uris Hall, New York, NY 10027, lgreen@research.gsb.columbia.edu, **Peter J. Kolesar**

Using numerical methods, we show that the commonly used SIPP approach to setting staffing requirements is inaccurate for many real situations. We propose 2 simple modifications of SIPP and simple guidelines for their use that produce reliable staffing levels in most real situations.

2) **Design of Multi-Level Call Centers**, **Edieal J. Pinker**, University of Rochester, Simon Grad. School, Rochester, NY 14627, pinker@ssb.rochester.edu, **Robert Shumsky**

We consider the design of a call centers in which front-line generalists refer some calls to specialists. Design parameters include the sets of calls referred to specialists and staffing levels for each type of server. The design decision affects staffing and training costs as well as service quality.

3) **Dimensioning Large Call Centers**, **Sem C. Borst**, Bell Labs. Lucent Technologies, 600 Mountain Ave., Rm. 2C-205, Murray Hill, NJ 07974-0636, sem@bell-labs.com, **Avishai Mandelbaum**, **Martin Reiman**

We consider the classic M/M/N (Erlang C) system where the arrival and service rates are given. Our goal is to choose N in order to minimize a total cost, which is the sum of staffing and waiting costs. We examine this problem for large call centers by considering asymptotics as the arrival rate grows large.

4) **Skills-Based Routing with Service-Level Constraints**, **Yongpin Zhou**, University of Pennsylvania, OPIM Dept., The Wharton School, Philadelphia, PA 19104-6366, yongpin@wharton.upenn.edu, **Noah F. Gans**

In the skill-based routing problem, many types of jobs arrive to multiple-server queue. Servers are heterogeneous, each possessing the ability to handle some subset of job types. The objective is to devise a routing scheme that best assigns incoming jobs to capable servers, subject to a service-level constraint.

#### MC07 Product Variety Management

Cluster: **Manufacturing & Logistics**  
Invited Session

Chair: **Jayashankar Swaminathan**, University of California, Haas Sch. of Bus., Berkeley, CA 94720, mjs@haas.berkeley.edu

1) **The Effect of Product Variety on Supply Chain Performance**,

**Ulrich W. Thonemann**, Stanford University, Terman Eng. 336, Dept. of IEEM, Stanford, CA 94305-4024, uthonema@leland.stanford.edu, **James R. Bradley**

We show that the cost of product variety is substantially greater than that suggested by the risk-pooling literature. Expected lead time and cost are not proportional to the square root of product variety, but increases at a rate that is asymptotically linear.

2) **Optimizing Product Line Selection under the Logit Choice Model**, **Candace A. Yano**, University of California, IEOR Dept., 4135 Etcheverry Hall, Berkeley, CA 94720-1777, yano@ieor.berkeley.edu, **Ursula Kraus**

When customers in a segment are heterogeneous in some respects, they may choose different products among those offered. We examine the problem of profit-maximizing product line selection under a logit choice model. We discuss structural results, a solution procedure and managerial insights.

3) **Design for Variety: Architecting Mass-Customized Products for Current & Future Generations**, **Mark Martin**, Stanford University, Dept. of Mechanical Eng., Stanford, CA 94305-4021, mvmartin@stanford.edu, **Kos Ishii**

We present a structured design method for architecting products with high variety. The method integrates input on changing customer needs, technology advances, interactions among product components and the uncertainty around these inputs. The process helps in developing designs which are less costly to manufacture and are more easily leveraged for future products.

4) **Commonality in Product Lines & Inventory Management**, **Jayashankar Swaminathan**, University of California, Haas Sch. of Bus., Berkeley, CA 94720, mjs@haas.berkeley.edu

We develop analytical models to capture the effect of commonality on independent inventory management, substitution and postponement strategies. In particular, we consider the cost of commonality and inventory benefits of commonality in an integrated model and provide various insights using a 2-product system.

#### MC08 Optimization of Freight & Fleet Management II

Sponsor: **Section on Logistics**  
Sponsored Session

Chair: **Amelia C. Regan**, University of California, Engineering Gateway 4151, Dept. of CEE, Irvine, CA 92697-2175, aregan@uci.edu

1) **Transportation Management Software Solutions for Retailers: Applications of Combinatorial Optimization**, **William J. Schineller**, Logistics Information Systems, Inc., 492 Old Connecticut Path, Framingham, MA 01701, bschineller@liscorp.com

Retail transportation departments tackle large-scale problems each day involving the building, routing and awarding of loads to common and private carriers. They seek to minimize costs by exploiting negotiated rates while satisfying pickup and delivery schedules, handling requirements and driver regulations. We describe applications of combinatorial optimization techniques for implementing today's and tomorrow's logistics strategies.

2) **A Decision Support System for Container Balancing**, **Debjit Das**, MIT, Ctr. for Transport. Studies, 77 Massachusetts Ave. Rm. 5008, Cambridge, MA 02139, debjit@mit.edu

A network model to balance empty containers between deficit and surplus ports is proposed. Locational values for nodes in a time-space network indicating revenue opportunities are estimated. The model recommends decisions to lease out, sell, store or reposition containers at the different ports based on all cost and revenue factors.

3) **An Inventory Routing Problem Model for the Construction of Oil Barge Pickup Routes**, **Charles E. Noon**, University of Tennessee, 613 SMC, Knoxville, TN 37996-0562, cnoon@utk.edu, **Anurag Agarwal**

We present a barge scheduling problem faced by an off-shore oil company and show how it can be modeled as a deterministic inventory routing problem. In spite of being deterministic, the problem remains quite challenging due to firm constraints on not reaching platform capacities and the objective of finding the least cost repeatable cycle...

4) **Local Truckload Vehicle Routing with Strict Time Window Constraints**, **Amelia C. Regan**, University of California, Engineering Gateway 4151, Dept. of CEE, Irvine, CA 92697-2175, aregan@uci.edu, **Xiubin Wang**

We describe a solution method for time constrained vehicle routing and scheduling tailored to local truckload trucking moves like those supporting rail or maritime intermodal operations. We present an MIP problem in which

explicit time constraints are replaced by flow variables.

### MC09 Inventory Management II

#### Contributed Session

**Chair:** Ann M. Campbell, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, ann@isye.gatech.edu

1) **The Effect of Information Sharing on the Positioning of Inventory in Distribution Systems**, *Shitao Yang*, University of North Carolina, Kenan-Flagler Bus. School, 130 South Estes Dr. A-8, Chapel Hill, NC 27514, uyst@email.unc.edu

Consider a 1-warehouse multi-retailer distribution system with stochastic demand. We simulated several inventory control systems with similar decision rules but different information requirements. The design reflects various information-sharing schemes observed in industry. The question is: Would information sharing change the positioning of inventory in a distribution system, and if so, how?

2) **Models for Multi-Plant Networks**, *Shailesh S. Kulkarni*, University of North Texas, c/o ML 1030, Cincinnati, OH 45221-0130, kulkarsh@econqa.cba.uc.edu, *Michael J. Magazine*, *Amiabh Raturi*

We develop simple models for gaining insight into the strategic multi-plant configuration problem. We study the impact of demand uncertainty, logistics costs and backorder penalty costs on the long-term configuration decision. We obtain closed form solutions and do sensitivity analyses wherever possible.

3) **A Joint Location-Inventory Model**, *Zuo-Jun Shen*, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208, zjshen@nwu.edu, *Mark S. Daskin*, *Collette R. Couillard*

We introduce a joint location-inventory model. We formulate this problem as a nonlinear model. This is then restructured as a set partitioning problem and solved using column generation. Model formulations are detailed and computational results are presented.

4) **Insertion Heuristics for Inventory Routing Problems**, *Ann M. Campbell*, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, ann@isye.gatech.edu, *Martin Savelsbergh*

In creating a feasible delivery schedule for vendors following an inventory routing policy, there are many important constraints and complexities that need to be handled: operating models for customer usage, customer requiring multiple deliveries per day, DOT regulations for drivers, variable length planning periods and delivery time windows.

### MC10 Complementarity Problems & Applications

**Cluster:** Optimization & Applications

**Sponsor:** Optimization Section

Sponsored Session

**Chair:** Michael C. Ferris, University of Wisconsin, Comp. Sci. Dept., 1210 West Dayton St., Madison, WI 53706-1685, ferris@cs.wisc.edu

1) **A Descent Method for Monotone Continuous Complementarity Problems**, *Andreas Fischer*, Technical University of Dresden, Mommsenstr. 13, Dresden, 01062, Germany, fischer@math.tu-dresden.de, *V. Jeyakumar*

Given a nonlinear complementarity problem with a monotone function  $F$  we consider the case that  $F$  is continuous but not necessarily Lipschitz-continuous or differentiable. For solving such a problem a derivative-free method is proposed. The proof of global convergence properties relies on the use of approximate Jacobians.

2) **Trust Regions Methods in Complementarity**, *Todd S. Munson*, University of Wisconsin, Dept. of Computer Sci., 1210 West Dayton St., Madison, WI 53706, tmunson@cs.wisc.edu, *Michael C. Ferris*

Very large complementarity problems are becoming more prevalent in industry; yet the codes currently used are not particularly well suited to this environment. We discuss recent work in using trust region methods on huge complementarity problems. We focus on the reliability and scalability of our algorithm.

3) **Complementarity Problems in Statistics**, *Stephen J. Wright*, Argonne National Lab., MCS Div., 9700 South Cass Ave., Argonne, IL 60439, wright@mcs.anl.gov

A variety of computational problems in the modern statistics literature can be solved by means of complementarity formulations to which techniques such as interior-point methods are applied. We describe in particular our experience

with simultaneous variable selection, and mention also the "lasso" approach and various robust data-fitting techniques.

4) **Smoothing Methods for Support Vector Machines**, *Yuh-Jye Lee*, University of Wisconsin, Comp. Sci. Dept., 1210 West Dayton St., Madison, WI 53706, *Olvi L. Mangasarian*

Support vector machines play a fundamental role in data discrimination. The KKT conditions for a generalized SVM are smoothed by a sigmoid and solved by a Newton method. Superior tenfold cross-validation results on a number of datasets indicate the effectiveness of a smoothing approach to SVMs.

### MC11 Tutorial: Deterministic Global Optimization: Algorithms & Applications

**Cluster:** Global Optimization

**Sponsor:** Optimization Section

Sponsored Session

**Chair:** Nick Sahinidis, University of Illinois, Dept. of Chem. Eng., 600 South Mathews Ave., Urbana, IL 61801, nikos@uiuc.edu

1) **Tutorial: Deterministic Global Optimization: Algorithms & Applications**, *Nick Sahinidis*, University of Illinois, Dept. of Chem. Eng., 600 South Mathews Ave., Urbana, IL 61801, nikos@uiuc.edu

In the context of deterministic approaches to global optimization, this tutorial is designed to: expose the key ideas of solution algorithms, i.e., B&B, convexification, decomposition, etc.; describe and demonstrate leading software solution technologies; provide an account of successful applications; and propose an array of opportunities in application areas that are largely unexplored.

### MC12 Marketing Applications of Economic Models

**Sponsor:** College of Marketing

Sponsored Session

**Chair:** Rajeev Tyagi, University of California, Grad. Sch. of Mgmt., Irvine, CA 92697

1) **On the Optimality of Price Discrimination in Industrial Markets**, *Rajeev Tyagi*, University of California, Grad. Sch. of Mgmt., Irvine, CA 92697

We examine the choice between price discrimination and uniform pricing for a monopolistic supplier selling an intermediate product to downstream manufacturers who differ in their efficiencies of production. We show situations where, contrary to the standard textbook results on price discrimination, the suppliers prefers uniform pricing over price discrimination even when the buying manufacturers differ in their willingness to pay...

2) **withdrawn - author request of 10/11**, *Barry Nault*, University of California, Grad. Sch. of Mgmt., Irvine, CA 92697

3) **Bargaining Models of Channels**, *Ganesh Iyer*, Washington Univ., Olin Sch. of Bus., CB 1133, One Brookings Dr., St. Louis, MO 63130

We develop a model of distribution channels using a bargaining theory approach. This model demonstrates that the previous models proposed in the marketing literature are special cases of our model.

4) **Defensive Strategies against a Private Label: Price Cut vs. Equity Building**, *S. Chan Choi*, Rutgers University, 180 University Ave., Fac. of Mgmt., Newark, NJ 07102

Private labels have become a major force in retail marketing posing a great threat to national brands. In many product categories, they are among the best-selling brands. Understanding the nature of competition from private labels is essential in designing defensive strategies for the national brands. We examine 2 major defensive strategies for a manufacturer facing a private label competition...

### MC13 Modeling Consumer Demand

**Sponsor:** College of Marketing

Sponsored Session

**Chair:** Alan Montgomery, University of Pennsylvania, Wharton Sch./Mktg. Dept., 1400 SH-DH, Philadelphia, PA 19104

1) **Why do Prices Fall When Demand Peaks?**, *Peter E. Rossi*, University of Chicago, Grad. School of Bus., 1101 East 58th St., Chicago, IL 60637, *Anil Kashyap*, *Judy Chevalier*

No abstract supplied.

2) **No Title Supplied**, *Andrew Ainslie*, Cornell University, 547 Malott Hall, JGSM, Ithaca, NY 14853

No abstract supplied.

3) **No Title Supplied**, *Alan Montgomery*, University of Pennsylvania, Wharton Sch./Mktg. Dept., 1400 SH-DH, Philadelphia, PA 19104

No abstract supplied.

#### MC14 Modularity

**Sponsor:** Technology Management Section/College on Organization Science

Sponsored Session

**Chair:** Melissa A. Schilling, Boston University, Mgmt. Policy Dept., 595 Commonwealth Ave., Boston, MA 02215, melissa1@bu.edu

1) **Modularity in Technology, Organization & Society**, *Richard N. Langlois*, University of Connecticut, 332 Monteith, 341 Mansfield Rd., Storrs, CT 06269-1063, langlois@uconnvm.uconn.edu

From the perspective of the theory of modular systems, we revisit the literature of property rights in the economics of organization. How far can the principles of modularity take us in understanding the boundaries of the firm? How far have existing theories of property rights already taken us?

2) **Modularity & the Management of Knowledge Assets**, *Ron Sanchez*, Copenhagen Business School, Nansensgade 19, Sixth Floor, Copenhagen, DK-1366, Denmark, sanchez@cbs.dk

We examine the role of product and process architectures in the identification and management of an organization's knowledge assets. We consider how decomposing products and processes into functional components and specifying component interfaces enables the identification of key knowledge assets in an organization's product creation and realization capabilities.

3) **Metamorphic Change: Challenges in Migrating the Installed Base**, *Raghu Garud*, NYU, Stern Sch. of Bus., 7-13 Tisch Hall, 40 West 4 St., New York, NY 10012, rgarud@stern.nyu.edu, *Sanjay Jain*, *Corey Phelps*

Each generation of Netscape's Navigator simultaneously builds upon and substantially extends earlier generations. We label such migratory processes that synthesize elements of continuity and change as "metamorphic." We identify 3 fundamental mechanisms of this process: modularly upgradable product architectures, intermediate product generations and active management of the product's meaning.

4) **Towards a General Modular Systems Theory**, *Melissa A. Schilling*, Boston University, Mgmt. Policy Dept., 595 Commonwealth Ave., Boston, MA 02215, melissa1@bu.edu

Modularity, or the "loose coupling" of systems, is a concept applicable to many kinds of systems, including technological, biological, organization and social. We seek to build a general theory of modular systems, drawing on studies of modularity, complexity theory, the resource-based view of the firm and transaction cost economics.

#### MC15 Advances in Technical Entrepreneurship & Innovation Management

**Sponsor:** Technology Management Section  
Sponsored Session

**Chair:** David L. Gibson, University of Texas, IC2 Institute, 2815 San Gabriel, Austin, TX 78705, davidg@icc.utexas.edu

1) **Advances & Alternative Models for Technology & Innovation Management Educational Programs**, *Michael K. Badawy*, Virginia Tech., Sch. of Business, PO Box 3987, Merrifield, VA 22116-2931, mbadawy@vt.edu

We explore current research findings on various models of technology management educational delivery adopted by universities. An assessment of these models will be undertaken along with a proposed curriculum for a graduate degree in the management of technology. Implications for academic and executive educational programs in this field will also be discussed.

2) **IC2 Education Program in Global Networked Entrepreneurship Education**, *David L. Gibson*, University of Texas, IC2 Institute, 2815 San Gabriel, Austin, TX 78705, davidg@icc.utexas.edu

In 1996, the IC2 Institute, the University of Texas at Austin, launched an innovative 12-month MS degree program in Science & Technology Commercialization. Classes are currently held (every other Friday and Saturday) simultaneously in Austin, Texas, the Washington DC area and Monterrey, Mexico with MSTC technology commercialization project teams

working with Latin America, Europe, Asia and Russia.

3) **Science & Technology Driven Entrepreneurship: Advances in Curriculum Design & New Pedagogy**, *Sarfraz A. Mian*, SUNY, Sch. of Business, 1 Swetman Hall, Oswego, NY 13126, mian@oswego.edu

In recent years, a number of institutions of higher education have introduced science- and technology-based new venture development course/programs as a significant form of the curriculum design and pedagogical innovations in their emerging entrepreneurship education programs. We study the best practices in university programs in various North American universities.

4) **Creating New Directions in Globally Distributed PhD Education**, *Dottie Eastman Agger-Gupta*, The Fielding Institute, PO Box 61122, Kensington RPO, Calgary, Alberta, T2N 4S6, Canada, dotagger@fielding.edu

In 1974, The Fielding Institute was founded to support self-directed, mid-career adult PhD education. Today, students, faculty and alumni in this international community of scholar practitioners use Internet-based, multi-media collaboration tools to support new initiatives in quality learning, research, critical thinking and social justice initiatives. Among these initiatives are cross-program interactive seminars...

#### MC16 Robust Methods for Decision Making with Asset Modeling Systems

**Sponsor:** Financial Services Section  
Sponsored Session

**Chair:** Adam J. Berger, Lattice Financial, 55 Princeton-Hightstown Rd., Princeton Junction, NJ 08550, aberger@latticefinancial.com

1) **Robust Methods for Decision Making with Asset Modeling Systems**, *Adam J. Berger*, Lattice Financial, 55 Princeton-Hightstown Rd., Princeton Junction, NJ 08550, aberger@latticefinancial.com

For certain planning problems that employ output from an asset model, small changes in the asset assumptions can yield large changes in the optimization results. We describe a method for improving the robustness of the optimization solutions with respect to deviations in the underlying asset model assumptions.

2) **An Integrated Risk Management System for the American Re-Insurance Company**, *Chris Madsen*, American Re-Insurance, 555 College Rd East, Princeton, NJ 08543, cmadsen@amre.com

An integrated risk management system must generate reasonable results, based on sound economic principles. We discuss the notion of reasonableness for a large reinsurance company.

3) **Real Options Modeling in Spreadsheets**, *Dawei Bai*, Bear Stearns & Company, 245 Park Ave., 10th Floor, New York, NY 10167

Real options provide insights in situations where uncertainty is a major concern and NPV is inadequate. The concept has recently found applications in many areas, such as Internet stock pricing. We demonstrate a simple spreadsheet system showing the practical issues that arise when conducting these studies.

4) **Credit Risk Portfolio Models**, *H. Ugur Koyluoglu*, Oliver, Wyman & Company

Credit portfolio risk analysis and management deals with identification, quantification, and management of credit risk at the individual borrower and portfolio levels. This examination reveals that all standard models in practice belong to a single framework, which has significant implications for acceptance of these new techniques by end-users and regulators.

#### MC17 Production Planning & Worker Scheduling Contributed Session

**Chair:** Jack C. Hayya, Pennsylvania State University, Dept. of MS, 303 Beam Bldg., University Park, PA 16802, jch@psu.edu

1) **Employee Staffing Levels in Service Firms: Shortage & Surplus Costs**, *John C. Goodale*, Ball State University, College of Bus., Muncie, IN 47306, jgoodale@bsu.edu, *Rohit Verma*, *Madeleine E. Pullman*

Employee shortages and surpluses in service firms are consequences of unbalanced levels of customer arrivals and scheduled staff. By describing a service in terms of appropriate attributes, discrete choice analysis is used to predict customer arrivals and to identify shortage and surplus costs for employee scheduling.

2) **Worker Scheduling in Dynamic Workload Environments**,

**Wipawee Tharmmaphornphilas**, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA 15261, wist5+@pitt.edu, **Bryan A. Norman**

We consider the problem of developing robust job rotation schedules in physically demanding work environments where the task loads are stochastic. The objective is to find a schedule that minimizes the potential for worker injury. We consider alternative solution methodologies and present computational results for test problems.

**3) The Simultaneous Planning of Production, Capacity & Inventory in Seasonal Demand Environments**, **James R. Bradley**, Cornell University, 321 Sage Hall, Johnson Grad. Sch. of Mgmt., Ithaca, NY 14853-6201, jrb28@cornell.edu, www.johnson.cornell.edu/facultybios/bradley.html, **Bruce A. Arntzen**

In addressing capacity and inventory decisions separately, managers often ignore the interaction between capacity and inventory, which can lead to an imbalance of capacity and inventory. Our model simultaneously plans capacity, inventory, and the production schedule using a fractional objective function (return on assets). Two manufacturers are implemented our model.

**4) An Integrated Production-Inventory Model under General Time-Dependent Demand**, **Jaë-Dong Hong**, South Carolina State University, IE Dept., Orangeburg, SC 29117-7722, jdhong@msn.com, **Jack C. Hayya**

We consider an integrated production-inventory model that integrates the dependencies between the end product and its input materials under general time-dependent demand. Our purpose is to develop a general solution procedure for the optimal production policy where both production batch size and production cycle are unrestricted.

## MC18 Applications of Discrete Optimization

Cluster: Discrete Optimization  
Invited Session

Chair: Oktay Gunluk, AT&T, 120 Laurel Ave., Rm. D5 3D-21, Middletown, NJ 07748, oktay@att.com

**1) Resource Allocation in a Multicast Tree**, **Murali S. Kodialam**, Bell Labs, 101 Crawfords Corner Rd., Holmdel, NJ 07733, muralik@lucent.com, **Steven Low**

We consider the problem of bandwidth allocation in a multicast tree in order to optimize some global performance measure. We assume that each receiver has a budget to be used for bandwidth allocation along its path from the source. We formulate and solve the problem of minimizing the sum of the link costs.

**2) Fault-Tolerant Virtual Path Layout in ATM Networks**, **Andrew Vakhutinsky**, United Airlines, Chicago, IL, andrew.vakhutinsky@ual.com, **Michael O. Ball**

We present an integer programming model and solution approach to virtual path layout in ATM networks, which seeks to optimize performance and provides restoration of network services in case of a link failure. The solution methods developed employ relaxation and aggregation of variables, feasible solution heuristics and valid inequalities.

**3) Portfolio Optimization: A Model & Heuristic to Capture the Trade-off Between Replication Error & Number of Instruments**, **Edoardo Amaldi**, Politecnico di Milano, DEI, via Ponzio 34/5, Milano, 20133, Italy, amaldi@cs.cornell.edu/amaldi@elet.polimi.it, **Jean-Francois Puztaszeri**

We describe a new method for solving the general portfolio replication problem constrained in the number of instruments. The conventional approach relies on imposing an explicit constraint, in spite of the fact that it is difficult in practice to determine a priori an upper bound on the number of instruments...

**4) An Integer Programming Model for the Weekly Tour Scheduling Problem**, **Hanan Luss**, BELLCORE, RRC - 1166, 444 Hoes Ln, Piscataway, NJ 08854, hluss@notes.cc.bellcore.com, **Tolga Cezik**, **Oktay Gunluk**

We study a workforce planning and scheduling problem in which weekly tours of agents must be designed. A weekly tour consists of 5 daily shifts and 2 days off, where daily shifts within a tour may be different from each other. We describe an integer programming formulation and discuss several solution approaches...

## MC19 Mixed Integer Programming & its Applications

Cluster: Discrete Optimization  
Invited Session

Chair: Gabor Pataki, Columbia University, Dept. of IE/OR, Comp. Opt. Research Ctr., New York, NY 10027, gabor@ieor.columbia.edu, http://www.ieor.columbia.edu/~gabor/

**1) Convergence of a Cutting Plane Method for General Mixed-Integer Problems by Generating Cuts & Near-Optimal Solutions**, **Jonathan H. Owen**, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, owenj@iems.nwu.edu, **Sanjay Mehrotra**

We show how to construct a globally convergent cutting plane algorithm for general mixed-integer linear programs by generating disjunctive cuts at optimal as well as near-optimal solutions of the linear programming relaxation.

**2) A Planning Problem of Forest Management**, **Monique Guignard-Spielberg**, University of Pennsylvania, The Wharton Sch., 1320 SH-DH, Philadelphia, PA 19104-6366, guignard@grace.wharton.upenn.edu, **Andres Weintraub**, **Nicolas Andalaft**, **Pablo Andalaft**, **Adrian Magendzo**, **Alexis Wainer**

We consider a 2-to-5 year management problem in pine plantations in Chile, concerning the areas to cut, the amounts to produce to meet various timber demands and the roads to build. We describe strategies to improve the MIP solution process, and present computational results based on actual instances.

**3) Optimizing Contact Strategies**, **Eric Bibelnicks**, IBM Global Business Intelligence Solutions, N 1951 Spring Rd., Ogema, WI 54459, ebibeln@us.ibm.com

Direct mail companies traditionally select which customers to mail on a point-in-time basis. We present results on several integer optimization formulations on building mailing strategies over a window of time.

**4) Lift & Project vs. Branch & Bound: A User's Guide**, **Gabor Pataki**, Columbia University, Dept. of IE/OR, Comp. Opt. Research Ctr., New York, NY 10027, gabor@ieor.columbia.edu, http://www.ieor.columbia.edu/~gabor/, **Sebastian Ceria**

Practitioner's frequently ask, "Will cutting planes help solving a hard MIP, if B&B cannot do it in itself?" We attempt to give an answer by presenting computational results with various cutting strategies on very difficult MIPS and disjunctive programs.

## MC20 Static Traffic Assignment I

Sponsor: Transportation Science Section  
Sponsored Session

Chair: Kyriacos C. Mouskos, New Jersey Institute of Technology, Inst. of Transport, University Heights, Newark, NJ 07102, mouskos@megahertz.njit.edu

**1) Traffic Assignment under Demand Uncertainty**, **Athanasios Ziliaskopoulos**, Northwestern University, 2145 Sheridan Rd., Evanston, IL 60208, a-z@nwu.edu, **S. Travis Waller**, **David E. Boyce**

UE models typically do not account for demand uncertainty, although demand models produce at least a measure of uncertainty for the projected demand. We prove that the UE solution is a convex function of demand, and by invoking Jensen's inequality we demonstrate that disregarding the demand uncertainty can have significant implications on planning decisions.

**2) Solving a Nonadditive Traffic Equilibrium Problem**, **Kelley Scott**, Princeton University, Dept. of Civil Eng. & OR, Princeton, NJ 08544, kellys@princeton.edu, **David Bernstein**

Several formulations and related solution algorithms exist for finding the user equilibrium flow through a transportation network. However, when path costs are nonadditive, the standard solution approaches for this asymmetric TEP may not be sufficient. We present methods for solving a nonadditive TEP formulated as a variational inequality problem, along with initial numerical results...

**3) Asymmetric Traffic Assignment in Signalized Urban Transportation Networks**, **Wu Sun**, New Jersey Institute of Technology, Inst. of Transp., University Heights, Newark, NJ 07102, wxs3191@megahertz.njit.edu, **Kyriacos C. Mouskos**

The major pair of conflicting movements at signalized intersections are the left-turning and the opposite through movement. The impacts of these 2 conflicting movements on each other are asymmetric. We present a methodology and experimental results of an asymmetric traffic assignment model in urban networks.

## MC21 Modeling Dynamic Networks

Sponsor: Transportation Science Section  
Sponsored Session

**Chair:** Elise D. Miller-Hooks, Pennsylvania State University, 212 Sackett Bldg., Dept. of Civil & Environ. Eng., University Park, PA 16802

**1) Bitstream Algorithms for Shortest Path Problems in Dynamic Networks, Ismail Chabini, MIT, 77 Massachusetts Ave., Rm. 1-263, Cambridge, MA 02139-4307, Vinay Yappadanavar**

We show formulations and algorithms for shortest path problems in dynamic networks using a bitstream representation of dynamic data. Savings in computational speed as well as memory storage are evaluated theoretical and experimentally. Parallelism at the bit level is also explored.

**2) Optimal Algorithms for Shortest Path Problems in Discrete Dynamic Networks, Ismail Chabini, MIT, 77 Massachusetts Ave., Rm. 1-263, Cambridge, MA 02139-4307, Peng Sun**

We present algorithms for various types of shortest path problems in discrete dynamic networks including stochastic time-dependent networks as well as deterministic multidimensional networks. The computational efficiency of these algorithms is demonstrated theoretically as well as experimentally.

**3) Variants of an A\* Algorithm for Shortest Path Problems in Dynamic Networks, Ismail Chabini, MIT, 77 Massachusetts Ave., Rm. 1-263, Cambridge, MA 02139-4307, Shan Lan**

We present the variants of A\* algorithm for shortest path problems in dynamic networks. We exploit some special characteristics of dynamic networks to find better estimations of the shortest distances, which makes the algorithm find an optimal shortest path more efficient than existing algorithms. We analyze the algorithm under different conditions and address the issues of admissibility and optimality...

**4) Parallel Implementations of Dynamic Shortest Paths Algorithms, Ismail Chabini, MIT, 77 Massachusetts Ave., Rm. 1-263, Cambridge, MA 02139-4307, Vinay Yappadanavar**

We present efficient process-based and thread-based implementations of dynamic shortest path algorithms. Two classes of computing platforms are investigated to solve a variety of shortest path problems in dynamic networks. Efficient techniques for data communication and problem decomposition are shown.

**MC22 Litigation & Litigation Avoidance in IT Outsourcing Contracts**

**Cluster:** IT Outsourcing: Integrating Research, Teaching & Practice Invited Session

**Chair:** Eric K. Clemons, University of Pennsylvania, The Wharton Sch., 1315 Locust Walk, SH-DH 6366, Philadelphia, PA 19104

**1) Applying Economics Principles to IT Outsourcing Litigation, Eric K. Clemons, University of Pennsylvania, The Wharton Sch., 1315 Locust Walk, SH-DH 6366, Philadelphia, PA 19104**

No abstract supplied.

**2) Trends in Outsourcing Litigation**

No abstract supplied.

**MC23 Petroleum Logistics I**

**Sponsor:** Energy, Natural Resources & Environment Sponsored Session

**Chair:** Emmanuel D. Chajakis, Princeton University, Princeton, NJ 08544-5263, manos@titan.princeton.edu

**1) New Insights into Multi-Dimensional Process History Data, Victoria Brooks, Process Plant Computing Ltd., PO Box 43, Gerrards Cross, Buckinghamshire, SL9 8UX, England, UK, Robin Brooks**

Conventional process data analysis is limited to time trend displays of up to 6 variables and simple regression. We describe the remarkable insights gained through the use of parallel coordinate geometry as a visualisation tool. 'Holes' discovered in processes studied imply grave disturbances to existing process control mathematics.

**2) Energy Industry Supply Chain Optimization Case Studies, Steve Venner, Bonner & Moore Associates, Inc., 2727 Allen Parkway, Ste. 1100, Houston, TX 77019, steve\_venner@bonnermoore.com**

The wide versatility of commercial decision support tools will be illustrated through a discussion of three examples of how these supply chain optimizers are being utilized in the energy industry. These examples will range from long-term strategic planning to short term operational planning case studies.

**3) New Analytical Tools for Upstream Crude Logistics, Steve Welch, Maritrans Management Services Inc., 1818 Market St., Ste. 3540, Philadelphia, PA 19103, swelch@maritrans.com, Emmanuel D. Chajakis**

Bringing crude oil to the refinery is a very complex process depending on several parameters. Focussing on marine transportation, we demonstrate how the use of new management science tools can enhance a refinery's crude supply scheduling and reduce logistics costs.

**MC24 Risk-Adjusted Outcome Assessment of Provider Performance**

**Sponsor:** Health Applications Section Sponsored Session

**Chair:** Ramesh K. Shukla, Virginia Commonwealth University, Dept. of Hlth. Admin., Richmond, VA 23298-0203, shukla@hsc.edu

**1) Changing Physician Behavior Using Neural Network Analytic Techniques, Randy C. Axelrod, Sentara Healthcare, 4417 Corporation Ln., Virginia Beach, VA 23462, rcaxelro@sentara.com**

I will present a use of neural network analysis of hospital discharge data to develop physician specific performance profiles. The application was developed by Sentara Healthcare to improve risk-adjusted outcomes through interactive feedback technique to physicians. Implementation issues related to political behaviors will also be discussed.

**2) Evaluation of Clinical Pathways for Sickle Cell Patients in a Teaching Hospital, John P. Pestian, Eastern Virginia Medical School, Ctr. for Pediatric Res., Norfolk, VA 23510-1001, jpestian@chkd.com, William C. Owen, Susanne Hughes, Andrea D. Wenger, Ellen Vasser, Gene F. Luckstead**

We evaluate the effectiveness of CPs in reducing ALOS and costs for sickle cell patients. The implementation of a CP for sickle cell patients admitted for VOC allows nurses to wean continuous infusion MS based on established criteria results in more effective and efficient patient management.

**3) Public Accountability of Provider Performance: A Model of a Public/Private Partnership in Virginia, Michael T. Lundberg, Virginia Health Information, 1108 E. Main St., Ste. 1201, Richmond, VA 23219, michael@vhi.org, Ramesh K. Shukla**

To develop reliable and useful public information on provider performance, the state of Virginia placed this responsibility into the hands of an independent not-for-profit organization comprised of all health care stakeholders. With assistance from academia, focus groups, and providers, Virginia Health Information is developing varied provider measurement systems using available data.

**4) Evaluation of APR-DRGs for Risk-Adjusted Outcomes of Hospital Performance, Ramesh K. Shukla, Virginia Commonwealth University, Dept. of Hlth. Admin., Richmond, VA 23298-0203, shukla@hsc.edu, Ron Fisher**

APR-DRGs classification system for risk-adjustment of hospital mortality data was tested for several statistical properties including: monotonic, discriminating power, stability of measurement, variance, and predictive validity. The system is generally valid for a large number of APR-DRGs but it also exhibits questionable performance across many APR-DRGs.

**MC25 Optimization Theory II**

**Contributed Session**

**Chair:** Marina Epelman, MIT, OR Center, Bldg. E40-130, 77 Massachusetts Ave., Cambridge, MA 02139, mepelman@mit.edu, <http://web.mit.edu/mepelman/www/>

**1) A Symbolic Barrier Algorithm, Kipp Martin, University of Chicago, 1101 East 58th St., Chicago, IL 60637, kipp.martin@gsb.uchicago.edu, John E. Borse**

We present a symbolic barrier algorithm for solving nonlinear optimization problems with inequality constraints. Using a projection algorithm, we find a Groebner basis for the first order conditions, take the barrier parameter to 0 in the limit and solve the resulting system of polynomials.

**2) Barrier Functional for Self-Scaled Cones, Raphael A. Hauser, Cornell University, 206 Rhodes Hall, Ithaca, NY 14853, hauser@orie.cornell.edu, <http://www.orie.cornell.edu/~hauser>**

Self-scaled cones have been completely classified but self-scaled barrier functionals have not. We show self-scaled barrier functionals that are invariant under the orthogonal group of the cone can be completely classified and are closely related to the universal barrier functional. For such barrier functionals, the smallest achievable value of the parameter equals...

**3) A Decreasing Sequence of Edmundson-Madansky Type Upper Bounds on the Expectation of a Convex Function, *Stefcho Dokov*, University of Texas, Grad. Program in OR/IE, Dept. of Mech. Eng., ETC 5.110, Austin, TX 78712, stefcho@mail.utexas.edu, *David P. Morton***

Assuming we have complete knowledge of the underlying distribution, we then build a decreasing sequence of Edmundson-Madansky type upper bounds on the expectation of a convex function. The sequence converges to the true expected value of the function, and it also generalizes Frauendorfer's upper bound in the multivariate case.

**4) Generalizing Condition Measures to Non-Conic Convex Problems, *Marina Epelman*, MIT, OR Center, Bldg. E40-130, 77 Massachusetts Ave., Cambridge, MA 02139, mepelman@mit.edu, http://web.mit.edu/mepelman/www/, *Robert M. Freund***

We study condition measures of convex problems in the more natural and general non-conic form, as opposed to the previously studied conic form. We show some interesting relationships between these condition measures and traditional condition measures and demonstrate connections to worst-case analysis of algorithms.

**MC26 Queuing Models for Communication Systems**

**Sponsor:** Applied Probability Society  
**Sponsored Session**

**Chair:** William A. Massey, Bell Labs, Lucent Technologies, 700 Mountain Ave., Office 2C-320, Murray Hill, NJ 07974-0636, will@research.bell-labs.com

**1) A Non-Semimartingale Diffusion Limit for a Model of Generalized Processor Sharing, *Kavita Ramanan*, Bell Labs, Lucent Technologies, 700 Mountain Ave., Office 2C-319, Murray Hill, NJ 07974-0636, kavita@research.bell-labs.com, *Martin Reiman***

We prove a heavy traffic limit theorem for a multi-class single station network with a generalized processor discipline. We characterize the limit diffusion as the strong solution to a reflected stochastic differential equation, and discuss conditions under which such a solution is a non-semimartingale.

**2) Asymptotic Behavior of an Overloading Queueing Network with Resource Pooling, *Louise Hosseini-Nasab*, AT&T, 200 Laurel Ave., Rm. E2-2D05, Middletown, NJ 07748, lhosseini@att.com**

We study a particular example of resource pooling, applicable in telecommunications, in which a network of parallel servers is fed by several arrival streams of customers. As congestion develops, queues form at each server. In some cases, which we characterize, we have resource pooling, which we define as an even spread of the customers over the network...

**3) Optimal Pricing in Queueing Systems with Quality of Service Constraints, *Steve Lanning*, Bell Labs, Lucent Technologies, 700 Mountain Ave., Murray Hill, NJ 07974-0636, *William A. Massey*, *Brian Rider*, *Qiong Wang***

We consider the general nonstationary Erlang blocking system or carried traffic model with cost sensitive customers. Given such a system where arrival rates are user cost dependent, we attempt to maximize revenue while keeping the probability of blocking below some fixed level. An approximate algorithm based on the exact analysis of a nonstationary infinite server or offered traffic model is presented.

**4) A Non-Stationary Offered-Load Model for Packet Networks, *Nicholas Duffield*, AT&T Labs Research, 600 Mountain Ave., Murray Hill, 07974-0636, *William A. Massey*, *Ward Whitt***

Motivated by the desire to appropriately account for complex features of network traffic, we propose a nonstationary offered-load model. Connections of multiple types arrive according to independent nonhomogeneous Poisson processes and general bandwidth stochastic processes (not necessarily Markovian) describe the individual user bandwidth requirements. We obtain expressions for the moment generating function, mean and variance of the total required bandwidth...

**MC27 New Developments in Simulation & Applications**

**Sponsor:** College on Simulation  
**Sponsored Session**

**Chair:** Pieter Blonk, SynQuest, Inc., 855 Route 146, Ste. 150, Clifton Park, NY 12065-3837, pblonk@synquest.com

**1) Selecting the Best System: Asymptotic Results for Optimal Computing Budget Allocation Algorithms, *Hsiao-Chang Chen*, SynQuest, Inc., 855 Route 146, Ste. 150, Clifton Park, NY 12065, hchen@synquest.com, *Chun-Hung Chen*, *Enver Yucesan***

We consider the problem of selecting the best system from a finite set of

alternatives. The methodology based on OCBA is an effective tool solving this type of problems via simulation, which can intelligently allocate the simulation budget to each candidate in order to reach the following 2 objectives: reduce the total computation cost and approach the same confidence level...

**2) A Simulator for Daily Supply Chain Plans at the Item Level, *Pieter Blonk*, SynQuest, Inc., 855 Route 146, Ste. 150, Clifton Park, NY 12065-3837, pblonk@synquest.com, *Hsiao-Chang Chen***

Modern industries with short cycle times require visibility to the daily level of their supply chain plans. SynQuest, Inc. has developed a supply chain planning application that uses a backward simulation technique to create a supply chain plan at item level using daily buckets. The simulator uses heuristics and guidance from an optimum plan created at an aggregate level...

**3) The Prince William Sound Risk Assessment: Using Simulation in Maritime Risk Management, *Jason R. W. Merrick*, Virginia Commonwealth University, Dept. of Math Sciences, 1015 West Main St. Box 842014, Richmond, VA 23284-2014, jrmerrick@saturn.vcu.edu**

After the Exxon Valdez ran aground on March 24, 1989, questions have remained concerning the safety of oil transportation in the Prince William Sound, Alaska. A contract team was charged with assessing the current risk of accidents and evaluating measures aimed at reducing this risk...

**MC29 Software Demonstration III**

**Software Demo Session**

**Chair:** To be announced

**1) Introducing DPL 4.0 Decision Analysis Software, *Ken Ko*, Applied Decision Analysis LLC, http://www.adainc.com**

DPL is the professional DA software, using influence diagrams, decision trees and spreadsheets. Graphical outputs include Rainbow Diagrams, Risk Profiles, Policy Trees and Policy Summaries. New in DPL 4.0: a new Win95 interface, strategy tables, graphical value of perfect information and control and more!

**2) New Programming Interface, *Rob Clark*, IBM, 522 South Rd., MSP356, Poughkeepsie, NY 12601, roclark@us.ibm.com, *Gyana Parija***

We will present an introduction to the new programming interface, which is intended to be the basis for the next version of the Optimization Solutions and Library products. There will be particular focus on enhancements to the Stochastic Extensions interface and we will show examples of the power, flexibility and performance of the new API.

**MC30 Loosely Coupled Components Project: Map-Based Military Planning**

**Sponsor:** INFORMS Computing Society  
**Sponsored Session**

**Chair:** Gordon H. Bradley, Naval Postgraduate School, OR Dept., Code OR/TW, Monterey, CA 93943, bradley@nps.navy.mil

**1) Loosely Coupled Components Project - Architecture, *Arnold H. Buss*, Naval Postgraduate School, OR Dept., Monterey, CA 93943-5118, buss@or.nps.navy.mil, *Norbert Schrepf***

The Loosely Coupled Components Project at the Naval Postgraduate School has designed and developed an architecture for platform independent, dynamic and distributed map-based planning systems for military planning written in Java. The architecture enables dynamic integration of map products, satellite images, overlays, network and graph algorithms and simulation components that are independently developed.

**2) Tactical Training Analysis System, *David Krizov*, Naval Postgraduate School, OR Dept., Monterey, CA 93943, dpkrizov@nps.navy.mil**

Java software for a handheld computer with a global positioning system (GPS) responder was developed to gather data during US Marine Corps live fire exercises. The results of the exercise are loaded into an after action review simulation that displays the results on the Loosely Coupled Components map system.

**3) Special Operations Mission Planning & Analysis Support System, *Keith Hattes*, Naval Postgraduate School, OR Dept., Monterey, CA 93943, kahattes@nps.navy.mil**

A Java system to automate construction of synchronization matrices and execution checklists using a critical path method (CPM) model was developed to support rapid planning and analysis during course of action development and mission analysis. The system and the network algorithms are components in the Loosely Coupled Components system.

**4) Future Development of the Loosely Coupled Components**

**Project, Gordon H. Bradley**, Naval Postgraduate School, OR Dept., Code OR/TW, Monterey, CA 93943, bradley@nps.navy.mil, **Arnold H. Buss**

The current focus of the Loosely Coupled Components Project is allow the components to be distribute over a computer network (wired and wireless) in order to support a common view of the planning process at several locations and to allow the remote execution of algorithms. Component standards allow anyone to develop software that can be integrated into the system.

### MC31 Quality Management I

Contributed Session

**Chair:** Binshan Lin, Louisiana State University, Dept. of Mgmt. & Mktg., One University Place, Shreveport, LA 71115-2399, blin@pilot.lsu.edu, <http://www.lsu.edu/faculty/~blin>

1) **Drivers of Internal & External Quality Measures: An Empirical Study**, *Debasish N. Mallick*, Boston College, Carroll Sch. of Mgmt., Chestnut Hill, MA 02467, mallickd@bc.edu, *Larry P. Ritzman*, *Hossein Safizadeh*

We emphasize the importance of understanding the difference between internal and external quality measures, particularly when trade-offs occur between quality, cost and time. Using a survey of 144 manufacturing firms, we explore the internal and external measures of quality.

2) **Management Science & Total Quality Management: Web-Based Delivery**, *Claude R. Superville*, Valdosta State University, Dept. of MIS, Valdosta, GA 31698-0076, csupervi@valdosta.edu

Issues in the Internet delivery of a primarily quantitative course and primarily qualitative course are explored. Discussion boards as interaction classrooms, e-mail as an assignment flow mechanism and student access are compared and contrasted in the Web-based offering of MS and TQM.

3) **A New Approach in Identifying & Analyzing Service Quality Dimensions**, *Bradley Vereen*, KLA-Tencor, Inc., 1 Technology Dr., Milpitas, CA 95035, brad@ccnet.com, *Zinovy Radovilsky*

A gap (difference) between the customer's perception of a completed service and management's evaluation of service quality is hypothesized, then statistically proved and measured. Factor analysis is used to group service quality dimensions into 4 independent factors. Regression equations were developed to relate the service quality dimensions derived from factor analysis to the common elements of the service quality management system.

4) **A Cost of Quality Framework for New Product Development**, *Binshan Lin*, Louisiana State University, Dept. of Mgmt. & Mktg., One University Place, Shreveport, LA 71115-2399, blin@pilot.lsu.edu, <http://www.lsu.edu/faculty/~blin>

We investigate how companies evaluate quality cost at different development stages and the approaches they use. A framework is presented that integrated new product design, new product development, production and quality management. Some implications and shortcomings of cost estimation methods are addressed.

### MC32 Control of Priced Telecommunications Networks

Cluster: Telecommunications Pricing & Control

Invited Session

**Chair:** Stephen D. Patek, University of Virginia

1) **Congestion Avoidance in Telecommunications Networks using Price Discounts**, *G. Anandalingam*, University of Pennsylvania, Dept. of Systems, Towne Bldg., Philadelphia, PA 19104-6315, *Neil Keon*

We present a method for satisfying blocking specifications for a provider offering guaranteed quality of service over a simple communications network, such as one might expect of a video-on-demand operator, for example. We propose a 2-stage pricing approach including the announced public price and a discount offered to individual users at the time of a connection request...

2) **QoS Model & Resource Accounting for Traffic Aggregates with Large Spatial Granularities**, *Hui Zhang*, Carnegie Mellon University, Pittsburgh, PA 05213, *Ion Stoica*

While traditional QoS research focuses on providing end-to-end QoS on a per flow basis, we will argue that it is also important to support QoS for traffic aggregates with large spatial granularities. We will discuss the desirable properties of QoS models for traffic aggregate and the challenges in supporting these models.

3) **A Fluid Model for Aggregate Internet Traffic with Application to Pricing of Internet Services**, *Stephen D. Patek*, University of Virginia, *Jorg Liebeherr*

We propose a fluid model for Internet traffic which lends itself well to simulation study of aggregate pricing strategies. We implement and test a measurement-based scheme where prices are driven by congestion at bottleneck links within the network.

### MC33 Optimizing Multiple Quality Characteristics

Sponsor: Quality, Statistics & Reliability

Sponsored Session

**Chair:** Jai-Hyun Byun, Gyeongsang National University, Dept. of IE, 900 Gazwa-Dong, Chinju Gyeongnam, 660-701, Korea, jbyun@nongae.gsnu.ac.kr

1) **Run-to-Run Process Control Strategy Development Based on DOE**, *Judy Jin*, University of Michigan, Dept. of IOE, 1729 IOE Bldg., Ann Arbor, MI 48109-2117, jhjin@engin.umich.edu

Run-to-run control is a challenging problem, especially when control variables have interactions. We present a systematic hierarchical run-to-run control strategy based on DoE by using quality indices as control objectives, in-process signal features as response variables and control variables as factors. Examples for stamping process control are presented.

2) **Trade-Off Issues in Multiresponse Experiments with the Consideration of Derringer-Suich's Desirability Function**, *Young Jin Kim*, Clemson University, Dept. of IE, Clemson, SC 29634, ykim@clemson.edu, *Byung-Rae Cho*

Virtually all product quality is judged by multiple quality characteristics. Therefore, the use of a simultaneous optimization is inevitable to trade off these characteristics. We discuss the connections of fuzzy set to the Derringer-Suich desirability function and study how the desirability function can be extended to the framework of a multi-response experiment...

3) **Some Approaches to Optimize Multiple Quality Characteristics**, *Jai-Hyun Byun*, Gyeongsang National University, Dept. of IE, 900 Gazwa-Dong, Chinju Gyeongnam, 660-701, Korea, jbyun@nongae.gsnu.ac.kr, *Kwang-Jae Kim*

We often have multiple quality characteristics to develop, improve and optimize industrial processes and products. It is not easy to optimize control factor settings where there are multiple quality characteristics. We suggest some approaches to optimize multiple characteristics and guidelines for the practitioners concern which approach to follow.

4) **Evolutionary Operation for Multiple Quality Characteristics**, *Jai-Hyun Byun*, Gyeongsang National University, Dept. of IE, 900 Gazwa-Dong, Chinju Gyeongnam, 660-701, Korea, jbyun@nongae.gsnu.ac.kr, *Yongyun Brian Kim*

EVOP is a method for continuously monitoring and improving a full-scale production process to obtain an optimal operating condition while production is under way. We propose a procedure to simultaneously optimize multiple quality characteristics. Using a desirability function concept, we present 2 approaches to deal with multiple characteristic EVOP problems...

### MC34 Information Systems Outsourcing: Factors & Effects

Sponsor: College on Information Systems

Sponsored Session

**Chair:** Karen Dowling, Arizona State University, Sch. of Acct. & Info Mgmt, PO Box 873606, Tempe, AZ 85287-3606, karen.dowling@asu.edu

1) **Information Driven Outsourcing**, *Alexander Talalayevsky*, Chapman University, Argyros Sch. of Bus., 333 North Glassell St., Orange, CA 92866, alex@chapman.edu, *Ira Lewis*

Decisions to outsource are information-driven. If a firm does not have the information to produce a good or service it tends to outsource to the market. Outsourcing is now viable for more informed alternatives traditionally performed in-house. New information and market mechanisms broaden outsourcing opportunities.

2) **Organization Learning & Knowledge Transfer in Selective Information Systems Outsourcing: A Tale of Two Organizations**, *Sandra Slaughter*, Carnegie Mellon University, 314A GSIA, Tech & Frew Sts, Pittsburgh, PA 15213, sandras+@andrew.cmu.edu, *Evelyn Barry*

In selective IS outsourcing, contractors work on software development teams with insourced workers. However, do such arrangements facilitate organization learning, and do contractors transfer their knowledge before changing assignments? In this study, we find that contractual incentives are necessary to encourage organization learning and knowledge transfer in selective I/S outsourcing.

3) **Assessing Facilitators & Barriers to ERP Outsourcing**

**Decisions: A Qualitative Approach**, *Karen Dowling*, Arizona State University, Sch. of Acct. & Info Mgmt, PO Box 873606, Tempe, AZ 85287-3606, karen.dowling@asu.edu, *Ajay Vinze*

Outsourcing decisions and contractual arrangements for ERP systems are usually associated with high dollar values and involve organizational risks. Using transactional cost and agency theories as our basis, we qualitatively studies outsourcer-outsourcee dyads to assess facilitators and barriers for ERP outsourcing decisions from the complementary perspectives of organizations involved.

**MC35 Dantzig Fest I**  
Invited Session

**Chair:** Richard W. Cottle, Stanford University, EES/OR Dept., Terman Engineering Ctr., Stanford, CA 94305-4023, cottle@soe.stanford.edu

1) **Perspectives on Leontief Substitution Systems**, *Arthur F. Veinott, Jr.*, Stanford University, Dept. of EES & OR, Stanford, CA 94305, veinott@soe.stanford.edu

Primal and dual Leontief substitution systems will be reviewed. They arise in dynamic programming, population management, weighted network flows, supply chains and investment. Topics include characterization of systems by LP, dual systems as polyhedral semisublattices, integrality of optimal solutions and polynomially bounded systems by LP; polynomial-time algorithms.

2) **Bimatrix Games Revisited**, *B. Curtis Eaves*, Stanford University, Dept. of EES & OR, Stanford, CA 94305, bceaves@soe.stanford.edu

To compute an equilibrium of a bimatrix game, we compute a path of equilibria to a path of games. In this process, the players adjust their mixed strategies alternately. Execution of the algorithm is much like the celebrated Lemke-Howson algorithm for the same purpose.

3) **Constraint Programming: A System for Implementing "Ad Hoc" Ground Rules of 1946**, *Irv Lustig*, ILOG CPLEX Division, 889 Alder Ave., Ste. 200, Incline Village, NV 89451, irv@ilog.com

Before Dantzig's development of LP in 1947, experts used "ad hoc" ground rules to determine plans for military planning. This led Dantzig to introduce an objective function and to develop the simplex method. We describe how constraint programming provides a framework for implementing the ground rules of the presimplex method days.

**MC36 Operations Management IV**  
Contributed Session

**Chair:** Luk N. Van Wassenhove, INSEAD, Boulevard de Constance, Fontainebleau, Cedex, 77305, France, luk.van.wassenhove@insead.fr

1) **Simultaneous Evaluation of Time-Cost-Quality Parameters in Project Management**, *Kassa Seyoum*, University of Maryland, 6585 Autumn Wind Circle, Clarksville, MD 21029, seyook@co.mo.md.us, seyoum@wam.umd.edu, *Chung-Li Tseng*

In the planning and design phases of a project, decisions are mainly made based on capital cost. Time and quality receive minimum consideration. In the execution phase, time impact becomes the primary factor. We will discuss the need to consider cost, time and quality simultaneously at all phases of a project cycle.

2) **Product Take-Back Channel Choice & Coordination in a Closed Loop Supply Chain**, *Canan R. Savaskan*, INSEAD, Blvd. de Constance, Fontainebleau, 77300, France, rezzan.canan.savaskan@insead.fr, *Shantanu Bhattacharya*, *Luk N. Van Wassenhove*

We address the problem of choosing the appropriate product take-back channel for the collection of post consumer products from customers. Recently, such closed loop supply processes with recovery have been operational for products such as one-time use cameras, copy and print cartridges, copiers and printers. Specifically we compare the optimality of 3 channel structures for the manufacturer...

3) **Design of a Product-Take Back System with Multiple Retail Outlets**, *Luk N. Van Wassenhove*, INSEAD, Boulevard de Constance, Fontainebleau, Cedex, 77305, France, luk.van.wassenhove@insead.fr, *Canan R. Savaskan*

We examine the reverse channel choice of a manufacturer when products are distributed through multiple retail outlets. The focus is to characterise the implications of vertical and horizontal strategic interaction within and across channels. By vertical interaction, we refer to the balance of power between the manufacturer and the retailers...

**MC37 INFORMS Case & Teaching Materials: Dialog with Instructors & Prospective Authors**

**Sponsor:** INFORM-ED

**Sponsored Session**

**Chair:** Thomas A. Grossman, University of Calgary, Fac. of Mgmt., 2500 University Dr. NW, Calgary, Alberta, T2N 1N4, Canada, grossman@ucalgary.ca

1) **INFORMS Case & Teaching Materials: Dialog with Instructors & Prospective Authors**

INFORMS Case & Teaching Materials has just been launched to develop and distribute classroom-tested teaching materials for OR/MS, including cases, games and lecture aids. We discuss our offerings and opportunities for case authors and seek input from OR/MS instructors and creators of teaching materials. Our Edelman Prize cases are available at <http://www.informs.org/Pubs/Cases>.

**MC39 Rail Operations Planning**

**Sponsor:** RASIG

**Sponsored Session**

**Chair:** Ajith B. Wijeratne, Norfolk Southern, 125 Spring St. SW, Mail 864 110, Atlanta, GA 30303, awijerat@nscorp.com

1) **Optimizing Intermodal Rail Operations**, *Alexandra M. Newman*, Naval Postgraduate School, OR Dept., Monterey, CA 93943, newman@nps.navy.mil

We propose an optimization model designed to increase operational efficiency of intermodal trains. We explain how this model can be used in various planning settings, how it can be tailored and how it can be extended to aid in decision making above and beyond intermodal train scheduling and container routing.

2) **NS Locomotive Fleet Planning System**, *Ajith B. Wijeratne*, Norfolk Southern, 125 Spring St. SW, Mail 864 110, Atlanta, GA 30303, awijerat@nscorp.com, *Arun G. Marar*

We have created a locomotive fleet planning system based on an NS locomotive routing model developed at Princeton University's CASTLE Research Lab. The routing model has been calibrated for NS operations based on historical data. LPS can be used to identify the tradeoffs between fleet size and locomotive utilization and train delay...

3) **Strategic Fleet Planning with Schedule Flexibility**, *Guy Desautniers*, GERAD, Ecole Polytechniques, 3000 ch. Cote-Ste. Catherine, Montreal, Quebec, H3T 2A7, Canada, guyd@cr.umontreal.ca, *Francois Soumis*, *Michel Dubois*

We present a strategic fleet planning system that was developed for a study at VIA Rail Canada. Given a target weekly train schedule with passenger demand, the system determines unit cycles such that demand is satisfied, inspection requirements are met and total (fixed and variable) costs are minimized, while allowing some flexibility on train departure times...

**Monday 15:00-16:30**

**MD01 As Time Goes By: Environmental Decision Analysis Models with Intertemporal Components**

**Sponsor:** Decision Analysis Society

**Sponsored Session**

**Chair:** L. Robin Keller, University of California, Grad. Sch. of Mgmt., 350 GSM, Irvine, CA 92697-3125, lrkeller@uci.edu, <http://www.gsm.uci.edu/~keller/>

1) **Intergenerational Discount Rates**, *Gretchen B. Chapman*, Rutgers University, Psychology Dept., Busch Campus, 152 Frelinghuysen Rd., Piscataway, NJ 08854-8020, gbc@rci.rutgers.edu, <http://www.rci.rutgers.edu/~gbc>

Whereas many environmental decisions have very long-term consequences (across generations), most time preference research examines relatively short delays (decades or less). Some health economists argue that intergenerational discount rates should be smaller than intragenerational rates, perhaps even 0. This empirical study compares decision makers' actual inter- and intragenerational discount rates.

2) **Preferences for Income & Health Distributions: A Verbal Protocol Analysis**, *Daniel Read*, University of Leeds, Centre for Decision Research, 11 Blenheim Terrace, Leeds, LS2 9JT, UK, dr@lubs.leeds.ac.uk, *Melanie Powell*

Subjects spoke aloud while choosing between pairs of future income or health distributions. For income, subjects preferred constant distributions; for health, they liked decreasing ones. Subjects explained that they wanted distributions to

match their ideal pattern of consumption, and they wanted income distributions to be easy to manage.

**3) Risk Perception in the Short Run & in the Long Run, Martin Weber**, Universitat Mannheim, Lehrstuhl für ABWL, Finanzwirtschaft Bankbetrieb., Mannheim, D-68131, Germany, [weber@bank.bwl.uni-mannheim.de](mailto:weber@bank.bwl.uni-mannheim.de), *Niklas Siebenmorgen, Elke U. Weber*

Perceived risk is an important component in evaluating investment alternatives. We compare subjects' risk perceptions for short-term and for long-term investment alternatives. We also investigate how the perception is influenced by the way the alternatives are presented.

**4) Modeling Environmental Decisions over Time, Jeffery L. Guyse**, University of California, Grad. School of Mgmt., 350 GSM, Irvine, CA 92697-3125, [jguyse@uci.edu](mailto:jguyse@uci.edu), *Thomas Eppel, L. Robin Keller*

Insights from experiments on preferences for temporal streams of environmental outcomes are used to deduce implications for prescriptive decision analysis elicitation procedures. We describe how the results are applied to typical environmental decisions, such as remediation of possible electro-magnetic field risks.

**5) Discounting Utility?, Manel Baucells**, UCLA, The Anderson School, 655 Levering Ave., Los Angeles, CA 90024, [mbaucell@anderson.ucla.edu](mailto:mbaucell@anderson.ucla.edu), *Rakesh K. Sarin*

We examine the normative appropriateness of the discounted utility model. We argue that some well-accepted normative principles for preferences over time are logically incompatible.

## MD02 Approximating Integer Packing & Covering Problems

Cluster: Combinatorial Optimization & Network Flows

Sponsor: Optimization Section  
Sponsored Session

Chair: Pinar Keskinocak, IBM, TJ Watson Research Ctr., Rte. 134, Yorktown Heights, NY 10598, [pinar@watson.ibm.com](mailto:pinar@watson.ibm.com)

**1) Strengthening the Integrality Gaps for Capacitated Network Design & Covering Problems: Inequalities, Bounds & Approximation Algorithms, Vitus Leung**, Sandia National Laboratories, PO Box 5800, Albuquerque, NM 87485-1110, [vleung@sandia.gov](mailto:vleung@sandia.gov), *Cynthia Phillips, Robert Carr, Lisa Fleischer*

For the network reinforcement problem, the obvious LP relaxation yields a large integrality gap. We give an LP relaxation with a constant integrality gap in some cases. We give a corresponding approximation algorithm. These results can be generalized to improve the integrality gap for a broad class of 0-1 IPs.

**2) On Some Generalizations of Set Cover, Goran Konjevod**, Carnegie Mellon University, Dept. of Math. Sci., Pittsburgh, PA 15213-3890, [konjevod@andrew.cmu.edu](mailto:konjevod@andrew.cmu.edu), *Robert Carr, Madhav V. Marathe*

We investigate (non)approximability of some generalizations of the set cover problem, presenting approximation algorithms and hardness results. Our methods include linear programming, randomized rounding, and greedy algorithms.

**3) Approximation Algorithms for the Multiple Knapsack Problem with Assignment Restrictions, Pinar Keskinocak**, IBM, TJ Watson Research Ctr., Rte. 134, Yorktown Heights, NY 10598, [pinar@watson.ibm.com](mailto:pinar@watson.ibm.com), *Milind Dawande, Jayant Kalagnanam, R. Ravi, Sibel Salman*

We are given items with positive weights, knapsacks with positive capacities and for each item a subset of knapsacks that the item can be assigned to is specified. We focus on obtaining approximate solutions in polynomial time, considering the objectives of maximizing assigned weight and minimizing utilized capacity.

## MD03 E-Commerce & Supply Chain Management

Sponsor: Manufacturing & Service Operations Management  
Sponsored Session

Chair: Warren H. Hausman, Stanford University, Dept. of IEEM, Terman Eng. Ctr., Rm. 350, Stanford, CA 94305-4024, [hausman@stanford.edu](mailto:hausman@stanford.edu)

**1) E-Commerce Architecture for Supply Chain Management, Seungjin Whang**, Stanford University, Grad. Sch. of Bus., Stanford, CA 94305

Supply chain management typically demands information sharing and coordination among multiple companies. The challenge is to design an information system that can support extensive multi-party coordination, e.g., channel assembly, merge-in-transit, order tracking, etc. We discuss the information hub as an architecture that can integrate front-end and back-end operations of e-commerce.

**2) Competitive Choice of Distribution Channel by Retail Banks, Reynold E. Byers**, University of Rochester, Simon Grad. Sch. of Bus. Admin, Rochester, NY 14627, *Phillip J. Lederer*

We examine the competitive choice of distribution channel by retail banks. Banks choose among several technologies: branch banks with ATMs, home electronic banking with remote electronic kiosks and branches with home banking. We consider heterogeneous customer channel preferences and study competition between banks in channel choice and pricing.

**3) "Internet-Inside" Supply Chain Management, Warren H. Hausman**, Stanford University, Dept. of IEEM, Terman Eng. Ctr., Rm. 350, Stanford, CA 94305-4024, [hausman@stanford.edu](mailto:hausman@stanford.edu)

The current revolution in e-business, e-commerce, extranets and related IT advances has created both new opportunities and new challenges for supply chain management. We explore some ramifications of the technological advances and present some likely scenarios regarding how supply chain management will adapt to a new "Internet-inside" paradigm.

## MD04 Economics & Game Theory Applications

Contributed Session

Chair: Vesna Pasetta, Cornell University, Uris Hall, Ithaca, NY 14853-7601, [vp11@cornell.edu](mailto:vp11@cornell.edu)

**1) Strategic Equilibrium for a Pair of Identical Competing Servers with Convex Cost & Balking, Duane Christ**, Rutgers University, RUTCOR, 15 Tilton Dr., Freehold, NJ 07728, [christ@rutcor.rutgers.edu](mailto:christ@rutcor.rutgers.edu), *Benjamin Avi-Itzhak*

A pair of identical servers compete for arriving customers which can balk. The objective of each server is to select a service rate which will maximize its own profit. The resulting 2-person game is shown to have a unique Nash equilibrium point when the cost function is convex.

**2) The Structure of Competing Takeover Bids, Chander Shekhar**, University of Melbourne, Melbourne Bus. Sch., 200 Leicester St., Carlton, Victoria, 3053, Australia, [c.shekhar@mbs.unimelb.edu.au](mailto:c.shekhar@mbs.unimelb.edu.au)

This research analyzes competing bids for takeovers. It is found that under certain conditions, the subsequent bids are likely to be similar to the initial bid. Also, there seems to be no first-mover advantage and the offered premiums may depend on the extent of bidders' business overlap with the target.

**3) Price Competition when Customers Queue, Jiangfan Zhong**, HKUST, Dept. of IE/EM, Clear Water Bay, Kowloon, Hong Kong, [zhongjf@ust.hk](mailto:zhongjf@ust.hk), *Hong Chen, Yat-Wah Wan*

A queue of customers may form as a result of time delaying. A duopoly price setting with customer queues is characterized. We establish the existence of Nash equilibrium when customer preferences are linear. The sensitivity analysis is performed for the equilibrium.

**4) On Economic Property Rights Agreements & Mangement of the Quality of Life, Vesna Pasetta**, Cornell University, Uris Hall, Ithaca, NY 14853-7601, [vp11@cornell.edu](mailto:vp11@cornell.edu), *Sonja Knezevic*

The new concepts of economic property rights agreements and information which exemplify nontrivial extensions of traditional economic devices of communication and corporate management, have been recently developed. They seem also to offer suitable procedures for partnership arrangements and measurement of the quality of economic interactions among agents in modern enterprises discussed here.

## MD05 Wagner Prize

Chair: To be announced

## MD06 Work-Sharing Systems

Sponsor: Manufacturing & Service Operations Management  
Sponsored Session

Chair: Donald D. Eisenstein, University of Chicago, Grad. School of Bus., 1101 East 58th St., Chicago, IL 60637, [don.eisenstein@gsb.uchicago.edu](mailto:don.eisenstein@gsb.uchicago.edu)

**1) Choice of Worker Sequence & Overlap in Worksharing Systems, John O. McClain**, Cornell University, Johnson Grad. Sch. of Mgmt., Sage Hall, Ithaca, NY 14853-6201, [jom1@cornell.edu](mailto:jom1@cornell.edu), *Joseph Thomas*

In bucket brigade and TSS systems, an operator carries an item downstream, performing operations until encountering an idle worker. However, if the encountered worker is busy (not prepared for a handoff), productivity may be lost. The amount lost depends on worker speeds, sequence and zones and work rules. We present new results on these problems.

**2) Coping with Individual Differences in Structuring Production, John A. Buzacott**, York University, Schulich Sch. of Bus., Toronto, Ontario, M3J 1P3, Canada, jbzacot@bus.yorku.ca

Even with considerable experience, different workers show significant differences in the time to perform repetitive tasks. This can have significant impact on the performance of production systems. We review these impacts and explore whether different divisions of work or structuring of production can reduce the impact of such differences.

**3) Partially Cross-Trained Workers & Skill Chaining, Mark P. Van Oyen**, Northwestern University, 2225 North Campus Dr., MLS Bldg., IE Dept., Evanston, IL 60208-3119, vanoyen@nwu.edu, **Wallace J. Hopp**

We delineate the key production system factors under which partial cross-training is appropriate and "skill chaining" is likely to be effective. We also present stochastic models of queueing systems with dynamic worker assignments that indicate the "opportunity" for system performance improvement using agile/cross-trained workers.

**4) Self-Organizing Distribution Systems, Donald D. Eisenstein**, University of Chicago, Grad. School of Bus., 1101 East 58th St., Chicago, IL 60637, don.eisenstein@gsb.uchicago.edu, **John J. Bartholdi, III**

A work-sharing scheme that is self-balancing can adapt to perturbations to reestablish balance. We have recently extended this idea to new environments in manufacturing and distribution.

**MD07 Scheduling & Optimization in Manufacturing Logistics**

**Cluster:** Manufacturing & Logistics  
**Invited Session**

**Chair:** Chung-Yee Lee, Texas A&M University, 238 Zachry Bldg., Dept. of IE, College Station, TX 77843-3131, cylee@acs.tamu.edu

**1) An Effective Planning Tool for Estimating Order Completion Time in the Electroplating Industry, Lei Lei**, Rutgers University, Dept. of MS/IS, Sch. of Mgmt., 180 University Ave., Newark, NJ 07102, llei@andromeda.rutgers.edu, **Qing Liu**

We propose an effective B&B-based procedure that estimates the completion time of customer orders in electroplating industry. The estimation is based on manufacturing processes with multiple products and time window constraints. Detailed analysis on the design of the bounding rules is presented, and practical uses of the proposed approach as a planning tool are discussed.

**2) Efficient Setup/Dispatching Policies for Reducing the Mean & Variance of Cycle-Time in Semiconductor Manufacturing, Kwok Fai Chu**, Chinese Univ. of Hong Kong, Dept. of Sys. Eng./Eng. Mgmt., Shatin, NT, Hong Kong, China, **Houmin Yan**

We consider the problem of reducing the mean and the variance of cycle time in semiconductor manufacturing where machines require setups for change-over. We introduce scheduling policies incorporating setups based on the slack windows. Uncertain factors such as machine breakdowns, random yields and stochastic setup times are considered. We conduct extensive simulations on real semiconductor wafer fabrication plants.

**3) Machine Scheduling with Transportation Considerations, Chung-Yee Lee**, Texas A&M University, 238 Zachry Bldg., Dept. of IE, College Station, TX 77843-3131, cylee@acs.tamu.edu, **Zhi-Long Chen**

We study machine scheduling problems with explicit transportation considerations. We study this class of scheduling problems by analyzing their complexity. We show that many problems are computationally difficult and propose polynomial or pseudo-polynomial algorithms for some problems.

**4) A Dynamic Lot Size Model with Demand Time Windows, Chung-Yee Lee**, Texas A&M University, 238 Zachry Bldg., Dept. of IE, College Station, TX 77843-3131, cylee@acs.tamu.edu, **Sila Cetinkaya**

We study the dynamic lot size model with demand time windows. Consequently, each demand has a corresponding earliest and latest due date. We provide a dynamic programming algorithm to solve the problem optimally for the non-backlogging case. Our solution method, especially for the backlogging case, is substantially different from that of the classical model.

**MD08 Retail Supply Chain Management**

**Sponsor:** Section on Logistics

**Sponsored Session**

**Chair:** Steve Smith, Santa Clara University, OMIS Dept., Leavey Sch. of Bus., Santa Clara, CA 95053-0382, ssmith@scu.edu

**Co-Chair:** Naren Agrawal, Santa Clara University, Dept. of Omis, Leavey Sch. of Bus., Santa Clara, CA 95053, nagrawal@scu.edu

**1) Pricing Mechanisms for Service Differentiated Customer Demand Classes, Vinayak V. Deshpande**, Purdue University, Krannert Grad. Sch. of Mgmt., West Lafayette, IN 47907, **Morris A. Cohen, Karen L. Donohue**

We examine pricing mechanisms to coordinate inventory decisions between a supplier and multiple buyers with differentiated service requirements. We develop an efficient, service differentiated pricing scheme which overcomes information asymmetry in the supply chain. We highlight the benefits of this scheme relative to current practice in the service parts industry.

**2) Efficient Supply Contracts for Assembled-to-Order Products with Short Product Life Cycles, Karen L. Donohue**, University of Pennsylvania, The Wharton Sch., OPIM, 1300 SH-DH, Philadelphia, PA 19104-6366, donohuek@wharton.upenn.edu

We examine supply contracts between a PC manufacturer and a major retail chain with the objective of identifying a contract that maximizes channel profits. The manufacturer produces computers to order, subject to component availability. We find that an options-based contract helps the retailer influence the manufacturer's pre-positioning decision to the betterment of both parties.

**3) The Benefits of Advance Booking & Discount Programs: Models & Analysis, Kumar Rajaram**, UCLA, Anderson Sch., 110 Westwood Plaza, Box 951481, Los Angeles, CA 90095-1481, kumar.rajaram@anderson.ucla.edu, **Chris Tang, Jihong Ou**

Consider a retailer who sells perishable seasonal products that have short selling season and a long replenishment lead time. This prevents the retailer from using actual sales data during the early part of the selling season to update demand forecasts and respond by replenishing stock within the selling season...

**4) A Bayesian Framework for Retail Model Stock, Steve Smith**, Santa Clara University, OMIS Dept., Leavey Sch. of Bus., Santa Clara, CA 95053-0382, ssmith@scu.edu, **Naren Agrawal**

In order to determine optimal allocation of a given quantity of a fashion item among non-identical stores, retail chains may adopt a multi-stage strategy. We develop a 2-stage Bayesian model that uses learning in the first stage to optimize stock allocation.

**MD09 Inventory Management III**

**Contributed Session**

**Chair:** Emmanuel S. Eneyo, Southern Illinois University, Dept. of MIE, Edwardsville, IL 62026-1805, eeneyo@siue.edu, <http://www.siue.edu/~eeneyo>

**1) Inventory Policies for High Cost/Low Demand Spare Parts under a Service Constraint, Deniz Caglar**, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, deniz@nwu.edu, **David Simchi-Levi, Sanjay Mehrotra**

We consider a multi-item spare parts inventory system where a warehouse serves multiple customers. The demand for the spare parts is very low and the parts are very expensive. The warehouse employs a base stock inventory policy for each spare part and has to meet the demand within a pre-specified response time...

**2) Pricing & Replenishment Strategies in a Distribution System with Competing Retailers, Fernando G. Bernstein**, Columbia Business School, 3022 Broadway, Uris Hall, Rm. 313, New York, NY 10027, fb65@columbia.edu, **Awil Federgruen**

We consider a 2-echelon distribution system in which a supplier distributes a commodity to N competing retailers. The demand rate of each retailer depends on all of the retailer's prices. We characterize pricing and replenishment strategies that optimize the supply-chain profits and compare these with equilibrium strategies in a decentralized system...

**3) A Dynamic Clearance Pricing Policy for Durable Goods, Kyung K. Lee**, Pusan National University, Dept. of IE, 30 Jangjeon-dong, Kumjeong-Ku, Pusan, South Korea, kkleee@hyowon.pusan.ac.kr

Inventory management of a product not to be produced anymore has a great

impact on the financial status of a company. Clearance pricing can make bigger sales volume together with great savings of inventory holding costs especially for durable goods with relatively large inventory carrying cost, and accordingly, cash inflow can be improved...

**4) Estimation of Inventory Carrying Cost as a Management Policy Variable, Emmanuel S. Eneyo**, Southern Illinois University, Dept. of MIE, Edwardsville, IL 62026-1805, eeneyo@siue.edu, http://www.siue.edu/~eeneyo

While the discussion of inventory carrying cost has largely been academic, there is also a practical use of it only as a management policy variable with respect to attaining overall company objectives. We will present a step-by-step procedure for estimating inventory carrying cost and highlight ways of using it to manage inventories and measure inventory performance.

#### MD10 Analytic Central Paths for Linear Programming & Complementarity

Cluster: Optimization & Applications

Sponsor: Optimization Section

Sponsored Session

Chair: Stephen C. Billups, University of Colorado, Dept. of Math., CB 170, PO Box 177364, Denver, CO 80217, sbillups@carbon.cudenver.edu

**1) Simultaneous Parametric Programming & Analytic Center Convergence, Allen Holder**, University of Colorado, Dept. of Math, CB 170, PO Box 177364, Denver, CO 80217-3364, agholder@math.cudenver.edu

Infeasible-interior-point methods are extensions of earlier interior-point algorithms under simultaneous parameterizations of the cost and right-hand side vectors. We provide a detailed analysis of the parameterized central path, characterize when such a path converges, and show that the parameterized central path is continuous when viewed as a set.

**2) Analytic Centers & Repelling Inequalities, Richard J. Caron**, University of Windsor, Dept. of Math. & Stats., 401 Sunset Ave., Windsor, Ontario, N9B 3P4, Canada, rcaron@uwindsor.ca, **Harvey J. Greenberg, Allen Holder**

A theory of "repelling inequalities" is introduced and applied to LP central paths. This gives rise to the concept of "prime analytic center" and it bridges the gap between algebraic and geometric descriptions of polytopes. We examine the "repelling central path" to explore the impact of representation on interior point methods.

**3) A Strongly Polynomial Rounding Procedure Yielding a Maximally Complementary Solution for a Class of Linear Complementarity Problems, Cornelis Roos**, Delft University of Technology, Fac. of Info. Tech. & Systems, Mekelweg 4, PO Box 5031, Delft, 2628 CD, The Netherlands, c.roos@its.tudelft.nl, **Tamas Terlaky, Jiming Peng**

We deal with SP5-star LCPs. We provide order estimates in terms of the input data for the variables along the central path. Using these estimates we present a strongly polynomial rounding procedure. With these estimates we can produce an exact maximally complementary solution in polynomial time.

**4) Central Paths of Complementarity Problems under Nonlinear Perturbations, Stephen C. Billups**, University of Colorado, Dept. of Math., CB 170, PO Box 177364, Denver, CO 80217, sbillups@carbon.cudenver.edu

We examine central paths of various classes of complementarity problems under certain perturbations of the problem data. These perturbations are defined as nonlinear functions of a scalar parameter. Conditions governing the continuity of the central paths as set-valued functions of the perturbation parameter will be presented.

#### MD11 Tutorial: Continuous Approaches to Discrete Optimization Problems

Cluster: Global Optimization

Sponsor: Optimization Section

Sponsored Session

Chair: Panos M. Pardalos, University of Florida, Ctr. for Applied Opt., ISE Dept., 303 Weil Hall, Gainesville, FL 32611-6595, pardalos@ufl.edu

**1) Tutorial: Continuous Approaches to Discrete Optimization Problems, Panos M. Pardalos**, University of Florida, Ctr. for Applied Opt., ISE Dept., 303 Weil Hall, Gainesville, FL 32611-6595, pardalos@ufl.edu

Discrete or combinatorial optimization problems, that is, problems with a discrete feasible domain and/or a discrete domain objective function, model a large spectrum of applications in computer science, OR and engineering. Solution methods for discrete optimization problems can be classified into combinatorial and continuous approaches. A typical combinatorial approach generates a sequence of states...

#### MD12 Marketing Plenary: Marketing Science - Accomplishments & Challenges in the Global Information Age

Sponsor: College of Marketing

Sponsored Session

Chair: Jerry Wind, University of Pennsylvania, Wharton School/Dept. of Mktg., 3620 Locust Walk, Philadelphia, PA 19104

**1) Marketing Plenary: Marketing Science - Accomplishments & Challenges in the Global Information Age, Paul Saatsoglou**, Bristol Myers Squibb, Dept. of Mktg. Research, **Sam H. Parker**

#### MD13 Marketing I

Contributed Session

Chair: Susan H. Godar, William Paterson University, Marketing & MS Dept., 300 Pompton Rd., Wayne, NJ 07470, godars@nebula.wilpaterson.edu

**1) Developing Positioning & Segmentation Strategies for Internet Search Engines: An Expectation Management Approach, Jianan Wu**, Tulane University, Freeman Sch. of Bus., New Orleans, LA 70118, jianan.wu@tulane.edu, **Dan Padgett**

We investigate the positioning relationship between expectations and performance evaluations applied to Internet search engines. In contrast to current approaches, our approach (PEMAP) explicitly considers the correlation between expectations and performance dimensions. By simultaneously modeling heterogeneity of evaluations of expectations and performance, our approach provides a new segmentation methodology.

**2) The Impact of Color on Web Survey Responses, Susan H. Godar**, William Paterson University, Marketing & MS Dept., 300 Pompton Rd., Wayne, NJ 07470, godars@nebula.wilpaterson.edu

Paper color impacts responses to questionnaires. Is the same true on the Web? The results of this empirical study show that responses to an affective instrument, Mach IV, vary with the use of background and front colors. Color may also influence the rate of response. Implications for marketers designing Web surveys is discussed.

**3) The Impact of Electronic Commerce & Value Added Logistics on Distribution Channels, Aimo J. Inkilainen**, Helsinki School of Economics, Runeberginkatu 14-16, PO Box 1210, Helsinki, 00101, Finland, inkilain@hkkk.fi, **Ari P. Vepsäläinen**

We use a general heuristic based on customer channel requirements for determining the structure of distribution systems. Specifically, we examine the impact of electronic commerce and value-added logistics, including recycling, on channel structure through changing customer density and emerging channel support needs.

**4) Identification of Synergy among Marketing Mix Variables, Noreen Radke Sharpe**, Babson College, Div. of Math & Science, Babson Park, MA 02457-0310, sharpen@babson.edu, **Abdul Ali**

We identify the existence of synergy among a marketing mix variable used to promote a frozen food product. Synergy, which exists when a suppressor variable has an enhancing effect on the coefficient of multiple determination, is not commonly discussed in the development of marketing programs. We demonstrate the feasibility of applying a new technical approach...

#### MD14 Distinguished Speaker Session

Sponsor: Technology Management Section

Sponsored Session

Chair: Mary Tripsas, University of Pennsylvania, Wharton School, 2000 SH-DH, Philadelphia, PA 19104-6370, tripsas@wharton.upenn.edu

**1) Distinguished Speaker Session, James Utterback**, MIT, Sloan Sch. of Mgmt., MA 01950

**MD15 Publishing in Technology Management Journals: Editors Forum I**

**Sponsor:** Technology Management Section  
Sponsored Session

**Chair:** Michael K. Badawy, Virginia Tech., Sch. of Business, PO Box 3987, Merrifield, VA 22116-2931, mbadawy@vt.edu

1) **Publishing in Technology Management Journals: Editors Forum I**, Michael K. Badawy, Virginia Tech., Sch. of Business, PO Box 3987, Merrifield, VA 22116-2931, mbadawy@vt.edu, Abbie Griffin, Maria Papadakis

No abstract supplied.

**MD16 Airline Passenger Revenue Management**

**Sponsor:** Revenue Management Section  
Sponsored Session

**Chair:** Aaron Putnam, PROS Strategic Solutions, 3223 Smith St., Ste. 100, Houston, TX 77006, aputnam@pwsosweb.com

1) **Revenue Management for Airline Alliances**, Andrew Boyd, PROS Strategic Solutions, 3223 Smith, Ste. 100, Houston, TX 77006, aboyd@prosweb.com

Do airline alliances need to perform centralized revenue management to generate maximum revenues, or can simple, practical forms of decentralized control be implemented? Theoretical and applied results are presented.

2) **A Markov Decision Problem-Based Approach to the Airline YM Problem**, Victoria C. P. Chen, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, victoria.chen@isye.gatech.edu, Ellis L. Johnson, Dirk P. Guenther

We present a new approach to the airline seat allocation problem. Our approach LP models and regression splines to bound and estimate the value function of an MDP formulation of the problem. We provide simulation results that show revenue gains of up to 8% over other approaches.

3) **From Segment-Based Revenue Management Systems to Origin-Destination Type Systems: Reengineering Issues & Methodology to Obtain Bid Price**, Dinesh Menon, US Airways, 2345 Crystal Dr., Arlington, VA 22227, dinesh@usairways.com, Richard H. Zeni, Spyros Kontogiorgis

As part of the biggest outsourcing deal with SABRE, USAirways recently adopted a new revenue management strategy based on market level inventory control mechanism using bid prices, which marked a significant departure from its previous system that controlled inventory using segment-based allocations. We present how availabilities and fares from the existing system were re-computed at the flight leg level...

4) **Strategic Capacity Decisions for Flexible Resources under Uncertainty**, Serguei Netessine, University of Rochester, Simon Grad. Sch. of Bus. Admin, Simon Hall 4322, Rochester, NY 14627, netessine@ssb.rochester.edu, Gregory Dobson, Robert Shumsky

We consider a firm that provides multiple services using both specialized and flexible capacity. We use an example of the airlines' use of first-class seats to satisfy economy-class demands. We derive the benefits of considering flexibility at the time of capacity investment decision and analyze the impact of correlation among demand classes.

**MD17 Production Planning I**

Contributed Session

**Chair:** Anders Segerstedt, Malardalen University, Dept. of Bus. & Informatics, Box 883, Vasteras, S-721 23, Sweden, anders.segerstedt@mdh.se

1) **withdrawn - author request of 10/3**, Omer S. Benli, Bilkent University, Dept. of IE, Ankara, 06533, Turkey, benli@bilkent.edu.tr, http://benli.bcc.bilkent.edu.tr

2) **Distributed Scheduling**, Ihsan Sabuncuoglu, Bilkent University, IE Dept., Bilkent, Ankara, 06533, Turkey, sabun@bilkent.edu.tr, Aysegul Topal

DS is a new paradigm that enables local decision makers to make their own schedules by considering local preferences and the overall system objectives. Since local decision makers act independently of each other, distributed systems should be carefully designed. We review the existing studies and discuss characteristics of bidding-based algorithms...

3) **Interactive Constraint Propagation**, Jacob Feldman, INTELENGINE, Inc., 320 Amboy Ave., Metuchen, NJ 08840,

feldman@intelengine.com, http://www.intelengine.com

INTELENGINE developed a framework to support real-time interactive constraint propagation. It can be used together with ILOG's toolkit for dynamic workforce scheduling. The same scheduling constraints control the execution of a power scheduling engine and manual overrides. The similar dynamic scheduling capabilities could be applied to different constraint-based systems.

4) **Excess Inventory Disposal under a Stationary Base-Stock Policy**, Sila Cetinkaya, Texas A&M University, Dept. of IE, College Station, TX 77843-3131, sila@tamu.edu, http://ie.tamu.edu/faculty/cetinkaya/cetinkaya.html, Mahmut Parlar

We study a 1-time disposal decision associated with a stochastic inventory problem. We assume that the system is operated under a stationary base-stock policy and excess stock can be liquidated by specifying a reduced price. We present analytical models for optimizing disposal decisions.

5) **A Heuristic Method for Capacity Constrained Multi-Level Production Based on a Frequency Approach**, Anders Segerstedt, Malardalen University, Dept. of Bus. & Informatics, Box 883, Vasteras, S-721 23, Sweden, anders.segerstedt@mdh.se

The problem of deciding order quantities in capacity constrained multi-level production is tackled with a frequency approach, meaning that during a specified maximum time interval, all items are produced once, twice, 4 times, 16 times, etc. Every item has a current initial inventory. Different items have different setup and operation times in the different machines where they are produced.

**MD18 Network Flows: Techniques & Applications**

Cluster: Discrete Optimization

Invited Session

**Chair:** Leslie A. Hall, Johns Hopkins University, Dept. of Math. Sciences, Baltimore, MD 21218, lah@jhu.edu

1) **A New Property & Faster Algorithm for Baseball Elimination**, Kevin Wayne, Princeton University, 35 Olden St., Princeton, NJ 08544, wayne@cs.princeton.edu

The baseball elimination problem is to determine which teams are mathematically eliminated from finishing the season in first place. We present a new and surprising threshold property for the problem. Using the new property and network flow techniques, we obtain a faster baseball elimination algorithm.

2) **Approximating Multicommodity Flow Independent of the Number of Commodities**, Lisa Fleischer, Columbia University, IEOR Dept., New York, NY 10027, lisa@ieor.columbia.edu

We present the first fully polynomial time approximation scheme for maximum multicommodity flow that is independent of the number of commodities  $k$ . Our algorithm is faster than the best previous algorithms by this factor of  $k$ . We also improve the run time of the best previous FPTAS for maximum concurrent flow.

3) **Approximating Disjoint-Path Problems**, Stavros Koliopoulos, NEC Research Institute, 4 Independence Way, Princeton, NJ 08540, stavros@research.nj.nec.com, Clifford Stein

We describe recent work on approximation algorithms for the basic combinatorial problem of finding edge-disjoint paths in a graph and its variations such as vertex-disjoint paths and unsplitable flow. As part of our techniques we obtain new results on approximating packing integer programs.

**MD19 Combinatorial Optimization Problems**

Cluster: Discrete Optimization

Invited Session

**Chair:** Nelson F. Maculan, Federal University of Rio de Janeiro, COPPE-Sistemas, PO Box 68511, Rio de Janeiro, 21945-970, Brazil, maculan@cos.ufrj.br

1) **A New Relaxation in Conic Form the Euclidean Steiner Problem in  $\mathbb{R}^n$** , Marcia Fampa, Federal University of Rio de Janeiro, Math & COPPE Sistemas, PO Box 68511, Rio de Janeiro, 21945-970, Brazil, fampa@cos.ufrj.br, Laura Bahiense, Nelson F. Maculan

We present a new mathematical programming formulation for the ESTP in  $\mathbb{R}^n$ . We relax the integrality constraints on this formulation and transform the resulting relaxation into a standard convex programming problem in conic form. We consider then an efficient computation of an  $\epsilon$ -optimal solution for the latter problem using interior-point algorithms. We finally employ the solution computed as a lower bound for ESTP in a B&B scheme to solve problem instances to optimality.

2) **A Local Search for the Euclidean Steiner Problem in  $\mathbb{R}^n$** , Gerard Plateau, Universite Paris-Nord, Lab. d'Informatique, Av

Jean-Baptiste Clement, Villeteuse, 93430, France, gp@lipn.univ-paris13.fr, *Flavio Montenegro, Nelson F. Maculan*

In a B&B scheme for solving a given Euclidean Steiner problem in  $\mathbb{R}^n$  it is very important to obtain good feasible solutions. We propose an approach in order to develop a local search which can be applied in a metaheuristic method. For this local search we define a neighborhood of a given Steiner tree topology and we report computational results.

**3) Decomposition Approaches for Solving Network Design Problems, Abdel Lisser**, CNET, 38-40 rue du General Leclerc, Issy Les Moulineaux, 92131, France, abdel.lisser@cnet.francetelecom.fr

We propose comparisons between different decomposition methods such as ACCPM, Dantzig-Wolfe and the bundle method used for solving network design problems. Relaxation of different constraints are used and their problems are solved using such decompositions. Numerical results on real network are given.

**4) A Study of Preconditioners for Network Interior Point Methods, Joaquim J. Judice**, Universidade de Coimbra, Dept. de Matematica, Coimbra, 3000, Portugal, judice@dragao.it.uc.pt, *L. F. Portugal, Mauricio G. C. Resende, Geraldo Veiga*

We compare families of preconditioners used in conjugated gradient-based implementations of network interior point methods. Using PDNET, a computational comparison of preconditioners on a set of standard problems is presented. Based on upper bounds on the condition numbers of the reconditioned matrices, we offer an improved understanding of the effectiveness of conjugate gradient computations...

## MD20 Static Traffic Assignment II

Sponsor: Transportation Science Section  
Sponsored Session

Chair: Kyriacos C. Mouskos, New Jersey Institute of Technology, Inst. of Transport, University Heights, Newark, NJ 07102, mouskos@megahertz.njit.edu

**1) Solving the Toll Design Problem with Multiple User Groups, Mei Chen**, New Jersey Institute of Technology, Inst. of Transp., University Heights, Newark, NJ 07102, *David Bernstein*

The toll design problem, similar to the continuous network design problem, can be simplified to a single level NLP problem under certain assumption. Tests show that this simplified problem is much easier to solve than the bilevel formulation and the assumption condition can be well kept.

**2) Computational Study of State-of-the-Art Path-Based Traffic Assignment Algorithms, Anthony Chen**, University of California, Dept. of Civil & Environ. Eng., Inst. of Transport. Studies, Irvine, CA 92697, *Der-Hong Lee, R. Jayakrishnan*

We present an extensive computation study on 2 of the state-of-the-art path-based algorithms: the disaggregate simplicial decomposition and the gradient projection. In addition to the computational comparisons, we also evaluate the quality of the solutions with a realistic large-scale network.

**3) A Simultaneous Multi-Class Multi-Mode Equilibrium Model with a Nested Logit Demand Model, Michael A. Florian**, University of Montreal, CRT, 5160 Decaire Blvd., Ste. 610, Montreal, Quebec, H3X 2H9, Canada, mike@inro.ca, *Jia Hao Wu, Shuguang He*

We consider a complex multi-class multi-mode network equilibrium model with a nested logit demand model structure. The model is formulated as a variational inequality problem and solved by a Gauss-Seidel block decomposition approach. The resulting algorithm makes use of computational blocks which are network equilibrium assignment, transit assignment, 2-dimensional balancing and matrix computations.

## MD21 Routing, Control & Planning Algorithms for Transport Systems

Sponsor: Transportation Science Section  
Sponsored Session

Chair: Kyriacos C. Mouskos, New Jersey Institute of Technology, Inst. of Transport, University Heights, Newark, NJ 07102, mouskos@megahertz.njit.edu

**1) Analytical Dynamic Traffic Assignment Algorithms, Ismail Chabini**, MIT, 77 Massachusetts Ave., Rm. 1-263, Cambridge, MA 02139-4307

We present various algorithms for analytical dynamic traffic assignment models. Techniques for efficient implementations of these algorithms are given. Computational results demonstrate the efficiency of these algorithms.

**2) Intermediate-Term Planning for Intermodal Networks using**

**GIS, Maria Boile**, Lafayette College, Dept. of Civil & Environ. Eng., Easton, PA 18042, maria@athena.cadlab.lafayette.edu, *Michael Haynes*

A mathematical model of intermediate-term planning for intermodal transportation networks has been developed and integrated with a GIS. The model considers transit operator's responses to the expected volume of ridership. The interface exploits the graphical nature of GIS technology allowing for better communication of model results.

**3) Experiments with RHODES, a Real-Time Traffic Adaptive Control Strategy, Pitu B. Mirchandani**, University of Arizona, ATLAS Res. Ctr., SIE Dept., Tucson, AZ 85721, pitu@sie.arizona.edu, *David E. Lucas, K. L. Head*

We discuss simulation and field experiments with RHODES, a real-time traffic-adaptive control strategy for an urban network. These experiments show a significant traffic performance improvement over current approaches. Issues dealing with implementation of new research and barriers to overcome will be highlighted.

## MD22 Internet Applications

Contributed Session

Chair: Yosef S. Sherif, California State University, MIS Dept., Fullerton, CA 92834, jsherif@fullerton.edu

**1) withdrawn - author request of 9/8, J. P. Shim**, Mississippi State University, Dept. of MIS, PO Box 9581, Miss State, MS 39762, *Young B. Shin*

**2) A Natural Language Interface-Based Internet Search System, Sumali J. Conlon**, University of Mississippi, School of Bus. Admin., University, MS 38677, conlons@bus.olemiss.edu, <http://www.olemiss.edu/~mksumali>, *Tabitha L. James, Bart L. Garner*

Current Internet search engines tend to present large numbers of irrelevant items and frequently ignore relevant items, due to a lack of language understanding capabilities. Our research develops an intelligent Internet search system which incorporates natural language processing techniques using the programming language prolog.

**3) Quality Vs. Quantity in Searching the Web, Neji Hajji**, Middle Georgia College, 1100 2nd St. SE, Cochran, GA 31014, nhajji@warrior.mgc.peachnet.edu

Using standard search engines to extract useful information from the Web has become a formidable task even for the advanced user. This research looks into using knowledge discovery methods that are appropriate for business data to increase the quality of a Web-based search.

**4) Information Security Solutions for EDI, I-EDI & E-Commerce, Bel G. Raggad**, Pace University, Info. Systems Dept., 861 Bedford Rd., Pleasantville, NY 10570, braggad@pace.edu

Online business technologies are no longer optional. Executives are therefore faced with the real challenge of developing a strategic plan that redefines the new requirements and directions for survival or success in this new business environment. We present a comparative study of EDI, I-EDI and e-commerce in terms of their efficiency and identify and explain how current information security solutions apply to them.

**5) Security of Electronic Commerce, Yosef S. Sherif**, California State University, MIS Dept., Fullerton, CA 92834, jsherif@fullerton.edu

We explore models and protocols to improve the security and conduct of e-commerce transactions. Robust e-commerce encompasses the secure processes of information, negotiation, fulfillment and satisfaction. We will also expose vulnerabilities, threats and expected risks facing e-commerce and propose measures for adequate security.

## MD23 Petroleum Logistics II

Sponsor: Energy, Natural Resources & the Environment  
Sponsored Session

Chair: Murthy V. Mudrageda, Maritrans Management Services Inc., 1818 Market St., Ste. 3540, Philadelphia, PA 19103, mmudrageda@maritrans.com

**1) Maritime Hazardous Materials Transportation: A Risk-Based Network Approach, Lefteris Iakovou**, University of Miami, Dept. of IE, PO Box 248294, Coral Gables, FL 33124, lefteris@eng.miami.edu, *Lalit Yudhbir, Christos Douligeris*

We consider the strategic routing problem of maritime transportation of hazardous materials on a multicommodity multiple origin-destination network. We present a novel risk assessment methodology that provides risk cost estimates that are used by a network flow model to provide optimal routes while

minimizing total transportation and risk costs.

**2) Combining Optimization & Simulation in Marine Logistics Analysis, Murthy V. Mudrageda**, Maritrans Management Services Inc., 1818 Market St., Ste. 3540, Philadelphia, PA 19103, mmudrageda@maritrans.com, **Emmanuel D. Chajakis**

We have modeled certain petroleum distribution systems in which experienced operators schedule the use of marine transportation equipment for high fleet profitability and quality customer service. We describe our experience with embedding optimal solvers and heuristics within simulation to create a decision support tool for strategic and tactical decision making.

**3) An Evolutionary-Based Optimization System that Maximizes Profits for Gas Traders in the Physical Gas Marketplace, Shadrack Orero**, Hatch Associates Ltd., 2800 Speakman Dr., Mississauga, Ontario, L5K 2R7, Canada, sorero@hatch.ca, **Rob McConnell**

In the deregulated gas market, gas traders have multiple places they can buy/sell gas. The gas markets and supplies are connected through a mesh of pipelines that have flow limitations and varied costs for transmission. We show how an evolutionary algorithm allows traders to maximize profit on their trades.

## MD24 Managing Hospital Operations: Capacity, Cost-Effectiveness, Inventory & Scheduling

**Sponsor:** Health Applications Section  
Sponsored Session

**Chair:** Liam O'Neill, Cornell University, N132 MVR Hall, Ithaca, NY 14853-4401, lo22@cornell.edu

**1) Assessing Capacity Management Orientations & Hospital Performance, Lynn Ling X. Li**, Butler University, Coll. of Bus. Admin., Indianapolis, IN 46208-3485, lili@thomas.butler.edu

Hospital capacity planning is studied to better understand US hospitals' patterns of capacity decisions. The relationship between capacity management orientations and hospital performance is assessed. Hospitals do change their capacity decisions in response to major environmental shifts. Simply changing capacity strategies does not always imply performance advantages.

**2) Cost Analysis of the VIA Blood Gas Monitor, Peter E. Hilsenrath**, University of Iowa, Htlh. Mgmt. & Policy, 2700 Steindler Bldg., Iowa City, IA 52242-1008, peter-hilsenrath@uiowa.edu, **Brian J. Dahl**

New technology permits continuous monitoring of blood gases. This is achieved with catheter tubes providing blood for testing in a sensor unit. Blood is returned to the patient, resulting in minimal phlebotomy loss. Test results are provided within 1 or 2 minutes, much faster than alternatives such as central laboratories. Testing costs are lower for patients requiring more than 20-30 tests...

**3) Anaesthesia Scheduling, John T. Blake**, Dalhousie University, Dept. of Indust. Eng., PO Box 1000, Halifax, NS, B3J 2X4, Canada, john.blake@dal.ca, **Sandra Eaves**

The Queen Elizabeth Health Sciences Centre (QEII) is Atlantic Canada's largest hospital. The amalgamation of 4 institutions, the QEII has more than 1100 beds spread throughout 11 buildings. As such, it presents a number of interesting operational challenges. Schedulers at the QEII must find feasible assignments of 46 anaesthesiologists to 31 operating rooms and clinical assignments each day...

**4) Using MRP to Improve Materials Management at University Hospital, Liam O'Neill**, Cornell University, N132 MVR Hall, Ithaca, NY 14853-4401, lo22@cornell.edu, **Michael Murphy**

Managing green (surgical) linen inventory is a particularly challenging task, due to day of week effects, short lead times, and the high cost of stock-outs. We developed an MRP-type system to manage the flow of green linen at the University of Iowa Hospitals & Clinics. This project resulted in inventory reductions of some items by as much as 20% and an estimated annual savings of at least \$20,000.

## MD25 Optimization Theory III Contributed Session

**Chair:** Alice E. Smith, University of Pittsburgh, Dept. of IE, 1031 Benedum Hall, Pittsburgh, PA 15261, aesmith@engrng.pitt.edu

**1) Preprocessing Algorithms for Optimizing Generalized Networks, Karen R. Lewis**, SMU, PO Box 750122, Dallas, TX 75275-0122, klewis@seas.smu.edu

We present methods for eliminating nodes and arcs from a generalized network in order that the associated mathematical problem may be solved faster. The optimal solution to the original problem may be extracted from the optimal

solution to the reduced problem.

**2) A Straightforward Way of Solving Robust Optimal Planning Models via Scenario Decomposition, Victor M. Alborno**, Universidad Tecnica Federico Santa Maria, Dept. de Industrias, Av Espana 1680, Casilla 110V, Valparaiso, Chile, valborno@ind.utsfm.cl, **Luis B. Contesse**

We propose a straightforward way of extending the application of standard optimization techniques for solving deterministic models of robust optimization. The proposed algorithms use a particular scenario decomposition technique that generates subproblems of a similar nature than the underlying original deterministic problem with the subsequent advantages in reducing the implementation cost.

**3) The Convergence of a Gradient Based Algorithm for Linear Programs that Computes a Saddle Point, Yi Shang**, University of Michigan, IOE Dept., College of Eng., 1205 Beal Ave., Ann Arbor, MI 48109-2117, shangyi@engin.umich.edu, **Beong Choi, Romesh Saigal, Wanshan Zhu, Marvin D. Trout**

We construct a Lagrangian function and generate a gradient based iterative scheme to find the saddle point of this function. We will show that the saddle point solves the linear program. Choice of the step size is critically related to the convergence of this method. The conditions for convergence of this method will also be discussed...

**4) An Ant System Approach to Redundancy Allocation Problem, Yun-Chia Liang**, Auburn University, Dept. of ISE, Auburn, AL 36849, yulst8@pitt.edu, **Alice E. Smith**

A problem-specific ant system is developed and demonstrated to solve the redundancy allocation problem of a series-parallel system. The ant system algorithm presented is combined with an adaptive penalty method and a local search heuristic to deal with the highly constrained problem. Experiments were conducted on a well-known set of sample problems proposed by Fyffe, Hines & Lee.

## MD26 Markov Decision Processes

**Sponsor:** Applied Probability Society  
Sponsored Session

**Chair:** Thomas F. Reid, AFIT, Dept. of Math & Stats., 2950 P St., Bldg. 640, WPAFB, OH 45433-7765, treid@afit.af.mil, thomas.reid@afit.af.mil

**1) A New Algorithm for Finite-Horizon Continuous-Time Markov Decision Processes, Vidyadhar G. Kulkarni**, University of North Carolina, Dept. of OR, Smith Bldg., CB 3180, Chapel Hill, NC 27599, vkulkarn@email.unc.edu, kulkarni@or.unc.edu, **Tugrul Sanli**

We consider a finite-horizon continuous-time Markov decision process with lump-sum costs and non-O terminal costs. We assume finite and countable state and action spaces. Using existing theory, we present a numerically efficient and stable algorithm to solve the problem.

**2) Optimal Admission Control for Single-Buffer Markovian Systems, Thomas F. Reid**, AFIT, Dept. of Math & Stats., 2950 P St., Bldg. 640, WPAFB, OH 45433-7765, treid@afit.af.mil, thomas.reid@afit.af.mil, **Vidyadhar G. Kulkarni**

Consider a system where sources arrive according to a Poisson process, stay for an exponentially distributed random time and input fluid according to continuous time Markov chain environment process. We present a method for finding the optimal admission policy using complete system information. We also present a simple numerical example.

**3) A Markov Decision Process Model for Airline Meal Provisioning, Jason Goto**, University of British Columbia, Fac. of Commerce, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, jgoto@unixg.ubc.ca, **Martin L. Puterman, Mark E. Lewis, Stephen Jones**

An airline caterer seeks to provide a meal quantity for each flight that closely matches final passenger load. Faced with preparation lead time, the caterer must determine meal quantities well in advance of departure. We describe a Markov decision process model that shows how to adjust meal quantities at key decision points to minimize ordering costs.

**4) Undiscounted Two-Person Zero-Sum Stochastic Games, Melike Baykal-Gursoy**, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, gursoy@rci.rutgers.edu, **Muge Zeynep Avsar**

Consider games with finite state and finite action spaces under the long-run average payoff criterion. First, a decomposition algorithm is presented to solve general stochastic games, solution of which gives the best stationary strategies

of the game. Then, an algorithm to solve communicating games is proposed...

## MD27 Spreadsheets & OR/MS

Contributed Session

**Chair:** Nancy S. Balaguer, Babson College, Babson Hall 211C, Babson Park, MA 02457, balaguer@babson.edu

1) **Speeding Up the Learning Curve with Excel Solver**, *Denise Sakai Troxell*, Babson College, Babson Park, MA 02154, troxell@babson.edu, *Joe Aieta*

In many quantitative courses, the software of choice for modeling, including linear programming problems, is Excel. Students often struggle when formulating and structuring optimization problems with spreadsheets. This paper presents strategies using screen capture software and graphic presentations which enable students at all levels to quickly grasp and effectively use the Excel Solver Add-In.

2) **Development of Marketing Model Library**, *Keiichiro Nakagawa*, NTT Data Corp., Shinjuku Park Tower 24th Fl, 3-7-1 Nishi-Shinjuku 3-Chome, Shinjuku-ku, Tokyo, 163-1024, Japan, nakagawa@riss.nttdata.co.jp, <http://www.nttdata.co.jp>, *Hiroyuki Takahashi*, *Naoyuki Tsunematsu*, *Takashi Namatame*

We developed the library of add-in macros in Excel for heavy-duty marketing data analyses. This library contains virtually all functions and statistical methods necessary to use marketing models. Using dynamic link library, our macros run much faster than VBA-scripted macros.

3) **The Value of Multiple Methods when Assessing Excel Skills & their Business Applications**, *Nancy S. Balaguer*, Babson College, Babson Hall 211C, Babson Park, MA 02457, balaguer@babson.edu, *Joyce C. Gordon*

We examine the effectiveness of multiple methods in assessing the ability to apply Excel skills in a business context. We use interactive simulation software to assess fundamental spreadsheet skills in pre- and post-tests administered to 400 students. Then, for the same cohort, we use Excel to assess the application of the skill set in solving business problems. Statistical results will be presented.

## MD28 Decision Technology in SCM in Semiconductor Industry Applications: Best Can Do

Cluster: E-Business & Decision Technology in Semiconductors  
Invited Session

**Chair:** John Milne, IBM Microelectronics Division, PROFIT Dept., Essex Junction, VT 05402, jmilne@us.ibm.com

1) **Total Order Management at Silconix**, *Harpal Singh*, Supply Chain Consultants, Inc., 5604 Fairmont Dr., Linden Green Center, Wilmington, DE 19808, hsihgn@supplychain.com

We will cover a specific implementation of the general OPD SCM methodology referred to as TOM at Silconix using the Chesapeake Decision Sciences tool called MIM. The team doing the implementation were members of Supply Chain Consulting, CDS, OPD and Silconix.

2) **Best Can Do at IBM Microelectronics Division**, *Mahesh Pati*, IBM Microelectronics Division, PROFIT Dept., Essex Junction, VT 05402, pati@us.ibm.com, *Dan S. Dangat*

IMD is one of the world's largest producer of chips, modules and cards supplying parts for both IBM box plants, i.e., the System 390, and outside customers, i.e., Dell. IMD has facilities in North America, Europe and Asia. Planning Resources Optimally for Integrated Technology's (PROFIT), which began 5 years ago...

## MD29 Software Demonstration IV

Software Demo Session

**Chair:** To be announced

1) **Scitor Process v3**, *Roger Meade*, Scitor Corporation, rmeade@scitor.com

Scitor Process v3 is a breakthrough for process management. See how Scitor Process helps you with process mapping, process optimization and process communication utilizing Internet technologies. Learn how leading organizations have employed Scitor Process to improve process performance, customer satisfaction and the bottom-line.

2) **The New AIMMS 3.0 Modeling System**, *Johannes J. Bisschop*, Paragon Decision Technology BV, PO Box 3277, Haarlem, 2001 DG, The Netherlands, j.bisschop@paragon.nl, *G. de Lange*

The new AIMMS 3.0 modeling system will be introduced both conceptually and through examples. Special emphasis will be placed on advanced GUI objects (Gantt chart, network object), advanced language topics (modeling of time, unit

conventions), security issues (VAR licensing, user database) and advanced developments (API, code generation, matrix updates).

## MD30 Simulation Applications II

Contributed Session

**Chair:** Lisa A. Schaefer, Arizona State University, Dept. of IMSE, Tempe, AZ 85287, lisa.schaefer@asu.edu, [www.public.asu.edu/~schaefer](http://www.public.asu.edu/~schaefer)

1) **The Cost Impact of Contingent Workers on a Manufacturing System under Learning & Forgetting**, *Jeff K. Stratman*, University of North Carolina, Kenan-Flagler Bus. Sch., CP 3490, McColl Hall, Chapel Hill, NC 27599-3490, stratmaj@bschool.unc.edu, [www.bschool.unc.edu/phd/stratmaj](http://www.bschool.unc.edu/phd/stratmaj), *Aleda V. Roth*, *Wendell G. Gilland*

Using discrete event simulation, a labor-intensive manufacturing operation is modeled, analyzing the cost impact of contingent work force learning and forgetting under various employment policies and product switching frequencies. Our results indicate that the hidden costs associated with the use of contingent workers may offset anticipated savings in labor costs.

2) **Simulation-Based Estimation of Tolerance Intervals**, *E. Jack Chen*, University of Cincinnati, PO Box 210130, Cincinnati, OH 45221-0130, chenj@econqa.cba.uc.edu, <http://www.econqa.cba.uc.edu/~chenj>, *W. David Kelton*

We discuss the implementation of a sequential procedure to construct quantiles and tolerance intervals of the steady-state distribution of a stochastic process. The procedure is based on the phi-mixing theorem. We show that our sequential procedure gives valid quantiles and tolerance intervals.

3) **Value-at-Risk Calculation using Monte Carlo Simulation**, *Jin Wang*, Valdosta State University, Dept. of Math & Comp. Sci., 1500 North Patterson St., Valdosta, GA 31698-0040, jwang@valdosta.edu, <http://www.valdosta.edu/~jwang>

We investigate efficient Monte Carlo methodology to compute value-at-risk when changes in the underlying factors are not normally distributed.

4) **Flow Theory for Flocks of Autonomous Mobile Physical Agents**, *Lisa A. Schaefer*, Arizona State University, Dept. of IMSE, Tempe, AZ 85287, lisa.schaefer@asu.edu, [www.public.asu.edu/~schaefer](http://www.public.asu.edu/~schaefer)

We describe a study of navigation rules modeling autonomous entities and the development of a theory to describe their traffic flow. Due to advancing computer technology, models with many objects are becoming more practical for analyzing engineering systems with many agents and complex rules governing individual agent actions.

## MD31 Quality Management II

Contributed Session

**Chair:** Mohamed Djerdjour, Plattsburgh State University, School of Bus. & Economics, 101 Broad St., Plattsburgh, NY 12901, mohamed.djerdjour@plattsburgh.edu

1) **Distribution of Quality Costs: Evidence from an Aeronautical Firm**, *Can Simga-Mugan*, Bilkent University, Dept. of Mgmt., PO Box 8, Ankara, 06533, Turkey, simga@bilkent.edu.tr, *Erdal Erel*

We investigate the distribution of quality costs in an aeronautical defense company and that find the appraisal costs make up the largest portion of total quality costs. A taxonomy of quality costs is provided in which both tangible and intangible quality costs, such as the certification expenses of quality systems, are included.

2) **The Relationship between TQM Practices & Organizational Performance in Higher Education**, *Danny I. Cho*, University of Northern British Columbia, Fac. of Business & Mgmt., 3333 University Way, Prince George, BC, V2N 4Z9, Canada, chod@unbc.ca, <http://www.unbc.ca>

We examine the relationship between TQM practices and organizational performance in higher education. Our analysis is based on the scoring guidelines in the 1998 Education Criteria of the Baldrige National Quality Award. We discuss how TQM would affect organizations in higher education and introduce a systematic method of evaluating an organization's performance resulting from using TQM tools.

3) **Outcome Assessment in the Classroom: Employing the SERVQUAL Model**, *Dennis F. X. Mathaisel*, Babson College, Babson Hall, Babson Park, MA 02457, dfxm@mit.edu, [web.mit.edu/dfxm/www/](http://web.mit.edu/dfxm/www/), *Clare L. Comm*

According to the AACSB, a major accreditation agency for collegiate business schools, education has to be outcome-based. In measuring classroom instructor effectiveness and student learning outcomes, the authors suggest using the

SERVQUAL model. This instrument focuses on the different between perceptions and expectations relating to the quality of a service.

**4) An Application of Basic Quality Management Tools to Improve Operations in a Post Office, Mohamed Djerdjour, Plattsburgh State University, School of Bus. & Economics, 101 Broad St., Plattsburgh, NY 12901, mohamed.djerdjour@plattsburgh.edu**

We report on a successful application of basic quality control/management tools to improve operations in a main post office in a developing country. Problem areas such as identification, cause and effect analysis and solution implementation will be discussed. Moreover, the operations management and the cost savings realized will be presented.

### MD32 Intelligent Agents in Electronic Markets

Sponsor: INFORMS Computing Society  
Sponsored Session

Chair: Hemant Bhargava, Carnegie Mellon University, Heinz Sch. of PP&M, 5000 Forbes Ave., Pittsburgh, PA 152123, bhargava@computer.org

**1) An Intelligent Employment Market for Military Officers, Mark E. Nissen, Naval Postgraduate School, 555 Dyer Rd., Code SM/Ni, Monterey, CA 93943-5000, mnissen@nps.navy.mil**

Employment markets encounter substantial friction, particularly in the military, which uses centralized job planning systems. Intelligent agent technology offers good potential to reduce this market friction, and the mall metaphor of an agent-based employment market, called The Intelligent Employment Mall, can eliminate the inefficiencies of centralized planning in the military.

**2) Function Composition in an Electronic Market, Atip Asvanund, Carnegie Mellon University, Heinz Sch. of PP&M, 5000 Forbes Ave., Pittsburgh, PA 15213, atip@computer.org, Hemant Bhargava, Ramayya Krishnan**

**3) Model Composition using Filter Spaces, Kaushal Chari, University of South Florida, College of Bus., 4202 E Fowler Ave., CIS 1040, Tampa, FL 33620-7800, kchari@coba.usf.edu**

In DSS domain, a sequence of models is typically executed in response to a user query. The problem of selecting and executing a sequence of models is called the model composition problem. We will present a new theoretical construct called filter spaces to support model composition. Filter spaces have interesting features that include support for automating model composition.

### MD33 Metamodels for Computer-Based Design I

Sponsor: Quality, Statistics & Reliability  
Sponsored Session

Chair: Timothy W. Simpson, Pennsylvania State University, Dept of IME, 207 Hammond Bldg., University Park, PA 16802, tws8@psu.edu

**1) Design of Experiments for Fitting Multiple Metamodels, Russell R. Barton, Pennsylvania State University, Dept. of IME, 207 Hammond Bldg., University Park, PA 16802, barton@simplex.psu.edu, Martin Meckesheimer, Frej Limayem, Bernard Yannou**

Metamodels are models of simulation models that can serve as computationally inexpensive surrogates. Often, multiple metamodels must be fitted to the same simulation model, then one set of runs can provide fitting data for all metamodels. We look at the design of such experiments for a desk lamp design problem.

**2) Optimizing With Global Approximations: Some Computational Results, Michael W. Trosset, College of William & Mary, Dept. of Math, PO Box 8795, Williamsburg, VA 23187-8795, trosset@math.wm.edu**

Various researchers have proposed using global approximations to facilitate optimizing expensive objective functions. Efficient algorithms must select evaluation sites in ways that balance the goals of minimizing and improving the current approximation to the objective function. We report computational results on the efficacy of several such algorithms.

**3) A Comparison of Metamodeling Strategies for Computer-Based Engineering Design, Timothy W. Simpson, Pennsylvania State University, Dept of IME, 207 Hammond Bldg., University Park, PA 16802, tws8@psu.edu**

Metamodeling strategies to facilitate computer-based design and optimization are becoming more readily available. Ongoing research into the efficacy of different metamodeling strategies is discussed. Several examples are used to compare the ease of use, accuracy and computational expense of response surfaces, kriging, radial basis functions and multivariate adaptive regression splines.

### MD34 No Title Supplied

Sponsor: College on Information Systems  
Sponsored Session

Chair: Anandhi S. Bharadwaj, Emory University, Goizueta Business School, Atlanta, GA 30322, anandhi\_bharadwaj@bus.emory.edu

**1) Using IT for Knowledge Management: What we Know & What we Don't Know, Mani Subramani, University of Minnesota, Dept. of Info & Dec. Sci., msubramani@csom.umn.edu, Gordon B. Davis**

Firms are deploying a variety of IT initiatives for knowledge management: from indexed document repositories and discussion databases to virtual team rooms and skills inventories. Using data collected from knowledge managers, we provide an analysis of lessons learnt and the challenge facing researchers in this area.

**2) Choice of IT Infrastructural Components for Strategic Explication of Knowledge, Amrit Tiwana, Georgia State University, Robinson Coll. of Bus., Dept. of CIS, 9th Fl, 35 Broad, Atlanta, GA 30302-4015, atiwana@gsu.edu**

To meet competitive challenges in a rapidly evolving business environment, organizations need to effectively create, locate, capture and share knowledge and expertise within the firm. However, much of a firm's knowledge is experiential and tacit. IT provides a viable means for explicating this knowledge and further allows it to be leveraged by workers involved in knowledge intensive tasks...

**3) Information Technology & Organizational Knowledge: A Resource-Based Analysis, Anandhi S. Bharadwaj, Emory University, Goizueta Business School, Atlanta, GA 30322, anandhi\_bharadwaj@bus.emory.edu**

Organizational knowledge has become a key component of organizational resources. Drawing on the resource-based view of the firm that attributes organizational performance to unique resources and skills, we examine linkages between a firm's IT capability and its ability to create knowledge capital. We explore the dimensions of organizational knowledge and IT-based mechanisms and processes for creating and sustaining organizational knowledge.

### MD35 Dantzig Fest II

Invited Session

Chair: Alan J. Hoffman, IBM, TJ Watson Research Ctr., Yorktown Heights, NY 10598, hoffa@watson.ibm.com

**1) The Simplex Method, Combinatorial Theorems & Totally Ordered Abelian Groups, Alan J. Hoffman, IBM, TJ Watson Research Ctr., Yorktown Heights, NY 10598, hoffa@watson.ibm.com**

Harking back to a 1957 paper of David Gale, we show that all the combinatorial theorems of type "max something = min something," proved via linear program duality and total dual integrality, are valid when one set of variables (primal or dual) are elements of a totally ordered abelian group.

**2) Solving Linear Programs with Billions of Columns, Ellis L. Johnson, Georgia Institute of Technology, School of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, ellis.johnson@isye.gatech.edu**

Airline crew scheduling has given an impetus to solving linear programs with a large number of columns. Other examples where such linear programs arise are cutting stock problems and, in general, from Dantzig-Wolfe decomposition. Convergence has been the main computational difficulty. Some methods that speed convergence and allow solving some problem classes to optimality are given.

**3) Comments about the Future of Operations Research, George B. Dantzig, Stanford University, OR Dept., Stanford, CA 94305-4022, george-dantzig@worldnet.att.net**

No abstract supplied.

### MD36 Effectiveness of University-Industry Cooperative Research

Cluster: R&D Technology & Knowledge Management  
Invited Session

Chair: Catherine P. Ailes, SRI International, 1611 North Kent St., Arlington, VA 22209

**1) No Title Supplied, Catherine P. Ailes, SRI International, 1611 North Kent St., Arlington, VA 22209**

No abstract supplied.

**2) No Title Supplied, J. David Roessner, SRI International, 1611**

North Kent St., Arlington, VA 22209

No abstract supplied.

3) **No Title Supplied, Irwin Feller**, Pennsylvania State University

No abstract supplied.

4) **No Title Supplied, Michael D. Santoro**, Lehigh University

No abstract supplied.

### MD37 INFORMS' First Case Competition: An Introduction to the Competition Rules

Sponsor: INFORM-ED

Sponsored Session

Chair: James J. Cochran, University of Cincinnati, QAOM Dept., PO Box 210130, Coll. of Bus. Admin., Cincinnati, OH 45221-0130, cochraj@econqa.cba.uc.edu

1) **INFORMS' First Case Competition: An Introduction to the Competition Rules, Peter C. Bell**, University of Western Ontario, Ivey School of Bus., London, Ontario, N6A 3K7, Canada, pbell@ivey.uwo.ca, **M. Diane Burton, Sherwood C. Frey, Jr., Thomas A. Grossman, Donna C. Llewellyn**

We introduce INFORMS first case competition. We will discuss the rules and introduce the judges. The judges will also provide some guidelines for writing effective cases.

### MD38 Production Planning V

Contributed Session

Chair: John S. Hollywood, MIT, 77 Massachusetts Ave., Rm. E40-130, Cambridge, MA 02139, jshollyw@mit.edu, http://web.mit.edu/jshollyw/www

1) **Parallel Machine Scheduling with Sequence-Dependent Setup Times, Mary E. Kurz**, University of Arizona, Dept. of SIE, PO Box 210020, Tucson, AZ 85721-0020, maryk@sie.arizona.edu, **Ronald G. Askin**

Three heuristics for parallel machine scheduling with sequence-dependent setup times to minimize makespan will be presented and compared. Setup times (symmetric and asymmetric) are characterized by the mean and variance. Additional factors such as mean processing time, range of processing time, number of jobs and number of machines are considered.

2) **Solving a Scheduling Problem in Design for Supply Chain Management, David W. He**, University of Toledo, Dept. of MIME, College of Eng., Toledo, OH 43606, dhe@eng.utoledo.edu, **Astghik K. Babayan**

We address a scheduling problem associated with the design for supply chain management with an assembly-driven product differentiation strategy. A heuristic algorithm for efficiently solving the scheduling problem is developed. The computational experiment shows that the heuristic algorithm provides optimal and near-optimal solutions to the scheduling problems.

3) **Linear Approximation Planning Models for Job Shops, John S. Hollywood**, MIT, 77 Massachusetts Ave., Rm. E40-130, Cambridge, MA 02139, jshollyw@mit.edu, http://web.mit.edu/jshollyw/www, **Stephen C. Graves**

We derive linear models that approximate the behavior of a job shop in which the production rules are general continuous functions of the work-in-queue. These models estimate the first 2 moments of steady-state production and queue lengths and may be used for capacity planning and tactical planning.

### MD39 Cognitive Aspects of Planning & Scheduling Support II

Cluster: Planning & Scheduling

Invited Session

Chair: Rene Jorna, University of Groningen

1) **Multi-Site Scheduling using Soft Computing Techniques, Jurgen Sauer**, University of Oldenburg, sauer@informatik.uni-oldenburg.de

Multi-site scheduling deals with the scheduling problems of an enterprise with several distributed production sites where sites use the intermediate products of other sites to manufacture the products of the enterprise, i.e., in car or airplane manufacturing. In the multi-site scheduling scenario, we differentiate between a global and a local scheduling level...

2) **Cognitive Planning & Problem Solving in Old Age, J. P. Das**, University of Alberta, Alberta, BC, Canada, j.p.das@ualberta.ca

The suggestion that a decrement in speed of information processing and diminished short-term memory are the root causes of decline in planning efficiency in old age is examined. Neuropsychological links to planning process and behavioral observations during problem solving are reviewed within the context of 3 other major processes comprising attention and 2 information integration components of simultaneous and successive processing...

3) **Mathematical Algorithms, Formal Systems & Planning, J. Simons**, University of Groningen, PO Box 800, Groningen, 4700, The Netherlands, j.l.simons@bdk.rug.nl

Many theoretical articles and practical case studies refer to the applicability of mathematical algorithms for solving planning problems. Most theoretical studies tend to emphasize the generality of the chosen mathematical approach. Many case studies show the limited use of mathematics for real life planning problems. Planning is defined as a (human) resource allocation management task.

### Monday 16:45-18:00

#### ME41 Edelman Plenary: Extended Enterprise Supply Chain Management at IBM Personal Systems Group & Other Divisions

Plenary Session

Chair: Russ Labe, Merrill Lynch, Mgmt. Science Group, Section 3I, PO Box 9065, Plainsboro, NJ 08536, rlabe@na2.us.ml.com

1) **Edelman Plenary: Extended Enterprise Supply Chain Management at IBM Personal Systems Group & Other Divisions, Jean Pierre Briant**, IBM Integrated Supply Chain, Rte. 100, Somers, NY 10589, briant1@us.ibm.com, **Bob Moffat, Grace Lin, David D. Yao, Rob Allan**

The asset management tool is an extended enterprise supply chain analysis tool. It was developed to support IBM's reengineering to achieve quick customer responsiveness with minimal inventory. AMT consists of advanced modeling, optimization, simulation and data extraction modules. It has been implemented at IBM and its channel partners and has generated \$750M savings.

### Tuesday 08:15-09:45

#### TA01 Decision Analysis Awards

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Detlof von Winterfeldt, University of Southern California, Sch. of Policy/Planning/Dev., VKC 368, Los Angeles, CA 90089, detlof@aol.com

#### 1) Decision Analysis Awards

#### TA02 Methods for 0-1 Programming Problems

Cluster: Discrete Optimization

Invited Session

Chair: Matthew J. Saltzman, Clemson University, Dept. of Math. Sci., Clemson, SC 29634-1907, mjs@clemson.edu

1) **A Reformulation & Network-Based Solution Strategy for the Quadratic 0-1 Knapsack Problem, Paul T. Hadavas**, Clemson University, Dept. of Math. Sci., Clemson, SC 29634, phadava@math.clemson.edu, **Warren Adams**

We present an exact solution strategy for the quadratic 0-1 knapsack problem. The method employs a reformulation-linearization technique to promote tight polyhedral-based bounds that are embedded within an enumerative strategy. Maximum flow networks are utilized in a Lagrangian dual approach to compute these bounds throughout the enumeration.

2) **Exploiting Special Structures Through the Use of Conditional Logic, Robin Lougee-Heimer**, IBM TJ Watson Research Center, Rte. 134, PO Box 218, Yorktown Heights, NY 10598, robinlh@us.ibm.com, **Warren Adams**

Conditional logic is a flexible and versatile approach for strengthening mixed 0-1 linear programming formulations. By exploiting special problem structures within the conditional logic approach, we derive new valid linear inequalities which theoretically dominate published coefficient adjustment strategies.

3) **A Cutting-Plane Algorithm Using the Level-2 Adams-Sherali Reformulation Linearization Technique, Matthew J. Saltzman**, Clemson University, Dept. of Math. Sci., Clemson, SC 29634-1907, mjs@clemson.edu, **Jill M. Forrester**

We describe an extension of the Life-and-Project algorithm of Balas, et al.,

incorporating cuts from the level-2 RLT of Adams & Sherali. Extensive computational results will be presented.

### TA03 Buyer-Supplier Interactions in a Supply Chain

**Sponsor:** Manufacturing & Service Operations Management  
**Sponsored Session**

**Chair:** Candace A. Yano, University of California, IEOR Dept., 4135 Etcheverry Hall, Berkeley, CA 94720-1777, yano@ieor.berkeley.edu

#### 1) Coordination in Decentralized Assembly Systems with Uncertain Component Yields, *Haresh B. Gurnani*, HKUST, Dept. of Info. & Sys. Mgmt., Clear Water Bay, Kowloon, Hong Kong, mnharesh@ust.hk, *Yigal Gerchak*

Consider a decentralized assembly system with component production yield losses. Since the number of assembled units equals the lowest component's yield, and each supplier only considers its own costs, the firm needs to devise incentives to align suppliers' interests with each other's and its own. We explore implications of several such schemes.

#### 2) Supply Chain Dynamics under Price & Service Competition, *Andy A. Tsay*, Santa Clara University, Leavey Sch. of Bus. OMIS Dept., 500 El Camino Real, Santa Clara, CA 95053, atsay@sculsb.scu.edu, *Naren Agrawal*

We study a supply chain in which a manufacturer distributes a product to 2 independent retailers, who in turn, use service as well as retail price to directly compete for end customers. We examine the drivers of each firm's strategy, and the consequences for total sales, market share and profitability.

#### 3) Supply Contracts & the Value of Flexibility, *Elizabeth C. Junqueira*, University of California, Dept. of IE/OR, 4135 Etcheverry Hall, Berkeley, CA 94720-1777, junqueir@ieor.berkeley.edu, *J. George Shanthikumar*, *Candace A. Yano*

Quantity flexibility within a supply contract provides value to the customer, but causes additional costs for the supplier. We develop models to assess the value or cost of greater flexibility when multiple customers order goods from a capacity-constrained supplier. These models provide insights into contract design and selection.

#### 4) Matching Supply & Demand: The Value of a Second Chance, *Philip C. Jones*, University of Iowa, College of Bus., 5230B Pappajohn, Iowa City, IA 52242, *Timothy J. Lowe*, *Rodney Traub*

A fundamental problem that an operations manager often faces involves developing and executing a production plan to meet uncertain demand. When production system yields are uncertain, the task is even more challenging. We consider this latter environment, but where there is an opportunity for 2 production periods prior to the realization of demand.

### TA04 Economics Applications

**Contributed Session**

**Chair:** Janet M. Wagner, University of Massachusetts, Dept. of MSIS, 100 Morrissey Blvd., Boston, MA 02125, profwagner@aol.com, wagner@umb.edu

#### 1) A Prescriptive Model for Inclusive Strategic Planning, *Ronald N. Taylor*, Rice University, Jones Grad. Sch. of Admin., 301 Herring Hall, 6100 Main St, Houston, TX 77005-1892, rtaylor@rice.edu

Considerable research attention has been directed to stakeholder "inclusiveness" in the strategic planning process. We draw upon relevant research to develop a prescriptive strategic planning model to get the right stakeholders around the right table, discussing the right issues.

#### 2) An Analytical Proactive Approach for Evaluating Strategic Performance, *Germaine H. Saad*, Widener University, 1 University Place, Chester, PA 19013, germaine.h.saad@widener.edu

Constant and rapid change of business environments resulted in past performance not indicative of future business success. The prevailing financial performance measures, however, focus only on the outcomes already achieved. An analytical process model is introduced which accounts for both current achievements and their impact on the business future.

#### 3) Market Characterization: From Brick & Mortar to On-Line Retailing, *Gilles Reinhardt*, University of Alberta, Fac. of Business, 3-40H Business Bldg., Edmonton, Alberta, T6G 2R6, Canada, gilles.reinhardt@ualberta.ca, <http://www.bus.ualberta.ca/greinhardt>

We first provide a model that encompasses factors that influence the choice of retailer by a generic consumer. Those include price, waiting cost and product intangibility. Secondly, we observe that competitive behavior among retailers will result in separating equilibria where some firms will prefer not to compete

through on-line means.

#### 4) Measuring the US Tax Code for Horizontal Equity, *Janet M. Wagner*, University of Massachusetts, Dept. of MSIS, 100 Morrissey Blvd., Boston, MA 02125, profwagner@aol.com, wagner@umb.edu, cc.umb.edu, *Peter Westort*

Horizontal equity is the principal that equals pay equally. Various measures of horizontal equity have been proposed and used but what is often unrecognized is that each measure uses a different (and sometimes quite odd) underlying model of the tax code. We systematically examine these measures, their underlying models and their pros and cons.

### TA05 Location Models I

**Sponsor:** Section on Location Analysis  
**Sponsored Session**

**Chair:** Oded Berman, University of Toronto, Rotman Sch. of Mgt., 105 St. George St., Toronto, Ontario, M5S 3E6, Canada, berman@mgmt.utoronto.ca, <http://mgmt.utoronto.ca/bios/berman/>

#### 1) Locating Surveillance Cameras using Integer Programming, *Jae Young Choi*, SUNY, Dept. of IE, 342 Bell Hall, Buffalo, NY 14260, jychoi@buffalo.edu, *Joyendu Bhadury*

Locating surveillance cameras reduces to the well-known art gallery problem. We demonstrate how they can be formulated as covering models from location theory and solved using integer programming.

#### 2) A Facility Location Problem with Stochastic Customer Demand, *Qian Wang*, SUNY, Dept. of IE, 342 Bell Hall, Buffalo, NY 14260, qwang@acsu.buffalo.edu, *Rajan Batta*, *Christopher M. Rump*

We study the location of service facilities where customer demand follows a Poisson stream and each facility operates as an M/M/1 queue. We assume that every customer travels to his closest facility to receive service. For this model, we develop several solution procedures and report on their computational performance.

#### 3) Spatial & Temporal Analysis of Forest Fire Initial Attack Systems, *David L. Martell*, University of Toronto, Fac. of Forestry, 33 Willcocks St., Toronto, Ontario, M5S 3B3, Canada, martell@smokey.forestry.utoronto.ca, *Kazi S. Islam*

Forest fire initial attack airtanker systems are spatial queueing system with fires as customers that arrive at rates that vary across time and space and airtankers as servers that travel to their customers. We demonstrate how spatial and temporal variables can be incorporated into daily airtanker deployment models.

#### 4) A Compatibility-Based Genetic Algorithm for the p-Median Problem, *Mark S. Daskin*, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208, daskin@iems.nwu.edu, *Jeffrey Dvoretz*, *Susan H. Owen*

Previous attempts to apply genetic algorithms to the P-median problem have been thwarted by reproduction mechanisms that result in too many or too few facilities being sited. A new approach that circumvents these problems is outlined. The approach is based on the compatibility of parent chromosomes. Test results are presented.

### TA06 System Dynamics in Service & Operations Management

**Sponsor:** Manufacturing & Service Operations Management  
**Sponsored Session**

**Chair:** Edward G. Anderson, University of Texas, Business Sch., Dept. of Mgmt., CBA 4.202, Austin, TX 78712, edanderson@mail.utexas.edu, <http://www.bus.utexas.edu/~anderson/>

#### 1) Feedback Dominance in the Service Profit Chain, *Rogelio Oliva*, Harvard Business School, Soldiers Field Rd., Bakery Library Rm. 182, Boston, MA 02163, roliva@hbs.edu

The service profit chain is a widely used conceptual framework linking employee satisfaction, customer satisfaction and loyalty and financial performance. The framework relies on a series of reinforcing mechanisms. A system dynamics model is used to determine the dominant feedback mechanisms under different scenarios and derive policies to improve performance.

#### 2) What Makes Managers Start Fires?, *Nelson Repenning*, MIT, Sloan School, E53-339, 30 Wadsworth St., Cambridge, MA 02139, nelsonr@mit.edu

Managers often complain that they spend too much time on fire-fighting and not enough time on other activities. I present a simple model suggesting structural

causes of such myopia in operations contexts and show that the result is robust under a variety of assumptions concerning the extent of human rationality.

**3) Impacts of Concealing Rework on Iteration Cycles & Development Project Schedule Performance, David N. Ford, University of Bergen, Dept. Info. Science, Hermann Fossigt 6, Bergen, 5020, Norway, david.ford@ifi.uib.no**

Developers and managers regularly conceal rework requirements from team members. We use a causal dynamic project model to investigate the impacts of concealment on iteration cycles and the 90% syndrome. Iteration cycles are characterized with number, length, speed and concurrence to explain how concealment impacts project schedule performance.

**4) Managing Forward Contracts in Electronics Supply Chains: A Case of Integrating System Dynamics & Real Option Theory, Edward G. Anderson, University of Texas, Business Sch., Dept. of Mgmt., CBA 4.202, Austin, TX 78712, edanderson@mail.utexas.edu, http://www.bus.utexas.edu/~anderson/**

Electronics manufacturers face cyclical shortages in components and contract manufacturing capacity. One way to avoid these is to use forward contracts among firms in the supply chain. However, pricing is often difficult due to unpredictable and rapid obsolescence. System dynamics is used to remedy these problems.

**TA07 Manufacturing Logistics Applications**

**Cluster: Manufacturing & Logistics**

**Invited Session**

**Chair: V. Jorge Leon, Texas A&M University, Dept. of ET/IE, College Station, TX 77843-3367, jleon@acs.tamu.edu**

**1) Work in Process Control in a Semiconductor Wafer Fabrication Facility, Jeffrey S. Smith, Texas A&M University, 239A Zachry Eng. Ctr., College Station, TX 77843-3131, jsmith@tamu.edu, Doug Wilson**

The development and use of lot dispatching strategies at a semiconductor wafer fabrication facility is described. Our goal was to develop a lot dispatching policy that took as input the expected demand for each product family and the WIP position within the fab and determined the lot release strategy for the subsequent period.

**2) Logistics in Mexican/US Manufacturing, J. Rene Villalobos, University of Texas, Dept. of MIE, El Paso, TX 79968-0521, renev@vlobos.me.utep.edu, Paul M. Griffin**

The increasing presence of US manufacturing firms in Mexico requires the reassessment of production and logistics strategies for bi-national manufacturing. We will discuss issues of production/logistics in Mexico and how the infrastructure in Mexico will determine the success of the approach for final product distribution.

**3) A Stochastic Programming Approach to Decentralized Capacity Planning for a Semiconductor Manufacturer, Suleyman Karabuk, Lehigh University, Dept. of IME, 200 West Packer Ave., Bethlehem, PA 18015, suk6@lehigh.edu, S. David Wu**

The strategic capacity-planning problem can be described as finding of how to configure the existing manufacturing facilities for each technology and what capacity expansions to make within the next medium-term planning period. We develop a stochastic programming model to address the problem in a decentralized decision making framework.

**4) Scheduling a High-Mix PCB Assembly Facility, V. Jorge Leon, Texas A&M University, Dept. of ET/IE, College Station, TX 77843-3367, jleon@acs.tamu.edu**

We describe a scheduling project with a world-class company where the facility under consideration is a PCB assembly facility with high-mix of products and erratic demand. The presentation contains the analysis of the products' technical and demand characteristics, and development of a scheduling tool.

**TA08 Military Logistics**

**Sponsor: Section on Logistics**

**Sponsored Session**

**Chair: Mahyar Amouzegar, RAND Corp., 1700 Main St., Santa Monica, CA 90407, mahyar@rand.org**

**1) Understanding the Costs of Quality in Army Logistics, Eric Peltz, RAND Corporation, 1700 Main St., Santa Monica, CA 90407, peltz@rand.org**

The Army has made dramatic gains in the speed of some logistics processes, but the logistics leadership has recognized that an increased focus on quality is required to gain the full benefit of the Velocity Management approach. We begin by defining and measuring the costs of poor quality of Army logistics to

motivate improvement.

**2) Agile Combat Support Posture for the Expeditionary Aerospace Force, Robert Tripp, RAND Corporation, 1700 Main St., Santa Monica, CA 90407, tripp@rand.org, Lionel Galway**

Radical change in the international security environment will require corresponding changes in both in force organization and in logistics support. We present a framework for planning support for the US Air Force's Expeditionary Aerospace Force and provide some preliminary outlines of the infrastructure required.

**3) LANTIRN Support Options for the Expeditionary Aerospace Force: Preliminary Analysis, Amatzia Feinberg, RAND Corporation, 1700 Main St., Santa Monica, CA 90407, feinberg@rand.org**

As the US Air Force's global paradigm shifts from major engagements to more frequent, smaller scale expeditionary missions, logistics support structures of critical weapons systems must change. We assess multiple maintenance structures in light of various operational scenarios over the next 10 years. Our focus is on laser guided munition delivery capabilities...

**4) A Munitions Model for the Expeditionary Air Force, Mahyar Amouzegar, RAND Corp., 1700 Main St., Santa Monica, CA 90407, mahyar@rand.org, Lionel Galway**

One of the major constraints in meeting the timeline demand in the new EAF is the munitions requirement. We have developed an employment-driven logistics process munitions model consisting of rules and algorithms that computes the process timelines and requirements for material, equipment, and personnel.

**TA09 Inventory Management IV**

**Contributed Session**

**Chair: Kwan E. Wee, Purdue University, 205 Airport Rd., Apt. 14, West Lafayette, IN 47906, kwaneng\_wee@mgmt.purdue.edu**

**1) Optimal Allocation of Pallets in Closed Queuing Networks, Gopal Bethmangalkar, University of Arizona, 1010 East Mabel St., #218, Tucson, AZ 85719, gopal@u.arizona.edu, http://www.u.arizona.edu/~gopal, Ronald G. Askin**

The problem of determining the throughput rate with a specified number of pallets in an FMS can be solved using MVA. The problem of determining the number of pallets of each type with specified throughput rate can be solved using a similar problem structure. An algorithm that finds the minimum value for the number of pallets in the system is developed and extended to general service time distributions.

**2) Inventory Management with Stochastic Demand in Overlapping Selling Seasons when Beginning & End of Selling Seasons are also Uncertain, Yih-Long Chang, Georgia Institute of Technology, DuPree Coll. of Mgmt., Atlanta, GA 30332-0520, yihlong.chang@mgt.gatech.edu, B. Joon Park**

It has been observed in the retail industry that there is quite a degree of overlap between successive selling seasons. The beginning and end of selling seasons are often uncertain as well. The traditional newsvendor problem overlooks those issues. Our inventory management model explicitly considers overlapping and uncertainty in selling seasons.

**3) Inventory Management at Service Facilities for Systems with Perishable Items, Kandiyan P. Sapna, University of Toronto, Rotman Sch. of Mgmt., 105 St. George St., Toronto, Ontario, M5S 3E6, Canada, sapna@mgmt.utoronto.ca, Oded Berman**

This article deals with inventory control of perishable products at service facilities. The maximum inventory and number of customers in the system are finite. Orders are placed when inventory is 0 and are replenished instantly. We determine the optimal stocking level that minimizes the expected cost rate for a Markovian system.

**4) A Model to Evaluate the Value of Information Sharing in an Assemble-to-Order Inventory System: A Queuing Approach, Kwan E. Wee, Purdue University, 205 Airport Rd., Apt. 14, West Lafayette, IN 47906, kwaneng\_wee@mgmt.purdue.edu, Maqbool Dada**

Motivated by the prevailing trend of consolidation of warehouses as a way to improve the performance of the supply chain, we study an assemble-to-order inventory system with component commonality under the context of CONWIP (constant-work-in-process). Under CONWIP, the level of WIP is maintained at a constant level...

**TA10 Simulation-Based Optimization****Cluster:** Optimization & Applications**Sponsor:** Optimization Section

Sponsored Session

**Chair:** Gul Gurkan, Tilburg University, Ctr. for Economic Research, PO Box 90153, Tilburg, 5000 LE, The Netherlands, ggurkan@kub.nl

1) **On Rate of Convergence of Monte Carlo Approximations of Stochastic Programs**, *Alexander Shapiro*, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332, ashapiro@isye.gatech.edu, *Tito Homem-de-Mello*

We discuss Monte Carlo simulation-based approximations of a stochastic programming problem. We show that if the corresponding random functions are convex piecewise smooth and the distribution is discrete, then (under mild additional assumptions) an optimal solution of the approximating problem provides an exact optimal solution of the true problem for sufficiently large sample size with probability.

2) **Asymptotics & Confidence Regions for Stochastic Variational Inequalities**, *Mert Demir*, University of Wisconsin, IE Dept., 1513 University Ave., Madison, WI 53706-1539, *Stephen M. Robinson*

We develop asymptotic properties of sample-path solutions for stochastic variational inequalities. The key idea is to reformulate the variational inequality as a single-valued equation by using the normal map. As a byproduct we obtain confidence regions for the solution estimates produced by the sample-path method.

3) **Central Limit Theorems for Perturbation-Analysis-Based Stochastic Approximation with Averaging**, *Pierre L'Ecuyer*, Universite de Montreal, DIRO, CP 6128, Succ Centre-Ville, Montreal, Quebec, H3C 3J7, Canada, lecuyer@diro.umontreal.ca, *Qian-Yu Tang*

Central limit theorems are given for a perturbation-analysis Robbins-Monro single-run optimization algorithm with averaging of the iterates, for Harris-recurrent processes, in terms of the cumulative CPU time. The optimal convergence rate can be reached without identifying the regeneration points explicitly.

4) **Periodic Transportation Scheduling under Uncertainty**, *Tito Homem-de-Mello*, Ohio State University, Dept. of IWSE, 1971 Neil Ave., Columbus, OH 43210-1271, homem-de-mello1@osu.edu, *Anton J. Kleywegt*

We study a logistics problem that is encountered in many industries. In this model, products are distributed to or collected from customers according to a regularly repeating periodic or cyclic schedule. Uncertainty play a role, in the form of unknown demand, and penalties are incurred for customer shortages and route failures...

**TA11 Applications of Optimization in the Process Industry****Cluster:** Industrial Applications of Optimization

Invited Session

**Chair:** Ignacio E. Grossmann, Carnegie Mellon University, Dept. of Chem. Engineering, Pittsburgh, PA 15213, grossmann@cmu.edu

1) **Determining the Value of Corn Hybrids for the Animal Feed Market**, *Matthew H. Bassett*, Dow AgroSciences, 9330 Zionsville Rd., Indianapolis, IN 46268

We discuss the creation of a linear programming optimization tool to determine the marginal value of Supercede\* corn hybrids when sold into the animal feed market. Results generated by this tool are used in negotiations about existing corn hybrids and a measure for advancement of hybrids currently in development.

2) **Supply Chain & Financial Optimization**, *Conor M. McDonald*, EI DuPont de Nemours & Co., CR&D Experimental Station, E1/221, Wilmington, DE 19880-0101, conor@magellan.es.dupont.com

We explore the manner in which large scale optimization is used to analyze the impact of supply chain decisions on the overall financial performance of corporation, with particular emphasis on the the balance sheet and corporate cash flows. Industrial examples featuring extensive and complicated supply chains will be presented.

3) **Optimization of Complete Petrochemicals Production Systems**, *Metin Turkay*, Mitsubishi Chemical Corporation, D&E Res. Ctr. Mizushima Plant, Kurashiki, Okayama, 712, Japan, mturkay@seigi2.mt.m-kagaku.co.jp, *Tatsuyuki Asakura*, *Yukikazu Natori*

Petrochemical complexes are highly integrated combination of process plants. A

systematic approach to treat petrochemical complexes as integrated complete systems rather than a collection of disconnected subsystems was developed using the generalized disjunctive programming framework. The application of the optimization approach is illustrated on a real petrochemical complex.

4) **Optimal Planning & Scheduling of Investment, Development & Operation of a Portfolio of Offshore Gas Fields**, *Sriram Vasantharajan*, Mobil Technology Company, Midway Rd, Dallas, TX 75244, sriram\_vasantharajan@email.mobil.com, *Stan Cullick*, *Aldo Vecchiatti*

Determining an optimal capital investment plan and production policy to develop, manage and monetize a portfolio of gas fields warrants integration of a multitude of technical components to make the best business decisions. The decision process spans the entire production chain: reservoirs, fields, wells, platforms, pipelines, processing, transportation and utilization...

**TA12 Marketing Strategy****Sponsor:** College of Marketing

Sponsored Session

**Chair:** Shilpa Lele-Pingle, Syracuse University, School of Mgmt., Syracuse, NY 13244, slele@syr.edu

1) **The Asymmetric Effect of Marketing vs. Manufacturing Motives on the Evolution of Firm Partnerships**, *Shilpa Lele-Pingle*, Syracuse University, School of Mgmt., Syracuse, NY 13244, slele@syr.edu, *Douglas Bowman*

We study how the motivation (marketing vs. manufacturing) for creating a cross-functional, cross-boundary partnership affects its evolution, and whether it is acquired or disbanded. A model of the determinants of duration and mode of termination of a partnership is developed and tested using data from 2 industries.

2) **Survival Analysis of First Mover Advantages**, *Barry L. Bayus*, University of North Carolina, Kenan Flagler Business Sch., McColl Bldg., CB 3490, Chapel Hill, NC 27599-3490, barry\_bayus@unc.edu, *William P. Putsis, Jr.*, *Bruce G. S. Hardie*

Extensive literature exists on first mover advantages in the marketing, strategy and economics literature. Much of the work on this topic is concerned with which factors (i.e., related covariates) drive "success" in the industry being studied. However "success" vis-a-vis first mover advantages and order-of-entry effects can take on many meanings...

3) **Managing Customer-Initiated Contact: The Impact on Customer Loyalty**, *Douglas Bowman*, Emory University, Goizueta Sch. of Bus., Atlanta, GA 30322, doug\_bowman@bus.emory.edu, *Narakesari Narayandas*

Customer-initiated contacts represent opportunities for vendors to build and manage customer loyalty and to influence word-of-mouth. We develop a model to explain the response to vendor performance during customer-initiated contacts and test it using data from over 1,500 customer-initiated contacts.

4) **Competitive Advertising & Brand Rivalry**, *Dung Nguyen*, University of Pittsburgh, 240 Mervis Hall, Pittsburgh, PA 15260

We first propose a theoretical structure to characterize multi-brand firms' optimal advertising strategies and then subject the model to econometric analysis. While the literature has focused on competition among single-brand firms where rival brands are clearly designated, truly rivalrous brands in a multi-brand competitive environment may NOT be identified a priori...

**TA13 Structural Models****Sponsor:** College of Marketing

Sponsored Session

**Chair:** Surendra Rajiv, University of Chicago, Grad. Sch. of Bus., 1101 E 58th St., Chicago, IL 60615

1) **A Structural Model of Household Response to Promotions**, *P. B. Seetharaman*, Washington University, Olin Sch. of Business, St. Louis, MO

When marketing researchers estimate brand choice models using scanner panel data, it is typically assumed that households maximize product class utility in the current period only. However, in some product categories, households stockpile on deals, i.e., they buy more than the amount necessary for current-period consumption...

2) **Active vs. Passive Loyalty: A Structural Model of Consideration Set Formation**, *Nitin Mehta*, University of Chicago, *Surendra Rajiv*, *Kannan Srinivasan*

We offer an econometric framework that models consumer's brand choice decision as a 2-stage process: consideration set formulation followed by brand selection from the brands in the consideration set. We formulate a structural

model that allows past purchases and market mix variables to affect both the stages of the decision process...

**3) Cross Selling & Customer Retention in the Financial Industry, Baohong Sun,** Carnegie Mellon University, Grad. Sch. of Indust. Admin., Pittsburgh, PA 15213, bsun@andrew.cmu.edu, *Fusun Gonul*

Companies grow by cross-selling services to existing customers than by attracting new customers. Further, customer retention is enhanced with cross-selling of multiple accounts or services as customer switching costs increase with multiple relationships. These realizations have led to a focus on relationship management over customer lifetime and cross-selling in financial services industry.

**4) A Structural Model of Brand Choice & Purchase Quantity Decisions, B. P. S. Murthi,** University of Texas, Sch. of Mgmt., Box 830688, Richardson, TX 75083-0688, *Surendra Rajiv, Kannan Srinivasan*

We propose a structural model of simultaneous quantity and brand choice decisions in a consumer goods product category. We adopt a flexible functional form specification of the indirect utility function. We also incorporate state dependence and habit persistence as well as a detailed unobserved heterogeneity structure. The comprehensive specification of the detailed unobserved heterogeneity structure...

**TA14 Evolving Issues of New Technologies**

**Sponsor:** Technology Management Section  
Sponsored Session

**Chair:** Lanny Karns, SUNY, Sch. of Business, Oswego, NY 13126, karns@oswego.edu

**1) An Analysis of Core Competencies within the Context of Performance Management Systems, Manuel A. Mena,** SUNY, Sch. of Bus., Oswego, NY 13126, mena@oswego.edu, *Lanny Karns, Kenneth Shaw*

Performance management systems are crucial to any management development program, especially those within high performance organizations experiencing technology transformation. The nucleus of this study is the identification of those core competencies employed within those systems and their subsequent utility as performance criteria.

**2) Modeling Social & Cultural Characteristics in the Diffusion of Technology, Ding Zhang,** SUNY, School of Business, Oswego, NY 13126-2529, zhang@oswego.edu, *Jonathan H. Owen, Alfred Nioko, June Dong*

A mathematical model was developed to study the social and cultural characteristics in the diffusion of technology. Of particular interest is the second diffusion of existing technology in new markets where government policies, social behavior and cultural and technology environments are crucial factors for success.

**3) The Emperor's New Degree: Higher Education & the Internet, Daryl Close,** Tiffin University, Dept. of Philosophy, 155 Miami St., Tiffin, OH 44883, dclose@compuserve.com, *Richard Skolnik*

The Internet has been forecasted to have a profound impact on the structure of higher education. Traditional colleges are warned of extensive competitive pressures from degree programs delivered over the Internet. We develop a framework for analyzing the efficacy of Internet-delivered degree programs.

**4) The Impact of the National Labor Relations Act on the Introduction of New Technologies, Steven E. Abraham,** SUNY, Sch. of Bus., 109F Swetman Hall, Oswego, NY 13126, abraham@oswego.edu, *Bart D. Finzel*

Firms must give consideration to legal implications before adopting innovations to support new technologies. An area of the law that is often overlooked is the NLRA. Further, given current interpretations, many provisions of the NLRA inhibit the ability of unionized firms from adopting workplace innovations that complement and support new technologies.

**TA15 Publishing in Technology Management Journals: Editors Forum II**

**Sponsor:** Technology Management Section  
Sponsored Session

**Chair:** Dundar Kocaoglu, Portland State University, Eng. Mgmt. Program, Portland, OR 97207-0751, kocaoglu@emp.pdx.edu

**1) Publishing in Technology Management Journals: Editors Forum II, Dundar Kocaoglu,** Portland State University, Eng. Mgmt.

Program, Portland, OR 97207-0751, kocaoglu@emp.pdx.edu, *Hal Linstone, Fred Phillips*

No abstract supplied.

**TA16 Airline Forecasting & Cargo Revenue Management**

**Sponsor:** Revenue Management Section  
Sponsored Session

**Chair:** Dirk P. Guenther, SABRE Technology Solutions, Research Group, 1 East Kirkwood Blvd., MD 7390, Southlake, TX 76092, dirk\_guenther@sabre.com

**1) Stochastic Approximation in Revenue Management Problems when Demands are Nonstationary, Jeff I. McGill,** Queen's University, Sch. of Business, Kingston, Ontario, K7L 3N6, Canada, jmcgill@business.queensu.ca, *A. J. Taylor*

We discuss statistical issues relating to the application of stochastic approximation to sequences of single period inventory and revenue management problems.

**2) Hierarchical Forecasting for Origin & Destination Airline Applications, John D. Salch,** PROS Strategic Solutions, 3223 Smith, Ste. 100, Houston, TX 77006, jsalch@prosweb.com, *Edward L. Kambour III*

Forecasting demand for airline seats in an O&D environment poses many difficulties. Sparse data is standard and requires specialized models. Correlation exists at many levels which further complicates the models. Hierarchical techniques for addressing these issues will be addressed.

**3) Benefits of a Bid Price Control Policy in Airline Cargo Revenue Management, Mikael Weigelt,** PROS Strategic Solutions, 3800 Buffalo Speedway, Ste. 350, Houston, TX 77098, mweigelt@prosweb.com, *Shankar Sivaramakrishnan*

We discuss an LP formulation of the short-term cargo revenue management problem. The model is used to determine bid prices which in turn lead to accept/reject decisions for cargo transportation requests. Based on a simulation study, we show the large profit potential of revenue management in the airline cargo industry.

**4) Routing Consideration in the Airline YM Problem, Dirk P. Guenther,** SABRE Technology Solutions, Research Group, 1 East Kirkwood Blvd., MD 7390, Southlake, TX 76092, dirk\_guenther@sabre.com, *Victoria C. P. Chen, Ellis L. Johnson*

Our research deals with the cargo YM problem. That is, we investigate how cargo routing can be modeled as part of the YM problem. We discuss modifications of models for the passenger YM problem and present some computational results.

**TA17 Production Planning II**

Contributed Session

**Chair:** Sergio V. Maturana, Catholic University of Chile, Casilla 306, Correo 22, Santiago, 22, Chile, smaturan@ing.puc.cl

**1) A Two-Machine Flowshop Batching Problem with Minimum Flow Time, Michal Tzur,** Tel Aviv University, Dept. of IE, Tel Aviv, 69978, Israel, tzur@eng.tau.ac.il, *Joseph Bukchin, Michal Jaffe*

We analyze a 2-machine flowshop batching problem with subplot-attached setups. The objective is minimum average flow time and general batch sizes are allowed. We identify properties of the optimal solution and provide an algorithm to solve the problem. Our computational study indicates that our solution technique is very efficient.

**2) Bicriteria Stochastic Single Machine Scheduling, Hossein H. Soroush,** Kuwait University, Dept. of Stats. & OR, PO Box 5969, Safat, 13060, Kuwait, hsoroush@kuc01.kuniv.edu.kw

We study the problem of scheduling a static set of jobs on a single machine when job attributes are stochastic. The objective is to find an optimal schedule which minimizes the expected value of a cost function of 2 performance criteria associated with each schedule. Exact solution procedures are proposed for some cost functions.

**3) Scheduling N Products with Variable Demand on a Single Facility, Mohsen ElHafsi,** University of California, Anderson Grad. Sch. of Mgmt., Riverside, CA 92521-0203, mohsen.elhafsi@ucr.edu, *Bajis M. Dodin*

The problem of scheduling N independent products on a single production facility is studied. It is assumed that the demand varies over time. Demand can be backordered or lost, and the setup cost is sequence dependent. Several

theoretic results are developed leading to an efficient B&B method for solving the problem. Computational results are provided.

**4) Analysis of Applying Robust Optimization to the Aggregate Production Planning of a Manufacturing Firm, Sergio V. Maturana,** Catholic University of Chile, Casilla 306, Correo 22, Santiago, 22, Chile, smaturan@ing.puc.cl, **Benjamin F. Plaut**

Using historic data, we compare the results that would have been obtained using robust optimization and deterministic optimization to support the aggregate production planning process with the real plans generated by the planners. We try to determine how well each of these would have performed given uncertain demand.

## TA18 Boolean Functions & Generalizations

Cluster: Discrete Optimization

Invited Session

Chair: Peter L. Hammer, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854-8003, hammer@rutcor.rutgers.edu

**1) Representations of Discrete & Pseudo-Boolean Functions, Jan C. Bioch,** Erasmus University Rotterdam, Dept. of Comp. Sci., FEW H9-30, P.O. Box 1738, Rotterdam, 3000 DR, The Netherlands, bioch@few.eur.nl

We discuss representations of discrete functions and pseudo-Boolean functions such as normal forms. We show that pseudo-Boolean functions can be viewed as discrete functions and discuss the relationship between the representations of pseudo-Boolean functions and discrete functions.

**2) Boolean Concepts in Convexity, Stephan Foldes,** Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854, sfoldes@rutcor.rutgers.edu, **Peter L. Hammer**

The Boolean notions of implicant, prime implicant, disjunctive and conjunctive normal form are generalized to discrete convexity spaces, of which the Boolean cube is an example. We show the validity of the consensus method, dual resolution method and double dualization method under certain separability assumptions.

**3) Classes of Pseudo-Boolean Functions, Peter L. Hammer,** Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854-8003, hammer@rutcor.rutgers.edu, **Stephan Foldes**

Pseudo-Boolean functions, i.e. real-valued functions in several 0-1 variables, have lattice-algebraic representations similar to the disjunctive and conjunctive normal forms of Boolean functions. We present characterizations of these representations for the classes of monotone, linear, quadratic, Horn, disjunctive submodular and supermodular pseudo-Boolean functions.

## TA19 Transportation Forecasting

Cluster: Forecasting Transportation

Invited Session

Chair: Kenneth D. Lawrence, NJIT, School of Mgmt., Newark, NJ 07102, lawrence@tesla.njit.edu

**1) Freight Forecasting using Geographic Information Systems, Maria Boile,** Lafayette College, Dept. of Civil & Environ. Eng., Easton, PA 18042, maria@athena.cadlab.lafayette.edu, **Jeremy Brodney**

A combination of numerical methods and probabilistic analysis has been used to develop a freight forecasting model. We present the development and implementation of this model in a GIS environment.

**2) Predicting Inter- & Intra-County Freight Flows: A Comparison of Models, Kenneth D. Lawrence,** NJIT, School of Mgmt., Newark, NJ 07102, lawrence@tesla.njit.edu, **Gary B. Kleinman**

We build on previous work that developed a regression-based model for forecasting truck borne between states in the continental US. Prior forecasting models proved capable of predicting interstate freight flow information. We study demonstrates that the model is also useful in predicting freight flow at the county-level for New Jersey.

**3) The Effects of Using Censored Data in a Yield Management System, Richard H. Zeni,** SABRE Technology Solutions, 2345 Crystal Dr., Arlington, TX 22227, rick\_zeni@notes.sabre.com

A yield management forecasting system uses historical booking data to generate forecasts of future demand. This data is often constrained by either the capacity of the aircraft or the booking limit of the fare class. The problem of using censored demand data in a yield management system is studied...

## TA20 Space Shuttle Upgrades

Contributed Session

Chair: Louis R. Fussell, Futron Corp., 1120 NASA Rd. One, Ste. 310, Houston, TX 77058, lfussell@futron.com, http://www.futron.com

**1) Decision Analysis Support for Space Shuttle Improvements, Keith A. Pauley,** United Sp Alliance, 1150 Gemini, Houston, TX 77686, keith.a.pauley@usahq.unitedspacealliance.com

United Space Alliance (USA) has developed the Shuttle Advanced Vehicle Improvement Evaluation (SAVIE) tool and supporting process to assess space shuttle system upgrades and modifications. SAVIE utilizes multi-attribute DA methodology which maps benefits to the Space Shuttle Program goals and objectives. An explicit financial business case analysis is also used to support programmatic decision-making.

**2) Optimizing the Space Shuttle Upgrades Program for Twenty First Century Effectiveness, Kerry N. Lohr-Williams,** Boeing North American, 12214 Lakewood Blvd., MS AA-96, Downey, CA 90242-2693, kerry.lohr-williams@boeing.com

Boeing uses artificial intelligence GAs to optimize the Space Shuttle Upgrade Program. The Boeing model maximizes total program effectiveness, through time, by selecting the best combination of which upgrades to perform and when. Effectiveness measures include both monetary and non-monetary benefits such as shuttle safety and reduced turnaround time.

**3) Strategic Upgrade Shuttle Planning, Elric McHenry,** NASA, NASA-JSC, Code MA, 2101 NASA Rd. 1, Houston, TX 77058, elric.n.mchenry1@jsc.nasa.gov

The space shuttle development goal is to operate a strategic and proactive upgrade program to keep the shuttle flying safely and efficiently until 2012 and beyond. To do this, the shuttle program development office integrates upgrade information from various advocates and independent assessments to determine the best shuttle upgrade portfolio.

**4) A Space Shuttle Upgrades Decision Support System, Louis R. Fussell,** Futron Corp., 1120 NASA Rd. One, Ste. 310, Houston, TX 77058, lfussell@futron.com, http://www.futron.com, **David K. Yeung, Barney B. Roberts**

The Space Shuttle Upgrades DSS uses cost utility functions to integrate upgrade information into a single expected upgrade value (EUUV). The EUUV is then used to compare the relative merit of a large number of upgrade candidates and focus attention on the upgrades with the greatest potential.

## TA21 Airline Crew Scheduling

Contributed Session

Chair: Stefan E. Karisch, Carmen Systems AB, Odinsgatan 9, Gothenburg, S-411 03, Sweden, stefan.karisch@carmen.se, http://www.carmen.se

**1) Airline Crew Rostering Optimization, Niklas Kohl,** Carmen Systems AB, Odinsgatan 9, Gothenburg, S-411 03, Sweden, naklas.kohl@carmen.se, http://www.carmen.se, **Stefan E. Karisch, Peter Sutton**

It is a challenging optimization problem to create optimal personalized crew rosters which include preassignments and training requirements while satisfying all rules and regulations. We present results obtained using the Carmen crew assignment system together with a number of major airlines.

**2) Column Generation with a Rule Modeling Language for Airline Crew Pairing, Curt A. Hjorring,** Carmen Systems, Odinsgatan 9, Gothenburg, SE-411 03, Sweden, curt.jhorrning@carmen.se, http://www.carmen.se, **Jesper Hansen**

The rules that define pairings are complex and were previously hard coded into column generators. A more general solution is a rule system that returns a simple yes/no for a partial/complete pairing. We present results from a rule system-based column generator, concentrating on the network refinements that provide performance.

**3) Constraint Programming-Based Column Generation for Airline Crew Assignment, Stefan E. Karisch,** Carmen Systems AB, Odinsgatan 9, Gothenburg, S-411 03, Sweden, stefan.karisch@carmen.se, http://www.carmen.se, **Niklas Kohl, Ulrich Junker, Torsten Fahle, Meinolf Sellman**

Column generation is commonly used for solving problems such as airline crew assignment with complex and difficult constraints. We formulate the subproblem as a constraint satisfaction problem and introduce an efficient path constraint exploiting dual information from the master problem. We present computational results based on real crew assignment data.

**TA22 Information Systems****Contributed Session**

**Chair:** Pedro R. Kanof, George Washington University, School of Eng. & Applied Sci., 1669 32nd St. NW, Washington, DC 20007, pkanof@aol.com

1) **South Jersey Hospital Systems, Shaoping Zhao**, Stockton College of New Jersey, Jim Leeds Rd., Pomona, NJ 08240-0195, szhao@stockton.edu, **Haidong Liu**

Our analysis shows that SJHS and their information systems are evolving processes. The combination of the 2 is a challenging integration for any organization. We also provide detailed analysis of the development of SJHS information and SJHS strategies to counter competitive forces and meet customer's demand through the information systems.

2) **The Web Classroom of the Future, Walter E. Rodriguez**, Florida Gulf Coast University, 10501 FGCU Blvd. So., Fort Myers, FL 33965-6565, wrodriguez@fgcu.edu, <http://www.fgcu.edu/wrodriguez>

An integrated Java-based environment has been developed for learning web-based management information systems at Florida Gulf Coast University's Department of Computer Information Systems. We present the distributed learning strategies as well as the integrated use of commercial and in-house course shells. The Web Classroom of the Future (<http://itech.fgcu.edu/cis/image.htm>) consists of integrated course management software...

3) **Mitigating Moral Hazard in Information Technology Contracting With A Pilot Project, Eli M. Snir**, University of Pennsylvania, The Wharton Sch., 1348 SH-DH, OPIM Dept., 3620 Locust Walk, Philadelphia, PA 19104, eli@wharton.upenn.edu

Two-staged contracts can be used to mitigate some of the difficulties of contracting for IT that stem from the inability to monitor vendors, even when client's benefits are non-contractible. Analyzing the game-theoretic implications of such contracts provides insight into the efficiency losses from current practices.

4) **Y2K: Projection of Hope for the Future, Pedro R. Kanof**, George Washington University, School of Eng. & Applied Sci., 1669 32nd St. NW, Washington, DC 20007, pkanof@aol.com

We ask how the Y2K problem came to be and what can be done to prevent similar problems in the future. Previous software development followed the irrational course of minimizing the cost of testing and documentation, resulting in millions of lines of code with incomplete development or testing documentation.

**TA23 Modeling Competition in Electricity Supply**

**Sponsor:** Energy, Natural Resources & the Environment

**Sponsored Session**

**Chair:** Scott Rogers, University of Toronto, Dept. of MIE, 5 Kings College Rd., Toronto, Ontario, M5S 3G8, Canada, rogers@mie.utoronto.ca

1) **Model-Based Comparison of Pool vs. Bilateral Trading of Electricity, Derek W. Bunn**, London Business School, Sussex Place, Regents Park, London, NW1 4SA, England, UK, dbunn@lbs.ac.uk, **John Bower**

One of the basic design issues in the creation of competitive electricity markets relates to the relative merits of pool, day-ahead auctions versus continuous, bilateral trading. We use agent-based simulation, applied in detail to the proposed changes to the England and Wales Pool.

2) **On Detrimental Network Investments, Yves Smeers**, Universite Catholique de Louvain, CORE, 34 Voie du Roman Pays, Louvain la Neuve, 1348, Belgium, smeers@core.ucl.ac.be, **Jacqueline Boucher, Olivier Daxhelet**

Investments in the grid remain a difficult issue in restructured electricity systems. We extend some theorems of Bushnell & Stoft on detrimental network investments to market power and alternative transmission pricing rules.

3) **GENCOMP 3.0: A Model of Competition among Generating Firms, Scott Rogers**, University of Toronto, Dept. of MIE, 5 Kings College Rd., Toronto, Ontario, M5S 3G8, Canada, rogers@mie.utoronto.ca

We describe a model of competition among electric generating firms. The model allows different types of firms: strategic, traditional and supply curve and various classes of demand. It solves for a Nash equilibrium. Applications to real systems are described.

**TA24 Modeling Health Care Operations**

**Sponsor:** Health Applications Section

**Sponsored Session**

**Chair:** Murray J. Cote, Trinity University, 715 Stadium Dr., San Antonio, TX 78212-7200, mjccote@trinity.edu

1) **Allocating Beds Between Private & National Health Service Patients, Ann van Ackere**, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, UK, avanackere@lbs.ac.uk, **Christian Haxholdt**

A hospital present in the private and NHS markets must allocate beds between both sectors. Challenges include defining a suitable objective, trading off waiting times, revenue, resource utilisation, etc. A key issue is whether revenues generated by treating private patients can be allocated to treating NHS patients.

2) **An Application of Market & Capacity Analysis for Locating & Sizing a Rural Neonatal Intensive Care Unit, Charles E. Noon**, University of Tennessee, 613 SMC, Knoxville, TN 37996-0562, cnoon@utk.edu

This presentation is concerned with the locating, sizing and staffing of an NICU. The proposed unit is designed to provide NICU service for a system of rural hospitals. A finite-capacity queuing model was used in conjunction with a GIS representation of market and competition.

3) **The Patient-Care Episode & Examining Room Capacity, Murray J. Cote**, Trinity University, 715 Stadium Dr., San Antonio, TX 78212-7200, mjccote@trinity.edu

The stochastic model is constructed for patient-care episodes in a family practice clinic. The model's purpose is 2-fold. First, the model provides an individual patient's perspective of the patient-care episode. Second, through an amendment to the model, the impact of examining room capacity on the patient-care episode is examined.

4) **Modeling Proposed In-Patient Hospital Drug Distribution Systems: Procedures vs. Practice, Ann van Ackere**, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, UK, avanackere@lbs.ac.uk, **Bryony S. Dean, Nicholas D. Barber, Stephen Gallivan**

An observational study of medication administration errors revealed significant discrepancies from the improvements predicted by the simulation model. This model represented procedures which ought to be followed in the present distribution system, rather than actual behaviour, implying that alternative systems were compared to an inappropriate base-case.

**TA25 Optimization Theory Potpourri****Contributed Session**

**Chair:** Halit Uster, University of Alabama, IE Dept., Box 870288, Tuscaloosa, AL 35487-0288, huster@coe.eng.ua.edu

1) **A Study of the Multiple Choice Multi-Period Knapsack Problem, Edward Y. H. Lin**, University of New Brunswick, Faculty of Admin., PO BOX 4400, Fredericton, NB, E3B 5A3, Canada, yhlin@unb.ca

We examine the multi-period knapsack problem with multiple choice constraints in the interface of multiple choice programming and knapsack problems. We first study the properties of the problem and present 2 heuristics. By incorporating these 2 heuristics, we then introduce 2 enumeration methods to locate the true optimum of the problem. Preliminary computational experience is reported.

2) **withdrawn - author request of 10/1, Christiano Lyra**, State University of Campinas, FEEC-UNICAMP-CP 6101, Campinas Sao Paulo, 13081-970, Brazil, chrlyra@densis.fee.unicamp.br, **Marcos N. da Costa**

3) **Local Search Algorithms for the Bin-Packing Problem & their Relationships to Various Construction Heuristics, Takayuki Osogami**, IBM Japan Ltd., 1623-14 Shimotsurama, Yamato-shi, Kanagawa-ken, 242-8502, Japan, osogami@jp.ibm.com, <http://www.sf.t.u-tokyo.ac.jp/~osogami/>, **Hiroyuki Okano**

A tradeoff between the speed and the qualities of solutions by various local search algorithms for the bin-packing problem is discussed. Intensive numerical experiments show that their performances depend on the initial solutions built by the construction heuristics. A new local search algorithm that has a good tradeoff is proposed.

4) **withdrawn - author request of 8/24, Prabhu Manyem**, North Carolina State University, Dept. of OR, Box 7913, Raleigh, NC

27695-7913

5) **Duality in Constrained Continuous Location Models**, *Halit Uster*, University of Alabama, IE Dept., Box 870288, Tuscaloosa, AL 35487-0288, huster@coe.eng.ua.edu, *Robert F. Love*

We consider an LP norm multi-facility continuous location model with linear and distance constraints and provide the dual formulation which has a linear objective function. We also present a numerical example on the solution of the dual formulation.

#### TA26 Queues with Heavy-Tailed Input and/or Service

Sponsor: Applied Probability Society  
Sponsored Session

Chair: Carl M. Harris, George Mason University, Sch. of Info. Tech. & Eng., Fairfax, VA 22030, charris@gmu.edu

Co-Chair: Martin J. Fischer, MITREtek Systems, Mclean, VA 22101, mfischer@mitretek.org

1) **Pareto Queues**, *Carl M. Harris*, George Mason University, Sch. of Info. Tech. & Eng., Fairfax, VA 22030, charris@gmu.edu, *Martin J. Fischer*

The management of the Internet requires analysis methods for queues with heavy-tailed interarrival and/or service distributions such as the Pareto. The key problem is that the use of such heavy-tailed distributions does not allow development of simple congestion formulas, especially in situations in which the relevant random variables do not possess all moments...

2) **Long-Range Dependence & Queueing Effects for Variable Bit Rate Video**, *Daniel P. Heyman*, AT&T Bell Laboratories, Holmdel, NJ 07733, dph@buckaroo.ho.att.com, *T.V. Lakshman*

We present results concerned with source models for H.261 coded variable bit rate video. As video sources make up more of the traffic on emerging broadband digital networks, statistical source models of video traffic are needed to design networks that deliver acceptable picture quality at minimum cost, and to control and shape the output rate of the coder.

#### TA27 Dynamic Programming Approximations

Cluster: Dynamic Programming  
Invited Session

Chair: Benjamin Van Roy, Stanford University, Dept. of EES/OR, Terman Engineering Ctr., Stanford, CA 94305-4023, bvr@stanford.edu

1) **Neuro-Dynamic Programming & Rollout Algorithms**, *Dimitri P. Bertsekas*, MIT, 77 Massachusetts Ave., Rm. 35-210, Cambridge, MA 02139, dimitrib@mit.edu, *John N. Tsitsiklis*

We will provide an overview of neuro-dynamic programming and will discuss new developments, including the analysis and the computation of rollout policies in stochastic optimal control and in combinatorial optimization.

2) **Reinforcement Learning for Global Optimization**, *Justin Boyan*, NASA Ames, jab+@cs.cmu.edu

One view of reinforcement learning is that it considers the trajectories produced during search as data to be mined for enabling improved decision-making on future search trajectories. We will review recent work on applying learning to combinatorial optimization domains in this way and present new results in a TSP-like flight planning domain.

3) **Stability of Approximate Value Iteration & Applications in Finance**, *Benjamin Van Roy*, Stanford University, Dept. of EES/OR, Terman Engineering Ctr., Stanford, CA 94305-4023, bvr@stanford.edu

We will discuss instabilities that arise in approximate value iteration and we will show how these instabilities can be overcome for 2 particular classes of problems: options pricing and dynamic portfolio optimization.

4) **Parameter Estimation for Dynamic Programming Approximations**, *Anton J. Kleywegt*, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, anton@isye.gatech.edu

The optimal value function of a dynamic program is often approximated with a parameterized function. Several methods have been proposed to estimate the parameters, including stochastic approximation. These have desirable properties, but suffer from slow convergence. Alternative methods are proposed and compared.

5) **Multi-Value Functions: Efficient Automatic Action Hierarchies for Multi-Goal Markov Decision & Reinforcement**

**Learning Tasks**, *Andrew Moore*, Carnegie Mellon University, Robotics Inst., Sch. of Computer Sci., Pittsburgh, PA 15213

When you've planned a strategy to get to some goal in an uncertain, noisy world, but then someone asks about a different goal, what do you do? We review some approaches and come up with a somewhat surprising result: it's actually not much harder to plan in advance for all possible start/goal combinations than for just one start and/or goal...

#### TA28 Core Techniques to Match Assets with Demand in the IBM Microelectronics SCM Process

Cluster: E-Business & Decision Technology in Semiconductors  
Invited Session

Chair: Dan S. Dangat, IBM Microelectronics Division, PROFIT Dept., Essex Junction, VT 05402, dangat@us.ibm.com

1) **Advanced MRP at IBM Microelectronics**, *John Milne*, IBM Microelectronics Division, PROFIT Dept., Essex Junction, VT 05402, jmilne@us.ibm.com

We will describe an MRP specific to the semiconductor industry that integrates LPs and MRP logic to substantively improve the quality of the MRP run and still meet performance objectives. AMRP is a critical tool for IMD and runs every night setting factory floor priorities.

2) **Projecting WIP Forward to Stocking Points at IMD**, *Roger R. Gung*, IBM Industry Solutions Lab., Supply Chain Opt., 17 Skyline Dr., J1-G35, Hawthorne, NY 10532, rgung@us.ibm.com

The number of operations in the production of semiconductor products can number over 400. Typically, core engines to match assets with demand prefer to operate with far fewer manufacturing activity decision points and little value add is lost by this aggregation. However, the key is to have a robust process to flush the WIP forward...

3) **Available to Promise at IBM Microelectronics**, *Rahul Nahar*, IBM Microelectronics Division, PROFIT Dept., Essex Junction, VT 05402, rnahar@us.ibm.com, *Rahul Jindani*

We will provide an overview of the ATP application at IMD. Specific focus will be provided on how this tool integrates with the matching engine output, makes use of the WEB, communicates with SAP and the rules used to govern ATP decisions.

#### TA29 Software Demonstration V Software Demo Session

Chair: To be announced

1) **Palisade Corporation**, *Sam McLafferty*, Palisade Corporation, 31 Decker Rd., Newfield, NY 14867, tgradel@palisade.com

We will demonstrate @RISK 4.0. @RISK is a Monte Carlo simulation add-in to Microsoft Excel, the world's leading risk analysis tool. Just released, version 4.0 includes 2 decision analysis tools that until now had been available only as separate programs: BestFit, which fits distribution functions to data sets, and RISKview, which allows previewing and editing of distribution curves...

2) **A Multicriteria, Multi-Scenario, Multi-Actors Decision-Making Software: Decision Lab 2000**, *Alexandre Cvetkovic*, Visual Decision, Inc., acvetkovic@visualdecision.com

Decision Lab 2000 Executive Edition is productivity software that helps the user find the best solution to even the most challenging decisions. Based on the PROMETHEE methods developed at the Free University of Brussels, Decision Lab 2000 includes major improvements over existing software: partial and complete rankings...

#### TA30 Tutorial: Collaboration Mechanisms for Autonomous Software Agents

Sponsor: INFORMS Computing Society  
Sponsored Session

Chair: Sarosh Talukdar, Carnegie Mellon University, Dept. of ECE, Pittsburgh, PA 15213, talukdar@ece.cmu.edu

1) **Tutorial: Collaboration Mechanisms for Autonomous Software Agents**, *Sarosh Talukdar*, Carnegie Mellon University, Dept. of ECE, Pittsburgh, PA 15213, talukdar@ece.cmu.edu, *Sesh Murthy*

This tutorial covers collaboration mechanisms by which teams of diverse software agents can become effective in solving optimization problems. The mechanisms used by scientific communities, insect societies and other organizations are identified. A taxonomy of mechanisms is developed. The use of its better members is illustrated for multiobjective, steel-mill scheduling.

**TA31 Stochastic Maintenance & Production/Inventory Models****Cluster:** Reliability Modeling**Invited Session****Chair:** Ulku Gurler, Bilkent University, Endustri Muhendisligi Bolumu, Dept. of IE, Ankara, 06533, Turkey, ulku@bilkent.edu.tr

1) **A Multiple-State/Inventory System Subject to Failure, *Izak Duenyas***, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109, duenyas@umich.edu, *Seyed Iravani*

We analyze the optimal repair and inventory control policy in a production/inventory system consisting of a single multiple-state machine which is subject to random shocks. A simple structured policy is then introduced to approximate the optimal policy. Finally, a heuristic approach is developed for our simple control policy.

2) **Approximation of System Effectiveness of a Production System with Output Buffer, *Frank A. Van Der Duyn Schouten***, Tilburg University, Ctr. of Economic Research, PO Box 90153, Tilburg, 5000 LE, The Netherlands, f.a.vdrduynschouter@kub.nl, *Stephan G. Vanneste*

An approximate method is developed to calculate the system effectiveness of a complex production system with a single output buffer. The system consists of many components, each of which is subject to random failure and repair with exponentially distributed repair times. The approximation method is based on the regenerative analysis of a stochastic process. The result has been successfully applied in the design phase of production facilities in oil and gas industries.

3) **Bayesian Replacement Strategies for Railroad Tracks, *Refik Soyer***, George Washington University, Monroe Hall 403, MS Dept., 2115 G St. NW, Washington, DC 20052, soyer@gwu.edu, *Jason R. W. Merrick*

We present a modulated Poisson process model to describe the failure behavior of rail tracks. In this model, the intensity function of the process accounts for wear and the effect of covariates. We discuss parametric and semiparametric Bayesian approaches for the analysis and present optimal replacement strategies for rail tracks by accounting for covariate information.

4) **A Policy for the Maintenance of a Multistate Multicomponent Series, *Alev Kava***, Columbia University, IEOR Dept., 500 West 120th St., New York, NY 10027, alev@ieor.columbia.edu, *Ulku Gurler*

For maintenance purposes, various levels of performance are identified for components. We consider a multicomponent system where each component's lifetime is described by several stages. A control policy is employed where each component is replaced immediately upon failure and the system is replaced when the number of components in the critical stage exceeds a threshold value...

**TA32 Pricing Data Communication Networks****Sponsor:** Technical Section on Telecommunications**Sponsored Session****Chair:** Philipp Afeche, Northwestern University, Dept. of Mgr. Econ. & Dec. Sci, Kellogg Grad. Sch. of Mgmt., Evanston, IL 60208-2001, p-afeche@nwu.edu

1) **Demand & Provisioning of Quality-Differentiated Internet Access, *Pravin P. Varaiya***, University of California, Dept. of EECS, Berkeley, CA 94720, varaiya@eecs.berkeley.edu, *Richard Edell*

Although flat-rate continues to be the predominant form in which Internet access is sold, that form of pricing is unviable. We discuss the provisioning and demand for quality-differentiated Internet access as revealed in the ongoing market trial INDEX (Internet Demand Experiment). Started in April 1998, it involves about 70 participants.

2) **Delivering Multiple QoS Via a Market-Based Web Caching & Replication System, *Jeffrey Mackie-Mason***, University of Michigan, Dept. of Economics, Lorch Hall, Sch. of Info., Ann Arbor, MI 48109, jmm@umich.edu

We present a simple generalization of existing caching replacement and service policies to implement a multiple-QoS network service. Our market-based procedure induces efficient load distribution across users and adaptation across multiple distributed caches. Experimental data show that our system delivers higher aggregate user value than LRU and LFU.

3) **Price & Service Differentiation in Data Networks, *Philipp Afeche***, Northwestern University, Dept. of Mgr. Econ. & Dec. Sci, Kellogg Grad. Sch. of Mgmt., Evanston, IL 60208-2001, p-

afeche@nwu.edu

Currently, Internet access price and service differentiation is mainly based on connection bandwidth. This scheme limits the choice of quality-sensitive consumers and the ability of Internet Service Providers to control quality and finance their infrastructure. We study the design and benefits of further forms of price and service differentiation.

**TA33 Metamodels for Computer-Based Design II****Sponsor:** Quality, Statistics & Reliability**Sponsored Session****Chair:** Kwok-Leung Tsui, Georgia Institute of Technology, School of ISyE, Atlanta, GA 30332, ktsui@isye.gatech.edu

1) **Construction of Response Surfaces using Both Response Functions & Design Sensitivities, *F. van Keulen***, Delft University of Technology, The Netherlands, f.vankeulen@wbmt.tudelft.nl, *Raphael T. Haftka*

Response surface techniques mostly use only function values, even when derivatives are inexpensively available. Potentially, the use of these derivatives can greatly reduce the cost of constructing response surfaces. We explore how to combine function and derivative values in the construction of response surfaces, depending on the accuracy of the values of function and derivatives.

2) **Application of the OA/MARS Stochastic Dynamic Programming Method to Inventory Forecasting Problems, *Victoria C. P. Chen***, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, victoria.chen@isye.gatech.edu

We present numerical solutions to inventory forecasting problems using a statistical perspective of the continuous-state SDP optimization model. The accuracy of the OA/MARS SDP solution method (Chen et al 1999), which employs orthogonal arrays and multivariate adaptive regression splines, is examined via simulations which vary certain user-specified parameters.

3) **Comparison of Response Surface & Kriging Models in Robust Design, *Yao Lin***, Georgia Institute of Technology, Woodruff Sch. of Mech. Eng., Sys. Realization Lab, Atlanta, GA 30332-0405, gts226d@prism.gatech.edu, *Kiran Krishnapur, Janet K. Allen, Farrokh Mistree*

Using a 1-variable case study, we compare and contrast the use of response surface models and kriging models for approximating non-random, deterministic computer analyses in robust design with a large and highly non-linear design space. Through theoretical analysis, we find that more robust solutions can be achieved with kriging models than with response surface models.

4) **withdrawn - chair request of 10/5, *Amit Srivastava***, University of Buffalo, Dept. of Mech. & Aerospace, 1010 Furnas Hall, Buffalo, NY 14260, ars7@acsu.buffalo.edu, *Kurt Hacker, Kemper Lewis*

**TA34 No Title Supplied****Sponsor:** College on Information Systems**Sponsored Session****Chair:** Karma Sherif, Temple University, CIS Dept., RM 300 Wachman Bldg., Philadelphia, PA 19122

1) **withdrawn - author request of 10/11, *Patricia Cornwell***, Hewlett-Packard Laboratories, 1501 Page Mill Rd., MS 1U-4B, Palo Alto, CA 94304-1126, patricia\_cornwell@hpl.hp.com

2) **With So Many IT Changes, How Can You Gain Reuse: Ah, Business Objects, *Jeanette Breton***, Shell Services International, 211 Scarlet Maple Dr., Sugar Land, TX 77479, breton@shellus.com

The technology industry is changing so rapidly. New advancements in the web, electronic commerce, embedded systems, mobile computing, data warehouses, components and other technologies provide many opportunities to customers, but can dramatically increase IT costs if businesses can not capitalize on reusing and integration their IT environment. Can business objects help in managing these technology changes and costs?

3) **The Myths of Distributed Development & Software Reuse, *Munir Mandviwalla***, Temple University, Comparison, Eval. & Dev. Lab., CIS Dept, Rm. 312 Wachman Hall, Philadelphia, PA 19122, mandviwm@thunder.ocis.temple.edu

We will focus on the results of a project in which the CIS Comparison, Evaluation & Development Lab compared and evaluated current distributed development approaches. Modern distributed development approaches are one of the major users of object oriented computing and software reuse concepts. Results indicate that several commonly held perceptions about distributed development are inaccurate.

4) **Daydreams of Reuse Experts: What May & May Not Come**

**True, Karma Sherif**, Temple University, CIS Dept., RM 300 Wachman Bldg., Philadelphia, PA 19122, *Ajay Vinze*

Several reuse experts have identified an extensive list of provisions for building a successful reuse infrastructure. The study of reuse practices in 5 different sites shows that management is skeptical about investing heavily in reuse. A new approach to reuse adoption is required that takes into consideration the pressures of project deliveries and global competition.

**TA35 Tutorial: Maximizing Shareholder Wealth for Large Financial Companies: Integrated Financial Planning Invited Session**

**Chair:** John M. Mulvey, Princeton University, Program in Financial Eng., Sch. of Eng. & Applied Sci., Princeton, NJ 08544, *mulvey@princeton.edu*

**1) Tutorial: Maximizing Shareholder Wealth for Large Financial Companies: Integrated Financial Planning, John M. Mulvey**, Princeton University, Program in Financial Eng., Sch. of Eng. & Applied Sci., Princeton, NJ 08544, *mulvey@princeton.edu*

We describe recent efforts by financial organizations to render major decisions within a unified planning environment. The integrated financial planning system tracks marginal risk-adjusted returns for all business activities on a real-time basis. It pinpoints the best opportunities for growth and contraction. A dynamic, stochastic optimization model provides the ideal framework for coordinating the company's operations...

**TA36 Teamwork & Innovation Management**

**Cluster:** R&D Research & Knowledge Management  
**Invited Session**

**Chair:** Gary Lynn, Stevens Institute of Technology, Howe Sch. of Tech. Mgmt., Castle Point on Hudson, Hoboken, NJ 07030

**1) Innovation & the Fuzzy Front End, Peter Koen**, Stevens Institute of Technology, Castle Pt. on Hudson, Hoboken, NJ 07030

Companies are struggling with how they can get better ideas into the new product pipeline. I will discuss this issue and share research and insights into this important but poorly understood topic.

**2) Team Learning & New Product Development, Ali Akgun**, Stevens Institute of Technology, Castle Pt. on Hudson, Hoboken, NJ 07030

We will discuss my findings on how new product teams learn and improve over time and how they learn from within their team as well as from people external to the team.

**3) Metrics for Team Learning: A Report Card Approach, Gary Lynn**, Stevens Institute of Technology, Howe Sch. of Tech. Mgmt., Castle Point on Hudson, Hoboken, NJ 07030

I will present a new benchmarking approach for measuring team learning and the practices that enhance it. I will also share research on the knowledge management practices of more than 450 new product teams from around the world.

**TA37 Panel: Philosophies of Teaching OR/MS in MBA Programs**

**Sponsor:** INFORM-ED

**Sponsored Session**

**Chair:** George G. Polak, Wright State University, MSIS Dept., 271 Rike Hall, Dayton, OH 45435, *george.polak@wright.edu*

**1) Panel: Philosophies of Teaching OR/MS in MBA Programs, Thomas A. Grossman**, University of Calgary, Fac. of Mgmt., 2500 University Dr. NW, Calgary, Alberta, T2N 1N4, Canada, *grossman@ucalgary.ca*, **Anuj Mehrotra**, University of Miami, Dept. of MS, Sch. of Bus. Admin., Coral Gables, FL 33124, *anuj@miami.edu*, **Joseph D. Blackburn**, Vanderbilt University, 401 21st Ave. South, Nashville, TN 37203, *blackbj1@ctr.vax.vanderbilt.edu*, **Keith Womer**, University of Mississippi, School of Bus. Admin., University, MS 38677, *womer@bus.olemiss.edu*, <http://www.bus.olemiss.edu/womer.htm>, **George G. Polak**, Wright State University, MSIS Dept., 271 Rike Hall, Dayton, OH 45435, *george.polak@wright.edu*

The role of OR/MS in the MBA curriculum is rapidly changing. Many schools have replaced their traditional OR/MS MBA course with a composite of OR/MS, operations management and/or statistics, while other schools have

entirely eliminated OR/MS from their MBA curriculum. Each participant will discuss his/her institution's philosophy for teaching OR/MS in their MBA program. A discussion will follow the presentations.

**TA42 Threats to Life & Limb**

**Sponsor:** Public Programs & Processes Section  
**Sponsored Session**

**Chair:** Arnold I. Barnett, MIT, Sloan Sch. of Mgmt., OR Ctr., E53-379, Cambridge, MA 02139-4307, *abarnett@mit.edu*

**1) Hospital Care: A Marvelous Success & a Profound Failure, William P. Pierskalla**, UCLA, Anderson Grad. Sch. of Mgmt., 110 Westwood Plaza, Box 951481, Los Angeles, CA 90095-1481, *william.pierskalla@anderson.ucla.edu*, <http://www.anderson.ucla.edu>

Every year, millions of people are made better in US hospitals. Unfortunately, however, more than 150,000 die annually in these same hospitals from preventable events. The causes are primarily system and process failures and some, much fewer, people mistakes. OR/MS provides an armamentarium of knowledge and methods to address these failures.

**2) Repeat Testing for HIV, Ed Kaplan**, Yale University, Sch. of Organization & Mgmt., Box 208200, New Haven, CT 06520-8200, *edward.kaplan@yale.edu*

Certain populations, e.g., US Army personnel, are subjected to repeat HIV testing. A simple model frames the decision of "how often to test" as a tradeoff between the cost of testing and the cost of undetected infections. It provides an "implicit valuation" approach towards judging when repeat testing policies are sensible.

**3) Linking Recent Trends in Violence & Incarceration, Alfred Blumstein**, Carnegie Mellon University, Heinz School of PP&M, NCOVR, 5000 Forbes Ave., Pittsburgh, PA 15213-3890, *ab0q@andrew.cmu.edu*

America's homicide rate is now the lowest in 30 years. The incarceration rate is quadruple its previously stable value and continues to climb. Some have claimed that increased imprisonment deserves credit for less homicide, while others deny that link. We try to sort out these competing claims.

**4) The Cost of Cancer to a Major Employer, Arnold I. Barnett**, MIT, Sloan Sch. of Mgmt., OR Ctr., E53-379, Cambridge, MA 02139-4307, *abarnett@mit.edu*, **Mary Barton**, **Howard Birnbaum**, **Pierre Cremieux**, **Mitchell Slavin**

Beyond direct treatment costs for cancer, employers who offer health insurance may pay indirect costs. Patients weakened by treatments, for example, might be more prone to fall or, because of reduced mobility, less likely to suffer auto accidents. We estimate the full cost of cancer to a large American company.

**Tuesday 10:00-11:30**

**TP41 Plenary: The Next Era of Medical Education & Health Care**

**Plenary Session**

**Chair:** To be announced

**1) Invited Plenary: The Next Era of Medical Education & Health Care, William N. Kelley**, University of Pennsylvania Health System, Sch. of Medicine 21 Penn Tower, 399 South 34th St., Philadelphia, PA 19104-4385, *kelleyw@mail.med.upenn.edu*

The dynamic and uncertain health care environment in the US poses particular challenges for academic medical centers entrusted with the critical responsibility to train the nation's future clinicians and physician-scientists. Over the past decade, Dr. Kelley envisioned and built Penn State's Health System, which now ranks among the top 3 academic medical centers in the country. Dr. Kelley will discuss how this was accomplished, assess current and future challenges for academic medical centers and describe what he sees as the next era of medical education and health care in America. In sketching the larger vision, he will devote attention to the impact that emerging OR/MS technologies and new modes of electronic communication will have on medical education, research and patient care.

**Tuesday 13:00-14:30**

**TC01 Panel: Decision Analysis: Where do We Go from Here?**

**Sponsor:** Decision Analysis Society  
**Sponsored Session**

**Chair:** Detlof von Winterfeldt, University of Southern California, Sch. of Policy/Planning/Dev., VKC 368, Los Angeles, CA 90089, detlof@aol.com

**1) Panel: Decision Analysis - Where do We Go from Here?, Howard Kunreuther**, University of Pennsylvania, Wharton Sch. of Economics, OPIM Dept., Philadelphia, PA 19104, kunreuther@wharton.upenn.edu, **James E. Smith**, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, jes9@mail.duke.edu, **Eric Horvitz**, Microsoft Research, Decision Theory Group, One Microsoft Way, Redmond, WA 98052-6399, horvitz@microsoft.com, **Carl S. Spetzler**, Strategic Decisions Group, 2440 Sand Hill Rd, Menlo Park, CA 94025-6900, spetzler@sdg.com, **Barbara Mellers**, Ohio State University, Dept. of Psychology, Columbus, OH 43210, mellers.1@osu.edu, **Gordon B. Hazen**, Northwestern University, IEMS Dept., McCormick Sch., Evanston, IL 60208-3119, hazen@iems.nwu.edu

In many quiet ways, decision analysis has become an important part of several fields, including computer science, medical decision making, business strategy, finance and environmental management. This panel brings experts from these fields together to discuss the future of decision analysis.

## TC02 Discrete Optimization: Theory & Applications

**Cluster:** Discrete Optimization

**Invited Session**

**Chair:** Hanif D. Sherali, Virginia Polytechnic Institute & State University, Dept. of ISE, Blacksburg, VA 24061, hanifs@vt.edu

**1) Models & Algorithms for a Synchronous Optical Network Design Problem, Jonathan C. Smith**, VPI & SU, Dept. of ISE, Blacksburg, VA 24061, **Hanif D. Sherali**, **Youngho Lee**

We present tight models for the problem of clustering traffic demand on SONET rings subject to ring capacity and node cardinality constraints. Various classes of valid inequalities and branching mechanisms are explored. Computational experience is provided.

**2) Lagrangean Probing for Hard Combinatorial Optimization Problems, Monique Guignard-Spielberg**, University of Pennsylvania, The Wharton Sch., 1320 SH-DH, Philadelphia, PA 19104-6366, guignard@grace.wharton.upenn.edu, **Siwhan Kim**, **Xiaopei Wang**

Lagrangean relaxation-based variable fixing performed at the top node of a BB tree may permit the solution of otherwise unsolvable IP problems. The implementation differs for problems with or without knowledge of the optimal cone of the integer hull of the Lagrangean subproblems. We present computational results.

**3) A Physical Ring Design Problem of Synchronous Optical Networks for Mass Market Multimedia Telecommunication Services, Youngho Lee**, Korea University, Dept. of IE, Sung-Buk Ku Anam Dong 5-1, Seoul, 136-701, Korea, ylee@kucncx.korea.ac.kr, **Jeonghee Han**, **Seongin Kim**

We present a node weighted SRP arising from the deployment of SONETs. We have developed 2 mathematical models and some valid inequalities. Computational results show that valid inequalities and preprocessing rules are effective for solving the problem optimally.

## TC03 Retail Operations

**Sponsor:** Manufacturing & Service Operations Management  
**Sponsored Session**

**Chair:** Marshall Fisher, University of Pennsylvania, The Wharton School, OPIM Dept., Philadelphia, PA 19102, fisher@opim.wharton.upenn.edu

**Co-Chair:** Ananth Raman, Harvard University, Grad. Sch. of Bus. Admin., Morgan Hall, Boston, MA 02136, araman@hbs.harvard.edu

**1) Consumer Learning in Store Visits: Similarity, Adaptation & Anticipation, David R. Bell**, University of Pennsylvania, The Wharton Sch., Mktg. Dept., Philadelphia, PA 19104, **Teck-Hua Ho**

Through store visits, consumers learn about a store's product prices, availability and other attributes. We model how this past shopping experience and anticipation about future visits affect consumers' store choice. We test the model using scanner panel data from five stores, 520 households and 66,694 shopping trips.

**2) Operations Management, Stock Performance & Bankruptcy**

**in Retailing, Vishal Gaur**, University of Pennsylvania, The Wharton Sch., Dept. of OPIM, Philadelphia, PA 19104, vishal@grce.wharton.upenn.edu, **Marshall Fisher**, **Ananth Raman**

Using public data on 350 retailers over 20 years, we correlate share price appreciation and bankruptcy with possible predictor variables. We find that return on assets and sales growth explain about 50% of the variation in share price appreciation, but attempting to grow sales too quickly increases bankruptcy risk.

**3) Estimating Retail Demand & Lost Sales, Giulio Zotteri**, Harvard University, Grad. Sch. of Bus., Horgan Hall, Boston, MA 02163, **Ananth Raman**

We present a simple technique for estimating retail demand and lost sales. Our approach works even when demand is non-stationary and each customer can buy more than one unit. Using retail data, we are able to estimate demand and lost sales at the item-store level within 2.5% of demand.

**4) Forecasting the Demand for Fashion Products, Noel Watson**, University of Pennsylvania, The Wharton School, Dept. of OPIM, Philadelphia, PA 19104, nwatson@grace.wharton.upenn.edu, **Marshall Fisher**, **Gerry Schleiffer**

We model life cycle demand for fashion products as a function of a small amount of early sales at selected test stores together with initial and planned price and inventory levels. We report initial experience using this approach at a major manufacturer/retailer of women's fashion shoes.

## TC04 Industry Studies

**Contributed Session**

**Chair:** Gunduz Ulusoy, Bogazici University, Dept. of IE, PK2 Bebek, Istanbul, 80815, Turkey, ulusoyg@boun.edu.tr

**1) Efficiency Improvement Measures for the Croatian Hotel Industry in Transition, Vesna Vrtiprah**, University of Split, Fac. Tourism & Foreign Trade, Lapadska obala 7, Dubrovnik, 20000, Croatia, bvvesna@ftvt.hr

The Croatian hotel industry, due to war and transitional processes, is burdened with numerous problems: unsatisfactory ownership structure, technical-technological suboptimality, very low occupancy rates, business losses, etc. A crisis exists with product, marketing, management, business and tourist policies. We examine ways of efficiently improving this economically important branch.

**2) Trade Liberalization & the US Cotton Growth & Consumption, Agapi L. Somwaru**, ERS/USDA, 1800 M St. NW, Rm. S5010, Washington, DC 20036, agapi@econ.ag.gov, **Leslie Meyer**, **Stephen MacDonald**, **Xinshen Diao**

Changes in consumers preference for natural fibers and trade liberalization significantly affected imported textile over time. We applied a decomposition approach to understand changes in cotton's pattern of trade and trade liberalization and estimated a structural demand system for determining the factors affecting cotton consumption. Results reveal the importance of policies including trade liberalization on US fiber demand for cotton.

**3) The Real Sector in the Croatian Economy - Problems & Possible Solutions, Duro Benic**, Faculty of Tourism & Foreign Trade, Lapadska Obala 7, Dubrovnik, 20000, Croatia, dbenic@ftvt.hr

The central problem to the transition of the Croatian economy is the low achievement of the real sector based upon the low efficiency of Croatian enterprises. There are numerous directions of action for improving the efficiency of Croatian enterprises of which we note downsizing and restructure state enterprises, improving management education levels, and completing the privatization agenda.

**4) Benchmarking Competitive Strategies & Best Manufacturing Practices: A Study into 4 Sectors of the Turkish Industry, Gunduz Ulusoy**, Bogazici University, Dept. of IE, PK2 Bebek, Istanbul, 80815, Turkey, ulusoyg@boun.edu.tr, **Ilknur Iki**

We report on a survey conducted in 1997 and 1998 which included 82 companies from various sectors of the Turkish industry for quantifying how well they match up to best practices, both in the practices and operational outcomes and to quantify the impact of this matching on overall business performance.

## TC05 Location Models II

**Sponsor:** Section on Location Analysis  
**Sponsored Session**

**Chair:** Joyendu Bhadury, California State University, Dept. of Mgmt. & Finance, Sch. of Business & Economics, Hayward, CA 94542, jbhadury@csuhayward.edu

**1) New Approaches to Location of Competitive Facilities: Modeling Market Expansion & Cannibalization, Oded Berman,** University of Toronto, Rotman Sch. of Mgt., 105 St. George St., Toronto, Ontario, M5S 3E6, Canada, berman@mgmt.utoronto.ca, <http://mgmt.utoronto.ca/bios/berman/>, **Dmitry Krass**

We study the problem of locating new competitive facilities on a network with some pre-existing facilities. One of the most common approaches to this problem is via the spatial interaction modal network with some pre-existing facilities. However, this model fails to capture market expansion that may occur as a result of location...

**2) Spatial Competition on Multiple Markets, H. A. Eiselt,** University of New Brunswick, Fac. of Administration, PO Box 4400, Fredericton, NB, E3B 5A3, Canada, eiselh@fac.fadmin.unb.ca

Duopolists locate facilities on different markets, so that competition ensues on each individual market. Both duopolists decide how many resources to allocate to each of its facilities so as to maximize an overall objective. A variety of resource allocation and location strategies are examined in a series of computational tests.

**3) An Overview of the Multiple Objective Path Covering Problem, Subhash C. Narula,** Virginia Commonwealth University, School of Bus., 1015 Floyd Ave., Richmond, VA 23284-4000, snarula@vcu.edu, **T. Brian Boffey**

The point covering problems have been well studied and many practical applications have been reported in the literature. By contrast, the path covering problems have been scarcely studied. We discuss various path covering models and suggest some further avenues of research.

**4) Locating Input/Output Points Optimally in a Layout Problem, Shoou-Jiun Wang,** SUNY, 342 Bell Hall, Dept. of IE, Buffalo, NY 14260, sw@eng.buffalo.edu, **Rakesh Nagi, Joyendu Bhadury**

We formulate a model that combines the twin problems of minimum location of a (possibly finite-sized) supply facility with that of the location of input/output points on the demand and supply facilities. Solution methodologies are presented.

#### TC06 Panel: Industry-University Partnerships in Enterprise Resource Planning

**Sponsor:** Manufacturing & Service Operations Management  
Sponsored Session

**Chair:** Vipul K. Gupta, St. Joseph's University, Dept. of Mgmt. & IS, 5600 City Ave., Philadelphia, PA 19131, gupta@sju.edu

**1) Panel: Industry-University Partnerships in Enterprise Resource Planning, Vipul K. Gupta,** St. Joseph's University, Dept. of Mgmt. & IS, 5600 City Ave., Philadelphia, PA 19131, gupta@sju.edu, **Morris A. Cohen,** University of Pennsylvania, The Wharton School, Dept. of OPIM, Philadelphia, PA 19104-6366, cohen@grace.wharton.upenn.edu, **Hal Gueatal,** SUNY, Dept. of Mgmt., Sch. of Bus., 1400 Washington Ave., Albany, NY 12222, hgg37@nycap.rr.com, **Sabyasachi Mitra,** George Institute of Technology, DuPree Sch. of Mgmt., Atlanta, GA 30332-0520, saby.mitra@mgt.gatech.edu, **Daniel C. Pantaleo,** University Alliance Program, SAP America Inc., 3999 West Chester Pike, Newtown Square, PA 19073, daniel.pantaleo@sap-ag.de, **Bay Arinze,** Drexel University, Dept. of Mgmt., Coll. of Bus. & Admin., Philadelphia, PA 19104, diokpa@bellatlantic.net, **Dongjun Wu,** Drexel University, Dept. of Mgmt., 32nd & Chestnut St., Philadelphia, PA 19104, wudj@drexel.edu

Due to an ever-increasing demand for enterprise resource planning consultants, the major ERP software vendors have started establishing relationships with educational institutions. Since 1996, several universities have joined SAP's initiative, the SAP University Alliance Program, and Peoplesoft's initiative, Peoplesoft on Campus. Panelists will share their experiences with these initiatives and identify teaching and research opportunities.

#### TC07 Distributed & Game Theoretic Models in Manufacturing Logistics

**Cluster:** Manufacturing & Logistics  
Invited Session

**Chair:** Kadir Ertogral, Lehigh University, Dept. of IME, 200 West Packer Ave., Bethlehem, PA 18015, kae2@lehigh.edu

**1) Proactive Equilibrium for Distributed Job Shop Scheduling, Erhan Kutanoglu,** Lehigh University, Dept. IME, 200 West Packer Ave., Bethlehem, PA 18015-1582, **S. David Wu**

We analyze the theoretical requirements for distributed scheduling. We consider a distributed process where independent agents compete for resources while making decisions based on its local utilities. We propose a new equilibrium model that combines the features of optimization and game theoretic search.

**2) A Two-Stage Stochastic Programming Model for Asynchronous Resource Scheduling, Mingzhou Jin,** Lehigh University, Dept. IME, 200 West Packer Ave., Bethlehem, PA 18015-1582, mij2@lehigh.edu, **S. David Wu**

We formulate a 2-stage stochastic programming model for a distributed scheduling problem. The model allows independent and self-interest job agents to request resources in an asynchronous fashion. To solve the stochastic program a new L-Shaped decomposition method is proposed to address the issue raised by the integer recourse.

**3) Designing Distributed Production-Planning Systems using Scenario Analysis, Hakan Golbasi,** Lehigh University, Dept. of IME, 200 West Packer Ave., Bethlehem, PA 18015, hag2@lehigh.edu, **S. David Wu**

We explore ways to design distributed planning systems for large-scale production systems. Based on the inter-dependencies of product demand scenarios, we propose a distributed design where product managers may consider market scenarios for their own products while coordinating resource sharing.

**4) Auction-Based Coordination of Production Planning in the Supply Chain, Kadir Ertogral,** Lehigh University, Dept. of IME, 200 West Packer Ave., Bethlehem, PA 18015, kae2@lehigh.edu, **S. David Wu**

We develop an auction-based mechanism that coordinates the schedules across production facilities. The method is based on a reformulation of the multi-stage multi-item capacitated lot-sizing problem. The proposed procedure allows the facilities to optimize their own utilities while coordinating with others.

#### TC08 Planning & Scheduling Models for Supply Chain Management

**Sponsor:** Section on Logistics  
Sponsored Session

**Chair:** Gautam Mitra, Brunel University, Dept. of Math. & Stats., Cleveland Rd., Uxbridge, Middlesex, UB8 3PH, England, UK, gautam.mitra@brunel.ac.uk

**1) Using Option Pricing in Supply Chain Models, John R. Birge,** University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, jrbirge@engin.umich.edu

Supply chain planning models typically do not include the effects of risk in a consistent framework with financial valuation. We will present an approach based on option pricing results to achieve financial consistency. We will then show how the decisions may vary from traditional models that are not consistent.

**2) On Supply Chain Management Planning Optimization under Uncertainty, Laureano F. Escudero,** IBERDROLA Ingenieria y Consultorio, Avda de Burgos, 8B, Edif. Genesis, Madrid, 28036, Spain, leb@iberdrolaingenieria.es

We present a modeling framework for the optimization of a manufacturing, assembly, distribution and service supply chain planning problem under uncertainty covering product demand and component supply. The automotive sector has been chosen as the pilot area but the approach has far reaching applications. We use a 2-stage scenario analysis model based on a partial recourse approach...

**3) A Supply Chain Planning Model under Uncertainty, Gautam Mitra,** Brunel University, Dept. of Math. & Stats., Cleveland Rd., Uxbridge, Middlesex, UB8 3PH, England, UK, gautam.mitra@brunel.ac.uk, **Cormac A. Lucas, Ali Mirhassani, Chandra Poojari**

A supply chain planning model under uncertainty is formulated as a 2-stage stochastic program with discrete first stage decision variables. Solution of the model using the Lagrange multiplier method and parallel algorithm is then discussed and some computational results are presented. This work has been partially supported by The European Union, SCHUMANN project.

**4) An Information-Driven Logistics Postponement Model,**

**Donald P. Warsing**, University of North Carolina, Kenan-Flager Bus. Sch., CB 3490 McColl Bldg., Chapel Hill, NC 27599-3490, don\_warsing@unc.edu, <http://www.bschool.unc.edu/phd/warsing/>

We consider a distributor of short-life cycle products that has access to a normal and a fast mode of transportation. Time gained via postponing shipments allows the collection of information to better estimate demand. A Bayesian-updating approach is used to develop postponement strategies for this finite-horizon, non-stationary demand environment.

#### TC09 Supply Chains I Contributed Session

**Chair:** Jayavel Sounderpandian, University of Wisconsin, Dept. of Technology, 900 Wood Rd., Kenosha, WI 53141-2000, sounderp@uwp.edu, <http://www.uwp.edu/academic/business/faculty/jay>

1) **Learning & the Outsourcing Decision**, **Geoffrey G. Parker**, Tulane University, Freeman Sch. of Bus., New Orleans, LA 70118, geoffrey.parker@tulane.edu, **Edward G. Anderson**

Component outsourcing is a critical supply chain decision for any firm. Through outsourcing, firms can achieve lower unit costs, but may reduce their internal capacity for innovation. We present a model that attempts to capture the unit cost versus learning opportunity trade-off for multiple markets.

2) **Effects of Investment for Leadtime Reduction on a Supply Chain**, **Saibal Ray**, University of Waterloo, MS Dept., Waterloo, Ontario, N2L 3G1, Canada, s3ray@engmail.uwaterloo.ca, **Elizabeth M. Jewkes**

Supplier leadtime is a competitive priority in manufacturing systems. We model the optimal investment in reducing the mean and variance of supplier leadtime on a single-supplier, single-buyer supply chain when the supplier can pass on some of the investment cost to the buyer in terms of increased price.

3) **Designing the Supply Chain: The Impact of Product & Process Modularity**, **Jovan Grahovac**, Tulane University, Freeman Sch. of Bus., New Orleans, LA 70118, jovan.grahovac@tulane.edu, **Geoffrey G. Parker**

4) **Formation & Maintenance of Supply Chains**, **Jayavel Sounderpandian**, University of Wisconsin, Dept. of Technology, 900 Wood Rd., Kenosha, WI 53141-2000, sounderp@uwp.edu, <http://www.uwp.edu/academic/business/faculty/jay>

Supply chain management requires first the formation of the chain using available links, then the maintenance of that chain. The first step involves combinatorial challenges and the second step, game theoretic challenges. We details these challenges and offer suggestions for overcoming them.

#### TC10 Tutorial: Financial Applications of Stochastic Optimization

**Cluster:** Optimization & Applications

**Sponsor:** Optimization Section

**Sponsored Session**

**Chair:** William T. Ziemba, University of British Columbia, Fac. of Commerce, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, ziemba@interchange.ubc.ca

1) **Tutorial: Financial Applications of Stochastic Optimization**, **William T. Ziemba**, University of British Columbia, Fac. of Commerce, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, ziemba@interchange.ubc.ca

#### TC11 Optimization Applications to Supply Chain Management I

**Cluster:** Industrial Applications of Optimization

**Invited Session**

**Chair:** Ramki Desiraju, IBM Corp., Consulting Group, 17 Skyline Dr., Hawthorne, NY 10532, ramki@us.ibm.com

1) **Advanced Material Resource Planning in Microelectronics Manufacturing**, **Roger R. Gung**, IBM Industry Solutions Lab., Supply Chain Opt., 17 Skyline Dr., J1-G35, Hawthorne, NY 10532, rgung@us.ibm.com

We present an advanced material resource planning tool for microelectronics manufacturing. This tool partitions data for a large group of part numbers and applies LP, MRP and Heuristic Best-Can-Do algorithm to the partitioned data sets to generate an integrated optimal material resource plan.

2) **On Managing Supply Chain Assets over their Life Cycles**,

**Daeki Kim**, i2 Technologies, 50 Main St., Ste. 1000, White Plains, NY 10606, **Omer Bakkalbasi**

We address the management of major supply chain assets over several years at minimal total discounted cost. Our approach supports purchase, sale, lease and outsource decisions of supply chain assets spanning their life-cycle. We present our computational experiences in solving the resulting mixed-integer non-linear optimization problem.

3) **Integrating Simulation & Optimization to Improve Inventory Management in an Integrated Supply Chain**, **Brian Eck**, IBM, Rte. 52, Bldg. 320A, Rm. 2AB7-431, Hopewell Junction, NY 12533, brianeck@us.ibm.com, **Feng Cheng**

For complex supply chains, safety stock optimization and discrete event simulation for scenario evaluation pose significant challenges in modeling, data collection, and analysis. We present how we used an integrated modeling environment to facilitate improvements to IBM's supply chain, including concept validation of delayed customization in hard drive OEM business.

#### TC12 Product Strategy

**Sponsor:** College of Marketing

**Sponsored Session**

**Chair:** Jinhong Xie, University of Florida, Warrington Coll. Bus. Admin., PO Box 117150, Gainesville, FL 32616, xiej@dale.cba.ufl.edu

1) **Product Strategy in Markets with Network Externalities & Competing Technological Standards**, **Jinhong Xie**, University of Florida, Warrington Coll. Bus. Admin., PO Box 117150, Gainesville, FL 32616, xiej@dale.cba.ufl.edu, **Baohong Sun**

We examine new product strategy in the presence of network externalities. Special attention is given to the impact of competing technological standards on an innovator's incentive to encourage imitation (cloning) and the optimal level of product differentiation. The firms' optimal strategies are found as the solution to a Nash equilibrium.

2) **Pre-Concept New Product Forecasting**, **Steven M. Shugan**, University of Florida, 2030 NW 24th Ave., Gainesville, FL 32605, shugan@dale.cba.ufl.edu

Our goal is to provide an approach for very early predictions for new products, which includes conformance uncertainty. We make predictions before formulating the new product concept. Although we would not expect to resolve all or most the uncertainty at this early stage, we hope to provide significant reduction in development uncertainty...

3) **Predicting New Product Success using Artificial Neural Network Decision Support Systems**, **R. Jeffrey Thieme**, Syracuse University, **X. Michael Song**, **Roger Calantone**

We develop an ANN DSS-based on a multilayer feedforward network structure with a piecewise cross-validation procedure. The predictive power of the system is compared to traditional statistical methods using historical data of 612 new product development projects and a case study.

4) **Modeling Buyers Upgrading Behavior on Successive Versions of Products: Theoretical & Empirical Analyses**, **Sang-Hoon Kim**, Stanford University, 59-C Escondido Village, Stanford, CA 94305, **Seenu Srinivasan**

When should a consumer upgrade to a new version if the product keeps improving? How long does it take for a consumer to substitute an improved product or technology for an old one? What factors affect the time to upgrade? Based on insights obtained from theoretical (structural) analyses, a multiattribute dynamic choice model is developed...

#### TC13 Disaggregate Models of Innovation Diffusion

**Sponsor:** College of Marketing

**Sponsored Session**

**Chair:** Rabikar Chatterjee, University of Pittsburgh, Katz Grad. Sch. of Business, Mervis Hall, Pittsburgh, PA 15260

1) **Diffusion: An Agent-Based Model to Study Diffusion of Competitive Innovations in a Spatial/Social Context**, **Kerimcan Ozcan**, University of Michigan, 701 Tappan St., Ann Arbor, MI 481089, **Venkatram Ramaswamy**, **Rabikar Chatterjee**

We study several aspects of the diffusion innovations phenomenon, first analytically and then in a simulated world of spatially and socially located economic agents consisting of competing firms offering the innovation and consumers who are potential adopters. The firms send advertised performance and price signals to individual or groups of consumers...

2) **A Model of Innovation Adoption & Disadoption Featuring Media Effects & Social Contagion**, **Christophe Van den Bulte**,

University of Pennsylvania, Wharton Sch., 3620 Locust Walk, Philadelphia, PA 19104-6371, *Thomas W. Valente*

Viewing innovation adoption and disadoption as transitions in a 2-state Markov chain allows one to model adoption and disadoption of new products in a single binary probability equation. We apply this simple model to assess the differential impact of media campaigns and social network influence on adoption versus disadoption of contraceptives in Bolivia.

**3) The Implications of Price & Demand Dynamics for a Durable Innovation when Consumers Form Adaptive Price Trend Expectations, Rabikar Chatterjee**, University of Pittsburgh, Katz Grad. Sch. of Business, Mervis Hall, Pittsburgh, PA 15260

Models of the diffusion of durables typically make one of two extreme assumptions about how consumers' adoption decisions are influenced by expectations of future prices - consumers are assumed to be either myopic (i.e., their decisions are not influenced by future expectations at all) or to use rationally their future expectations based on perfect foresight...

#### TC14 Advances in Business Gaming Simulations

**Sponsor:** Technology Management Section

**Sponsored Session**

**Chair:** Sharma Pillutla, Towson University, Coll. of Bus. & Econ., 8000 York Rd., Towson, MD 21204-7097, spillutla@towson.edu

**1) From Local Area Network to Client/Server Technology in a Business Gaming Simulation, Precha Thavikulwat**, Towson University, Dept. of Mgmt., 8000 York Rd., Towson, MD 21252-0001, pthavikulwat@towson.edu

To apply business gaming simulations to the problem of assessing business education, business gaming simulations must become as sophisticated as best-practice technology in the everyday world. The purpose and problems of porting a business gaming simulation from LAN to client/server technology are explicated.

**2) Using a Computer Simulation Game as a Performance Predictor of Business Graduates: A Comparison of BBA vs. MBA Candidates, Sarfraz A. Mian**, SUNY, Sch. of Business, 1 Swetman Hall, Oswego, NY 13126, mian@oswego.edu, *Gowri Shankar*

A computerized strategic management simulation game is used as performance predictor and a learning tool for potential business graduates. This research allowed me to develop output measures and apply them in a relatively controlled environment to compare the performance of a sample of BBA and MBA candidates in a BPS capstone course.

**3) Applying Web-Based Software Technology to a Business Gaming Solution, Sharma Pillutla**, Towson University, Coll. of Bus. & Econ., 8000 York Rd., Towson, MD 21204-7097, spillutla@towson.edu

In order to sustain and enhance usage of business simulations for pedagogical and assessment purposes, game technology has to keep pace with the rapidly advancing sophistication of technology. Web-based software offers the convenience of making simulations games available independent of place and time. We discuss one such implementation of a game implemented on the Web using CGI-bin programs.

#### TC15 Genetic & Neural Programming

**Cluster:** Genetic & Neural Programming

**Invited Session**

**Chair:** Bonnie E. Rubenstein-Montano, University of Maryland, Dept. of IS, 1000 Hilltop Circle, Baltimore, MD 21250, brubens@umbc.edu

**1) Solving Planning Problems with Noisy Objective Functions, Markus Konstrorfer**, Johann Wolfgang Goethe-Universitat, Inst. fur Wirtschaftsinformat., Frankfurt am Main, Germany, konstrof@wiwi.uni-frankfurt.de

Real world planning problems can involve noisy data. Therefore, methods used in real world applications need to be able to cope with noise. The quality of solutions found for the job shop scheduling problem with a noisy objective function using GAs, SA and TS are compared. All 3 methods are able to avoid getting stuck in local optima...

**2) An Empirical Look at a Genetic Algorithm for Negotiation Support, Ross A. Malaga**, University of Maryland, Dept. of IS, 1000 Hilltop Circle, Baltimore, MD 21250, rmalaga@umbc.edu, *Bonnie E. Rubenstein-Montano*

Negotiation support systems (NSS) can be used to help parties to a negotiation reach a compromise solution. We describe a GA-based NSS (GANSS) that is

able to determine potentially acceptable outcomes for complex multi-party, multi-objective negotiations. GANSS manipulates both the potential solutions and the set of criteria determined by the negotiation participants...

**3) Changing Negotiation Parameters over Time using a Genetic Algorithm, Bonnie E. Rubenstein-Montano**, University of Maryland, Dept. of IS, 1000 Hilltop Circle, Baltimore, MD 21250, brubens@umbc.edu, *Ross A. Malaga*

Negotiations can be characterized as complex, group decision making problems where each decision maker is motivated by different objectives and preferences. A variety of techniques have been applied to complex negotiations with varying levels of success. The GA is one technique that has performed fairly well. We report on the implementation of a GA for negotiations with adaptive parameters...

**4) Investor Risk Preferences & Market Risk Premiums: A Study using Evolutionary Computing, Thomas A. Ottaway**, Kansas State University

We investigate the source of market risk premiums: individual risk preferences. By examining the wealth characteristics of agents of different risk preferences, we study the financial incentives of investors to demonstrate different risk preferences. To accomplish this, we use a computer model of the stock market that utilizes artificial adaptive agents...

#### TC16 Energy Revenue Management

**Sponsor:** Revenue Management Section

**Sponsored Session**

**Chair:** Marija Ilic, MIT, Dept. of EECS, Bldg. 10-059, 77 Massachusetts Ave., Cambridge, MA 02139, ilic@mit.edu

**1) Power Plant Valuation with Physical Constraints, Chung-Li Tseng**, University of Maryland, Dept. of Civil Engineering, College Park, MD 20742, chungli@eng.umd.edu, <http://www.eng.umd.edu/~chungli>

The power plant valuation problem is formulated as a multi-stage stochastic problem. Assume the prices for both electricity and the fuel used by the generator follow some Ito processes. At each period, the operator must decide to run or not to run the unit so as to maximize expected profit subject to physical constraints.

**2) Revenue Management Opportunities in the Energy Industry, Paul Koster**, PROS Strategic Solutions, 3800 Buffalo Speedway, Ste. 350, Houston, TX 77098, pkoster@prosweb.com, *Biroj Buraparate, Nicola Secomandi, Shankar Sivaramkrishnan*

We discuss revenue management opportunities in the energy industry, especially as they arise in the natural gas pipeline and electricity sectors. We also highlight differences and similarities with other revenue management applications.

**3) Objective of Electric Transmission Pricing under Open Access, Marija Ilic**, MIT, Dept. of EECS, Bldg. 10-059, 77 Massachusetts Ave., Cambridge, MA 02139, ilic@mit.edu, *Jean-Pierre Leotard*

We state a rigorous mathematical formulation of the performance objectives in centralized electric power industry. We briefly describe main issues related to sub-optimal performance. Nevertheless, this objective is used as a benchmark for comparing how closely separate generation, transmission and distribution businesses could come to meeting this objective under competition...

#### TC17 Production Planning III

**Contributed Session**

**Chair:** Erhan Kozan, Queensland University of Technology, Sch. of Math Sci., GPO Box 2434, Brisbane, Queensland, 4001, Australia, e.kozan@fsc.qut.edu.au, <http://www.maths.fsc.qut.edu.au/asor>

**1) Scheduling a Batch Processing Machine with Non-Identical Job Sizes, Meral Azizoglu**, Middle East Technical University, Dept. of IE, Ankara, Bilkent, 06531, Turkey, meral@ie.metu.edu.tr, *Scott T. Webster*

The problem of scheduling batch processors captures an element of complexity common to many practical scheduling problems. We describe a B&B procedure applicable to a batch processor model with arbitrary job processing times, weights and sizes. The objective is to minimize total weighted completion time...

**2) Sequencing Mixed-Model Assembly Line Under Andon System, Considering Fatigue, Timothy J. Flynn**, University of Alabama, 6036 Crowne Falls Parkway, Hoover, AL 35244, flynt@proctr.cba.ua.edu, *John Mittenenthal, Charles P. Schmidt*,

**David M. Miller**

In this job sequencing decision problem, the andon system results in additional constraints linking all workers. Formulation of a mathematical model for this problem is presented, both with and without operator fatigue. The model was verified using canned optimization software. Modifications required to solve large problems are discussed.

**3) A Material Handling & Inventory System for an Assembly Plant, Erhan Kozan**, Queensland University of Technology, Sch. of Math Sci., GPO Box 2434, Brisbane, Queensland, 4001, Australia, e.kozan@fsc.qut.edu.au, <http://www.maths.fsc.qut.edu.au/asor>

A comprehensive analytical framework for examining the relative merits of alternative material handling and inventory strategies for a truck factory is developed. The model is based on extensions of the VRP. Solutions to the model have been obtained by an implementation of a heuristic technique.

**4) Sequencing Algorithms for Uncapacitated Assembly Line with Non-Serial Converging Branch Structure, Robert L. Burdett**, Queensland University of Technology, Dept. of Math. Sci., GPO Box 2434, Brisbane, Queensland, 4001, Australia, burdett@fsc.qut.edu.au, **Erhan Kozan**

Sequencing on mixed model assembly line in general involves solving a permutation flowshop problem under the minimum makespan objective with respect to serial precedence relationships between final assembly stations and multiplicity. However, sub-assembly stations with complicated precedence relationships arise in reality. We address sequencing in such an environment.

**TC18 Binary Optimization**

**Cluster:** Discrete Optimization  
**Invited Session**

**Chair:** Peter L. Hammer, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854-8003, hammer@rutcor.rutgers.edu

**1) Approximating the Optimum of a Posiform, Endre Boros**, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854-8003, boros@rutcor.rutgers.edu, **Tomas Badics**

We provide polynomial time approximation algorithms for both the maximization and minimization of a posiform. These algorithms are based on optimizing convex and concave majorants and minorants of the given posiform, and using a fairly simple rounding technique and some elementary inequalities.

**2) Recent Developments in Solving 0-1 Quadratic Programming Problems, Mohammad Amini**, University of Memphis, Dec. Sciences Area, Fogelman Coll. of Bus. & Econ., Memphis, TN 38152, mamini@cc.memphis.edu, **Bahram Alidaee, Fred W. Glover, Gary A. Kochenberger**

An unconstrained 0-1 quadratic programming problem, an important research area in pseudo-Boolean function optimization, models an exceptional variety of discrete optimization problems, including those with constraints. We survey recent breakthroughs by several groups in solving these problems by both heuristic and exact methods.

**3) Quadratic 0-1 Knapsack Problems, David J. Rader**, Rose-Hulman Institute of Technology, Dept. of Math., Terre Haute, IN 47803, david.rader@rose-hulman.edu

We will discuss dynamic programming algorithms for certain quadratic 0-1 knapsack problems. These give polynomial algorithms for special cases. In addition, a fully polynomial approximation scheme for a class of quadratic 0-1 knapsack problems will be given.

**TC19 Forecasting Applications**

**Cluster:** Forecasting Transportation  
**Invited Session**

**Chair:** Kenneth D. Lawrence, NJIT, School of Mgmt., Newark, NJ 07102, lawrence@tesla.njit.edu

**1) A New Measure of Relative Forecast Errors for Measuring the Accuracy of Forecasting Hot Beverage Sales, Ron Klimberg**, St. Joseph's University, Haub School of Mgmt., 5600 City Ave., Philadelphia, PA 19131, klimberg@sju.edu, **Harold Rahmlow, Tricia Carney**

The results of developing several forecasting models to predict hot beverage sales for a large food industry company will be presented. A new measure of relative percentage error was used to measure and compare the accuracy of these models and will be introduced and discussed.

**2) Predicting the Impact of Corporate Governance on Financial Performance: A Neural Network Approach, Claire Simmers**, St. Joseph's University, Dept. of MIS, 5600 City Ave., Philadelphia, PA

19131, simmers@sju.edu, **Murugan Anandarajan**

Using neural networks, the relationship between corporate governance and financial performance is examined. Agency theory posits that separation of ownership and control leads to self-interested actions by managers, therefore, the need for monitoring mechanisms to protect owners, i.e., shareholders. Increasingly, boards of directors are being pressured, especially by institutional investors, to be strong governance mechanisms...

**3) Utilizing Artificial Intelligence to Improve SAP R/3's Forecasting Capabilities, Murugan Anandarajan**, Drexel University, Dept. of Mgmt., 32nd & Chestnut St., Philadelphia, PA 19104, murugan.anandarajan@drexel.edu, **Arinze Bay, Dongjun Wu**

As the leading enterprise software package, SAP R/3 incorporates several forecasting models within the production planning (PP) module. These range from moving average models to exponential smoothing models. However, a major shortcoming of SAP is its inability to select the most accurate forecasting model. While the use of trend and seasonality characteristics are a good start...

**4) Forecasting High Speed Internet Access Demand in the Residential Market Place, Kenneth D. Lawrence**, NJIT, School of Mgmt., Newark, NJ 07102, lawrence@tesla.njit.edu, **Joseph H. Wen, William J. Havlena**

We will focus on the forecasting of the demand for various forms of high speed Internet access in the residential marketplace. The alternatives include cable modem, satellites, and high speed telephone methods of access. This study will be based upon actual data collected with the State of New Jersey.

**TC20 Airline Delays**

**Contributed Session**

**Chair:** John R. Birge, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, jrbirge@engin.umich.edu

**1) Airline Scheduling Recovery Following Disturbance: A Bi-Level Decision-Making Approach, Sheng-Chen A. Huang**, University of California, 107 McLaughlin Hall, Inst. of Transport. Studies, Berkeley, CA 94720-1720, schuang@ce.berkeley.edu, <http://www.ce.berkeley.edu/~schuang>, **Adib Kanafani**

The decisions of airline schedule control under unforeseen disturbances are made at 2 levels: local station control centers and a system-wide airline operations center. We explore the structure of this decision-making process in an attempt to understand ways in which recovery from disturbance can be made.

**2) Delay Attribution for an Airport, Hsiao-Shen Tsao**, University of California, 107 McLaughlin Hall, Inst. of Transport. Studies, Berkeley, CA 94720-1720, tsao@newtonberkeley.edu, [www.its.berkeley.edu/staff/tsao/jacob.html](http://www.its.berkeley.edu/staff/tsao/jacob.html), **Sheng-Chen A. Huang**

The USDOT publishes flight arrival delays which are often used to gauge congestion at an airport. Since part or all of an arrival delay may be caused by conditions elsewhere or airline operations, we develop an algorithm to more accurately attribute delays, using ASQP data, cluster analysis, etc.

**3) Journey Management: Passenger Reaccommodation in the Age of Global Airline Alliances, Michael D. Clarke**, Sabre, Inc., 1 East Kirkwood Blvd., MD 7390, Southlake, TX 75063, michael.clarke@sabre.com, **Ladislav Letovsky, Abdoul K. Sylla**

We consider the impact of off-schedule operations and schedule recovery procedures on passenger flow. To effectively deal with this problem, up-to-date flight schedule information is necessary as well as detailed passenger itinerary data (typically stored in passenger name records). Our methodology is developed around an itinerary generation engine...

**4) Generating Delay Distributions for Airline Crew Scheduling, Joyce W. Yen**, University of Michigan, Dept. of IOE, 1205 Beale Ave., Ann Arbor, MI 48109-2117, jyen@engin.umich.edu, **John R. Birge**

We discuss the methodology for establishing delay distributions for airline flights. Once a distribution is established, we generate flight disruption scenarios. This information is used in a stochastic programming analysis of the airline crew scheduling problem with disruptions.

**TC21 Transportation Planning**

**Contributed Session**

**Chair:** Wafik H. Iskander, West Virginia University, IMSE Dept., PO Box 6070, Morgantown, WV 26506-6107, iskander@cemr.wvu.edu

**1) Capacitated Survivable Network Design, Roland Wessaely**, Zentrum für Informationstechnik, Takustr. 7, Berlin-Dahlem, D-14195, Germany, wessaely@zib.de, <http://www.zib.de/wessaely>

We study the transport network design problem with capacity and survivability restrictions. We formulate the problem as an MIP and present an investigation of the facet-structure of associated polyhedra as well as heuristic algorithms. Computational results for real-world data are reported.

2) **Traffic Policy & Economic Evaluation of a Traffic Infrastructure Construction Program in Croatia, Damir Simulcik**, University of Zagreb, Faculty of Traffic Sci., Vukeliceva 4, Zagreb, 10000, Croatia, simulcik@fpz.hr, <http://www.fpz.hr>

The integrality of traffic infrastructure structures in the traffic and economic system of Croatia is the element of harmonious linkage of all subsystems within the economic system. The investment policy should be based on objective methodological procedures and congruent activity of the traffic and economic subsystem and system segments...

3) **Sustainable Transport for Tourism, Ivo Ban**, University of Split, Fac. Tourism & Foreign Trade, Lapadska obala 7, Dubrovnik, 20000, Croatia, iban@ftv.hr

International and domestic tourism shows increasing numbers of tourists annually. Traffic congestion problems are intensified (air and road) as transport is an integral part of tourism. Today, tourism transport is an immense problem at local, national, transboundary and global levels. Development policies have to be oriented towards sustainable tourist transport.

4) **Cost-Benefit Analysis for Highway Planning, Venkataramani Rajamohan**, West Virginia University, IMSE Dept., PO Box 6070, Morgantown, WV 26506-6107, vrajamoh@wvu.edu, **Wafik H. Iskander, Majid Jaraiedi**

A model was developed to perform cost-benefit analysis and evaluation of alternatives available for new highway construction and/or refurbishment of existing highways. Special attention was given to the development of a methodology and software to estimate the road user costs/benefits.

## TC22 Information Systems Applications

### Contributed Session

**Chair:** Richard G. Mathieu, University of North Carolina, Cameron School of Bus., Dept. of PDS, Wilmington, NC 28403, mathieur@uncwil.edu, <http://www.uncwil.edu/people/mathieur>

1) **A Diffusion Model of Information Engineering Methods, Adel M. Aladwani**, Kuwait University, PO Box 34927, Edailiyah, 73251, Kuwait, adwani@kuc01@kunjiv.edu.kw

IEMs represent innovations for potential organizational users. Therefore, users' perceptions about these methods can to a large extent explain their diffusion patterns. We propose an IEM diffusion model, which focuses on perceptions of IEM as key determinants.

2) **Competitive Forces & Value Chain Models in Strategic Information Systems, Haidong Liu**, Cabrini College, 610 King of Prussia Rd., Radnor, PA 19087-3698, hliu@stockton.edu, **Shaoping Zhao**

We investigate and review how competitive forces and value chain models can be used to identify opportunities for strategic information systems. We show that strategic use of the models may enhance a companies' competitive position and supply a strategic advantage. Examples are used to demonstrate the analysis.

3) **Process Development for Case Management Concepts in a Call Center Environment: Implementation of Radiance at Sun Microsystems, Brad A. Decker**, Sun Microsystems, 500 Eldorado Blvd., MS UBRM03-192, Broomfield, CO 80021, brad.decker@central.sun.com, **Blaine K. Taylor**

A case management system is selected for implementation in the Sun Microsystems, Enterprise Services Customer Care Centers. Rapid application development implies standardization of the case management tool.

4) **Towards a Manufacturing Information System for Operationalizing the Kanban Setting Problem, Richard G. Mathieu**, University of North Carolina, Cameron School of Bus., Dept. of PDS, Wilmington, NC 28403, mathieur@uncwil.edu, <http://www.uncwil.edu/people/mathieur>, **Barry A. Wray**

We present research leading to the design of a localized information system which stores shop floor data used to generate production rules for determining the optimal number of kanbans within the production facility. A computer architecture is proposed that can operationalize the kanban setting problem in a JIT environment.

## TC23 Designing Electricity Auction Markets

**Sponsor:** Energy, Natural Resources & the Environment  
Sponsored Session

**Chair:** Richard P. O'Neill, Federal Energy Regulatory Commission, Office of Economic Policy, 888 First St. NE, Washington, DC 20426, richard.oneill@ferc.fed.us

## TC24 Efficiency Measurement in Health Care

**Sponsor:** Health Applications Section

### Sponsored Session

**Chair:** Sharon Schweikhart, Ohio State University, Hlth. Svcs. Mgmt. & Policy Div, Sch. of Pub. Hlth., 1583 Perry, Columbus, OH 43210-1234, schweikhart.1@osu.edu

1) **Impact of Case-Mix Measures on Estimated Hospital Efficiency Scores, Michael D. Rosko**, Widener University, Dept of Hlth & Med Serv Admin, One University Pl, Chester, PA 19013, michael.d.rosko@widener.edu, **Jon A. Chilingirian**

A 2-stage approach is used in a stochastic frontier analysis of the factors affecting hospital efficiency. In the first stage, a translog cost-function is used to estimate inefficiency scores. In the second stage, inefficiency scores are regressed against independent variables to test hypotheses that come from X-inefficiency theory.

2) **Profiling the Efficiency of Healthcare Providers Performing Coronary Artery Bypass Graft Procedures, Jon A. Chilingirian**, Brandeis University, Heller Sch. for Adv. Studies, 415 South St., Box 9110, Waltham, MA 02554-9110, chilingirian@binah.cc.brandeis.edu, **Mitchell Glavin, Sarita Bhalotra**

DEA is applied to the empirical study of best practices of Pennsylvania healthcare providers performing coronary artery bypass graft procedures in 1994/95. Modeling surgical care as a multi-input, multi-output service production process, DEA is used to conduct an empirical study of provider efficiency and identify best practices.

3) **withdrawn - author request of 10/1, Sharon Schweikhart**, Ohio State University, Hlth. Svcs. Mgmt. & Policy Div, Sch. of Pub. Hlth., 1583 Perry, Columbus, OH 43210-1234, schweikhart.1@osu.edu

4) **Effectiveness Measures for Health Policy & Outcomes Research, Ann S. McAlearney**, Ohio State University, Hlth. Svcs. Mgmt. & Pol. Div., Sch. of Pub. Hlth., 1583 Perry, Columbus, OH 43210-1234, mcalearney.1@osu.edu, **Sharon Schweikhart, Dev S. Pathak**

Quality of life concepts and measures are increasingly used in clinical and policy research. We review indicators such as QALYs, DALYs and HALEs, assessing each according to their conceptual underpinnings, applicability, interpretability and limitations. We also analyze current, potential and ideal roles of these measures for health policy and outcomes research.

## TC25 Combinatorial Optimization Applications

### Contributed Session

**Chair:** Illya V. Hicks, Rice University, CAAM Dept., MS 134, 6100 Main St., Houston, TX 77005-1892, ivhicks@caam.rice.edu, <http://www.caam.rice.edu/~ivhicks>

1) **On the Complexity of a Class of Combinatorial Optimization Problems With Uncertainty, Igor Averbakh**, Western Washington University, 812 Indian Terrace, Bellingham, WA 98225, averbakh@cc.wvu.edu

We consider a robust (minmax regret) version of the problem of finding the minimum weight base of a uniform matroid with uncertainty in weights of elements. A polynomial algorithm is presented for the case where uncertainty is represented by means of interval estimates for the weights.

2) **A New Lagrangean Relaxation Approach for the Hop-Constrained Minimum Spanning Tree Problem, Cristina Requejo**, Universidade de Coimbra, Dept. Matematica, Largo D. Dinis, Coimbra, 3000, Portugal, mcsr@mat.uc.pt, **Luis Gouveia**

We present a new Lagrangean relaxation for the HMST problem which is derived from a hop-indexed formulation. Computational results show that lower bounds given by the new relaxation dominate lower bounds given by an older Lagrangean relaxation. For dense graphs, the new Lagrangean relaxation proves to be a reasonable alternative to solving the LP relaxation of the hop-indexed model.

3) **withdrawn - author request of 10/1, Andrew J. Schaefer**, Georgia Institute of Technology, School of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, schaefer@isye.gatech.edu, **George L. Nemhauser**

4) **Planar Branch Decompositions, Illya V. Hicks**, Rice

University, CAAM Dept., MS 134, 6100 Main St., Houston, TX 77005-1892, ivhicks@caam.rice.edu, <http://www.caam.rice.edu/~ivhicks>

Branch decompositions and branchwidth were introduced by Robertson & Seymour in their proof of Wagner's conjecture. We present a heuristic for the minimum fill-in problem based on branch decompositions and a polynomial time algorithm to compute optimal branch decompositions for planar graphs based on a paper by Seymour & Thomas.

## TC26 Applied Probability Numerical Algorithms for Telecommunication Systems

Sponsor: Applied Probability Society/Technical Section on Telecommunications  
Sponsored Session

Chair: Les D. Servi, GTE Laboratories, 40 Sylvan Rd., Waltham, MA 02254-1128, lds0@gte.com

1) **A Single Server Queue with Markov-Modulated Service Times**, *Yongpin Zhou*, University of Pennsylvania, OPIM Dept., The Wharton School, Philadelphia, PA 19104-6366, yongpin@wharton.upenn.edu, *Noah F. Gans*

Telecommunications systems may have correlated service times that can be modeled as Markov modulated. For example, in networks a change in data source may change service requirements. We show the occupancy distribution of 2-state M/MMPP/1 queues is the superposition of 2 matrix-geometric series and compare these systems to their M/G/1 analogues.

2) **Bilingual Server Call Centers**, *David A. Stanford*, University of Western Ontario, Dept. Stat. & Actuarial Sci., Western Science Ctr., London, Ontario, N6A 5B7, Canada, stanford@fisher.stats.uwo.ca, *Winfried K. Grassmann*

In 1993 the authors introduced the bilingual server model, a queue in which servers are either partially trained (unilingual) or fully trained (bilingual). Customers likewise require simple service that all can provide, or specialized service (minority language) from the bilingual servers. This extension to that work compares the impacts on the system based on the ability or inability to detect the need for specialized service prior to initial service contact. Numerical examples are provided.

3) **Equilibrium Distribution of Block-Structured Markov Chains with Repeated Rows: The GTH Algorithm Revisited**, *Les D. Servi*, GTE Laboratories, 40 Sylvan Rd., Waltham, MA 02254-1128, lds0@gte.com

Many mobile telephone applications require solving a Markov chain whose transition matrix has a block tri-diagonal structure with each block itself tri-diagonal. We present algorithmic improvements to the 1985 GTH algorithm, present generalizations to Markov chains with 3 or more dimensions and examine the case of repeated rows.

## TC27 Applications of Adaptive Markovian Decision Processes

Cluster: Dynamic Programming  
Invited Session

Chair: Apostolos N. Burnetas, Case Western Reserve University, Dept. of OR & Op. Mgmt., 10900 Euclid Ave., Cleveland, OH 44106-7235, atb4@po.cwru.edu

1) **Models for Adaptive Airline Revenue Management**, *Michael N. Katehakis*, Rutgers University, New Brunswick, NJ 08903, mnk@andromeda.rutgers.edu

We investigate the revenue impact of alternative policies for airline reservation pricing in a duopoly market, under constraints on the passenger tendency to 'sell up' to higher fares or choose the competing carrier. The policies are based on estimation of demand distributions by booking class and time before departure.

2) **Adaptive Multivariate Exponentially Weighted Moving Average Control Charts**, *Kevin W. Linderman*, University of Minnesota, 3-235 Carlson Sch. of Mgmt., Minneapolis, MN 55455, klinderman@csom.umn.edu, *Thomas E. Love*

MEWMA control charts are used to monitor processes with several quality characteristics. In contrast to the usual practice of keeping design parameters, i.e., sample size, sampling frequency, etc., static during monitoring, we investigate the design of adaptive MEWMA control charts where parameters can vary based on evidence about the process state.

3) **Maintenance Policies for Two-Dimensional Warranty**, *Elmira Popova*, University of Texas, Dept. of Mech. Engineering, Austin, TX 78712, elmira@mail.texas.edu, *Tom Chen*

Two-dimensional warranty has been used extensively in auto industry. We propose a maintenance policy under 2-dimensional warranty. The policy's control limits are established via simulation-optimization interface. Their stability is analyzed.

4) **Adaptive Supplier Selection/Procurement Policies under Unknown Quality Characteristics**, *Apostolos N. Burnetas*, Case Western Reserve University, Dept. of OR & Op. Mgmt., 10900 Euclid Ave., Cleveland, OH 44106-7235, atb4@po.cwru.edu

We consider a retailer's problem of selecting among different suppliers, under partial information about each supplier's quality characteristics. Alternative policies are proposed that adaptively determine the supplier and the order size, based on experience accumulated from previous procurements. Their optimality properties are discussed.

## TC28 Demand Forecasting Applications & Decision Technology

Cluster: E-Business & Decision Technology in Semiconductors  
Invited Session

Chair: Mahesh Pati, IBM Microelectronics Division, PROFIT Dept., Essex Junction, VT 05402, pati@us.ibm.com

1) **Demand Forecasting at IBM Microelectronics**, *Jonathan Wong*, IBM Microelectronics Division, Demand Mgmt, Mktg & Sales, Waltham, MA, jhpwong@us.ibm.com

The demand management process includes gathering monthly worldwide sales forecast and customer reservation/buffer by customers, marketing judging FC weekly with the aid of system generated build recommendation at detail customer level or at aggregated geographic tier/product levels. Benefits of supply/demand integration, order netting automation, allocation optimization, 24 hours order commit...

2) **Demand Forecasting at Temic Semiconductors**, *Harpal Singh*, Supply Chain Consultants, Inc., 5604 Fairmont Dr., Linden Green Center, Wilmington, DE 19808, hshign@supplychain.com, *Robert Fox*

We will describe a demand forecasting application at Temic Semiconductor Corp. Additionally, we will provide an overview core decision technology used to build the demand forecasting applications at IMD and Temic. Finally, we will touch on the amount of customization usually required in building this type of application.

## TC29 Software Demonstration VI Software Demo Session

Chair: To be announced

1) **Modeling with LINDO, LINGO & What'sBest**, *Mark Wiley*, LINDO Systems, Inc., 1415 North Dayton St., Chicago, IL 60622, mwiley@lindo.com

LINDO Systems will be highlighting a new interior point solver as well as speed and feature enhancements to our popular mathematical modeling packages. We will demonstrate LINDO, a powerful linear and integer programming engine, LINGO, an integrated modeling language with linear/nonlinear solvers and What'sBest, a large scale linear/nonlinear spreadsheet solver.

2) **XPRESS-MP for Modeling & Optimization**, *Sebastian Ceria*, Dash Optimization, Inc., sceria@dashopt.com

XPRESS-MP is a state-of-the-art, fully integrated software solution for modeling and optimization. We will show how the XPRESS-MP software suite allows the programmer to manipulate the in-core representation of the problem using the notation used to specify the model, thus avoiding the traditional separation between modeler and optimizer...

## TC30 Tutorial: Intelligent Agents for Routing & Scheduling Problems

Sponsor: INFORMS Computing Society  
Sponsored Session

Chair: Sam R. Thangiah, Slippery Rock University, Comp. Sci. Dept., Slippery Rock, PA 16057, sam.thangiah@sru.edu

1) **Tutorial: Intelligent Agents for Routing & Scheduling Problems**, *Sam R. Thangiah*, Slippery Rock University, Comp. Sci. Dept., Slippery Rock, PA 16057, sam.thangiah@sru.edu

Intelligent agents are being used from filtering e-mail to performing auctions for commodities in real-time. This tutorial defines the concept of intelligent agents, reviews the current literature for routing and scheduling problems and describes some of the complex problems that have been solved using intelligent agents. In addition, we give examples on developing agent-based systems using commercial and freeware systems.

**TC31 Life Testing & Inspection**

**Cluster:** Reliability Modeling  
Invited Session

**Chair:** Thomas A. Mazzuchi, George Washington University, School of Eng. & Applied Sci., Washington, DC 20052, mazzuchi@seas.gwu.edu

1) **Simulation-Based Designs for Accelerated Life Tests, Refik Soyer**, George Washington University, Monroe Hall 403, MS Dept., 2115 G St. NW, Washington, DC 20052, soyer@gwu.edu, *Alaattin Erkanli*

We consider fixed designs and adopt a Monte Carlo-based approach that uses Markov chain Monte Carlo methods for evaluation of posterior risks. We illustrate our approach by considering a 2-point design problem when the life model is exponential and discuss extensions to sequential designs.

2) **Burn-In from a Bayesian Perspective, Dror Perlestein**, Rafael, Haifa, Israel, drorp@rafael.co.il, *Thomas A. Mazzuchi*

We consider the problem of burn-in design from a Bayesian viewpoint and look at the effects of uncertainty on several of the suggested design criteria.

3) **A Comprehensive Model for Accelerated Life Testing, J. Rene Van Dorp**, George Washington University, Dept. of Eng. Mgmt., 707 22nd St NW, Washington, DC 20052, dorprj@seas.gwu.edu, *Thomas A. Mazzuchi*

We discuss a general procedure for analyzing combinations of accelerated life testing scenarios including fixed stress and step-stress tests for repairable and non-repairable systems. The approach is Bayesian in nature and requires the use of Markov chain Monte Carlo methods for inference.

4) **A Procedure for General Inspection Policies, John G. Wilson**, Wake Forest University, Babcock Grad. Sch. of Mgmt., Box 7659 Reynolds Station, Winston-Salem, NC 27109, john.wilson@mba.wfu.edu, *Thomas A. Mazzuchi*

We consider the problem of optimal inspection for a general class of failure time distribution and illustrate the importance of uncertainty in the unknown distribution parameters.

**TC32 Pricing Communication Networks**

**Sponsor:** Technical Section on Telecommunications  
Sponsored Session

**Chair:** Christopher M. Rump, SUNY, 342 Bell Hall, Dept. of IE, Buffalo, NY 14260-2050, crump@eng.buffalo.edu

1) **How Sophisticated Pricing Can Harm Consumers, Jon M. Peha**, Carnegie Mellon University, Dept. of ECE, 5000 Forbes Ave., Pittsburgh, PA 15213-3890, peha@ece.cmu.edu

Future networks may offer services with guaranteed price and quality and services without. For the latter, prices may depend on network state, so prices rise with congestion. This approach can maximize the benefit derived from given network capacity, but who benefits? A monopoly using state-dependent pricing to maximize total benefits will increase its revenues, but will carry less traffic...

2) **Pricing Priority Services, Peter Marbach**, University of Cambridge, Ctr. for Comm. Sys. Res., 10 Downing St., Cambridge, CB2 2DS, UK, p.marbach@ccsr.cam.ac.uk

Differentiated services have been proposed to enhance the current best-effort service used in the Internet. In its simplest form, differentiated services can be thought of as a strict priority service. We study how priority services together with pricing can be used as a tool to allocate resources during congestion.

3) **Models for Service Facilities with Elastic Demand, Shaler Stidham, Jr.**, University of North Carolina, Dept. of OR, CB 3180, 210 Smith Bldg., Chapel Hill, NC 27599-3180, sandy@email.unc.edu

In many queueing applications (including telecommunications), the work submitted by a customer is random and elastic: the customer may be satisfied with completion of less than its potential work, depending on the current admission price and congestion. We consider both static and dynamic models for equilibrium and optimal flow control.

4) **Stability of Pricing Algorithms for Communication Networks, Christopher M. Rump**, SUNY, 342 Bell Hall, Dept. of IE, Buffalo, NY 14260-2050, crump@eng.buffalo.edu

We consider rate-based pricing among multiclass users in a communication network. Using a game-theoretic model of user behavior, we examine the existence and uniqueness of individually optimal "equilibrium" solutions and their impact on the social welfare of the network. We also explore conditions for convergence of iterative flow control algorithms that characterize the

stability of such solutions.

**TC33 Recent Work in Statistical Process Control**

**Sponsor:** Quality, Statistics & Reliability  
Sponsored Session

**Chair:** G. Geoffrey Vining, Virginia Tech, Dept. of Statistics, Blacksburg, VA 24061

1) **Economic Design of Variable Sampling Rate Control Charts for Monitoring the Process Mean & Variance, Zachary G. Stoumbos**, Rutgers University, Dept. of MS/IS, RUTCOR, 180 University Ave., Newark, NJ 07102-1895, stoumbos@andromeda.rutgers.edu, *Marion R. Reynolds, Jr.*

An economic model is developed for variable sampling rate control charts that are designed to simultaneously monitor the process mean and variance. This model quantifies the substantial reduction in cost and false-alarm rate that is achieved by using variable sampling rate charts instead of traditional fixed sampling rate control charts.

2) **Multivariate EWMA With Correlated Observations, Christina Mastrangelo**, University of Virginia, Dept. of Systems Eng., Thornton Hall, Charlottesville, VA 22903, christina@virginia.edu

Many processes produce large amounts of serially correlated, multivariate data. We consider the problem of monitoring such processes and present a multivariate EWMA chart which uses non-parametric empirical control limits, based on the "residuals."

3) **A Multivariate Nonparametric EWMA Chart Based on Interdirections, G. Geoffrey Vining**, Virginia Tech, Dept. of Statistics, Blacksburg, VA 24061, *Vivek Ajmani*

Typically, industrial processes involve 2 or more quality characteristics of interest, which one must monitor simultaneously. We propose an EWMA based on interdirections when 1 or more of these characteristics, i.e. a lifetime, follow a distinctly non-normal distribution.

4) **Statistical Monitoring & Diagnosis of Automatic-Controlled Processes, Fugee Tsung**, HKUST, Dept. of IE/EM, Clear Water Bay, Kowloon, Hong Kong, season@ust.hk <http://iesu5.ust.hk/dfaculty/tsung/>

As manufacturing quality has become a decisive factor in global market competition, statistical quality techniques such as SPC are becoming very popular in industries. With advances in sensing and data capture technology, large volumes of data are being routinely collected in the processes with EPC or APC...

**TC34 Electronic Commerce**

**Cluster:** State-of-the-Art in Information Technology  
Invited Session

**Chair:** Troy J. Strader, Iowa State University, Dept. of MIS, 300 Carver Hall, Ames, IA 50011-2063, tstrader@iastate.edu

1) **A Proposal for Valuing Information & Instrumental Goods, Marshall Van Alstyne**, University of Michigan, School of Info. 305D West Hall, 550 East University Ave., Ann Arbor, MI 48109-1092, mvanalst@umich.edu, <http://www.si.umich.edu/~nvanalst>

Traditional decision theory has difficulty expressing the value of information such as software or process know-how. This research integrates traditional Bayesian and computer science models to represent both uncertainty and algorithm. The combination can represent many standard theorems but can also resolve certain problems such as the buyer's inspection paradox.

2) **On-Line Casinos: Opportunities & Risks, Daniel G. Conway**, University of Florida, Dept. of DIS, Warrington Coll. of Bus., Gainesville, FL 32611, conwaydg@ufl.edu, *Gary J. Koehler*

"Virtual" casinos have invaded the Internet offering online sports books, blackjack, poker, etc. These are the same popular games and sports betting as in Las Vegas and elsewhere. Estimates put on-line gambling at \$1 billion by the year 2000. We examine this commerce and compare the opportunities and risks to traditional environments.

3) **Information Technology for Mass Customization, Michael J. Shaw**, University of Illinois, The Beckman Inst., 405 North Mathews Ave., Urbana, IL 61801, m-shaw2@uiuc.edu

The Web is an effective consumer interface for direct merchandising. Whole supply chains are at the same time increasingly linked electronically. This integration of an interactive interface and well-connected distribution/sales channel makes possible the implementation of mass customization. I will address related research and application issues.

4) **Information Economics & Electronic Markets, Troy J.**

**Strader**, Iowa State University, Dept of MIS, 300 Carver Hall, Ames, IA 50011-2063, tstrader@iastate.edu

Electronic markets enable search cost reduction for both buyers and sellers. They reduce time and effort associated with consumer search for product information and well as seller advertising. I identify the implications this has for market participants through an analytical model that builds on early information economics research.

### TC35 Tutorial: An Introduction to SAP R/3

Invited Session

**Chair:** F. Robert Jacobs, Indiana University, Kelley School of Bus., 10th & Fee Lane, Bloomington, IN 47405, jacobs@indiana.edu

1) **Tutorial: An Introduction to SAP R/3**, *F. Robert Jacobs*, Indiana University, Kelley School of Bus., 10th & Fee Ln, Bloomington, IN 47405, jacobs@indiana.edu

SAP's R/3 holds a 30% share of the ERP software market. Hardware and software features will be discussed together with the accelerated SAP implementation approach. A demonstration designed to highlight how the sales, operations and accounting functions are integrated in the context of a supply chain example will be conducted. Information concerning 2 courses that use R/3 that are now being offered at Indiana University will also be discussed.

### TC36 Knowledge Transfer across Boundaries

Cluster: R&D Technology & Knowledge Management

Invited Session

**Chair:** Paul Almeida, Georgetown University, McDonough Sch. of Bus., Washington, DC 20057, almeidap@gunet.georgetown.edu

1) **Product Sequencing: Vertical Integration, Diversification & Innovation**, *Ruth S. Raubitschek*, Georgetown University, McDonough Sch. of Bus., Washington, DC 20057, raubitsr@gunet.georgetown.edu, *Constance Helfat*

We suggest that a firm can create and sustain competitive advantage through innovation by strategically linking its products at a point in time and over time. Through case studies of high technology firms, we trace the co-evolution of competences, product sequencing and their relationship to vertical integration and diversification.

2) **Beyond Local Search: Boundary-Spanning Exploration in the Optical Disc Industry**, *Lori Rosenkopf*, University of Pennsylvania, The Wharton School, 2000 SH-DH, Philadelphia, PA 19104-6302, rosenkopf@wharton.upenn.edu, *Atul Nerkar*

Using patent citation data of firms in the optical disc industry, we explore the important question of how different types of boundary spanning technological search effects future innovative ability. The results of this study highlight the importance of considering both organizational and technological boundaries simultaneously.

3) **The International Mobility of Experts & Cross-Border Knowledge Building**, *Jaeyong Song*, Columbia University, Grad. Sch. of Bus., New York, NY 10027, js721@columbia.edu, *Paul Almeida*

We investigate the relationship between the cross-border mobility of experts and the technological development of firms in industrializing countries. We use patent citation data in the semiconductor industry to track the movement of major patent holders across countries and assess the impact of mobility home country innovation.

4) **Knowledge Transfer by International Firms: Responses to Government Policy Liberalizations**, *Stanley Nollen*, Georgetown University, McDonough Sch. of Bus., Washington, DC 20057, nollens@gunet.georgetown.edu, *Thomas Brewer*

We argue that liberalizations embedded in WTO agreements alter the mode of business participation (export vs. direct investment) and the economics of knowledge transfer. We further propose that the international transfer of explicit P knowledge increases while the transfer of knowledge decreases.

### TC37 Panel: What do Practitioners Want in New or Recent Graduates?

Sponsor: INFORM-ED

Sponsored Session

**Chair:** Frederic H. Murphy, Temple University, 2402 Pine St., School of Bus. & Mgmt., Philadelphia, PA 19122, v5256e@vm.temple.edu

1) **Panel: What do Practitioners Want in New or Recent**

**Graduates?**, *Russell Baris*, Pfizer Inc., 235 East 42nd St., New York, NY 10017-5755, barisr@pfizer.com, *Howard Finkelberg*, BBDO Inc., 1285 Av of the Americas, New York, NY 10019, finkelberg@bbdo.com, *Raj Nigam*, Merrill Lynch & Co. Inc., PO Box 9065, Princeton, NJ 08543-9065, raj\_nigam@ml.com

The members of this panel will all run or have run OR/MS groups and have hired into their groups graduates with different backgrounds with varying degrees of success. They will have strong views of what they are looking for as openings develop. Interestingly, their views are contradictory. We explore their views and try to reconcile the different attributes they look for and their work environments.

### TC38 Second-Order Cone Programming

Cluster: Nonlinear Programming

Invited Session

**Chair:** Robert J. Vanderbei, Princeton University, Civil Eng. & OR, ACE-42 E-Quad, Princeton, NJ 08544, rvdb@princeton.edu, <http://www.princeton.edu/~rvdb/>

1) **Solving Second-Order Cone Problems via Interior-Point Methods**, *Hande Yurttan*, Princeton University, Dept. of OR & Financial Eng., Princeton, NJ 08544, hyurttan@princeton.edu

Second-order cone programming problems are convex and the use of interior point methods to solve them has recently received much interest. The main issue we address is that some of these problems are nonsmooth at optimality. We report on a "variable" perturbation method to resolve this issue.

2) **Matrix Factorization Updates in Second Order Cone Programming**, *Katya Scheinberg*, IBM, TJ Watson Research Ctr., PO Box 218, Yorktown Heights, NY 10598, katas@watson.ibm.com

We will consider various low-rank updates of matrix factorization that help exploit sparsity in interior point methods for second order cone programming. We will compare efficiency and numerical stability of a few updates and present extensive computational results.

3) **Extension of Analysis from Semidefinite Programming to all Symmetric Cone Optimization Problems**, *Farid Alizadeh*, Rutgers Univ., RUTCOR, PO Box 5062, New Brunswick, NJ 08903, alizadeh@rutcor.rutgers.edu, *Stefan Schmieta*

We show that the polynomial-time complexity analysis of a class of primal-dual algorithms known as the commutative class extends verbatim to optimization problems over all symmetric cones. We use the properties of Jordan algebras to get the extension. Such semidefinite programming algorithms can be applied also to QCQP.

## Tuesday 14:45-16:15

### TD01 Decision Engines & their Drivers

Sponsor: Decision Analysis Society

Sponsored Session

**Chair:** Jeffrey K. Belkora, On Your Mind, Inc., 2421 Broadway, Redwood City, CA 94063, jeff@onyourmind.com

1) **Product Portfolio Management Decision Support at Eli Lilly & Company**, *Forrest D. Mellott*, Eli Lilly & Co., Lilly Corporate Ctr., Indianapolis, IN 46285, mellott\_forrest\_d@lilly.com, *Rafael Pena*

We use decision analysis to model the uncertainties, i.e., price, volume, cost, etc., associated with the registration and launching of various combinations of products into different markets. We compute the expected economic value added for various product and market scenarios and then roll those product scenarios up into user-specified portfolios.

2) **Real Time Decision Support Tools to Improve Quality & Decrease Unnecessary Costs: DA Approach to Managing Health Information Deliver**, *Doug Weiss*, Merck-Medco Managed Care LLC, 100 Summit Ave., MS R2-27A, Montvale, NJ 07645-1753, douglas\_weiss@merck.com, *Tom Brinkman*

The delivery of health care information to maximize positive patient behavior change involves dynamic decisions related to multiple data sources. Merck-Medco utilizes a unique decision analysis application to quantify the opportunity value (cost of complications) for patients in order to deliver integrated member services involving multiple media and personnel options.

3) **Collaborative Care Facilitation at the UCSF Breast Care Center**, *Carrie Sanders*, UCSF/Stanford Breast Care Center, 2299 Post St., Ste. 107, San Francisco, CA 94115, sanders@cc.ucsf.edu,

**Meredithe Mendelsohn**

Decision analysis is a framework for facilitating collaborative conversations, such as those between a doctor and patient. We focus on providing decision support for the patient-physician consultations that precede treatment decisions in our breast clinic.

**4) Building the Intelligent Program Office, Kevin Gerner, Gerner, Dorow & Associates, 4162 North Meridian St., Indianapolis, IN 46208, kgerner@gda-llp.com, Tam Dorow**

Decision analysis software allows program/project management consultants to target interventions. This capability, applied as part of a suite of project portfolio management methodology, is a crucial component of Gerner, Dorow & Associates' intelligent program management office methodology.

**5) Decision Engines for Enterprise Software, Jeffrey K. Belkora, On Your Mind, Inc., 2421 Broadway, Redwood City, CA 94063, jeff@onyourmind.com, Clint Korver**

On Your Mind is democratizing decision analysis by embedding it in intranet enterprise software systems, including portfolio risk management, call centers, and project prioritization. We are also using decision analysis to identify the market "sweet spots" that will propel On Your Mind into the ranks of the greatest software companies.

**TD02 Industrial Applications of Discrete Optimization****Cluster: Discrete Optimization****Invited Session**

**Chair: Julie A. Ward, Hewlett-Packard Laboratories, 1501 Page Mill Rd M/S 4U-1, Palo Alto, CA 94306-1126, ward@hpl.hp.com**

**1) Information Technology Project Portfolio Selection, Bruce W. Lamar, MITRE Corporation, 202 Burlington Rd., Bedford, MA 01730-1420, bwlamar@mitre.org**

We survey decision support tools and methodologies used to assist decision-makers in selecting the best mix of IT projects for an organization. Methods discussed include discrete optimization, MAUT, AHP, scorecards, checklists, cardinal and ordinal ranking, and cognitive models. Internal and external interaction effects are also considered.

**2) withdrawn - author request of 10/11, Amit Garg, IBM, TJ Watson Research Ctr., PO Box 218, Yorktown Heights, NY 10598, agarg@watson.ibm.com, Ying Tat Leung**

**3) Production Line Scheduling Using a Genetic Algorithm & Integer Programming, Siegfried Voessner, Stanford University, Dept. of EESOR, Stanford, CA 94305-4023, voessner@leland.stanford.edu, R. Kevin Wood**

We combine a GA and a standard B&B algorithm to solve an industrial production-line scheduling problem, i.e., an integer program. Two-way communication of incumbent solutions speeds the overall solution and heuristically derived solutions simplify the IP and tighten cuts. Computational results are provided.

**4) Automated Storage Area Network Fabric Design: A Math Programming Approach, Michael Kim-O'Sullivan, Stanford University, Dept. of EESOR, Terman Eng. Ctr. Rm. 421, Stanford, CA 94305-4023, mosu@leland.stanford.edu, Siegfried Voessner, Julie A. Ward, John Wilkes**

We consider the problem of finding the minimum-cost configuration of interconnect fabric elements, including switches, hubs, multiplexers and fiber channels, to support the performance requirements of a high-speed data network. The configuration must satisfy degree constraints and node and arc bandwidth constraints. Alternate approaches and computational results are presented.

**5) Efficient Selection of Components for System Order Coverage, Krishna Venkatraman, Hewlett-Packard Laboratories, 1501 Page Mill Rd., M/S 1U-13, Palo Alto, CA 94304, krishna@hpl.hp.com, Julie A. Ward**

A computer order consists of a set of components. The problem of finding the smallest component superset of a given percentage of historical orders arises in an HP order-fulfillment improvement strategy. We present heuristics and a Lagrangian-relaxation approach to compute the efficient frontier of order coverage and component set size.

**TD03 Incentives in Operations Management**

**Sponsor: Manufacturing & Service Operations Management  
Sponsored Session**

**Chair: Stefanos Zenios, Stanford University, Grad. Sch. of Business, Stanford, CA 94305-5015, stefzen@leland.stanford.edu**

**1) Braess' Paradox & Capacity Management in Decentralized Networks, Yasushi Masuda, Keio University, Faculty of Science & Tech., Yokohama, Kanagawa, 223-8522, Japan, masuda@ac.keio.ac.jp, Seungjin Whang**

Bottleneck analysis, although widely used for network capacity planning, fails to hold under a decentralized network, and its straightforward application may even hurt its system performance. We propose a modified bottleneck analysis that helps optimize the system performance in a decentralized network.

**2) Outcomes-Based Reimbursement in a Health Care Delivery System, Prashant C. Fuloria, Stanford University, Grad. Sch. of Bus., Stanford, CA 94305, fulhoria\_prashant@gsb.stanford.edu, Stefanos Zenios**

Consider a 2-party health care delivery system in which a principal delegates medical decisions to an agent. The principal represents a purchaser of medical services and the agent is an independent provider. We analyze this system using a dynamic principal-agent model and derive the "optimal" financial arrangement.

**3) Incentive Efficient Control of a Make-to-Stock Production System, Erica Plambeck, Stanford University, Dept. of EES & OR, Stanford, CA 94305, elp@leland.stanford.edu, Stefanos Zenios**

We consider a principal-agent problem in a make-to-stock production system in which a principal incurs inventory and backorder costs but delegates control of production to an independent agent. We derive the optimal contract that minimizes the principal's expected cost by creating incentives for a production rate that responds efficiently to changing demand conditions.

**TD04 Web-Enabled Organizational Decision Environment****Cluster: Decision Technology****Invited Session**

**Chair: Q. B. Chung, Villanova University, 800 Lancaster Ave., Villanova, PA 19085**

**1) Organizational Process Modeling & Execution: A Web-Based Approach, Vijayan Sugumaran, LeMoyne College, Dept. of Business Admin., Syracuse, NY 13214**

Organizations are constantly in search of ways to enhance productivity. Routine processes within an organization can be modeled using domain modeling techniques, and executed with the help of intelligent software agents. These agents can be designed to work cooperatively to achieve a common goal by incorporating reasoning, collaboration and communication activities exhibited by human agents...

**2) The Effects of Web Page Download Time on a Decision Maker's Behavior, James Otto, Villanova University, Coll. of Commerce & Finance, 800 Lancaster Ave., Villanova, PA 19085, William Wagner, Mohammad K. Najdawi**

We investigate the effects of Web page download time on a decision maker's switching behavior. Users were presented with several Web pages that downloaded at different rates. They could select, and switch between, any 5 of the 10 questions on the 10 different Web pages. Results and analysis are presented.

**3) Model Management on the Intranet: A Research Prospectus, Q. B. Chung, Villanova University, 800 Lancaster Ave., Villanova, PA 19085, Mohammad K. Najdawi**

It is known that decision models are frequently reused, but are not centrally managed as in the case of database management. We present the rationale/scheme to implement a model base and model management system on an Intranet to foster organizational use of shared models using Web technologies.

**TD05 Location Models III****Sponsor: Section on Location Analysis****Sponsored Session**

**Chair: Zvi Drezner, California State University, Dept. of MS/IS, Fullerton, CA 92834, zdrezner@fullerton.edu**

**1) Centroid Demand Point Aggregation for Median Location Problems, Richard L. Francis, University of Florida, Dept. of ISE, 303 Weil Hall, Gainesville, FL 32611-6595, francis@ise.ufl.edu, Arie Tamir**

Centroid demand point aggregation for median problems permits the analysis of self-canceling error. We give a low-order algorithm for computing the set of all points where the total error is zero, and equivalent conditions for the set to be

non-empty. We also explore related questions.

**2) A Competitive Facility Location Problem under Uncertainty, Shogo Shiode**, Kobe Gakuin University, Faculty of Econ., Arise 518, Ikawadani, Nishi-ku, Kobe, 651-2180, Japan, shiode@eb.kobegakuin.ac.jp

We consider a tree network on which there exist demand points whose weights are stochastic. There exist two competitive companies planning to construct their own facilities on the network. We consider the problem maximizing the total buying power acquiring from the market under a chance constraint.

**3) A Heuristic Technique for Location Problems with Concave Costs: Progressive Piecewise Linear Underestimation, Abdullah Dasci**, McGill University, Fac. of Mgmt., 1001 Sherbrooke St. West, Montreal, Quebec, H3A 1G5, Canada, adasci@management.mcgill.ca, **Vedat Verter**

We will present the PPLU technique, which proved to be an effective tool in solving a number of concave-cost facility location problem. PPLU takes advantage of underlying network structure in identifying a global optimum solution. Computational performance of the algorithm is quite encouraging...

**4) On the Planar k-Centrum Single Facility Location Problem with Euclidean Distances, Trevor S. Hale**, Ohio University, Dept. of IMSE, Athens, OH 45701-2979, thale@uscolo.edu

The planar k-centrum location problem is addressed. It is shown that the when k is equal to 2 or 3 the problem is equivalent to the minimax problem. Furthermore, when k is equal to n, the problem becomes the Weber problem. We will also present a solution methodology as well as necessary condition for optimality.

## TD06 Sequencing in Flexible Flow Systems

Cluster: Flexible Manufacturing Systems

Invited Session

Chair: Kathryn E. Stecke, University of Michigan, Sch. of Business Admin., 701 Tappan St., Rm. 5206, Ann Arbor, MI 48109-1234, kstecke@umich.edu

**1) Distributing Material Flows in a Manufacturing System with a Large Product Mix: A Model Based on Column Generation, Claudio Arbib**, Università degli Studi di L'Aquila, Dipt. Matematica Pure e Appl., via Vetoio, Coppito, 67010, Italy, arbib@univaq.it, **Gianfranco Ciaschetti, Fabrizio Rossi**

We deal with the assembly of micropumps and dispensers in a plant in central Italy. The problem is assigning operations to workcenters with due-date constraints and setup minimization. A column generation method is devised for situations of different size and complexity, and a sample of its effectiveness is exhibited.

**2) A Sequencing Heuristic for a Flexible Flow System with Mixed Volume Production & Stochastic Processing Times, Oleg Gusikhin**, 5829 Evergreen Rd., Apt. 4, Dearborn Heights, MI 48124, ogusikhin@visteon.com, **David J. Barich, Rahul Caprihan, David H. Ong**

We focus on the development of a sequencing heuristic for mixed volume production of parts whose demand sequence is prespect. Using a simulation approach, the efficiency of the heuristic is demonstrated for a flexible flow system with stochastic processing times, where rework results in out-of-sequence situations.

**3) Monolithic vs. Hierarchical Approach for Scheduling in Flexible Assembly Systems, Tadeusz J. Sawik**, University of Mining & Metallurgy, Dept. of Comp. Integrated Mfg., Crakow, 30-059, Poland, tsawik@wzn4.zarz.agh.edu.pl

Monolithic and hierarchical approach for FAS scheduling are compared. First, mixed integer programming formulations for scheduling in a general FAS and flexible assembly line are presented. Then, a hierarchical, 2-level loading and scheduling is discussed, where first the station workloads are balanced using a linear relaxation heuristic...

**4) Scheduling on a Moving Assembly Line with Limited Resequencing Flexibility, Maher Lahmar**, University of Minnesota, Dept. of Mech. Eng., Minneapolis, MN 55455, maher@me.umn.edu, **Hakan Ergan, Saifallah Benjaafar**

We consider the problem of resequencing a pre-arranged set of jobs on a moving assembly line with the objective of minimizing changeover costs. A changeover cost is incurred whenever 2 consecutive jobs do not share the same attribute. Attributes are assigned from a set of job-specific feasible attributes. Resequencing is limited by the availability of offline buffers.

## TD07 Planning & Coordination of Design, Manufacturing & Overhaul Activities

Cluster: Manufacturing & Logistics

Invited Session

Chair: Peter B. Luh, University of Connecticut, Dept. of Elect. & Systems Eng., 260 Glenbrook Rd., Storrs, CT 06269-2157, luh@brc.uconn.edu

**1) Virtual Design Environment: Evolutionary Programming in Printed Circuit Board Assembly Design, Robert J. Graves**, RPI, Decision Sci. & Eng. Systems, Troy, NY 12180-3590, graves@eamri.rpi.edu, **Raj Subbu**

Design-manufacturer-supplier decisions are critical to modern distributed manufacturing enterprises responding quickly to global pressures and the dynamic global marketplace. The VDE is a distributed information architecture that supports design decisions in a concurrent engineering mode of operation for such enterprises. It utilizes intelligent agents and evolutionary programming techniques in assisting designers to reduce costs and cycle time through design decisions.

**2) Inventory Management for Overhaul & Repair Operations, Robert Tomastik**, United Technologies Research Center, 411 Silver Ln, MS 129-70, East Hartford, CT 06108, tomasrn@utrc.utc.com, **Daniel Wang**

Overhaul and repair consists of dis-assembling a product into its parts, repairing the parts and then, before the repair is complete, re-assembling the product with parts from an inventory of repaired (or "rotable") parts. We present a stochastic programming algorithm for minimizing the rotable inventory subject to part-availability constraints.

**3) Supply Chain Coordination with Distributed Dynamic Lead Time Estimation, Michael Caramanis**, Boston University, Dept. of Mfg. Engineering, 15 Saint Mary's St., Boston, MA 02215, mcaraman@bu.edu, **Osman M. Anli**

We argue for dynamic lead time modeling in the production planning of stochastic multiple-cell production systems. An iterative algorithm with distributed subproblem solution and a generalized Benders coordinating master problem will be presented. Computational experience demonstrates significant inventory and backlog cost reduction relative to MRP based models.

**4) Effective Manufacturing Planning & Control by Combining Optimization with a Card-Based Scheme, Peter B. Luh**, University of Connecticut, Dept. of Elect. & Systems Eng., 260 Glenbrook Rd., Storrs, CT 06269-2157, luh@brc.uconn.edu, **Xiaohui Zhang, Robert Tomastik**

Effective planning and coordination of manufacturing activities within and across cells for on-time delivery and low inventory are difficult tasks because of complexity and shop floor uncertainty. We present a new method that synergistically combines Lagrangian relaxation of mathematical optimization for setting up schedules with a card-based scheme (POLCA)...

## TD08 Logistics I

Contributed Session

Chair: Indranil R. Bardhan, PricewaterhouseCoopers Mgmt. Consulting, One International Pl., Boston, MA 02110, indranil.bardhan@us.pwcglobal.com

**1) Demand Information Updates & Purchase Contracts with Bounded Demands, Hongyan Huang**, Chinese University of Hong Kong, Dept. of SE&EM, Hong Kong, Shatin NT, PR China, hyhuang@se.cuhk.edu.hk, **Houmin Yan, Suresh P. Sethi**

We study demand forecast updates and purchase contracts with a bounded demand distribution. The purchase contract provides the buyer an opportunity to adjust the initial commitments based on better demand information obtained at a later stage. We formulate it as a dynamic optimization problem. Since it is difficult to obtain an explicit optimal solution, we focus on a sub-optimal policy...

**2) Routing & Scheduling Just-in-Time Delivery Vehicles, James L. Bander**, University of Florida, 4440 SW Archer Rd. #301, Gainesville, FL 32608, jim.bander@umich.edu, **Chelsea C. White, III**

We develop and analyze a stochastic network model for determining the optimal routing policy and departure time for vehicles in a JIT environment.

**3) A Service-Based Bracket Pricing Model for Logistics Management in the Packaged Foods Industry, Indranil R. Bardhan**, PricewaterhouseCoopers Mgmt. Consulting, One International Pl., Boston, MA 02110, indranil.bardhan@us.pwcglobal.com

A service-based bracket pricing model was developed for a Fortune 100 conglomerate to help its packaged foods division improve its logistics operations and realize savings from better pricing decisions. A Monte Carlo simulation model was developed to represent the risk factors and uncertainties which drive pricing decisions...

### TD09 Supply Chains II Contributed Session

**Chair:** Amiya K. Chakravarty, Tulane University, Freeman Sch. of Bus., New Orleans, LA 70118, amiya.chakravarty@tulane.edu, <http://www.tulane.edu/~akc/amiya.html>

1) **TPL Services Strategies & Supply Chains, Anu H. Bask**, Helsinki School of Economics, Runeberginkatu 22-24, Helsinki, 00100, Finland, abask@hkkk.fi

The transforming role of TPL companies and services in supply chains is discussed. The question addressed is what services should TPL companies provide to varying types of seller and buyer relationships.

2) **Supply Chain Management: A Global Perspective, Ali R. Behnezhad**, California State University, Dept. of MS, Northridge, CA 91330-8245, ali.behnezhad@csun.edu

Logistics network structures for global operations will be presented. We will address the implementation issues unique to global supply chains. The concept of third-party logistics and their strategic dimensions will also be presented. The impact of Internet-based procurement on global supply chains will be discussed.

3) **How the Supply Chain can Profit from "Smart" Customers, Julia Stolle**, WHU Koblenz, Otto Beisheim GSM, Burgplatz 2, Vallendar, 56179, Germany, jstolle@whu-koblenz.de, **Arnd H. Huchzermeier, Ananth V. Iyer**

Based on empirical evidence we show that customers react "smart" to retail promotions by exploiting price transparency (in Euro-land) through stockpiling and walking. We develop a supply chain inventory model, where we will show that all members of the chain (manufacturers and retailers) can benefit from coordination of promotional activities. We utilize data from the German grocery industry.

4) **A Global Supply-Chain Platform, Amiya K. Chakravarty**, Tulane University, Freeman Sch. of Bus., New Orleans, LA 70118, amiya.chakravarty@tulane.edu, <http://www.tulane.edu/~akc/amiya.html>, **Nagraj Balakrishnan**

A product may use components from suppliers (or supplier groups) in  $n$  countries, and may be sold to customers in  $m$  countries. If a manufacturing facility could be located in any one of  $k$  countries, there would be  $n.m.k$  links in the supply chain. The cost structure on such links may not be identical, since the labor costs, taxes, tariffs and transportation costs vary...

### TD10 Machine Learning & Data Mining

**Cluster:** Optimization & Applications

**Sponsor:** Optimization Section  
Sponsored Session

**Chair:** Olvi L. Mangasarian, University of Wisconsin, Comp. Sci. Dept., 1210 West Dayton St., Madison, WI 53706-1685

1) **Increasing the Generalization of Perceptron Decision Trees, Kristin P. Bennett**, RPI, Math Sciences Dept., 110 8th St., Troy, NY 12180, bennek@rpi.edu, **Donghui Wu**

The problem of increasing the generalization of perceptron decision tree is addressed. Three new algorithms are introduced to enlarge the margins of perceptron decision trees. Extensive experiments on various data sets show that all three algorithms outperform OC1, one of the popular perceptron decision tree systems.

2) **Feature Selection with Genetic Algorithms, W. Nick Street**, University of Iowa, MS Dept., 108 Pappajohn Bldg., Iowa City, IA 52242, nick-street@uiowa.edu, **Filippo Menczer, Melania Degeratu**

We describe local selection, an effective and efficient means for enforcing population diversity in evolutionary computing and demonstrate its use in multi-objective optimization. The technique is applied to the feature selection problem in inductive learning, the search for a small subset of predictive features that achieves optimal generalization.

3) **Scalable Decision Tree Construction, Johannes Gehrke**, University of Wisconsin, Computer Sci. Dept., 1210 West Dayton St., Madison, WI 53706, johannes@cs.wisc.edu, **Venkatesh Ganti, Raghu Ramakrishnan, Wei-Yin Loh**

We introduce a new algorithm for decision tree construction that improves upon

earlier algorithms in both performance and functionality. The algorithm constructs several levels of the tree in only two scans over the training database and has the ability to incrementally update the tree.

4) **Generalized Support Vector Machines for Data Discrimination, Olvi L. Mangasarian**, University of Wisconsin, Comp. Sci. Dept., 1210 West Dayton St., Madison, WI 53706-1685, **David R. Musicant**

GSVMs with arbitrary kernels are used for generating linear or nonlinear separating surfaces to discriminate between elements of a set belonging to different categories using linear or quadratic programming formulations. Successive overrelaxation can handle datasets with as many as 10 million points.

### TD11 Optimization Applications to Supply Chain Management II

**Cluster:** Industrial Applications of Optimization  
Invited Session

**Chair:** Ramki Desiraju, IBM Corp., Consulting Group, 17 Skyline Dr., Hawthorne, NY 10532, ramki@us.ibm.com

1) **Challenges in Business Process Optimization, Narayan Venkatasubramanian**, i2 Technologies, 919 East Las Colinas Blvd., 16th Floor, Irving, TX 75039, narayan@i2.com

Supply-chain planning has emerged as a hot area commercially. The broader problem of business process optimization is a commercially interesting prospect. Intelligent decision making in this area remains largely unexplored at the level of detail essential for intensive study. We present the challenges and suggestions for future research in this area.

2) **A Collaborative Solution Framework for Supply Chain Integration, Kumar Bhaskaran**, IBM, Rte. 134, PO Box 218, Yorktown Heights, NY 10598, bha@us.ibm.com, **Nitin Nayak, Daniel P. Connors, Terry Heath**

Effective supply chain management requires collaboration amongst demand, production, distribution, and transportation planning functions within an enterprise, and suppliers, dealers, customers, and logistics providers. We describe a solution framework for secure intra- and inter-enterprise collaboration to provide right information and tools to right people at right time anywhere in the supply chain.

3) **Inventory Management in the Grocery Industry with an Eye on Profitability & Service, James D. Brom**, IBM, 8365 Pilot Ct, Colorado Springs, CO 80920, jdbrom@us.ibm.com

High inventory turns and low levels of inventories traditionally indicate a healthy operation but they don't necessarily serve the best interests of the business. In some cases, inventory may cost less than expediting and transportation. We use grocery supply chain simulation to manage inventories, while focusing on total landed costs.

4) **Facets of the Cardinality Constrained Knapsack Problem, Ismael R. de Farias, Jr.**, SUNY, Dept. of IE, 403 Bell Hall, Buffalo, NY 14260-2050, ismael@akula.isye.gatech.edu, **Ellis L. Johnson, Eva Lee, George L. Nemhauser, Jean-Phillip Richard**

In several optimization problems at most  $K$  out of  $N$  alternatives can be selected. Examples include location-allocation, synthesis of networks and portfolio optimization. We derive strong valid inequalities for this general class of problems and show how they can be used in a B&C scheme to obtain global optimal solutions. We report computational results that demonstrate their usefulness.

### TD12 State-of-the-Art Approaches to Catastrophe Model Estimation & Managerial Relevance

**Sponsor:** College of Marketing  
Sponsored Session

**Chair:** Terence A. Oliva, Temple University, Dept. of Mktg., Speakman Hall, 1810 North 13th St., Philadelphia, PA 19122-6038, oliva@sbm.temple.edu

1) **A Cusp Catastrophe Model for Turnover among Air Force Recruits in their First Term of Enlistment, Stephen Guastello**, Marquette University, Dept. of Psychology, Milwaukee, WI 53201-1881, 6155guastell@vms.csd.mu.edu

We elaborate the method of structural equations for testing catastrophe theory hypotheses. These are polynomial equations and linear comparisons that can be used in conjunction with ordinary least squares regression. The method is demonstrated with a cusp catastrophe model for 2-stage personnel selection and used to predict performance and turnover among airmen during their first term of enlistment...

2) **Individual Catastrophes: A Hierarchical Bayes Approach to**

**Catastrophe Modeling, Lynd D. Bacon**, Lynd Bacon Associates, 545 Hamilton Wood, Homewood, IL 60430-4403, lynd.bacon@lba.com, <http://www.lba.com>

Catastrophe models have been shown to provide managers with useful perspectives on consumer behavior dynamics, e.g., Oliva et al. 1992, 1995, 1997. Approaches for estimating such models described in the literature, e.g., Guastello, 1992, 1995, etc., assume fixed effects, that is, the same response dynamics are assumed to characterize all observed entities...

**3) An Algorithm for Estimating Multivariate Catastrophe Theory Models: GEMCAT II, Rense Lange**, Illinois State Board of Education, Dept. Standards & Assessments, 100 North First St. E 216, Springfield, IL 62777-0001, rlange@smtp.isbe.state.il.us, **Terence A. Oliva, Sean McDade**

Based on earlier work by Oliva, DeSarbo, Day & Jedidi (1987), GEMCAT II provides a flexible method to test catastrophe models with a single behavior dimension while allowing for a priori variable specifications and multivariate, (e.g., latent) dependent and independent variables. The system uses an efficient hybrid algorithm combining the downhill simplex and Powell's conjugate gradient method...

### TD13 Modeling Consumer Behavior & Retail Strategy

**Sponsor:** College of Marketing

**Sponsored Session**

**Chair:** David R. Bell, University of Pennsylvania, The Wharton Sch., Mktg. Dept., Philadelphia, PA 19104

**1) Retail Promotions, Household Expenditures & Budget Allocation Decisions: An Empirical Analysis, Xavier Dreze**, University of Southern California, Marshall Sch. of Business, Los Angeles, CA 90089-1421, **Patricia Nisol, Naufel Vilcassim**

We investigate whether households' budgets in grocery shopping environment are preset before entering the store or are flexible and determined while in the store-specific offerings encountered during the visit. The almost ideal demand system model is estimated using data on market basket purchases.

**2) An Across-Category & Store Format Model of Consumer Response to Private Label Branding, Andrew Ainslie**, Cornell University, 547 Malott Hall, JGSM, Ithaca, NY 14853, **David R. Bell, Sanjay K. Dhar**

We develop and estimate a consumer brand choice model that allows for across-category correlation in consumer preference for brand names. The model is used to assess the effectiveness of alternative umbrella branding strategies, and to the extent to which each can contribute to building store equity.

**3) Inter-Store Differences in Related Category Purchases: Cross-Category Effects & the Role of Aisle Adjacencies, Venkatesh Shankar**, University of Maryland, Smith Sch. of Business, Van Munching Hall, College Park, MD 20742, vshankar@rhsmith.umd.edu, **Gabriel Biehal, Richard M. Durand, Pallassana K. Kannan**

Are there differences among stores in consumer purchases of the same product category (after controlling for store size)? What are the effects of purchases of one product category on the purchases of another related category? How do aisle adjacencies of product categories impact their purchases? To answer these questions, develop regression models and estimate them using OLS and 3SLS methods...

**4) Multi-Category Analysis using the "Multivariate-Multinomial Probit" Model, Puneet Manchanda**, University of Chicago, **Asim Ansari, Sunil Gupta**

Consumers choose multiple items (across categories) in many situations such as grocery shopping and mail-order purchasing. We investigate 2 market outcomes of multi-category choice behavior, brand extension and market structure, through the use of a new model form. This model, the multivariate-multinomial probit model, allows us to investigate consumer choices both within and across categories...

### TD14 Building Technological Capabilities Multiple Perspectives

**Sponsor:** Technology Management Section

**Sponsored Session**

**Chair:** Deborah Dougherty, Rutgers University, Fac. of Mgmt., Org Mgmt. Dept., 111 Washington St., Newark, NJ 07102, doughert@everest.rutgers.edu

**1) Technological Intensity, Formative Stages & Performances of Alliances, Varghese George**, Rutgers University, Fac. of Mgmt. Org. Mgmt. Dept., 111 Washington St., Newark, NJ 07102, vgeorge@andromeda.rutgers.edu, **George F. Farris**

Contrary to popular notions, highest firm-level technological intensity is shown to be associated with low alliance formation. A conceptual model extends this finding, demonstrating that high technological intensity can hinder alliances' performance by stretching formative stages of the life cycle, making them difficult to manage and vulnerable to external influences.

**2) Creating Technological Capability in Service Organizations, Deborah Dougherty**, Rutgers University, Fac. of Mgmt., Org Mgmt. Dept., 111 Washington St., Newark, NJ 07102, doughert@everest.rutgers.edu

Service organizations face a particular challenge in managing technology since it is embedded in certain people. The study compares manufacturing-like service firms with professional practice firms to highlight services' unique knowledge-building challenges and to explore how these challenges vary by type of operating system.

**3) Using Information & Internet Technology in Strategic Decision Making: Caveats & Remedies, dt ogilvie**, Rutgers University, Fac. of Mgmt. Org. Mgmt. Dept., 111 Washington St., Newark, NJ 07102-1897, dt.ogilvie@newark.rutgers.edu

There is an increasing use of the Internet and IT in business decision making, but a failure to examine their impact. I discuss problems that arise from overemphasizing technology and neglecting to consider the psychological and structural downsides of its use, techniques to overcome these constraints and implications for praxis.

**4) The Underlying Elements of Two Critical Organizational Routines: Unpacking Knowledge Management, Daniel Z. Levin**, Rutgers University, Fac. of Mgmt. Org. Mgmt. Dept., 111 Washington St., Newark, NJ 07102, levin@business.rutgers.edu

Favorable outcomes for 2 knowledge-intensive routines, technology transfer and technology roadmapping, require not just a kind of sterile, anonymous organizational ability to absorb knowledge, as the learning literature might suggest, but also a high degree of comfort and use of power to make the knowledge flow happen.

### TD15 Genetic Algorithms

**Contributed Session**

**Chair:** Ulrich Derigs, University of Cologne, Pohligstr. 1, Albertus Magnus Platz, Cologne, 50969, Germany, derigs@informatik.uni-koeln.de

**1) A Genetic Algorithm for the Orienteering Problem, Alice E. Smith**, University of Pittsburgh, Dept. of IE, 1031 Benedum Hall, Pittsburgh, PA 15261, aesmith@engrng.pitt.edu, **Fatih M. Tasgetiren**

The orienteering problem is a version of the TSP and has applications in vehicle routing and production scheduling. We present a GA with a random key representation to solve the problem. Employing 3 sets of test problems from the literature, the performance of the GA has been evaluated against problem specific heuristics and ANNs.

**2) A Genetic Algorithm-Based Approach to Process Design & Scheduling, In Lee**, Seton Hall University, Dept. of Computing & Dec. Sci., 400 South Orange Ave., South Orange, NJ 07079

Our overall objective is to evaluate the feasibility and potential for integrating 2 manufacturing decisions (process design and scheduling) into a combined decision model using GAs to minimize makespan.

**3) An Ordinal Approach for Developing an Adaptive Genetic Algorithm, Loo Hay Lee**, National University of Singapore, Dept. of Ind. & Systems Eng., Kent Ridge, Singapore, 119260, Singapore, iselee@nus.edu.sg, <http://www.eng.nus.edu.sg/ise/leeh.html>, **Yingli Fan**

In GAs, selecting a good representation of chromosome, crossover and mutation probability is not a trivial job. We will use the concepts of ordinal optimization and Bayesian learning to develop a self-learning adaptive GA. This algorithm has achieved good results on several problems.

**4) AGAPE: The Adaptive Genetic Algorithm Programming Environment, Ulrich Derigs**, University of Cologne, Pohligstr. 1, Albertus Magnus Platz, Cologne, 50969, Germany, derigs@informatik.uni-koeln.de, **Michael Heckmann, Markus Zils**

We present the concept of adaptive GAs and report on experiences with using AGAPE, our adaptive GA-based DSS generator in designing a DSS for machine scheduling within a PPS-Leitstand.

### TD16 Hotel Revenue Management

**Sponsor:** Revenue Management Section

**Sponsored Session**

**Chair:** Ahmet Kuyumcu, Talus Solutions, Inc., 4751 Best Rdo., Ste. 300, Atlanta, GA 30337-5609, akuyumcu@talus.net

**1) Before/After Revenue Measurement: Case Study of a Yield Management Implementation at a Hotel, Kalyan Talluri,** Universitat Pompeu Fabra, 27 Ramon Trias Fargas, Barcelona, 08005, Spain, talluri@upf.es

What is the revenue impact of a yield management implementation? How to measure the revenue impact of an implementation and how to decide what can be credited to yield management? We discuss a case study at a hotel and the complications that may arise in practice.

**2) Impact of Disaggregation on Hotel Forecasting Accuracy, Sheryl E. Kimes,** Cornell University, Sch. of Hotel Admin., 335 Statler Hall, Ithaca, NY 14853, sek6@cornell.edu, **Larry R. Weatherford, Sunmee Choi, Darren Scott**

Hotel revenue management relies on arrivals forecasts by length of stay and rate class. We studied the impact of various levels of aggregation/disaggregation on forecast accuracy and make recommendations for future practice.

**3) A Procedure for Min Max Length of Stay Control in the Hotel Industry, Ahmet Kuyumcu,** Talus Solutions, Inc., 4751 Best Rdo., Ste. 300, Atlanta, GA 30337-5609, akuyumcu@talus.net

LOS restrictions can be represented by a min max pair in some CRSs or PMSs in the hotel industry. An integer programming model that generates min max LOS recommendations is formulated, and a solution procedure based on polyhedral graph theory is proposed. Initial computational results are summarized.

#### TD17 Production Planning IV

Contributed Session

**Chair:** Cheng-Shuo Wang, Purdue University, Sch. of IE, 1287 Grissom, West Lafayette, IN 47907-1287, chengshu@ecn.purdue.edu

**1) Lot-Streaming With Variable Sublots in a Flow Shop, Shu-Chu Liu,** Ntl. Pingtung University of Science & Technology, 1 Hsueh Rd., Nei Pu, Pingtung, Taiwan, 912, ROC, sliu@mail.npust.edu.tw, **Zheng-Ren Chen**

In the past, the concept of consistent sublots is always discussed and applied in the lot-streaming problem. However, the drawback for consistent sublots may increase the makespan. We propose a method with the concept of variable sublots for a single job in a flow shop. Results show the proposed method, through flexibly allocating sublot sizes on each machine, outperforms others...

**2) withdrawn - author request of 9/30, Joao V. Moccellini,** University of Sao Paulo, School of Engineering, Av. Dr. Carlos Botelho 1465, Sao Carlos SP, 13560-250, Brazil, jvmoccel@sc.usp.br, producao.prod.eesc.sc.usp.br/producao/docmoccoce.htm

**3) withdrawn - author request of 9/30, Marcelo S. Nagano,** University of Sao Paulo, Faculty of Economics & Admin., Av. dos Bandeirantes 3900, Ribeirao Preto, SP, 14040-901, Brazil, msnagano@sc.usp.br, **Joao V. Moccellini**

**4) Incorporating Secondary Resources in Loading for a Flexible Manufacturing System, Bharatendu Srivastava,** Marquette University, Dept. of Mgmt., PO Box 1881, Milwaukee, WI 53201-1881, srivastavab@marquette.edu

Machine loading has a significant impact on the performance of an FMS, however, ignoring the secondary resources such as MHS can lead to serious scheduling problems that negatively impact the performance of the manufacturing systems. We address the likely impact of the supporting resources on the performance of an FMS.

**5) Comparison of Production Scheduling Approaches for the Chemical Industry, Niem-Trung L. Tra,** Virginia Tech., 701 Washington St., Apt. 4, Blacksburg, VA 24060, ntl@vt.edu, **John E. Kobza**

The main goal of production scheduling is to find an optimal solution that satisfies the demand while considering a variety of constraints and specific policies. We compare several production scheduling approaches for the chemical manufacturing industry. Schedules are created for production sequences constrained by the availability of resources, i.e., available processing time, manpower, storage space, etc.

**6) A Flow-Shop Problem Involving Batch & Setup Machines, Cheng-Shuo Wang,** Purdue University, Sch. of IE, 1287 Grissom, West Lafayette, IN 47907-1287, chengshu@ecn.purdue.edu, **Reha Uzsoy**

We study the 2-machine flow-shop problem where a batch processing machine

feeds a unit-processing machine with a family setup requirement. We prove that the scheduling problem is NP-hard if the number of job families is unrestricted. Several properties are derived and a B&B algorithm is developed based on the properties.

#### TD18 Recent Advances in Discrete Optimization

Cluster: Discrete Optimization

Invited Session

**Chair:** Pinar Keskinocak, IBM, TJ Watson Research Ctr., Rte. 134, Yorktown Heights, NY 10598, pinar@watson.ibm.com

**1) Strengthening Constraints of Integer Programs, Alper Atamturk,** University of California, Dept. of IEOR, Berkeley, CA 94720-1777, atamturk@ieor.berkeley.edu, **George L. Nemhauser, Martin Savelsbergh**

Improving LP representations of 0-1 integer programs has been shown to be very effective in solving these problems by LP-based search algorithms. We discuss a method to strengthen the constraints of general integer problems to improve linear relaxation bounds and present computational results.

**2) A Very Large Scale Neighborhood Search Approach for Set Partitioning Problems, Ozlem Ergun,** MIT, OR Ctr., 77 Mass Ave., Bldg. E40-130, Cambridge, MA 02139, ozie@mit.edu, **James B. Orlin**

The cyclic transfer neighborhood is an exponentially large neighborhood structure for set partitioning problems in general. It allows exchanges among several subsets. We use concepts and approaches from integer programming to develop and analyze algorithms to search this neighborhood for a profitable exchange.

**3) Variable Sized Bin Packing with Color Constraints, Milind Dawande,** IBM, TJ Watson Research Ctr., Rte. 134, Yorktown Heights, NY 10598, **Jayant Kalagnanam, Jay Sethuraman**

We consider the variable-sized bin packing problem with color constraints (VBPC), where each item has a color associated with it and there is a bound on the number of distinct colors allowed per bin. Our results include an asymptotic polynomial time approximation scheme and several approximation algorithms for VBPC and its variants.

#### TD19 Forecasting

Contributed Session

**Chair:** Zinovy Radovilsky, California State University, Hayward, CA 94542, zradovil@csuhayward.edu

**1) Technology Futuring & Textual Data Analysis, Kuang C. Wei,** Ford Motor Company, 2101 Village Rd., MD 3083, SRL Bldg., Dearborn, MI 48121, kwei@ford.com, **Robert M. Santer**

Technology futuring looks into traditional and innovative information sources, including large amounts of textual data, and provides insights of future technology potentials. Clustering techniques were used to analyze and present textual data on a multi-dimensional space for easy visualization. Theme maps show clusters of key technologies, developers and their interrelationships.

**2) Cost Estimating for Distributed System Design, Kent Webb,** San Jose State University, 13315 Simon Ln, Los Altos, CA 94022-3229, gkwebb@ispchannel.com

This case study examines the statistical and market research techniques used to project the costs for system components as part of the design process for a distributed interactive simulation system. A market survey of competitive trends provided critical information.

**3) SABRE Forecasting Efforts in Transportation, Lawrence A. Berk,** The SABRE Group, 22 Third Ave., Burlington, MA 01803, larry\_berk@notes.sabre.com

An overview of SABRE-Boston's successful forecasting practice. We recognize the growing market for forecasting/statistical analyses, particularly in conjunction with sophisticated optimization tools. We will overview the motor carrier and railroad business issues that necessitate forecasting, SABRE's reasons for entering the marketplace and successful applications combining forecasting and optimization.

**4) Forecasting in Excel: Capabilities & Efficiency, Zinovy Radovilsky,** California State University, Hayward, CA 94542, zradovil@csuhayward.edu

We analyze Excel's spreadsheet capabilities and add-ins for utilizing various forecasting methods, measurements of forecast accuracy and their applicability in Excel and optimization of time series forecasting parameters. We present several ways of making forecasting procedures in Excel more efficient by developing dialog boxes for various forecasting methods and identifying better

criteria of forecast accuracy.

## TD20 Some Graphical Interfaces for Mathematical Programming

Sponsor: INFORMS Computing Society  
Sponsored Session

Chair: David M. Gay, Bell Labs, Lucent Technologies, 600 Mountain Ave., Rm. 2C-463, Murray Hill, NJ 07974-0636, [dmg@bell-labs.com](mailto:dmg@bell-labs.com)

1) **User Interfaces for the AMPL Modeling Language, Brian W. Kernighan**, Bell Labs, Lucent Technologies, 600 Mountain Ave., Rm. 2C-518, Murray Hill, NJ 07974-0636, [bwk@bell-labs.com](mailto:bwk@bell-labs.com)

We will describe experiments with GUIs for AMPL, including successes and failures based on Visual Basic, Tcl/Tk, Java and others. Each has taught some lessons about interface design and about the strengths and weaknesses of interface-building tools, and suggests ways in which AMPL itself might evolve.

2) **A Generic Graphical Interface for Network Modeling, John W. Chinneck**, Carleton University, Systems & Computer Eng., 1125 Colonel By Dr., Ottawa, Ontario, K1S 5B6, Canada, [chinneck@sce.carleton.ca](mailto:chinneck@sce.carleton.ca), **Hongbo Li**

The ideal way to create and interact with network models is via graphical representations. We present software for drawing network models, extracting the LP model, obtaining a solution and displaying the results. The system takes advantage of the extensive facilities available in the underlying commercial network-drawing software (Visio).

3) **Visualization in GIDEN, Jonathan H. Owen**, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, [owenj@iems.nwu.edu](mailto:owenj@iems.nwu.edu), **Collette R. Coullard, David S. Dilworth**

GIDEN is a software environment for using and implementing network optimization algorithms. The environment features interactive graphical display and algorithm animation for network optimization problems. We describe the purpose and design of the visualization mechanisms in GIDEN and discuss the related issues of GIDEN solver development and extraction.

4) **Optimization as an Internet Resource, Robert Fourer**, Northwestern University, Dept. of IE/MS, 2225 North Campus Dr., Evanston, IL 60208-3119, [4er@iems.nwu.edu](mailto:4er@iems.nwu.edu)

Few users of optimization techniques have more than a handful of solver packages installed on computers they use regularly. Recent advances in network interfaces are beginning to encourage experimentation with a greater variety of solvers. This presentation surveys current Internet optimization interfaces and suggests priorities for making them more effective.

## TD21 Transportation Topics I

Contributed Session

Chair: Li-Kuo Rau, Purdue University, 1284 Civil Eng., West Lafayette, IN 47907, [likuo@ecn.purdue.edu](mailto:likuo@ecn.purdue.edu)

1) **Understanding Alert Effectiveness in Automated Warning Systems, Don Weitzman**, TRW, 1 Federal Systems Park Dr., Fairfax, VA 22033-4416, [don.ctr.weitzman@faa.gov](mailto:don.ctr.weitzman@faa.gov)

Warning systems are proliferating with the rapid pace of automation. Alerts signal potentially dangerous situations but they often turn out to be false. Accordingly, people will tend to ignore warnings. Can warning systems be designed so as to be useful? We will describe a quantitative analytical solution to this problem.

2) **The Toll Pricing Theory, Mehmet B. Yildirim**, University of Florida, ISE Dept., 303 Weil Hall, Gainesville, FL 23611, [ybayram@cao.ise.ufl.edu](mailto:ybayram@cao.ise.ufl.edu), **Donald W. Hearn**

We generalize the notion of toll pricing for the fixed demand traffic equilibrium problem by Hearn & Ramana to several traffic equilibrium models. We define a toll pricing framework where the determination of specific tolls can be carried out by optimization methods such as linear or integer programming.

3) **The Effects of Scheduled Time Off for Railroad Extraboard Crews, Pooja Dewan**, BNSF Railway, 2500 Lou Menk Dr., Ft. Worth, TX 76131, [pooja.dewan@bnsf.com](mailto:pooja.dewan@bnsf.com), **Kevin N. Crook**

Currently, railroad extraboard crews can be called to work at any time of the day throughout the year as long as they are rested. We present a model that can be used to analyze the effects on availability as well as costs of providing crews with scheduled days off.

4) **Using a Genetic Algorithm Approach to Calibrate Link Performance Function Parameters, Li-Kuo Rau**, Purdue University, 1284 Civil Eng., West Lafayette, IN 47907, [likuo@ecn.purdue.edu](mailto:likuo@ecn.purdue.edu),

## Jon D. Fricker

GAs are used to calibrate link performance function parameters, which lead to better traffic assignment results. Numerical experiments are conducted to demonstrate the feasibility of this approach, to seek the most effective configuration of GAs and to analyze the problem characteristics from an optimization perspective.

## TD22 Global Inventory & Logistics: Industry Issues

Sponsor: Manufacturing & Service Operations Management  
Sponsored Session

Chair: Ramesh Bollapragada, Lucent Technologies Bell Labs., 101 Crawfords Corner Rd., Rm. 2L-518, Holmdel, NJ 07733, [rbollapragada@lucent.com](mailto:rbollapragada@lucent.com)

1) **Stochastic Capacity Planning for Semiconductor Manufacturing, Sarah Hood**, IBM, TJ Watson Research Ctr., Rm. 35-264, PO Box 218, Yorktown Heights, NY 10598, [hood@watson.ibm.com](mailto:hood@watson.ibm.com)

The stochastic formulation of the strategic capacity planning problem deals with demand uncertainty. The solution is a tool set that is robust to changes in the mix of products between the time that the demand has to be forecasted for strategic planning purposes and the time that the orders are actually placed.

2) **Demand Signal Response, Alex Bangash**, Lucent Technologies Bell Labs., 101 Crawfords Corner Rd., Rm. 2L-518, Holmdel, NJ 07733

Lucent Technologies, Bell Laboratories designed a consensus-based demand planning process. This collaborative process ties the plans of production, marketing, product management and sales to define a common, consistent plan. The process allows the functions to work in tandem, but without restricting the autonomy of any individual function...

3) **An Algorithm for Scheduling On-Air Promotions on Network Television, Srinivas Bollapragada**, General Electric R&D, 1 Research Circle, K1-5C22A, Schenectady, NY 12309, [srinivas.bollapragada@crd.ge.com](mailto:srinivas.bollapragada@crd.ge.com)

Television networks schedule on-air promotions to increase the audience for their shows. Promotions are short advertisements for shows and typically consist of a scene from the show and an announcement of air date and air time. We present a math programming algorithm for efficiently scheduling promotions.

4) **Managing Component & End-Product Inventory under Demand & Supply Uncertainty & Customer Service Level Requirements, Jun J. Zhang**, Carnegie Mellon University, GSIA 24, Schenley Park, Pittsburgh, PA 15213, [jz2k@andrew.cmu.edu](mailto:jz2k@andrew.cmu.edu), **Ramesh Bollapragada, Uday S. Rao**

We consider a multi-echelon component-assembly inventory system with demand and supply uncertainty, non-0 lead times, and a target customer service level. Both components and end-products follow installation base-stock policies. We characterize the relation between the different base-stock levels and present solution algorithms to compute optimal stock levels, using decomposition approaches...

## TD23 Energy & Environmental Policy Modeling

Sponsor: Energy, Natural Resources & the Environment  
Sponsored Session

Chair: John Conti, Office of Policy, 1000 Independence Ave. SW, Washington, DC 20585, [john.conti@hq.doe.gov](mailto:john.conti@hq.doe.gov)

1) **The Use of the Policy Office Electricity Modeling System to Analyze Competitive Electricity Markets in the US, Frances Wood**, OnLocation Inc., 8100 Oak St., Dunn Loring, VA 22027, [fwood@onlocationinc.com](mailto:fwood@onlocationinc.com), **Lessly Goudarzi**

POEMS was developed for the DOE Policy Office specifically to address issues arising from the transition of regulated electricity monopolies to competitive markets. It integrates 2 existing models, the EIA's National Energy Modeling System and TRADELEC(TM), a detailed electricity model.

2) **The Application of MARKAL-MACRO in the Analysis of Reducing Carbon Emissions, Phillip Tseng**, US Department of Energy, 1000 Independence Ave., PO 21, Washington, DC 20585, [phil.tseng@hq.doe.gov](mailto:phil.tseng@hq.doe.gov)

Several modeling issues are important for climate change analysis, including technology innovation, technology learning, greenhouse emissions permit trading and the Clean Development Mechanism. We will discuss the MARKAL-MACRO model structure, the application of the model in identifying technology opportunities and implications for the equilibrium price of carbon permits.

3) **Use of Energy & Air Emissions Modeling at the EPA for**

**Developing Environmental Policies for the Power Industry, Sam Napolitano**, Environmental Protection Agency, napolitano.sam@epamail.epa.gov

The EPA has used the Integrated Planning Model (IPM) and other energy models to develop programs and policies for the control of air emissions from the electric power industry. Collectively, these models have given the EPA the ability to examine alternative control strategies for emissions of SO<sub>x</sub>, NO<sub>x</sub>, mercury and carbon dioxide.

#### TD24 Modeling Health Applications

**Sponsor:** Health Applications Section  
**Sponsored Session**

**Chair:** Sandra Potthoff, University of Minnesota, Carlson Sch. of Mgmt., Rm. 3-140, 321 19th Ave. South, Minneapolis, MN 55455-9940, potth001@tc.umn.edu

1) **Analytical Support of E-Commerce in the Pharmaceutical Industry, Moshe B. Rosenwein**, Merck-Medco Managed Care, L.L.C., 100 Summit Ave., Montvale, NJ 07645, moshe\_rosenwein@merck.com, **Stefanos Lepeniotis, Gerald B. Silverman**

We describe statistical and data analyses to support e-commerce applications in the mail-order, pharmaceutical business. Among the topics discussed are forecasting of demand for e-commerce, impact of e-commerce on other aspects of the business, e.g., customer service and characterizing e-commerce users by market segment.

2) **Targeting HIV Interventions in Injection Drug Users: Who is High-Risk & Should We Try to Find Them?, Amy R. Wilson**, University of California, Dept. of IE&OR, 4172 Etcheverry Hall, Berkeley, CA 94720, amy@ieor.berkeley.edu, **Shmuel S. Oren, James G. Kahn**

Targeting HIV prevention programs to high-risk IDUs improves outcomes; the magnitude of improvement depends on the definition of high risk. Different definitions require the collection of different types of participant-related data and may have implications for the data collection cost, the reliability of data gathered and the optimal prevention strategy.

3) **The Relationship Between Quality Management Practices & Performance in Long-Term Care Facilities, Sandra Potthoff**, University of Minnesota, Carlson Sch. of Mgmt., Rm. 3-140, 321 19th Ave. South, Minneapolis, MN 55455-9940, potth001@tc.umn.edu, **Douglas Olson, John C. Anderson, April Todd-Malmlov, Robert L. Kane**

SEM is used to analyze survey data from 75 Minnesota nursing facilities to assess the relationship between quality management practices and resident satisfaction, employee satisfaction and financial performance.

#### TD25 Global Optimization

**Contributed Session**

**Chair:** Khosrow Moshirvaziri, California State University, 1250 Bellflower Blvd., Long Beach, CA 90840, moshir@csulb.edu

1) **Approximating Global Optima of Nonlinear Programs by the Successive Convex Relaxation Method, Mitsuhiro Fukuda**, Tokyo Institute of Technology, Dept. of Math. & Comp. Sci., 2-12-1 Oh-Okayama, Meguro-ku, Tokyo, 152-8552, Japan, mituhiro@is.titech.ac.jp, <http://www.is.titech.ac.jp/~mituhiro/>, **Masakazu Kojima**

We consider an extension to NLPs of the successive relaxation method originally proposed by Kojima & Tuncel (1998) for nonconvex quadratic programs. Numerical experiments over NLPs to approximate global optima were conducted incorporating some heuristic issues to accelerate the convergence of the algorithm.

2) **Hands-On Global Optimization, Janos D. Pinter**, Pinter Consulting Services/Dalhousie University, 129 Glenforest Dr., Halifax, Nova Scotia, B3M 1J2, Canada, jdpinter@is.dal.ca, <http://is.dal.ca/~jdpinter/>

The LGO integrated application development environment serves to formulate, solve and visualize global (multiextremal) optimization models. We present a fully functional demonstration of LGO by solving several illustrative, practically motivated GO problems.

3) **Universal Global Method of Solving Non-Linear Systems Equations & Non-Linear Programming Problems with Multiple Functions, Vladimir A. Kamysnikov**, Tomsk State Architectural University, Dept. of Economy, POB 3046, Tomsk, 634003, Russia,

[kva\\_son@yahoo.com](mailto:kva_son@yahoo.com), <http://site.yahoo.com/baturovo>

Obviously there is no magic in title. The results obtained by me (proved theoretically) are the effects of extending the theory of convex functions. My algorithm was checked during two years of investigations and illustrated by solving of several hundred, better to say thousand of, tests and real nonlinear equations.

4) **On the Equivalent Formulations for Non-Convex Global Optimization, Khosrow Moshirvaziri**, California State University, 1250 Bellflower Blvd., Long Beach, CA 90840, moshir@csulb.edu, **Mahyar Amouzegar**

We explore equivalent formulations and algorithmic techniques for general continuous optimization. We then show how, in principle, the problem can be solved through a sequence of linear reverse convex programs. Related classes of problems, various formulations, solution properties and difficulties embedded in the problem are discussed.

#### TD26 Stochastic Processes Applications I

**Contributed Session**

**Chair:** Lerzan E. Ormeci, Eindhoven University of Technology, Fellowtel, Pastoor Petersstraat 47, Eindhoven, 5612 WB, The Netherlands, ormeci@eurandom.tue.nl

1) **Warranty Reserves for Non-Stationary Sales Processes, Shau-Shiang Ja**, SABRE Technology Solutions, 1 East Kirkwood Blvd., MD 7300, Southlake, TX 76092, shau-shiang.ja@sabre.com, **Vidyadhar G. Kulkarni, Amitava Mitra, Jayprakash G. Patankar**

Considering a stochastic sales process, first and second moments are derived for the manufacturer's total discounted warranty cost of a single sale. Expressions for the mean and variance of total discounted warranty costs for sales over the product life cycle are developed. Using a normal approximation, warranty reserves are calculated.

2) **Using Actuarial Ruin Theory to Calculate Lost Sales Probabilities, Sanford K. Cohn**, Richard Stockton College, Jimmie Leeds Rd., Pomona, NJ 08240, cohns@stockton.edu

We consider an inventory system with initial stock, a constant replenishment rate and a compound Poisson depletion process, basic actuarial ruin theory concepts are used to find the probability of experiencing a lost sale. Depending on the probability distribution of depletion size, either exact or approximate formulas are given.

3) **Prediction Regions in Experiments with Multiple Responses, Noel Artiles-Leon**, University of Puerto Rico, IE Dept., PO Box 5000, Mayaguez, PR 00681-9043, n\_artiles@rumac.uprm.edu

We develop a methodology to construct prediction regions in experiments with multiple responses using bootstrapping. Regression models for the responses were found and the errors were resampled with replacement to generate new observations, new regression models, and new optimal solutions. 95% prediction regions (characterized for being continuous and for having minimum coverage) were constructed.

4) **Idling Policies in Two-Class Queues With Batch Arrivals, Lerzan E. Ormeci**, Eindhoven University of Technology, Fellowtel, Pastoor Petersstraat 47, Eindhoven, 5612 WB, The Netherlands, ormeci@eurandom.tue.nl, **Apostolos N. Burnetas**

Consider the problem of acceptance/rejection of two-class customers arriving in batches to a service system. When an arriving batch can be partially accepted, the optimal idling policy is characterized via thresholds. When it can only be accepted as a whole, we provide counterexamples for the optimality of threshold policies.

#### TD27 DP Methodology

**Contributed Session**

**Chair:** Eugene A. Feinberg, SUNY, Harriman Sch. of Mgmt., Stony Brook, NY 11794-3775, eugene.feinberg@sunysb.edu, <http://www.ams.sunysb.edu>

1) **Dynamic Control Models for Target Hitting, Yi He**, University of Toronto, Rotman Sch. of Mgmt., 105 St. George St, Toronto, Ontario, M5S 3E6, Canada, yihe@mgmt.utoronto.ca, **Oded Berman, Dmitry Krass**

Hitting a future target is a stochastic process. The process control includes sequential decision making. We formulate the problems as dynamic programming models and explore fundamental structures. We also develop algorithms and present numerical results.

2) **Convergence with Dynamic Programming, Marius C. Silaghi**, Swiss Federal Institute of Technology Lausanne, Ecublens, Ecublens,

VAUD, 1015, Switzerland, silaghi@lia.di.epfl.ch, *Herve Bourlard*

We tackle the problem of finding subsequences of observations that optimize normalized costs of paths in Markov models and appear in speech recognition. The solution we present consists in generating a sequence. We prove that it converges in an acceptably bounded number of steps towards the solution, being particularly efficient.

3) **An Approximate Dynamic Programming Approach for Large-Scale Integer Programming**, *Ramazan Demir*, MIT, OR Ctr., 1 Amherst St., E40-194, Cambridge, MA 02139, rdemir@mit.edu, *Dimitris Bertsimas*

We propose an approximate dynamic programming methodology in order to solve large-scale integer programming. We use base-heuristic learning for value function approximation and several problem reduction techniques to solve integer programs. We report very encouraging computational results involving thousands of variables and constraints.

4) **Constrained Nonatomic Markov Decision Processes with Total Rewards**, *Eugene A. Feinberg*, SUNY, Harriman Sch. of Mgmt., Stony Brook, NY 11794-3775, eugene.feinberg@sunysb.edu, http://www.ams.sunysb.edu, *Aleksey B. Piunovskiy*

The well-known phenomenon is that randomized policies outperform non-randomized ones in constrained Markov decision processes with multiple objectives. For problems with expected rewards, we show that non-randomized policies are optimal if initial and transition probabilities are nonatomic. An inventory control application is considered.

**TD28 Core Techniques to Match Assets with Demand in the Chesapeake Decision Sciences Toolkit**

Cluster: E-Business & Decision Technology in Semiconductors  
Invited Session

Chair: Gary Sullivan, IBM Management Technologies Consulting, 5 Alexis Dr., Burlington, VT 05401, gsulliv@us.ibm.com

1) **MIMI Global Planner for Semiconductor Enterprises**, *Dwight Collins*, Aspen Technology, Inc., Chesapeake Supply Chain Div., New Provident, NJ, dec@chesapeake.com

About 7 years ago, CDS began the process of understanding the production planning and ATP requirements of firms in the semiconductor industry and incrementally enhance their tool kit where appropriate to meet these needs. This presentation will describe the core decision technology deployed by CDS to meet the needs of its customers and the evolution of this tool.

2) **MIMI Available to Promise**, *Walt Beadling*

We will describe the ATP portion of the CDS tool kit and how it intergrates with the global planning engine.

**TD29 Software Demonstration VII**  
Software Demo Session

Chair: To be announced

1) **Imagine That, Inc.**, *David Krahl*, Imagine That, Inc., 6830 Via Del Oro, Ste. 230, San Jose, CA 95119, davek@imaginethatinc.com

See why Extend is the acknowledged standard for discrete event and continuous simulation in top universities and corporations alike. View a demonstration of powerful Extend features such as top-down/bottom-up hierarchy, built-in activity-based costing, customizable animation, 1-click output analysis, automatic confidence intervals, sensitivity analysis, control panel interface...

2) **Mathematica**, *Anton Rowe*, Wolfram Research, Inc., anton@episoft.com

OR is poised to take a significant role in today's evolving logic servers. Using logic servers, OR methods can easily be served up to desktop clients. We will explore how the Mathematica kernel can be used to service Excel with real-time linear optimization services, made possible by the recently released Mathematica Link for Excel...

**TD30 Information Technology Support for Knowledge Networking**

Sponsor: INFORMS Computing Society  
Sponsored Session

Chair: Ramesh Sharda, Oklahoma State University, Coll. of Bus. Admin., Stillwater, OK 74078-0555, sharda@okstate.edu

1) **An Overview of Visualization Technologies for Knowledge Networks**, *Ozgur Turetken*, Oklahoma State University, Coll. of Bus. Admin., Stillwater, OK 74078, turetken@okstate.edu, *Ramesh Sharda*

We begin by describing the concept of knowledge networks. To enhance information sharing and reduce information overload, many techniques and technologies have to be employed. We survey the role and status of information visualization technologies. We conclude with a discussion of research opportunities and issues in knowledge networking.

2) **Visualizing Internet Search Results with Adaptive Self-Organizing Maps**, *Dmitri Roussinov*, University of Arizona, Dept. of MIS, McClelland Hall 430, Tucson, AZ 85721, dmitri@bpaosf.bpa.arizona.edu, *Hsinchun Chen*

Visualizing large collections of text documents by automatically created maps of categories reduces information overload and facilitates navigation. However, commercial software, including Internet search engines, has not adopted this approach yet. One of the possible reasons could be the low accuracy of category maps, especially in the case of very noisy input, such as Web pages...

3) **Management of Information Systems through a Fisheye View**, *Terence Ow*, University of Wisconsin, IOM Dept., School of Bus., 1221 Grainger Hall, Madison, WI 53706, thow@students.wisc.edu, *Ramesh Sharda*

The use of fisheye view is discussed in managing information systems. The technique provides a visual emphasis to the users' point of interest, while keeping a perspective of the overall information system. It is proposed to be more effective in the development and management of information systems.

**TD31 Fatigue & Reliability of Materials**

Cluster: Reliability Modeling

Invited Session

Chair: Simon Wilson, Trinity College, Dept. of Statistics, Dublin, Ireland, simon.wilson@tcd.ie

1) **Assessing Uncertainties Associated with Long-Term Reliability Estimates for Brittle Components**, *Ed Fuller*, National Institute of Standards & Technology, Ceramics Division, Gaithersburgh, MD 20899, edwin.fuller@nist.gov

In the simultaneous presence of tensile stresses and moisture, flaws in glasses and ceramics can grow, leading to time-dependent structural failure. Basic concepts of this phenomenon are reviewed from a fracture mechanics perspective. The use of non-parametric bootstrap techniques for assessing uncertainties associated with these reliability estimates is discussed. Several case studies are presented to illustrate various aspects of the analysis.

2) **Prediction of Fatigue Crack Growth via Frailty Models**, *Prem Goel*, Ohio State University, Dept. of Statistics, Columbus, OH 43210, goel@stat.ohio-state.edu, *Panickos Palettas*

Laboratory testing of structural fatigue yields replications, each representing the history of an individual crack growth over time. Hierarchical model-doubly stochastic Poisson process; mean proportional to mixture of Dirichlet processes with Pareto measures, provides an appealing model consistent with structural mechanics. MCMC implementation of this model is presented.

3) **Modeling the Reliability of Orthopedic Hip Replacements**, *Simon Wilson*, Trinity College, Dept. of Statistics, Dublin, Ireland, simon.wilson@tcd.ie

Hip replacements consist of a metal prosthesis inserted into the femur, secured with polymer cement. With use, cracks form and propagate in the polymer, eventually causing implant failure. We discuss statistical models for such crack growth and their use in inference and predicting prosthesis lifetime.

**TD32 Network Analysis & Design**

Sponsor: Technical Section on Telecommunications

Sponsored Session

Chair: Syam S. Menon, Oklahoma State University, Dept. of Mgmt., Stillwater, OK 74078, smemon@gsbalum.uchicago.edu

1) **A Preliminary Study of Dynamic TCP Parameter Modification**, *Mark Weiser*, Oklahoma State University, Dept. of Mgmt., Stillwater, OK 74078, weiser@okstate.edu, *Rick L. Wilson*

End-to-end data transport protocols have two main functions: Error recovery and congestion control. Within the domain of TCP, we investigate the current state of research in segment size, acknowledgment timers, and end-host buffering and present preliminary findings on a dynamic approach to modify these settings based on present network characteristics.

2) **A Column Generation Heuristic for Hybrid Fiber Co-Axial Network Design**, *Rakesh Gupta*, University of Texas, Sch. of Mgmt., Dallas, TX 75083, *Syam S. Menon*

Recent changes in the telecommunications industry have made the delivery of broadband services to the home very attractive. Cable television companies,

with co-axial cable already in place could benefit from the efficient design of hybrid fiber/co-axial networks. We present a column-generation based heuristic for the design of such networks.

### TD33 Statistical Control for Industrial Systems

Sponsor: Quality, Statistics & Reliability  
Sponsored Session

Chair: Harriet Nembhard Black, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706-1572, hbnem@engr.wisc.edu

1) **Steady-State Identification for Noisy Dynamic Systems with Startups**, *Ming-Shu Kao*, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706-1572, ming@cae.wisc.edu

Industrial control systems frequently experience process startups that have a transient phase. Knowledge about the transition from transient to steady-state condition can facilitate the monitoring and control of the steady-state process. We present statistical control procedures for signaling the steady-state condition. Simulation is used to evaluate their performance.

2) **Robustness Factors for Statistical Tests Based on Independent Observations**, *Rene Valverde*, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706-1572, valverde@students.wisc.edu

Many standard statistical tests assume that the observations to which they are applied are independent. We use simulation to examine some of these statistical tests for their properties of robustness to a lack of independence as reflected in "robustness factor."

3) **A Demerits Control Chart for Autocorrelated Data**, *David A. Nembhard*, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706-1572, nembhard@engr.wisc.edu

We develop a new moving centerline demerits (MCD) control chart for monitoring process quality where there are multiple defect severity levels and measurements tend to be autocorrelated. The MCD chart is applied to actual data from injection molding production lines and performs well with respect to signaling an out-of-control condition.

4) **Statistical & PID Controllers for Systems with Response Lags**, *Harriet Nembhard Black*, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706-1572, hbnem@engr.wisc.edu

We design 4 control policies to integrate SPC and EPC using a proportional-integral-derivative/moving centerline EWMA model. We specifically consider the impact of these policies for a system with response lags given by a second-order dynamic process and auto-correlated nonstationary outside disturbances.

### TD34 Uncertainty in IT

Cluster: State-of-the-Art in Information Technology  
Invited Session

Chair: Vicki McKinney, University of Wisconsin, School of Bus. Admin., Box 742, Milwaukee, WI 53201, vrm@uwm.edu

1) **Perceived Time Pressure & the Link Between Perceived Uncertainty & Selected Coping Strategies in a Project Management Environment**, *Mavis Sauer*, University of Texas, Arlington, TX, mcs3430@utarl.g.uta.edu

Using self-report data from Naval project managers, the relationship between PEU, time pressure, and coping was explored with PCA and canonical correlation. A significant correlation suggests that, under time pressure, the combination of confidence in predictability and lack of confidence in effects assessments is associated with behaviors of depression.

2) **Facing Uncertainty in Network Expansion**, *Charletta Gutierrez*, Northern Illinois University, Dept. of Op. Mgmt. & IS, Wirtz Hall 209, DeKalb, IL 60115, cgutierrez@niu.edu

3) **The Effect of Environmental Uncertainty on the Transfer of IT in Multinational Corporations**, *Guillermo Rodriguez*, ITESM Campus Estado de Mexico, Div. de Ingenieria/Arquitect., Dept. de Sistemas de Info., Atizapan de Zaragoza, 52926, Mexico, grdrz@campus.cem.itesm.mx

Among the many factors that affect the use of IT in organizations, environmental uncertainty is perhaps the one that better reflects the conditions of continuous change of today's business environment. This paper examines, empirically, how environmental uncertainty affects the transfer and leverage of information technology in multinational corporations.

4) **An Exploratory Study of Perceived Environmental Uncertainty & Disaster Recovery Planning**, *Vicki McKinney*, University of Wisconsin, School of Bus. Admin., Box 742, Milwaukee, WI 53201, vrm@uwm.edu

Despite the importance of DRP, academic research in this area has been limited. We use contingency theory as a foundation for examining interviews with IS managers to see if the organization's approach to DRP is predicted by the strategic planners' perceived uncertainty in the organization's environment.

TD35 **Tutorial: Management of Technology: What has Been (& Can Be) Learned from Research in Industrial Organization?**

Invited Session

Chair: Mihkel M. Tombak, Northwestern University, MEDS Dept., Kellogg Sch. of Mgmt., m-tombak@nwu.edu

1) **Tutorial: Management of Technology - What Has Been (& Can Be) Learned from Research in Industrial Organization?**, *Mihkel M. Tombak*, Northwestern University, MEDS Dept., Kellogg Sch. of Mgmt., m-tombak@nwu.edu

This tutorial will begin with an overview of some issues in MoT, including intellectual property rights, licensing, technology standards, financing (i.e., venture capital), organization (i.e., joint ventures) and technology policy. We will then review which fields, i.e., sociology, OB, history, POM and IO, etc., have contributed to research in MoT. Approaches in IO research will be discussed and the research of MoT issues in IO will be surveyed.

TD36 **The Role of Managerial Accounting in Managing R&D/New Product Development Processes**

Cluster: R&D Technology & Knowledge Management  
Invited Session

Chair: Manash R. Ray, Lehigh University, Coll. of Bus. & Economics, Rauch Bus. Ctr., 621 Taylor St, Bethlehem, PA 18015

1) **The Industrial Research Institute/Center for Innovation Management Studies R&D Database**, *Alden S. Bean*, Lehigh University

The CIMS and the IRI have collaborated on the development of an R&D database since 1992. Data are collected annually covering firm, laboratory and business sector R&D activities as well as several output variables that can be used to compute innovation performance metrics.

2) **The Role of Managerial Accounting in R&D Portfolio Management**, *Carey C. Curtis*, Southern Connecticut State University

An analysis of 6 years of data suggests that using net present value (NPV) as the sole criterion for R&D project selection is short-sighted. NPV may be appropriate for projects with risk/reward trade-offs similar to conventional capital budgeting projects but projects with higher risk/reward trade-offs should be assessed using internal rate of return...

3) **A Framework for Analyzing the Financial Impact of Cost/Time Tradeoffs in New Product Development**, *Marjorie Platt*, Northeastern University, *Julie Hertenstein*

No abstract supplied.

4) **The Use of Transaction Analysis in Managing New Product Development: Lessons From the Field**, *Manash R. Ray*, Lehigh University, Coll. of Bus. & Economics, Rauch Bus. Ctr., 621 Taylor St, Bethlehem, PA 18015

No abstract supplied.

5) **Analysis of R&D Productivity in Industrial Firms**, *Karl Einolf*, Mount St. Mary's College, 317 Knott Academic Ctr., Emmitsburg, MD 21727

The relationship between the composition of R&D investment and firm productivity is examined. Econometric techniques are used to explain the effect of R&D portfolios on total factor productivity growth for 21 industrial firms. DEA is also employed to generate a Malmquist productivity index to further explain the relationship.

TD37 **Panel: Best Cases**

Sponsor: INFORM-ED  
Sponsored Session

**Chair:** Peter C. Bell, University of Western Ontario, Ivey School of Bus., London, Ontario, N6A 3K7, Canada, pbell@ivey.uwo.ca

1) **Panel: Best Cases, Peter C. Bell**, University of Western Ontario, Ivey School of Bus., London, Ontario, N6A 3K7, Canada, pbell@ivey.uwo.ca

Several presenters will discuss a case that has proven effective in teaching their OR/MS course. Sample cases and, where possible, teaching notes will be made available to attendees.

### TD38 SQP Methods for Nonlinear Programming

**Cluster:** Nonlinear Programming  
Invited Session

**Chair:** Reha H. Tutuncu, Carnegie Mellon University, Dept. of Math. Sci., 6113 Wean Hall, Pittsburgh, PA 15213, reha@andrew.cmu.edu

1) **On Quasi-Newton Methods for Constrained Optimization, Michael Wagner**, Cornell University, Sch. of OR/IE, Rhodes Hall, Ithaca, NY 14853-3801, wagner@orie.cornell.edu

We present our current ideas on quasi-Newton algorithms for constrained optimization with our main contribution being an update to an approximation to the 1-sided projection of the Hessian of the Lagrangian which keeps the symmetric part positive definite. We will discuss globalization strategies as well as our computational experiments on test problems stemming from applications.

2) **Degenerate Nonlinear Programming with a Quadratic Growth Condition, Mihai Anitescu**, Argonne National Laboratory, 9700 South Cass Ave., MCS, Bldg. 221, Argonne, IL 60439, anitescu@mcs.anl.gov

We show that the quadratic growth condition and the Mangasarian-Fromovitz constraint qualification imply that local minima of NLPs are isolated stationary points. As a result, when started sufficiently close to such points, an \$L\_\infty\$ exact penalty sequential quadratic programming algorithm will induce at least R-linear convergence of the iterates to such a local minimum...

3) **An SQP-Based Interior Point Algorithm for Large-Scale Nonlinear Optimization, Andreas Waechter**, Carnegie Mellon University, Chemical Eng. Dept., 5000 Forbes Ave., Pittsburgh, PA 15213, andreasw@andrew.cmu.edu, **Lorenz T. Biegler, Reha H. Tutuncu**

An interior point algorithm for large-scale NLP is presented. We follow a primal-dual barrier approach. The barrier problems are solved using a reduced space SQP strategy with quasi-Newton approximation of the reduced Hessian of the original problem. Global and local behavior of the algorithm and numerical results are presented.

## Tuesday 16:30-18:00

### TE01 Decision Analysis Arcade

**Sponsor:** Decision Analysis Society  
Sponsored Session

**Chair:** Dana R. Clyman, University of Virginia, Darden Grad Sch. of Bus. Adm., Charlottesville, VA 22906-6550, clymand@darden.gbus.virginia.edu

1) **Sequential Valuation Networks & Asymmetric Decision Problems, Riza Demirer**, University of Kansas, Sch. of Business, Summerfield Hall SU318, Lawrence, KS 66045-2003, riza@ukans.edu, <http://lark.cc.ukans.edu/~rdemirer>, **Prakash P. Shenoy**

We deal with representation and solution of asymmetric decision problems. We describe a new representation called sequential valuation networks - a hybrid of Covaliu & Oliver's sequential decision diagrams and Shenoy's valuation networks. We illustrate our technique by representing and solving Howard's used car buyer problem in complete detail.

2) **The Link between Organizational Intelligence & Business Results, David Matheson**, Strategic Decisions Group, One Boston Place, 39th Floor, Boston, MA 02108-4467, dmatheson@sdcg.com, **James E. Matheson**

Since the publication of The Smart Organization, we have conducted extensive surveys linking our measure of organizational intelligence to performance. The result: smart organizations perform better, particularly in the areas of profitable growth. This demonstrates that the principles of the smart organization correlate with desirable actual business results.

### TE02 Discrete Optimization Methodology I Contributed Session

**Chair:** Wafik H. Iskander, West Virginia University, IMSE Dept., PO Box 6070, Morgantown, WV 26506-6107, iskander@cemr.wvu.edu

1) **A Semidefinite Programming-Based Nonrandomized Rounding Method for the Max-Cut Problem, Beong Choi**, University of Michigan, IOE Dept., 1205 Beal Ave., Ann Arbor, MI 48109-2117, bchoi@engin.umich.edu, **Romesh Saigal**

An SDP relaxation to the max-cut problem is known to produce randomized solutions that on the average result in an objective of at least .87856 times the optimal value. We present an SDP-based rounding method that produces a max-cut solution that results in an objective with a provable lower bound. Since the polynomial-time rounding method is not randomized, the bound is effective with probability 1.

2) **The Probabilistic Set Covering Problem, Patrizia Beraldi**, University of Calabria, Dept. of Elect. Systems & CS, Via P. Bucci, Rende, Cosenza, 87036, Italy, beraldi@parcolab.unical.it, <http://www.parcolab.unical.it>, **Andrzej Ruszczyński**

In a probabilistic set covering problem, the right hand side is a random binary vector and the covering constraint has to be satisfied with a prescribed probability. We shall present and compare specialized B&B methods on the notion of a p-efficient point of the distribution.

3) **withdrawn - author request of 9/10, Charles Audet**, Rice University, CAAM MS 134, 6100 Main St., Houston, TX 77005, charlesa@caam.rice.edu, <http://www.caam.rice.edu/~charlesa/>, **John E. Dennis**

4) **Minimization of Weighted Flow Times for Unrelated Parallel Processing, Wafik H. Iskander**, West Virginia University, IMSE Dept., PO Box 6070, Morgantown, WV 26506-6107, iskander@cemr.wvu.edu, **Majid Jaraiedi, Jaihyun Goo**

A 0-1 MIP model was developed to obtain optimal solutions for small problems. Two heuristic algorithms were developed and applied to obtain near optimal solutions for larger problems. Algorithms were also developed to calculate lower bounds for problems in order to evaluate the heuristic solutions.

### TE03 Issues in Production & Inventory Control

**Sponsor:** Manufacturing & Service Operations Management  
Sponsored Session

**Chair:** Tava Lennon Olsen, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, tlennon@engin.umich.edu

**Co-Chair:** Rachel Q. Zhang, University of Michigan, 222 IOE Bldg., 1205 Beal Ave., Ann Arbor, MI 48109-2117, rzhang@engin.umich.edu

1) **Inventory Planning & Revenue Management: A Unified Approach based on Capacity Allocation, İtir Karaesman**, Columbia University, 412 Uris Hall, Graduate School of Bus., New York, NY 10027, ik67@columbia.edu, **Garrett J. van Ryzin**

In revenue management, one makes a sequence of commitments to satisfy current demand with future capacity; in inventory planning, one makes a sequence of commitments of current capacity to satisfy future demand. We discuss recent work on a unified model that exploits this dual capacity allocation approach to these two problems.

2) **Optimal Inventory Policies in Systems with Deterministic Demand & Stochastic Demand, Katia C. Frank**, University of Michigan, Dept. of IOE, Ann Arbor, MI 48109-2117, kfrank@umich.edu, **Rachel Q. Zhang, Izak Duenyas**

We consider a periodic review inventory system with deterministic and stochastic demands. In each period, the deterministic demand has to be met while the stochastic can be turned down. Assuming that demand that can not be met at the time it occurs is lost, we successfully characterize the structure of the optimal solution.

3) **Inventory Policies with Forecast Revisions, Guillermo Gallego**, Columbia University, IEOR Dept., Mudd Bldg., 500 West 120th St., Rm. 331, New York, NY 10027, ggallego@ieor.columbia.edu, **Ozalp Ozerp**

We explore the structure of optimal stochastic inventory policies with and without fixed costs when the planner updates future demands over a forecasting horizon. Simple policies are obtained when the forecasting horizon is shorter than the replenishment lead times.

4) **Analytic Models for Deciding when to Outsource, Tava Lennon Olsen**, University of Michigan, Dept. of IOE, 1205 Beal

Ave., Ann Arbor, MI 48109-2117, tlennon@engin.umich.edu, *Hayriye Ayhan, Hasan Arslan*

Outsourcing and overtime are two common ways for a firm to increase its production capacity. Outsourcing, in particular, has become increasingly common in today's lean manufacturing environment. We discuss analytic models for making outsourcing and overtime decisions.

#### TE04 Tutorial: Theory & Application of the AHP

Cluster: Decision Technology

Invited Session

Chair: Matthew J. Liberatore, Villanova University, Coll. of Commerce & Finance, 800 Lancaster Ave., Villanova, PA 19085, liberatore@cf\_faculty.fin.vill.edu, liberator@ucis.vill.edu

1) Tutorial: Theory & Application of the Analytic Network Process, *Thomas L. Saaty*, University of Pittsburgh, Pittsburgh, PA 15260

The ANP is a new theory that extends the AHP to cases of dependence and feedback. The AHP can be mathematically shown to be a special case of the ANP. This tutorial will focus on both the theory and applications of the ANP. With the ANP any decision problem can be formulated in terms of clusters of elements and their interactions.

#### TE05 Location Models IV

Sponsor: Section on Location Analysis

Sponsored Session

Chair: Xavier Dreze, University of Southern California, Marshall Sch. of Business, Los Angeles, CA 90089-1421

1) Facility Location for Emergency Services with Mobile Servers, *Sandeep Vasudeva*, University of Toronto, Rotman Sch. of Mgmt., 105 Saint George St., Toronto, Ontario, M5S 3E6, Canada, vasudev@mgmt.utoronto.ca, *Oded Berman*

Mobile service units based at various facilities provide service to customers, located at nodes of a network. Under FCFS policy, every service unit serves the waiting customers going from node to node and returns to its home facility only when free. We develop an approximate model to calculate performance measures...

2) On the Collection Depots Location Problem, *Zvi Drezner*, California State University, Dept. of MS/IS, Fullerton, CA 92834, zdrezner@fullerton.edu, *George O. Wesolowsky*

Consider the problem of locating a new facility servicing demands. When a demand requires service, the server travels from the facility to the demand point, then to one of a number of collection depots, and back to the facility. We analyze the solution to this problem and report computational results.

3) Improved Lower Bounds for the Multimedial Location Problem, *Timothy J. Lowe*, University of Iowa, Coll. of Bus., Dept. of MS, S230A Pappajohn Bldg., Iowa City, IA 52242-1000, timothy-lowe@uiowa.edu, *James E. Ward, Ranganath S. Nugehalli*

The problem of locating  $n$  new facilities that interact with each other as well as  $m$  existing facilities is NP-hard. We give a new IP formulation, show that its LP relaxation provides a lower bound that is superior that of a previously published formulation and report computational results.

4) An Anchored Covering Location Model, *Scott A. Malcolm*, Planmatics, Inc., 15200 Shady Grove Rd., Ste. 450, Rockville, MD 20850, malcolm@udel.edu, *Charles ReVelle*

A model is developed for least-cost siting of a system of facilities such that each facility bears a specified relationship to its nearest neighboring facility. Facilities are sited to establish a path with that special property. Applications include establishing delivery sites, parcels for nature reserves and pollution monitoring stations.

#### TE06 Investment Decisions in Flexible Manufacturing Systems

Cluster: Flexible Manufacturing Systems

Invited Session

Chair: Kathryn E. Stecke, University of Michigan, Sch. of Business Admin., 701 Tappan St., Rm. 5206, Ann Arbor, MI 48109-1234, kstecke@umich.edu

1) An Overhead Cost Allocation Scheme to Support Quick Response Manufacturing, *Shyam Bhaskar*, University of Wisconsin, Ctr. for Quick Response Mfg., 1513 University Ave., Madison, WI 53706, bhaskar@cae.wisc.edu, *Rajan Suri, Ella Mae Matsumura*

We propose a new cost allocation basis to support the QRM strategy. Using analytical models from queuing theory and game theory, we establish the superiority of this overhead allocation basis over the other typical choices, in terms of providing a managerial incentive for lead time reduction.

2) Flexible Technology Investment: Examining the Impacts of Market Conditions and Competitive Uncertainty, *Richard M. Franza*, Bentley College, Dept. of Mgmt. AGC 324, 175 Forest St., Waltham, MA 02452, rfranza@bentley.edu, *Cheryl Gaimon*

High volume manufacturers invest in flexible technology in order to quickly exit obsolete markets and enter new ones. A model is presented to examine the firm's investment decision in "changeover" flexibility. A firm's decision is analyzed in the context of marketplace characteristics and uncertainty in the competitors' actions.

3) Cutting, Skiving & Pattern Sequencing: An Application from Automotive Component Manufacturing, *Claudio Arbib*, Universita degli Studi di L'Aquila, Dipt. Matematica Pure e Appl., via Vetoio, Coppito, 67010, Italy, arbib@univaq.it, *Francesco Di Iorio, Fabrizio Rossi, Fabrizio Marinelli*

In the production of transmission belts, raw materials are responsible of around 40% of the total cost, so yield optimization is a primary goal of the producer. An LP model for waste minimization is here proposed. Secondary goals considered are bottleneck workload control, quality control, and set-up minimization. Pattern sequencing to minimize WIP is also addressed.

4) Cycle Time Comparison of a Variety of Robotic Cells, *Suresh P. Sethi*, University of Texas at Dallas, Sch. of Mgmt. 2601 N Floyd Rd., MS J04.7, Box 830688, Richardson, TX 75083-0688, sethi@utdallas.edu, <http://www.utdallas.edu/~sethi>, *Jeffrey B. Sidney, Chelliah Sriskandarajah*

We investigate the productivity advantage of a variety of robotic cells by comparing their cycle times. The objective is the minimization of the steady state cycle time to produce a part or equivalently the maximization of the throughput rate. The motivation is to examine the cycle time advantage (or throughput advantage) of 2 alternatives to the flowshop with a single gripper robot.

#### TE07 Industrial Manufacturing Logistics Problems

Cluster: Manufacturing & Logistics

Invited Session

Chair: Robert H. Storer, Lehigh University, IMSE Dept., Mohler Lab., 200 West Packer Ave., Bethlehem, PA 18017, rhs2@lehigh.edu

1) Reliability Improvement at United Airlines using Simulation, *Dilek Tuzun*, United Airlines, Corporate R&D, WHQKB, 1200 East Algonquin Rd., Elk Grove Township, IL 60007, dilek.tuzun@ual.com

We present a simulation model of the flight schedule developed at United Airlines. The model focuses on maintenance operations and their relationship with schedule reliability to observe the effect of a proposed schedule on maintenance reliability and identify changes to both the schedule and the maintenance operation to improve reliability.

2) Integrating Logistics Models in Industry, *Michael Magent*, Air Products & Chemicals, Inc., Decision Sci. Dept., 7201 Hamilton Blvd., Allentown, PA 18195-1501, magentma@apci.com, *Andrew Bringham, Thomas W. Brinker*

Logistics models in industry were often developed as stand-alone applications. Technology advancement, data availability and experience created the opportunity for improved communication between related OR/IT applications in integrated systems. Approaches for effectively integrating models in areas such as forecasting, sourcing and scheduling will be discussed.

3) Real-Time Operations of a Painting Booth in the Automotive Industry for Minimizing the Color-Changeover Cost, *Wonjoon Choi*, Lehigh University, Dept. of IMSE, 200 West Packer Ave., Bethlehem, PA 18017, woc2@lehigh.edu

In an automotive painting booth, when the color changes from one body to the next, thinner and paint are wasted, incurring a color-changeover cost. The experiences of modeling the painting booth operation and designing and successfully installing a heuristic for minimizing the total cost of color-changeover will be addressed.

4) Early-Tardy Job Shop Scheduling, *Selcuk Avci*, Lehigh University, IMSE Dept., 200 Mohler Lab., 200 West Packer Ave., Bethlehem, PA 18015, sea4@lehigh.edu, *Robert H. Storer*

We investigate an early-tardy due date version of the classical job shop problem. We assume distinct due dates and unequal penalties for each task. We present an efficient problem space GA and compare its performance with

several simple scheduling construction algorithms.

**5) Heuristics for Scheduling Job Shops with Random Processing Times, Jaime M. Bustos**, Lehigh University, Dept. of IMSE, Mohler Lab., 200 West Packer Ave., Bethlehem, PA 18015, jmb9@lehigh.edu, **Robert H. Storer**

We present a model to incorporate variability into scheduling decisions for a job shop with random processing times. We study the problem of estimating the distribution function (and/or its first two moments) of a performance measure of a schedule and implement a method based in polynomial approximation to the PDFs.

## TE08 Logistics II

### Contributed Session

**Chair:** Zhaotong Lian, University of Massachusetts, Dept. of MIE, ELAB, Amherst, MA 01003, zlian@ecs.umass.edu, <http://farm.ecs.umass.edu/~atong>

**1) Dual-Mode of Supplies with Demand Information Updates: A Competitive Solution, Hua Xiang**, Chinese University of Hong Kong, Dept. of Sys. Eng. & Eng. Mgmt, Shatin NT, Hong Kong, China, hxiaang@se.cuhk.edu.hk, **Houmin Yan**

We study competitive behavior between a buyer and a supplier where purchases can be made at 2 separate times and with demand information updates. We show that there exists sub-game perfect Nash equilibrium where the buyer and the supplier optimize their objectives by choosing order quantities and prices, respectively.

**2) Asymptotically Optimal Stock Allocation, Kaj A. Rosling**, Lund University, Dept. of Production Mgmt., PO Box 118, Lund, SE-221 00, Sweden, kaj.rosling@ie.lth.se, <http://www.ie.lth.se/IE/Kaj/>, **Johan Marklund**

Warehouse stock is allocated among  $N$  independent retailers when  $m$  periods remain to the next shipment. The optimal form of the policy is derived as  $N$  approaches infinity. It implies that retailers should pay for accrued warehouse holding costs for items not ordered immediately. Numerical comparisons with Jackson (1988) are presented.

**3) Analysis of Supply Contracts with Discounts, Zhaotong Lian**, University of Massachusetts, Dept. of MIE, ELAB, Amherst, MA 01003, zlian@ecs.umass.edu, <http://farm.ecs.umass.edu/~atong>, **Abhijit Deshmukh**

We present an analysis of supply contracts over a rolling horizon where the per unit cost is discounted for items ordered later in the planning horizon. The buyers can update the requested quantities at each planning epoch at a proportional penalty cost. Our objective is to derive optimal ordering policies in order to minimize the total expected costs for the buyer.

## TE09 Supply Chains III

### Contributed Session

**Chair:** Julian M. Benjamin, Dept. of Transportation & Logistics, Economics Dept., Greensboro, NC 27411, benjamin@ncat.edu

**1) Coordinating Orders in a Supply Chain with Random Demands, Joong Y. Son**, University of Washington, Dept. of MS, Box 353200, Seattle, WA 98195-3200, sonjy@u.washington.edu, **Ted D. Klasterin, Kamran Moinzadeh**

We consider a 2-echelon supply chain with random demands where retailers can replenish stocks at a discounted price if they coordinate their orders with the wholesaler's cycle. We propose and analyze a periodic review replenishment policy for retailers and show how the wholesaler can maximize profits within this system.

**2) Allocating Costs in Supply Chains, Manuel P. Baghana**, Universidade Nova de Lisboa, Rua Marques de Fronteira 20, Lisboa, 1070, Portugal, mbaganha@fe.unl.pt

We merge 2 areas of research: the amplification of variability of demand introduced by the ordering decisions and the impact of cost allocation schemes on decision making. We present models showing that the mentioned distortions are induced by the schemes used to allocate costs among the different stages of a supply chain.

**3) The Valuation of Early Differentiation, Stefan Mohr**, WHU Koblenz, Otto-Beisheim GSM, Burgplatz 2, Vallendar, 56179, Germany, stefan.mohr@de.rolandberger.com, **Sunil Chopra, Arnd H. Huchzermeier**

Product postponement often leads to products that look increasingly similar. Consequently, consumer choice becomes more random and supply chain efficiency suffers. We propose a supply chain model that models this important

tradeoff. Moreover, we utilize data from the German grocery industry to estimate consumer responses for product line extensions.

**4) Total Logistics Cost Minimization of a Supply Chain, Julian M. Benjamin**, Dept. of Transportation & Logistics, Economics Dept., Greensboro, NC 27411, benjamin@ncat.edu

The total cost minimization of a logistics network including storage, ordering, shipping and production costs is compared to the supply chain approach. Differences are the emphasis by the supply chain approach on local networks and randomness of costs. The total cost approach is adapted to solve each of these differences.

## TE10 Optimization Prize for Young Researchers

### Sponsor: Optimization Section

#### Sponsored Session

**Chair:** Gerard Cornuejols, Carnegie Mellon University, Grad. School of IA, Pittsburgh, PA 15213-3890, gc0v@andrew.cmu.edu

**1) A Second-Order Bundle Method to Minimize the Maximum Eigenvalue Function, Francois Oustry**, INRIA Rhone Alpes, ZIRST, 655 av de l'Europe, Montbonnot St Martin, 38330, France, francois.oustry@inria.fr, francois.oustry@inrialpes.fr

We present a nonsmooth algorithm to minimize the maximum of eigenvalue of matrices belonging to an affine subspace on  $n \times n$  symmetric matrices. We show how a simple bundle method can be used to globalize the second-order method developed by Overton in the 1980s and recently revisited in the framework of the U-Lagrangian theory. With no additional assumptions, the resulting algorithm generates a minimizing sequence...

## TE11 Computational Mixed Integer Programming

### Cluster: Industrial Applications of Optimization

#### Invited Session

**Chair:** Eva Lee, Georgia Institute of Technology, School of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, evakylee@rainy.isye.gatech.edu

**1) A Parallel Primal-Dual Algorithm & its Application to Airline Crew Scheduling Problems, Diego Klabjan**, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, diego@isye.gatech.edu, **George L. Nemhauser, Ellis L. Johnson**

We develop a parallel version of a primal-dual simplex algorithm and we use it in a new algorithm for airline crew scheduling problems. A new heuristics based on specialized strong branching is part of the solution methodology.

**2) Planning Permanent Radioactive Seed Implants for Prostate Cancer Treatment via Mixed Integer Programming, Richard J. Gallagher**, Columbia University, Dept. of Medical Informatics, 161 Fort Washington Ave., New York, NY 10033, gallric@flux.cpmc.columbia.edu

We develop integer programming models to determine optimal seed configurations for radioactive implants for cancer treatment. LP-based heuristic procedures producing near-optimal plans are discussed. Cutting planes are applied to a perturbed system to close the integrality gap on difficult instances arising from prostate cancer cases.

**3) Optimal Shift Scheduling in Call Centers, Anuj Mehrotra**, University of Miami, Dept. of MS, Sch. of Bus. Admin., Coral Gables, FL 33124, anuj@miami.edu, **Kenneth E. Murphy, Michael A. Trick**

We present a B&P technique for optimal staff scheduling with multiple rest breaks, meal break and break windows. We devise and implement specialized branching rules suitable for solving the set covering type formulation implicitly, using column generation. In a direct comparison with an alternative method, our approach yields significant improvement in cpu time and the number of problem instances solved to optimality.

**4) Mixed Integer Programming Approaches to Brain Tumor Radiosurgery Treatment Planning, Eva Lee**, Georgia Institute of Technology, School of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, evakylee@rainy.isye.gatech.edu

MIP models developed to determine the optimal beams configurations and beam intensities for brain tumor radiosurgery are described. Fast heuristic procedures producing high-quality clinical plans are discussed and a parallel B&B procedure is outlined. Discussion of the application of these procedures to actual patient cases is presented.

## TE12 Marketing Plenary: Fundamental Issues & Directions for Marketing

Sponsor: College of Marketing  
Sponsored Session

Chair: George Day, University of Pennsylvania, The Wharton School, Philadelphia, PA 19104

Co-Chair: David B. Montgomery, Stanford University, 960 Wing Place, Stanford, CA 94305

1) **Marketing Plenary: Fundamental Issues & Directions for Marketing**, *Rajendra K. Srivastava*, University of Texas, Dept. of Mktg., CBA 7.202, Austin, TX 78712, *Richard Oliver, Allen Weiss*

## TE13 Marketing II Contributed Session

Chair: Tony Cox, Cox Associates, 503 Franklin St., Denver, CO 80218-3623, [tony@cox-associates.com](mailto:tony@cox-associates.com), <http://www.cox-associates.com/>

1) **Forecasting Purchases of Telecommunications Services via State Transition Models**, *Doug A. Popken*, Systems View, 9139 South Rrunner St., Highlands Ranch, CO 80126, [dpopken@systemsview.com](mailto:dpopken@systemsview.com), <http://www.systemsview.com>, *Tony Cox*

Telecommunications companies offer many subscriber services for customers to choose among. We modeled customer product bundles as states, and product adds or drops as transitions and compared several approaches to forecasting demand from historical state transition data. Hidden Markov modeling, with simply defined states, provided the best forecasts.

2) **Insights from a Two-Part Study Based on Cluster & Discriminant Analysis of Division I-A College Football Teams**, *Kabir C. Sen*, Lamar University, PO Box 10025, Beaumont, TX 77710, [senkc@hal.lamar.edu](mailto:senkc@hal.lamar.edu), *Donald I. Price*

The 112 colleges that have Division I-A college football teams are first segmented through a cluster analysis of 3 critical variables. Profiles of the resultant clusters are then developed through a discriminant analysis. Strategic implications for each segment are derived from the results.

3) **Steel Service Center in Transition**, *Erkki Hamalainen*, Helsinki School of Economics, PO Box 1210, Helsinki, 00101, Finland, [hamalain@hkkk.fi](mailto:hamalain@hkkk.fi), *Aimo J. Inkilainen*

SSCs have played a major role in traditional steel distribution. Now, after 3 development stages (import, domestic production, open market), their position is challenged by direct factory deliveries and flexible mills. We examine the drivers of industry transition from a managerial perspective and suggest value-added strategies for SSCs to survive.

4) **Causal Data Mining of Telecommunications Customer Data**, *Tony Cox*, Cox Associates, 503 Franklin St., Denver, CO 80218-3623, [tony@cox-associates.com](mailto:tony@cox-associates.com), <http://www.cox-associates.com/>

To achieve its promise, data mining must extract causal patterns from data, i.e., patterns that predict how changing some variables will change others. Yet, statistical associations usually lack unique causal interpretations. We present AI algorithms to create causal graph models and describe successful applications to predicting churn and purchases for telecommunications customers.

## TE14 Managing New Product Development

Sponsor: Technology Management Section  
Sponsored Session

Chair: Kingshuk K. Sinha, University of Minnesota, Carlson Sch. of Mgmt. 3-140, 321 19th Ave. South, Minneapolis, MN 55455, [ksinha@csom.umn.edu](mailto:ksinha@csom.umn.edu)

1) **New Product Development & Time-to-Market Performance: Examining the Relationship between NPD Investment Strategies/Market Characteristics**, *Janice Carrillo*, Washington University, Olin Sch. of Bus., CB 1133, 1 Brookings Dr., St. Louis, MO 63130-4899, [carrillo@wuolin.wustl.edu](mailto:carrillo@wuolin.wustl.edu), *Richard M. Franza*

Firms must develop appropriate design and production capabilities to introduce new products quickly. Investment approaches include technology, R&D, design tools and worker training. We present a model that examines the relationship between a firm's design and production capabilities and its time-to-market performance. The impact of market characteristics on NPD investment strategies is analyzed.

2) **Profiting from R&D in a Supplier Dominated Industry**, *Susan K. McEvily*, University of Pittsburgh, Katz Grad. Sch. of Bus.,

252 Mervis Hall, Pittsburgh, PA 15260, [smcevily@katz.pitt.edu](mailto:smcevily@katz.pitt.edu)

We examine how firms create value through R&D in a context where component suppliers introduce most of the radical technological innovations. We identify how different types of product development capabilities position firms to exploit new components in unique ways and relate them to the way firms profit from R&D.

3) **Strategic Decision Making in Sequential Product Development**, *Stella Y. Hua*, University of Wisconsin, Sch. of Business, OIM, Grainger Hall, Madison, WI 53706-1323, [yhua@bus.wisc.edu](mailto:yhua@bus.wisc.edu), *Urban Wemmerlov*

The "change intensive" nature of sequential products highlights the importance of strategic decisions such as the frequency, type and magnitude of product changes. Based on the analysis of data collected from more than 300 computer manufacturers, we explore factors that affect these decisions and provide insights into sequential product design and development.

4) **A Process Model for Managing Multiple-Concurrent New Product Development Projects: Analysis of Best Practices**, *Devesh Verma*, University of Minnesota, Carlson Sch. of Mgmt., 321 19th Ave. South, Minneapolis, MN 55455, [dverma@csom.umn.edu](mailto:dverma@csom.umn.edu), *Kingshuk K. Sinha*

We will report the development of a process model for effectively managing time varying interdependencies in multiple-concurrent NPD projects. The process model is developed based on our empirical analysis of best practice performance of NPD projects in a Fortune 500 high technology firm.

## TE15 Artificial Neural Net Applications Contributed Session

Chair: Yi Liao, North Carolina State University, Dept. of IE, 723 Chappell Dr., Raleigh, NC 27606, [yliiao2@eos.ncsu.edu](mailto:yliiao2@eos.ncsu.edu), <http://www4.ncsu.edu/~yliiao2>

1) **A Dynamic Analysis of Participation in Agricultural Risk Insurance Markets**, *Shiva Makki*, ERS/USDA, 1800 M St. NW, Rm. S5007, Washington, DC 20036, [smakki@econ.ag.gov](mailto:smakki@econ.ag.gov), *Agapi L. Somwaru*

We analyze the factors that influence a farmer's decision to participate or not to participate in agricultural risk insurance programs using the neural networks method. Preliminary analysis indicates that the demand for insurance products differs distinctively across commodities and regions. Results indicate that the geo-demographic factors significantly influence farmers participation in the agricultural risk insurance program.

2) **A Genetic Synthesis of Neural Networks for Product Entry Decisions**, *Brenda Mak*, University of Hong Kong, Dept. of Computer Sci., Pokfulam, Hong Kong, China, [bmak@csis.hku.edu](mailto:bmak@csis.hku.edu), *Robert W. Blanning, Susanna S. Ho*

GAs and neural networks were synthesized to analyze expert judgments. GAs were applied to optimize the network's weights and architecture. The synthesized genetic neural network was shown to outperform a neural network and a GA and/or tree in predicting expert heuristics on new product decisions.

3) **Nonlinear Models of Exchange Rates**, *A. A. M. Jamal*, Southeastern Louisiana University, Dept. of Mgmt., Hammond, LA 70402

Modeling exchange rates is an active area of research. We explore the application of neural network and other nonlinear techniques in estimating and forecasting exchange rates. Bilateral exchange rates between the US and its major trading partners will be studied. Each model will be evaluated in terms of its accuracy in predicting exchange rates...

4) **A Neural Network Approach for Fuzzy System Identification**, *Yi Liao*, North Carolina State University, Dept. of IE, 723 Chappell Dr., Raleigh, NC 27606, [yliiao2@eos.ncsu.edu](mailto:yliiao2@eos.ncsu.edu), <http://www4.ncsu.edu/~yliiao2>, *Henry L. Nuttle, Shu-Cherng Fang*

A neural network approach is proposed for system identification. Several implementation alternatives with respect to network architecture, number of hidden nodes, step length adjustment method and prevention of overfitting are tested and compared. A performance comparison between our neural network approach and a fuzzy clustering approach is also conducted.

## TE16 New Frontiers in Revenue Management

Sponsor: Revenue Management Section  
Sponsored Session

Chair: Sheryl E. Kimes, Cornell University, Sch. of Hotel Admin., 335 Statler Hall, Ithaca, NY 14853, [sek6@cornell.edu](mailto:sek6@cornell.edu)

1) **Determining Optimal Commitment Levels for Inclusive Tour**

**Packages using a Yield Management Model, Charles H. Rosa, SABRE Technology Solutions, 1 East Kirkwood Blvd., MD 7390, Southlake, TX 76092, charles\_rosa@sabre.com, Timothy L. Jacobs**

Four operators must book aircraft tickets and reserve rooms in hotels prior to knowing actual customer demand for all the travel packages that they offer. We develop a hierarchical model for determining optimal commitment levels such that overall expected revenue is maximized. We solve the model using a decomposition approach.

**2) Consumer Choice Behavior & its Implications for Retail Inventory & Pricing, Garrett J. van Ryzin, Columbia University, 412 Uris Hall, Grad. School of Bus., New York, NY 10027, gjv1@columbia.edu**

It is well known that consumer choice behavior (brand switching, buy-up, diversion, etc.) is an important phenomenon in many revenue management applications. However, incorporating choice behavior in revenue management models is a significant challenge. We review some recent progress applying discrete choice models to retail inventory and pricing problems.

**3) Yield Management Technologies in a Navy Training Quota Management System, Mei Zhang, SABRE Decision Technologies, 1 East Kirkwood Blvd., MD 7720, Southlake, TX 76092, mei\_zhang@sabre.com, Thomas A. Blanco, Leo Burns, Yanwen Wang**

Two categories of YM models are adopted in the Navy Quota Management System; the class booking limit models, and the student quota allocation models. Hundreds of thousands of reservations are made for US Navy personnel to attend training classes each year. Class booking limit models set the over-booking limit of each individual class...

**4) Restaurant Revenue Management: Concept Development & Application, Sheryl E. Kimes, Cornell University, Sch. of Hotel Admin., 335 Statler Hall, Ithaca, NY 14853, sek6@cornell.edu, Deborah I. Barrash, John Alexander**

Restaurant revenue management involves managing customer duration and making appropriate pricing decisions. We applied revenue management concepts to a small restaurant and developed a framework for future application and research.

## TE17 Replenishment Problems

Contributed Session

**Chair:** Suresh K. Goyal, Concordia University, DS & MIS Dept., 1455 de Maisonneuve Blvd. W, Montreal, Quebec, H3G 1M8, Canada

**1) Replenishment Variability in Lotsizing under Stochastic & Dynamic Demand, Connie K. Gudum, Copenhagen Business School, Dept. of MS & Statistics, Julius Thomsens Plads 10, 5, Frederiksberg, 1925, Denmark, connie@cbs.dk**

A comparison of lotsizing techniques under stochastic dynamic demand is made. In addition to the total cost and service level, the replenishment process given by each technique is compared. The variability of the replenishment process, i.e., order size and TBO, is important from a supply chain management perspective.

**2) An Extension of the Newsvendor Formulation with Multiple Periods & Concave Capacity Acquisition Costs, Peruvemba S. Ravi, University of Missouri, Dept. of Mgmt., Coll. of Bus., 215 Middlebush Hall, Columbia, MO 65211-6100, ravi@mail.olin.wustl.edu**

We extend the classic newsvendor formulation by incorporating a concave capacity acquisition cost function. A general multiperiod version of this problem is formulated. A solution procedure is provided for a special case of this problem.

**3) Economic Ordering Policy with Limited Shelf Life & Shortages, Suresh K. Goyal, Concordia University, DS & MIS Dept., 1455 de Maisonneuve Blvd. W, Montreal, Quebec, H3G 1M8, Canada**

A mathematical model is presented for determining economic order quantities for items having limited shelf life. The items have constant demand and shortages are permitted. As example is given to illustrate the method.

## TE18 Combinatorial Optimization Potpourri

Cluster: Discrete Optimization

Invited Session

**Chair:** Donna C. Llewellyn, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, donna.llewellyn@isye.gatech.edu

**1) A Polytope for a Product of Real Linear Functions in 0-1 Variables, Janny M.Y. Leung, Chinese University of Hong Kong, Systems Eng. & Eng. Mgmt. Dept, Shatin NT, Hong Kong, janny@se.cuhk.edu.hk, Don Coppersmith, Jon Lee**

In the context of integer programming, we develop a polyhedral method for linearizing a product of a pair of real linear functions in 0-1 variables. As an example, by writing a pair of integer variables in binary expansion, we have a technique for linearizing their product.

**2) A New Generic Separation Algorithm & its Application to the Vehicle Routing Problem, Ted Ralphs, Rice University, Dept. of Comp. & Applied Math., MS 134, 6100 Main St., Houston, TX 77055, tkr@caam.rice.edu, Leonid Kopman, Les E. Trotter**

We develop a new generic separation algorithm for combinatorial problems within the context of B&C. Using the COMPSys parallel B&C framework, we show that the algorithm can be used to generate capacity cuts as well as other classes of cutting planes for the VRP. Computational results will be presented.

**3) On Cuts of Bounded Order & the Linear Arrangement Problem, S.B. Horton, United States Military Academy, Dept. of Math. Sciences, West Point, NY 10996, as9492@usma.edu, R.B. Borie, Gary Parker**

We present an algorithm that, for a broad class of graphs, efficiently solves the problem of finding the minimum number of cut edges for each fixed value of the number of vertices on one side of the cut. We also investigate the relationship between this problem and the linear arrangement problem.

**4) On Solving Some Nonlinear Nonconvex Multicommodity Flow Problems, Michel Minoux, Laboratoire d'Informatique de Paris, Universite P et M Curie CNRS, 4 place Jussieu, Paris Cedex, F-75252, France, michel.minoux@lip6.fr**

Minimum cost multicommodity network flow problems arise as basic models in telecommunication network engineering. Two particularly difficult special cases will be considered: the case of concave increasing link cost functions and the case of discontinuous step-increasing link cost functions. An overview of some recent work on those problems will be presented including computational results obtained with both exact and approximate solution algorithms...

## TE19 Fluid Models

Cluster: Fluid Models

Invited Session

**Chair:** Vijay Chandru, Indian Institute of Science, Dept. Comp. Sci. & Automation, Bangalore, Karnataka, 560 012, India

**1) Using Fluid Models to Prove the Stability of Adversarial Queuing Networks, David Gamarnik, IBM, TJ Watson Research Ctr., PO Box 218, Yorktown Heights, NY 10598, gamarnik@watson.ibm.com**

A digital communication network can be modeled as an adversarial queuing network. An adversarial queuing network is considered stable if the number of packets stays bounded over time. We determine which adversarial queuing networks are stable under every work-conserving packet routing policy. We find that stability of an adversarial queuing network is implied by stability of an associated fluid queuing network.

**2) Sufficient Conditions for the Stability of Fluid Networks via Network Flow Analysis, John J. Hasenbein, University of Texas, OR Group, Dept. of Mechanical Eng., Austin, TX 78712, jhas@mail.utexas.edu, John Vande Vate**

We obtain sufficient conditions for global stability of a class d-station fluids networks. A primary tool in this work is the analysis of the structure of a related class of network flow problems. The conditions obtained have an appealing intuitive explanation in the original fluid network and in some cases are also necessary for global stability.

**3) Stability of Fluid Models under Static Buffer Priority Disciplines, Jozo Acksteiner, Jim G. Dai, John Vande Vate**

We outline an approach to determining the stability region of a fluid model under a static buffer priority discipline. We illustrate the approach on a 2-station fluid model under the LBFS-FBFS dispatching policy that gives higher priority to later classes at the first station and to earlier classes at the second station. Stability conditions for this fluid model and the corresponding queuing model are identical.

## TE20 Military Aviation Applications

Contributed Session

**Chair:** Abhijit Deshmukh, University of Massachusetts, Dept. of MIE, ELAB, Amherst, MA 01003, deshmkh@ecs.umass.edu

- 1) **Analyzing Future Airlift Needs**, *Robert T. Brigantic*, USAF, AMC/XPY, 4200 Scott Dr., Unit 3L3, Scott AFB, IL 62225, robert.brigantic@scott.af.mil, *Anthony F. Papaty*

The US Air Force, Air Mobility Command is conducting a major study to delineate airlift alternatives that meet the anticipated wartime delivery requirements. Study results will provide Defense Department decision makers with a relative assessment of the most cost-effective solutions to meet the expected future delivery requirements.

- 2) **Air Strike Planning: A Multi-Period Optimization Model for Platform-Weapon-Target Matching**, *Too-Ping Tan*, Blk. 5, Farrer Rd. 04-52, Singapore, 260005, Singapore, tantooping@hotmail.com

In military air strike planning, one of the biggest problems is platform-weapon-target matching. An optimal matching must account for the local characteristics of the platforms, weapons and targets, as well global constraints such as total assets available and overall military objectives. We present a linear optimization model for this problem.

- 3) **Performance Evaluation of Autonomous Unmanned Airborne Vehicle Systems**, *Abhijit Deshmukh*, University of Massachusetts, Dept. of MIE, ELAB, Amherst, MA 01003, deshmukh@ecs.umass.edu, *Zhaotong Lian*

We consider the path selection and performance estimation problems in UAV systems. Each UAV autonomously selects a path which maximizes the probability of reaching the target in the presence of threats. We present overall system performance estimations for different UAV path selection policies under centralized and decentralized information conditions.

## TE21 Transportation Topics II Contributed Session

**Chair:** Anna Nagurney, University of Massachusetts, Dept. of Finance & Op. Mgmt., Isenberg Sch. of Mgmt., Amherst, MA 01003, nagurney@gbfin.umass.edu

- 1) **Elicitation & Analysis of Systemicity within Project Risks**, *Mark Westcombe*, Strathclyde University, Dept. of Mgmt. Sci., 40 George St., Glasgow, G1 1QU, Scotland, UK, markw@mansi.strath.ac.uk, *Colin Eden*, *Terry Williams*, *Fran Ackermann*

Risks in complex projects are increasingly more inter-related and their impacts more systemic. An approach used on a large transport engineering project elicited risks in the form of a "cause map." Software analysis tools clustered the model's material and formed the basis of scenarios capturing the systemicity of project risk.

- 2) **The Use of Microscopic Simulation to Explore Traffic Stream Models at Freeway Merges, Diverge & Weave Areas**, *Ahmed F. Al-Kaisy*, Queen's University, 820 Castell Rd. #206, Kingston, Ontario, K7M 5X1, Canada, abdul@civil.queensu.ca, civil.queensu.ca/individ/abdul/Al-Kaisy.htm, *John A. Stewart*, *Michel W. Van Aerde*

We present an attempt to utilize the microscopic traffic simulation technique to investigate the patterns of variation in traffic stream models at ramp-freeway merge, diverge and weave areas. The research provided very useful insights into the patterns of change in traffic stream models at these critical areas that cannot be obtained using the conventional analytic techniques.

- 3) **Sustainable Transportation Systems & Pollution Permits**, *Anna Nagurney*, University of Massachusetts, Dept. of Finance & Op. Mgmt., Isenberg Sch. of Mgmt., Amherst, MA 01003, nagurney@gbfin.umass.edu

We develop a variational inequality framework for the definition and qualitative analysis of sustainable transportation systems through the perspective of pollution permits. We motivate the problem through the Braess paradox analogue for vehicular emissions and also provide an algorithm along with numerical results.

## TE22 Product & Process Development: Methods & Models Sponsor: Manufacturing & Service Operations Management Sponsored Session

**Chair:** Stephen M. Pollock, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, pollock@umich.edu

- 1) **Process Development for Assembled Products: Should Components or Assemblies be Made to Specifications?**, *David W. Glenn*, University of Michigan, IOE Dept., 1205 Beal Ave., Ann Arbor, MI 48109-2117, dwglenn@umich.edu, *Stephen M. Pollock*

Policies for adjusting processes for manufacturing assemblies can be characterized as "net build", adjustments so that parts satisfy design

specifications, and "functional build", adjustments so that the assembly satisfies design specifications. We analytically compare these policies when initial process capabilities, and the results of adjustments, are uncertain...

- 2) **Sourcing Parts of Complex Products: Evidence on Systems-Level Transaction Costs & Ex-Post Opportunism**, *Shannon Anderson*, University of Michigan, Sch. of Business Admin., Accounting Dept., Ann Arbor, MI 48109-1234, swanders@umich.edu, *David W. Glenn*, *Karen Sedatole*

We provide evidence that an important qualitative factor has been omitted in previous studies of incremental products costs: parts that are members of common subassemblies are subject to joint transaction costs. Data from an automobile manufacturer demonstrate that sourcing decisions for process tooling (dies) of stamped metal parts are jointly influenced by both component and subassembly characteristics...

- 3) **Optimized Product Development Processes**, *Andrew Kusiak*, University of Iowa, Dept. of IE, 4132 Engineering Bldg., Iowa City, IA 52242-1527, andrew-kusiak@uiowa.edu

In today's enterprise, it is imperative to reduce the design-to-manufacturing cycle time while improving the product quality and optimizing other performance measures such as cost, reliability, manufacturability, etc. Much of the challenge resides in the inherent gap between the product and process worlds. Most of the modeling methodologies for conceptual design of products are based on informal notation...

- 4) **Design Automation Use Models: A Framework for Controlling Design Releases**, *Nitin Joglekar*, MIT, E40-252, Cambridge, MA 02139, joglekar@po9.mit.edu, *Samir Patil*, *Daniel E. Whitney*, *Ali A. Yassine*

Our work is informed by use models of design automation tools that speed up the evolution of system design parameters and product information management tools that synchronize design releases into production starts. We present a framework for linking the frequency of releases with hierarchical control of the system design parameters.

## TE23 Environment Contributed Session

**Chair:** Nicholaas W. Bowes, US Environmental Protection Agency, Office of Pollution Prevention, 401 M St. NW, 7406, Rm. E223L, Washington, DC 20460, bowes.nick@epamail.epa.gov

- 1) **Optimization of Operating Conditions of Acrylonitrile Reactors**, *Abdulrazq Al-Zayed*, Kuwait Oil Co., c/o Ghanima Al-Sharrah, Univ. of Kuwait, Chem. Eng., Safat, 13060, Kuwait, benzayed@hotmail.com, *Ali Elkamel*, *Erdogen Alper*

Acrylonitrile is an important intermediate petrochemical which can be produced from ammonia, propylene and oxygen by the catalytic ammoxidation process. The reaction is accompanied by side reactions producing acetonitrile and hydrogen cyanide which needs to be minimized. The amounts of these waste products depend on a number of process parameters and the reactor configurations.

- 2) **Scaling the Importance of Environmental Losses: Social Values, Damage Assessment & the Method of Paired-Comparisons**, *Rob B. Gorter*, Compass Resource Management Ltd., 200-1260 Hamilton St., Vancouver, BC, V6B 2S8, Canada, rgorter@compassrm.bc.ca

We explore the use of paired-comparison surveys for determining the relative social value of various environmental damages and constructing compensation schedules to aid deterrence and fair restitution. Results indicate that people consistently rank the relative importance of environmental losses, providing encouraging prospects for using social values in formulating sanctions.

- 3) **R&D Portfolio Analysis for DoE Environmental Management**, *Gregory S. Parnell*, US Military Academy, Dept. of Systems Eng., Mahan Hall, rm. 432, West Point, NY 10996, fg7526@usma.edu, *Sheila Jordan*, *David Geiser*

The DoE's Office of Science & Technology is responsible for an annual budget of over \$250M. We describe the R&D portfolio analysis we have successfully used for the past 2 years to help environmental management decision-makers select the best R&D portfolio. We also discuss lessons learned.

- 4) **Assessing Equity to Risk from Airborne Toxic Chemicals: A New Risk-Based Model**, *Marc D. Shapiro*, University of Rochester, 57 Glasgow St., Rochester, NY 14608, mchs@troi.cc.rochester.edu, *Nicholaas W. Bowes*

Do different communities face unequal risks from industrial toxic emissions? We analyze data from the USEPA Office of Pollution Prevention and Toxics' new Risk-Screening Environmental Indicators Model. The RSEIM improves

upon previous models through weighting chemicals by toxicity and incorporating chemical-specific transportation and dispersion information to calculate distance-based risk scores.

## TE24 Health Applications

### Contributed Session

**Chair:** Nico J. Vandaele, University of Antwerp, UFSIA, Prinsstraat 13, Antwerp, 2000, Belgium, nico.vandaele@ufsia.ac.be

1) **An Empirical Analysis of Blood Donor Motivation, Holger Hinz**, Flensburg University, Kanzleistr. 91-93, Flensburg, 24943, Germany, hinz@uni-flensburg.de

The success of bloodbanks largely depends upon their acquisition potential with respect to blood donors. Since donor motivation may change over time or differ with respect to location, we designed and administered a new interview-based structured survey to better understand motivation schemes both in general and in the case of Flensburg.

2) **Optimal Batching at a Nuclear Magnetic Resonance Scanner, Nico J. Vandaele**, University of Antwerp, UFSIA, Prinsstraat 13, Antwerp, 2000, Belgium, nico.vandaele@ufsia.ac.be, **Sascha Cupers**

We study the optimal batching of patients for a high-tech NMR scanner. We minimize the expected patient lead-time including waiting, setup, preparation, measurement and post-measurement time. The policy allows for both the planned operations as well as the emergency calls. We use a queueing network approach.

3) **Scheduling Hospital Operations to Minimize Post Anesthesia Care Unit Costs, Vernon N. Hsu**, George Mason University, Sch. of Mgmt., 4400 University Dr., Fairfax, VA 22030, vhsu@som.gmu.edu

We consider a hospital ambulatory operating suite with multiple operation rooms and a PACU. The objective is to schedule the operations in operating rooms to minimize nursing requirements in the PACU. We develop an efficient heuristic that performs well on real and randomized data.

4) **No Title Supplied, Kaosong Vang**, University of Wisconsin, 2609 University Ave., Apt. 3, Madison, WI 53705, kaosong@cae.wisc.edu, **Patricia F. Brennan**

We characterized the experience of hospitalized patients who received mechanical ventilation by examining the duration of outcome of care. The survival rate for this study was 76%; only 2 patients died while still on the ventilator. Results suggest a paradoxical relationship between length of mechanical ventilation and survival rates.

## TE25 Network Flows

### Contributed Session

**Chair:** Matthew J. Liberatore, Villanova University, Coll. of Commerce & Finance, 800 Lancaster Ave., Villanova, PA 19085, liberatore@cf\_faculty.fin.vill.edu, liberator@ucis.vill.edu

1) **Interval Extensions of Longest Path Problems, Oya Ekin**, Bilkent University, Dept. of IE, Ankara, 06533, Turkey, karasan@bilkent.edu.tr, **Mustafa Pinar, Hande Yaman**

We investigate the well-known longest path problem on acyclic networks where the data is represented by intervals. The main motivation is the critical path problem under uncertainty in project management. We structure uncertainty by taking activity durations as intervals defined by known upper and lower bounds.

2) **The Maximum Flow in a Generalized Time-Varying Network, Dan Sha**, Chinese University of Hong Kong, Dept. of Systems Eng. & Mgmt., Shatin NT, Hong Kong, China, dsha@se.cuhk.edu.hk, **Xiaoqiang Cai, Wong Chak-Kuen**

We address a new version of the maximum generalized network flow problem, in which each arc has 3 numbers attached to it: a transit time, a capacity and a gain factor that are all time-varying. Find a flow reaching the sink as maximum as possible within a given time duration.

3) **Using Project Management Software in Different Work Environments, Matthew J. Liberatore**, Villanova University, Coll. of Commerce & Finance, 800 Lancaster Ave., Villanova, PA 19085, liberatore@cf\_faculty.fin.vill.edu, liberator@ucis.vill.edu, **Bruce Pollack-Johnson**

Using a random survey of PMI members, we analyze the factors influencing selection, usage and future development of PM software. The findings lead to a categorization of the differences in usage patterns by industry, experience and package. Software adopters should consider these findings concerning industry practice and individual circumstances.

## TE26 Stochastic Processes Applications II

### Contributed Session

**Chair:** Philipp Afeche, Northwestern University, Dept. of Mgr. Econ. & Dec. Sci., Kellogg Grad. Sch. of Mgmt., Evanston, IL 60208-2001, p-afeche@nwu.edu

1) **withdrawn - author request of 9/24, Dan Trietsch**, University of Auckland, Dept. of MSIS, Private Bag 92019, Auckland, New Zealand, d.trietsch@auckland.ac.nz, **David J. Robb**

2) **A Bayesian Service Availability Model, Effie Stavroulaki**, Pennsylvania State University, Dept. of MSIS, 303 BAB Bldg., University Park, PA 16802, stavroulaki@psu.edu, **Duncan K. Fong, Dennis Lin**

With a Bayesian approach, we examine how to set capacities for various resources, e.g., cars of different sizes, to satisfy stochastic customer demand, e.g., car-rentals. The objective is to maximize expected profit. We formulate and provide analytic solutions, together with numerical comparisons, for the 2X2 case.

3) **On Maximizing the Reliability of Two Component Series Systems in Discrete Time, Kemal Gursoy**, Long Is University, 1 University Plaza, H-700, Brooklyn, NY 11201, kgursoy@hornet.liunet.edu, <http://phoenix.liunet.edu/~kgursoy/>, **Michael N. Katehakis**

We consider optimal allocation of a repairman to the failed components of a series system. Components' lifetimes and repair times are independent, geometrically distributed and a component under repair may be changed instantaneously. We showed that the policy which allocates the repairman to the most reliable component maximizes the system availability.

4) **Mean Delay Performance in Stochastic Processing Networks with Priority Service, Philipp Afeche**, Northwestern University, Dept. of Mgr. Econ. & Dec. Sci., Kellogg Grad. Sch. of Mgmt., Evanston, IL 60208-2001, p-afeche@nwu.edu

We consider a queueing network where different job types are served according to a priority scheme. We derive an explicit formula for the steady-state expected total delay experienced by each job type.

## TE27 DP Applications

### Contributed Session

**Chair:** Arnab Bisi, University of Texas at Dallas, Sch. of Mgmt. 2601 N Floyd Rd., MS J04.7, Box 830688, Richardson, TX 75083-0688, abisi@utdallas.edu, <http://www.utdallas.edu/~abisi>

1) **Analysis of Supply Contracts with Discounts, Zhaotong Lian**, University of Massachusetts, Dept. of MIE, ELAB, Amherst, MA 01003, zlian@ecs.umass.edu, <http://farm.ecs.umass.edu/~atong>, **Abhijit Deshmukh**

We present an analysis of supply contracts over a rolling horizon where the per unit cost is discounted for items ordered later in the planning horizon. The buyers can update the requested quantities at each planning epoch at a proportional penalty cost. Our objective is to derive optimal ordering policies in order to minimize the total expected costs for the buyer.

2) **Predicting Protein Secondary Structure by Dynamic Programming, Larry E. Stanfel**, University of Alabama, Dept. of MS & Stats., Tuscaloosa, AL 35487-0226, lstanfel@cba.ua.edu

A protein's shape largely determines its function, so the ability to predict shape from a knowledge only of the amino acids constituting it would be highly useful. Engineering special purpose proteins would then be possible. We describe a novel and successful dynamic programming algorithm for predicting protein secondary structure.

3) **Dynamic Fleet Routing for Winter Storm Management, Fukuzawa Tomoko**, University of Michigan, Dept. of Elec. Eng./Comp. Sci., 2231 Cram Place, Apt. 2, Ann Arbor, MI 48105, tomokof@umich.edu, <http://www-personal.umich.edu/~tomokof>, **Chelsea C. White, III, James Dunlavy**

We present a procedure for determining in real-time what other plow or plows should be selected to complete the route of a disabled plow, in addition to completing their own routes, and for determining the new routes of these plows so as to minimize deadhead miles.

4) **Average Cost Optimality for an Unreliable Two-Machine Flowshop with a Limited Internal Buffer, Arnab Bisi**, University of Texas at Dallas, Sch. of Mgmt. 2601 N Floyd Rd., MS J04.7, Box 830688, Richardson, TX 75083-0688, abisi@utdallas.edu, <http://www.utdallas.edu/~abisi>, **Suresh P. Sethi, Ernst Presman**

We develop the theory of dynamic programming equation in terms of directional derivatives for an unreliable 2-machine flowshop with a limited internal buffer, convex cost and the long-run average cost criterion. For a sufficiently large upper bound on WIP, we establish a verification theorem and a partial characterization of the optimal policy.

## TE28 Changing Decision Technology Paradigms as a Result of E-Business

**Cluster:** E-Business & Decision Technology in Semiconductors  
**Invited Session**

**Chair:** Kenneth J. Fordyce, IBM Micro-Electronics Division, 227 Evergreen Lane, Hurley, NY 12443, fordyce@us.ibm.com

1) **Logistics Management System 15 years Later & Mobile Intelligent Agents in IBM Microelectronics**, *Gary Sullivan*, IBM Management Technologies Consulting, 5 Alexis Dr., Burlington, VT 05401, gsullivan@us.ibm.com

During the 1980s, the Burlington Advanced Industrial Engineering team developed an application known as LMS to dispatch the manufacturing floor of the IBM Burlington facility. LMS harnessed the then emerging information technologies of real-time decision support and knowledge based systems to provide unique business function. Their work was recognized by IBM, AAI, and INFORMS (then ORSA/TIMS)...

2) **Distributed & Collaborative Supply Chain Decision Making in Electronic Commerce**, *Sherman X. Bai*, University of Florida, Dept. of ISE, 303 Weil Hall, Gainesville, FL 32611, bai@ufl.edu

We will provide an overview of work to date on the NSF sponsored study: distributed and collaborative supply chain decision making in electronic commerce. This research is being done jointly by the University of Florida, MIT, Wharton and Lehigh. The work focuses on 4 areas: new approaches for the modeling of distributed heterogeneous decision systems...

## TE29 Software Demonstration VIII

Software Demo Session

**Chair:** To be announced

1) **Tutorial: Using the MPL Optimax 2000 Component Library with VBA for Excel & Visual Basic**, *Bjarni Kristjansson*, Maximal Software Inc., 2111 Wilson Blvd., Ste. 700, Arlington, VA 22201, bjarni@maximal-usa.com

The OptiMax 2000 is a highly anticipated Component Library (API), designed to take full advantage of the ActiveX Automation component software technology from Microsoft. Using step-by-step examples, we will demonstrate how to use the OptiMax 2000 to seamlessly integrate MPL into VBA for Excel/Access, Visual Basic, Visual C++, Delphi, Java and the Web...

## TE30 Modeling Systems for Constraint Logic Programming

**Sponsor:** INFORMS Computing Society  
**Sponsored Session**

**Chair:** John W. Chinneck, Carleton University, Systems & Computer Eng., 1125 Colonel By Dr., Ottawa, Ontario, K1S 5B6, Canada, chinneck@sce.carleton.ca

1) **The OPL Optimization Programming Language**, *Pascal Van Hentenryck*, Universite Catholique de Louvain, Dept. of Comp. Science & Eng., 2 Place Sainte-Barbe, Louvain la Neuve, B-1348, Belgium, pvh@info.ucl.ac.be

OPL is a modeling language that attempts to enhance traditional modeling languages from mathematical programming with constraint programming notations and algorithms and the ability to define search procedures at a high level. The novel modeling tools include higher-order constraints, logical combinations of constraints, arrays indexed by expressions containing variables, global constraints...

2) **Designing an Open Interface for Hooking Constraint Logic Programming Solvers to an Algebraic Modeling Language**, *Robert Fourer*, Northwestern University, Dept. of IE/MS, 2225 North Campus Dr., Evanston, IL 60208-3119, 4er@iems.nwu.edu, *David M. Gay*

Combinatorial modeling language extensions motivated by constraint logic programming methods are valuable to modelers, but introduce new difficulties in maintaining an open interface that can accommodate a variety of current and future solvers. We describe several representation and recognition issues that arise in extending the interface of the AMPL language.

3) **Modeling Support for Constraint Logic Programming**, *John*

*W. Chinneck*, Carleton University, Systems & Computer Eng., 1125 Colonel By Dr., Ottawa, Ontario, K1S 5B6, Canada, chinneck@sce.carleton.ca

Tools to assist in the formulation of correct models exist for the traditional forms of mathematical programming, e.g., infeasibility analyzers, convexity analyzers, etc., but CLP poses new challenges. We explore the kinds of support needed for CLP modelers and presents prototype computer tools.

## TE31 Visualization of Reliability Data

**Cluster:** Reliability Modeling  
**Invited Session**

**Chair:** Ehsan S. Soofi, University of Wisconsin, Sch. of Bus. Admin., PO Box 742, Milwaukee, WI 53201, esoofoi@csd.uwm.edu

1) **Authenticating Lethality & Vulnerability Measurements**, *Edward J. Wegman*, George Mason University, Ctr. for Comp. Statistics, MS 4A7, 4400 University Dr., Fairfax, VA 22030-4444, ewegman@gmu.edu

The cost implications for expensive military systems can be staggering. One approach to cost mitigation is the use of highly detailed CAD models of the system in a simulation of live fire. We describe the use of clustering algorithms to show that the binary damage vectors actually have a rather limited set of damage modes and that live fire tests tend to fall within the cluster of the most common damage modes.

2) **Ultrasonic Imaging of Cast Ductile Iron Projectiles**, *Wendy L. Poston*, Office of Naval Research, Prob/Stats Program, Code 3 11, 800 North Quincy St., Arlington, VA 22217-5660, postonw@onr.navy.mil, *Edward J. Wegman*, *O. Thomas Holland*

In developing a ductile iron casting process, a high production rate combined with the requirement of 100% non-destructive inspection mandates an automated and timely means of assuring quality and conformance to design specifications. This involves processing massive amounts of data. We present a method of visualizing the ultrasound data that provides a 3-D reconstruction of the projectile.

3) **Visualization of Reliability Data via Figural Animation**, *Kurt Pflughoeft*, University of Wisconsin, Sch. of Bus. Admin., PO Box 742, Milwaukee, WI 53201, pflug@csd.uwm.edu, *Ehsan S. Soofi*, *Fatemeh Mariam Zahedi*

Visualization by Figural Animation (VFA) uses length, color, orientation, shape and movement of various features of a caricature to display multidimensional structures. The lengths of the human features map magnitudes, colors represent categories and orientations show important correlation. We present a VFA application regarding the analysis of multidimensional reliability data.

## TE32 Knowledge Networking for Telecommunications Management

**Sponsor:** Technical Section on Telecommunications  
**Sponsored Session**

**Chair:** Alex Bordetsky, California State University, TELCOT Ctr. for Res., Hayward, CA 94542, bord@csuhayward.edu

1) **Adaptive Knowledge Networking for Satellite-Terrestrial Communications Management**, *Alex Bordetsky*, California State University, TELCOT Ctr. for Res., Hayward, CA 94542, bord@csuhayward.edu

The models of system dynamics, adaptation, and evolution in the knowledge networking for telecommunications managers are presented. The models are implemented via the set of intelligent agents providing collaborative knowledge construction, representation and filtering in configuring and managing the resources of heterogeneous satellite-terrestrial communications in accordance with QoS constraints.

2) **Integrating Intelligent Management Tools for Wireless Communication Networks**, *Chico Jayanthan*, AirTouch Communications, AirTouch Cellular, 2785 Mitchell Dr., Walnut Creek, CA 94598, chico.jayanthan@notes.airtouch.com

Major challenges exist in the areas of RF modeling, performance, surveillance, and security management of the wireless network. This study's conclusions indicate that complete integration of home grown software solutions with third party expert systems, relational database and reporting systems is the key to effective telecommunication network management...

3) **Using a Knowledge Base For Economic Analysis in Satellite Telecommunications Applications**, *Diane Satin*, California State University, Sch. of Bus. & Econ., Hayward, CA 94542,

dsatin@csuhayward.edu

Satellite telecommunication systems evolving in a rapidly changing technological environment carry both configuration solutions and cost planning considerations affecting design, end-use service and billing. With a knowledge base identifying costs (prices) as well as technological issues, managers may provide entire economic plans based on past experiences and with expert input.

**4) Integrating Base Station & Mobile Switching Center Location Algorithms with Knowledge-Based Planning for Cellular Communications, Seungwan Ryu, SUNY, Dept. of IE, Buffalo, NY, Joyendu Bhadury, Alex Bordetsky**

We develop 2 optimization schemes for locating bases stations and a mobile switching center for a cellular communications network and provide their empirical comparison. The knowledge base and collaborative conferencing with managers is used to adjust the identified location to semi-structured coverage and interference requirements.

**TE33 Recent Advances in Statistical Quality Improvement**

**Sponsor:** Quality, Statistics & Reliability  
Sponsored Session

**Chair:** Effie Stavroulaki, Pennsylvania State University, Dept. of MSIS, 303 BAB Bldg., University Park, PA 16802, stavroulaki@psu.edu

**1) Variable Selection in Product Design, Duncan K. Fong, Pennsylvania State University, Dept of MSIS, 303 Beam BAB, University Park, PA 16802, i2v@psu.edu**

A key element in off-line quality control is to identify the best set of variables to use in designing a product that will meet customers' expectations. We show how the information collected using the quality function deployment technique may be incorporated into a Bayesian variable selection model.

**2) Usability Assessment & Prediction for Electronic Products, Kwang-Jae Kim, Pohang University of Science & Technology, Dept. of Indust. Eng., San 31, Hyoja-Dong, Nam-Gu, Pohang, Kyungbuk, 790-784, Republic of Korea, kjk@postech.ac.kr, Sung Han, Myung Hwan Yun**

Usability is becoming increasingly important as a factor determining the overall quality and thus the success probability of a product. We develop a framework for assessing and predicting the usability of a product based on multivariate statistical techniques. A case study using home appliances will also be presented.

**3) A Multivariate Exponentially Weighted Moving Average Control Chart for Detecting Small Changes in Process Variability, Arthur B. Yeh, Bowling Green State University, Dept. of Appl. Stats. & OR, Bowling Green, OH 43403, byeh@rob.bgsu.edu**

We introduce a multivariate EWMA control chart. The proposed control chart is specifically designed for detecting small changes in the variability of multivariate quality characteristics. The performance of the proposed chart will be explored and real examples using the proposed chart will also be given.

**4) Another Look at the Process Capability Index, Minte Chao, Pennsylvania State University, Dept. of MS & IS, 303 Beam Bldg., University Park, PA 16802-1913, dkl5@psu.edu, Dennis Lin**

We take the very specific view that a proper value of PCI should represent the true yield of the process in various situations. Based on such an important concept, a universal PCI called  $\$C_y$  is proposed. The superiority of the new PCI is presented through examples.

**TE34 Knowledge Management**

**Cluster:** State-of-the-Art in Information Technology  
Invited Session

**Chair:** Gregory Madey, Kent State University, College of Bus., Kent, OH 44242, gmadey@kent.edu

**1) Knowledge Management: Introducing a Few Common Misconceptions, William Acar, Kent State University, Coll. of Business, Kent, OH 44242, wacar@bsa3.kent.edu, Alan T. Burns**

The field of KM, although seemingly new, is in many ways the intellectual inheritor of several established managerial and scientific disciplines, as well as the field of MIS. This fact is generally glossed over. We outline the implications of this and some other potential misconceptions.

**2) Artificial Organizational Learning: Plotting Knowledge through the Internet, Nancy Bogucki Duncan, Kent State University, Coll. of Business, PO Box 5190, Kent, OH 44242-0001, Murali S. Shanker**

Employees' tacit organizational knowledge cannot be captured through

traditional analysis methods. Firms' intranets may offer a new environment for knowledge discovery and documentation. Sites represent information nodes, while usage paths represent tacit knowledge. Can AI mechanisms such as neural nets be used to evaluate intranet usage paths for knowledge management?

**3) Using New Estimation Techniques to Capture Tacit Information Contained in Observed Decisions & Actions, Marvin D. Troutt, Kent State University, Dept. of Admin. Sci., Grad. Sch. of Mgmt., Kent, OH 44242, mtroutt@bsa3.kent.edu**

Actual customer, individual and organizational choices, decisions and behavior no doubt reflect tacit information on unstated values and perceived constraints. We consider models and techniques for making such information explicit. Performance efficiency techniques are featured. These techniques promise to provide more appropriate data mining models than regression in many contexts.

**4) Management of Tacit Inter-Organizational Knowledge through the use of Self-Organizing Processes, Gregory Madey, Kent State University, College of Bus., Kent, OH 44242, gmadey@kent.edu, Norman Johnson**

We investigate the use of self-organizing processes to create new (emergent) organizational knowledge. Examples from the Internet and a framework for the design of these self-organizing systems are presented.

**TE35 Tutorial: Retail Operations**  
Invited Session

**Chair:** Marshall Fisher, University of Pennsylvania, The Wharton School, OPIM Dept., Philadelphia, PA 19102, fisher@opim.wharton.upenn.edu

**Co-Chair:** Ananth Raman, Harvard University, Grad. Sch. of Bus. Admin., Morgan Hall, Boston, MA 02136, araman@hbs.harvard.edu

**1) Tutorial: Retail Operations, Marshall Fisher, University of Pennsylvania, The Wharton School, OPIM Dept., Philadelphia, PA 19102, fisher@opim.wharton.upenn.edu, Ananth Raman**

Retailing is an industry in which we see enormous differences in performance. At one extreme, we have Wal-Mart, which from a standing start in 1962 has grown to become the largest retailer in the world, making Sam Walton the wealthiest man in the US along the way. At the other extreme, about 15% of the largest retailers in the US went bankrupt in the 1980s.

**TE36 Probability Distributions & Stochastic Processes Applications**  
Contributed Session

**Chair:** Dale J. Hockstra, University of Evansville, 1800 Lincoln Ave., Evansville, IN 47722, dh3@evansville.edu, <http://www.evansville.edu>

**1) On the Identification & Treatment of Outliers, Armando Z. Milioni, Instituto Tecnológico de Aeronautica, CTA-ITA-IEMB, Sao Jose dos Campos, 12228-900, Brazil, milioni@mec.ita.cta.br, <http://www.ita.cta.br>, Arie Z. Dotan**

We evaluate new outliers' identification and treatment methods, comparing them to robust regression and to conventional identification methods. We propose a new treatment methodology based on the principle of non-eliminating outliers arbitrarily but smoothing the criteria of outliers' elimination with attribution of partial weights to marginal outliers.

**2) An Analytical Analysis of a Pull System with Exponential Processing Times, Abraham Grosfeld-Nir, Tel Aviv University, Recanati Grad. Sch. of BA, Faculty of Mgmt., Tel Aviv, 69978, Israel, grosfeld@post.tau.ac.il, Gil Zusman**

We show that pull production systems can be analyzed using quasi birth and death processes and calculate the 'infinitesimal generator', recursively in the number of stages. It turns out that WIP is almost linear in the number of machines and in buffer sizes, and that sometime 'push' is more efficient than 'pull'. We also develop a simple method to estimate the WIP and TP of large systems.

**3) Reorder Level Determination with Serially-Correlated Demand, Timothy L. Urban, University of Tulsa, 600 South College Ave., College of Bus. Admin., Tulsa, OK 74012, urbantl@utulsa.edu**

We investigate the effect of serially-correlated demand on the determination of appropriate reorder levels. We illustrate how the use of a variable reorder point can provide an appropriate service level while reducing the inventory requirements as well as the magnitude of stockouts.

**4) Confidence Intervals for Posterior Probabilities, Dale J.**

**Hockstra**, University of Evansville, 1800 Lincoln Ave., Evansville, IN 47722, dh3@evansville.edu, http://www.evansville.edu

In Bayes' theorem, the prior and conditional probabilities are traditionally viewed as fixed. However, in some applications, they are actually point estimates from samples and therefore have uncertainty. We investigate the resultant uncertainty in posterior probabilities and gives an example with medical data.

### TE37 Integrating OR/MS & Marketing in the Classroom

Sponsor: INFORM-ED

Sponsored Session

Chair: George G. Polak, Wright State University, MSIS Dept., 271 Rike Hall, Dayton, OH 45435, george.polak@wright.edu

#### 1) From Market Driven to Market Driving Organizations, Rohit Deshpande, Harvard Business School, Mktg. Sci. Inst., 1000 Massachusetts Ave., Cambridge, MA 02138

Business problems are inherently cross-functional. Hence being able to interchange functional lenses helps provide a more holistic view of the organization. One mechanism to do this is to bring the voice of the market into the voice of the manufacturer. Not only can this help develop new products but also new product platforms.

#### 2) Marketing Engineering: Linking OR to Marketing Decision Making, Arvind Rangaswamy, Pennsylvania State University, Smeal College of Bus. Admin., University Park, PA 16802-3007, arvindr@psu.edu

Marketing engineering is the art and science of developing and using interactive, customizable, computer-decision models for analyzing, planning and implementing marketing tactics and strategies. I will describe several examples of how we use marketing and engineering to train MBA students in OR thinking, techniques and insights for marketing decision making.

### TE38 Nonlinear Programming & Complementarity Problems

Cluster: Nonlinear Programming

Invited Session

Chair: Osman Guler, UMBC, Dept. of Math. & Stats., Baltimore, MD 21250, guler@pc15.math.umbc.edu

#### 1) Some Results on Semidefinite Linear Complementarity Problems, M. Seetharama Gowda, UMBC, Dept. of Math. & Stats., Baltimore, MD 21250, gowda@math.umbc.edu

We describe the P- and the globally uniquely solvable properties for semidefinite linear complementarity problems. In particular, we describe a connection between Lyapunov's theorem and the P-property of an appropriate linear transformation.

#### 2) Some Generalizations on Monotone Complementarity Problems, Osman Guler, UMBC, Dept. of Math. & Stats., Baltimore, MD 21250, guler@pc15.math.umbc.edu

Optimization, minimax and equilibrium problems can be cast as complementarity problems. Many are monotone for which there are attractive results and algorithms, including interior point methods. We will discuss an extension of monotone complementarity problems which have some attractive properties.

#### 3) On the Superlinear Convergence of Interior Point Methods, Florian Potra, UMBC, Dept. of Math & Stats., Baltimore, MD 21250, potra@math.umbc.edu

The study of superlinear convergence of interior-point methods for LP was initiated in the early 90s. Superlinear convergence is especially important for SDP, since no finite termination schemes exist for such problems. We present a superlinearly convergent interior-point method for SDP and discuss possible extensions.

#### 4) A Convergent Infeasible Interior-Point Trust-Region Method for Nonconvex Constrained Optimization, Paul Y. Tseng, University of Washington, Dept. of Math., Box 354350, Seattle, WA 98195, tseng@math.washington.edu

We present an infeasible interior-point trust-region method for an NLP with inequality constraints and twice differentiable objective and constraint functions. Under mild assumptions, i.e., boundedness of primal iterates, regularity of feasible solutions, second-order regularity of KKT points, etc., each cluster point of the iterates satisfies first- and (weak) second-order optimality.

## Wednesday 08:30-10:00

### WA01 Tutorial: Design System Failure Away with Systems Engineering & Decision Analysis

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Dennis M. Buede, George Mason University, Dept. of Systems Eng. & OR, Fairfax, VA 22030-4444, dbuede@gmu.edu

#### 1) Tutorial: Design System Failure Away with Systems Engineering & Decision Analysis, Dennis M. Buede, George Mason University, Dept. of Systems Eng. & OR, Fairfax, VA 22030-4444, dbuede@gmu.edu

In this tutorial, we introduce several techniques to support the definition of the engineering design problem, which includes the value space and trade space for making the design decisions. We then provide new material on how decision analysis can be used to address hierarchically defined, asynchronously solved design decisions.

### WA02 Discrete Optimization Methodology II

Contributed Session

Chair: Jian Yang, University of Texas, Dept. of MSIS, 1630 West 6th St. East, Austin, TX 78703, jiany@uts.cc.utexas.edu, http://uts.cc.utexas.edu/~jiany

#### 1) A Perturbation Heuristic for Quadratic 0-1 Programming, Kim Allemand, Thomas M. Lieblich

Given sparse matrix  $Q$ , the quadratic 0-1 programming problem consists of minimizing  $f(x) = x^T Q x$  where  $x$  is a 0-1 vector of dimension  $n$ . This problem is NP-hard and therefore, the most efficient results have been obtained by heuristics. However, these heuristics have been tested on randomly generated examples where the optimal solution is unknown...

#### 2) On the Independence Number of a Graph, Cyriel Van Nuffelen, University of Antwerpen, Prinsstraat 13, Antwerpen, 2000, Belgium, cyriel.vannuffelen@ufsia.ac.be

A new upper bound for the independence number of a graph is given in terms of the eigenvalues of the adjacency matrix.

#### 3) On the Complexity of Combinatorial Optimization Problems, Jian Yang, University of Texas, Dept. of MSIS, 1630 West 6th St. East, Austin, TX 78703, jiany@uts.cc.utexas.edu, http://uts.cc.utexas.edu/~jiany, Patrick Jaillet

We give new perspectives on algorithms solving combinatorial optimization problems. We observe the link between the spaces of problem instances sharing the same solutions and the problem's difficulty. We give conjectures and results on the traveling salesman and the assignment problems relating to the P-NP conjecture.

### WA03 Power Generation under Restructuring

Contributed Session

Chair: Chung-Hsiao Wang, Iowa State University, Dept. of IMSE, 205 Engineering Annex, Ames, IA 50011, wchrist@iastate.edu

#### 1) A Stochastic Model for Optimal Electric Power Generation in a Deregulated Market, Jorge Valenzuela, University of Pittsburgh, 215 Sandy Dr., Glenshaw, PA 15116, jfvst3+@pitt.edu, Mainak Mazumdar

A stochastic optimization problem for deciding optimal electric power generation levels under a deregulated environment is formulated. The power generation utility determines an optimal unit commitment schedule to maximize its profit over a short-term period while observing operational constraints. Probabilistic dynamic programming is used to solve the problem.

#### 2) Valuation of a Firm Based on Discounted Cash Flows: A Case Study, Anibal C. Irarrazabal, Universidad Catolica de Chile, Vicuna MacKenna 4860, Santiago, Chile, airarraz@ing.puc.cl

The key to successfully investing in a firm lies in understanding not only what the value is but the sources of that value. The valuation framework based on discounted cashflows is applied to Endesa Chile, the largest electric company in Chile, which was recently acquired by Endesa Espana.

#### 3) Optimal Scheduling of Sootblowers in Power Plant Boilers, Pedro M. Vasquez-Urbano, University of Puerto Rico, Math Dept., PO Box 9018, Mayaguez, PR 00681, pvasquez@math.upr.clu.edu

We study the optimization problem of scheduling activities at a utility power

plant. The objective is to develop an optimization approach to determine which sootblowers should be activated at any moment to maximize plant efficiency. Then, an optimization model is formulated for the sootblowing scheduling and different optimization approaches that combine NLP with heuristics methods.

**4) Generation Planning Model: A Real Options Approach, Chung-Hsiao Wang**, Iowa State University, Dept. of IMSE, 205 Engineering Annex, Ames, IA 50011, wchrist@iastate.edu, *Jo Min*

The electric power generation for utilities is moving toward uncertain and competitive environments. Under such environments, we formulate and analyze a generation planning model employing a real options approach with stochastic dynamic programming. Various managerial insights and economic implications will be provided via a numerical example.

#### WA04 The Future of Decision Computation

Cluster: Decision Technology

Invited Session

Chair: Ronald A. Howard, Stanford University, Eng. & Economic Systems Dept., Terman 324, Stanford, CA 94305-4025

**1) The Future of Decision Computation, Ronald A. Howard**, Stanford University, Eng. & Economic Systems Dept., Terman 324, Stanford, CA 94305-4025

We currently have many computational aids to assist in making better decisions. They differ in their philosophy, capability, required education of the user, ease-of-use, and cost. This session will present the present state of the field and the developments we may expect in the future.

#### WA05 Location Models V

Sponsor: Section on Location Analysis

Sponsored Session

Chair: Sanjay Melkote, Princeton University, Dept. of OR & Financial Eng., Princeton, NJ 08544, melkote@dragon.princeton.edu

**1) Location of Project-Based Subsidized Housing, Michael P. Johnson**, Carnegie Mellon University, Heinz Sch. of PP&M, Hamburg Hall, Rm. 2108A, Pittsburgh, PA 15213-3890, johnson2@andrew.cmu.edu

Public housing authorities make expensive and controversial decisions on where to locate (build or acquire) project-based subsidized housing. I present and solve a multiobjective location model that is based on the traditional fixed-charge location model. The model is applied to suburban Chicago data.

**2) The Plant Location & Flexible Technology Acquisition Problem, Vedat Verter**, McGill University, Faculty of Mgmt., 1001 Sherbrooke St. West, Montreal, Quebec, H3A 1G5, Canada, meter@management.mcgill.ca, *Abdullah Dasci*

We present an integrated model for simultaneous optimization of facility location and technology selection decisions. The objective is to determine the least cost configuration to satisfy demand while incorporating flexible technology. We discuss the analytical properties of the model and propose a solution technique.

**3) A New Heuristic for Solving Quadratic Assignment Problems, Eswar Sivaraman**, Oklahoma State University, 322 Engineering North, Stillwater, OK 74078, seswar@okstate.edu, <http://www.okstate.edu/cocim/members/eswar>

We present a new heuristic for solving quadratic assignment problems, which arise in the relative location of activities/facilities. Programmed implementations of the algorithm solve very large problems in a negligible amount of time. The performance of the heuristic is demonstrated, as applied to known problems from the literature.

**4) Solving the p-Hub Median Problem, Sanjay Melkote**, Princeton University, Dept. of OR & Financial Eng., Princeton, NJ 08544, melkote@dragon.princeton.edu

A new formulation for the p-hub median problem is presented. Computational results based on this formulation are discussed.

#### WA06 FMS Issues

Cluster: Flexible Manufacturing Systems

Invited Session

Chair: Kathryn E. Stecke, University of Michigan, Sch. of Business Admin., 701 Tappan St., Rm. 5206, Ann Arbor, MI 48109-1234, kstecke@umich.edu

**1) Push is Better than Pull for Some Flexible Manufacturing**

**Systems, Ananth Krishnamurthy**, University of Wisconsin, Ctr. for Quick Response Mfg., 1513 University Ave., Madison, WI 53706-1572, akrishna@cae.wisc.edu, *Rajan Suri, Mary Vernon*

Push strategies/kanban systems are generally believed to perform better than pull systems. However, we use queueing models and simulation to show that for systems with high product variety and variability in demand/processing times, push is superior with regard to several performance measures.

**2) Scheduling of Engineering Liaisons in Manufacturing System Development, John J. Liu**, University of Wisconsin, Sch. of Bus., Milwaukee, WI 53211, jll@uwm.edu

Engineering liaison is a communication vehicle between manufacturer and supplier(s) in developing manufacturing systems. When and how many liaison meetings to be scheduled have posed a difficult task. We address these problems using stochastic models, in the context of a specific FMS project at Giddings & Lewis, Inc.

**3) The Lazy Cook Problem, Claudio Arbib**, Università degli Studi di L'Aquila, Dipt. Matematica Pure e Appl., via Vetoio, Coppito, 67010, Italy, arbib@univaq.it, *Fabrizio Marinelli*

A cook must prepare  $n$  cakes with distinct baking times using an oven with  $m < n$  racks. Cakes to cook are taken from a table, carried to the oven, and then carried back using a trolley with the same capacity as the oven. What is the minimum number,  $q^*$ , of round trips required to cook?

**4) A Study on Autonomous Characterization of Parallel Arranged Machines, Susumu Fujii**, Kobe University, Dept. of Comp. & Systems Eng., Rokkoudai Nada, Kobe, 657-8501, Japan, fujii@seg.kobe-u.ac.jp, *Hiroshi Morita*

For parallel arranged machines producing several kinds of products, characterization of machines, i.e., assignment of specific kinds of products to each machine for production is preferably changed from time to time according to the variation of production mix for the efficient management of the production system. We propose an auction-based algorithm...

#### WA07 Planning for Nonstationary Uncertain Demand

Cluster: Manufacturing & Logistics

Invited Session

Chair: Sarah M. Ryan, Iowa State University, Dept. of IMSE, 205 Engineering Annex, Ames, IA 50011, smryan@iastate.edu

**1) Strategic Safety Stock Placement in Supply Chains with Non-Stationary Demand, Stephen C. Graves**, MIT, 77 Massachusetts Ave., Rm. E40-439, Cambridge, MA 02139-4307, sgraves@mit.edu, *Sean P. Willems*

The lifecycle for most products is becoming shorter; consequently, the product demand is never stationary, as assumed by most inventory models. We develop an optimization to determine the safety stock in a supply chain with bounded, non-stationary, and uncertain demand. Each stage operates with a base-stock policy and quotes a guaranteed service time to its customers.

**2) Stability of Supply Chain Policies in Non-Stationary Demand Environments, Ralph D. Badinelli**, Virginia Tech., Dept. of MS & IT, Blacksburg, VA 24061, ralphb@vt.edu

In highly dynamic environments, planners can instigate chaotic or unstable system behavior. However, sensible, general principles of production and inventory control should restrain supply chain systems from attaining such extreme behavior. Our objective is to prescribe policies that will produce stability and good performance when parameters of demand distributions are re-estimated over time.

**3) Heuristics for the Stochastic Capacitated Lot-sizing Problem, Isaac Chemmanam**, PricewaterhouseCoopers, 400 Northridge Rd., Ste. 1000, Atlanta, GA 30350, isaac.chemmanam@us.pwcglobal.com, *Charles R. Sox*

We present 3 heuristics for the stochastic capacitated lot sizing problem with setup carry-over. Two heuristics explicitly include a penalty cost for stockouts whereas the third includes a service-level instead of a penalty cost. Computational results are presented that compare the performance of these heuristics.

**4) Capacity Expansion with Nonstationary Demand Growth, Sarah M. Ryan**, Iowa State University, Dept. of IMSE, 205 Engineering Annex, Ames, IA 50011, smryan@iastate.edu

Recent work has shown that in capacity expansion with installation lead times, under a stationary policy, nonstationarity in demand mandates earlier capacity additions (with higher discounted cost). We investigate the performance of nonstationary policies to determine if they can maintain a specified service level with lower discounted installation costs.

**WA08 Manufacturing Applications I****Contributed Session**

**Chair:** Jeffrey E. Schaller, Eastern Connecticut State University, Dept. of Bus. Admin., 83 Windham St., Willimantic, CT 06226-2295, schallerj@ecs.cstateu.edu

1) **A Practical Approach for Determining Optimal Solutions to a One-Dimensional Cutting Stock Problem, Dennis D. Newhart,** Bethlehem Steel Corp., Homer Research Labs., Bldg. C, Bethlehem, PA 18016, rddn1@bsco.com, **Kenneth L. Stott, Jr., Floyd E. Wolf, Francis J. Vasko**

Cutting patterns for steel coils must address the economics of both trim loss and the number of slitter setups. In theory, the optimal solution can be found if all of the costs are known. In practice, a strategy is discussed to generate optimal, undominated solutions for review by management.

2) **A Hierarchical Approach for Cutting Stock Problems that Maximizes Yield & Minimizes Overgrading, Francis J. Vasko,** Kutztown University, Math Dept., Kutztown, PA 19530, vasko@kutztown.edu, **Dennis D. Newhart, Kenneth L. Stott, Jr.**

This paper describes a hierarchical algorithm, that efficiently and effectively generates cutting patterns for material that is to be cut at cold saws within a steel plant. This algorithm strives to maximize yield over all the material cut and simultaneously tries to minimize overgrading. An example will be given.

3) **A Queueing-Based Model for a Packing Line, Liesje deboeck,** University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, liesje.deboeck@ufsia.ac.be, **Nico J. Vandaele, Dominiek Callewier**

We use an open, multi-product, multi-machine queueing network in a make-to-order environment. We investigate the feasibility of the product mix for the packing line of a mattress manufacturer. Besides being a flexible and computational efficient approach, we methodologically reveal that the queueing approximations resolve managerial questions quickly.

4) **A New Branch & Bound Procedure for Minimizing the Sum of Squares Job Lateness on a Single Machine, Jeffrey E. Schaller,** Eastern Connecticut State University, Dept. of Bus. Admin., 83 Windham St., Willimantic, CT 06226-2295, schallerj@ecs.cstateu.edu

A new B&B procedure is presented for the problem of minimizing the sum of squares job lateness on a single machine. This procedure uses a new lower bound and dominance conditions and is compared to a procedure developed by Gupta & Sen. Computational results are presented.

**WA09 Supply Chains IV****Contributed Session**

**Chair:** Dongjun Wu, Drexel University, Dept. of Mgmt., 32nd & Chestnut St., Philadelphia, PA 19104, wudj@drexel.edu

1) **Optimal Commonality & Postponement Strategies for End-Product Components, Siki Timucin,** Stanford University, Dept. of IEEM, Stanford, CA 94305-4024, timucin@stanford.edu, **Margaret L. Brandeau**

We consider the problem of determining the configuration of end-product components and determining their points of differentiation in the supply chain. We consider production, setup, inventory holding and postponement costs. We characterize the optimal solution and analyze the sensitivity of the solution to different problem parameters.

2) **Optimal Policies Within Capacitated Supply Chains, Rodney P. Parker,** University of Michigan, Sch. of Bus. Admin., Ann Arbor, MI 48109-1234, rpparker@umich.edu

We show that the optimal policy within a multi-echelon system with limited capacity at each installation, is a modified echelon base-stock type policy. The conditions for this to be true is that the smallest capacity is found at the lowest installation. Discounted and average cost results are shown.

3) **Optimal Contract Design for a Two-Stage, Two-Market Supply Chain under Asymmetric Demand Information, Nicholas C. Petrucci,** University of Illinois, 350 Commerce West Bldg., 1206 South 6th St., Champaign, IL 61820, petrucci@uiuc.edu, **Rachel Yang**

We consider an optimal contract design problem for a manufacturer that supplies a dealer serving 2 markets or 2 dealers, each supplying 1 market. Each retailer assigns a distribution function to characterize the uncertain market demand that it serves but a parameter of that distribution is unknown to the manufacturer.

4) **Optimal Bidding & Contracting Strategies in Supply Chains for Non-Storable Commodities, Dongjun Wu,** Drexel University,

Dept. of Mgmt., 32nd & Chestnut St., Philadelphia, PA 19104, wudj@drexel.edu, **Paul R. Kleindorfer, Jin Zhang**

We model the interaction of long-term contracting and spot market transactions between suppliers and buyers in supply chains for non-storable commodities. Key questions addressed include the structure of the optimal portfolios of bidding and contracting and the pricing in market equilibrium. We extend single-supplier multi-buyer results to the multi-supplier case.

**WA10 Technology Management Issues in China****Sponsor: Technology Management Section****Sponsored Session**

**Chair:** Peter Ping Li, California State University, Sch. of Bus. Admin., Turlock, CA 95382, ptpli@toto.csustan.edu

1) **Does Foreign Technology Stimulate Indigeneous Technology? Empirical Evidence of China, Hongxin Zhao,** St. Louis University, Sch. of Bus. Admin., Inst. of Intl. Bus., St. Louis, MO 63108, zhaox@slu.edu

We examine the impact of foreign technology on the indigenous technology in the context of China. The data for 25 provinces in China from 1986-1995 suggest that foreign technology contributed positively to the development of indigenous technology in China, holding other control variables constant.

2) **Technology Management of International Joint Ventures in China, Tung-Lung Chang,** Long Is University, Coll. of Mgmt., 720 Northern Blvd., Brookville, NY 11548, tchang@cwpost.liu.edu

Joint ventures have been crucial for Chinese companies to acquire necessary technologies, including product, process and management know-how. We focus on joint ventures formed between foreign firms and Chinese state-owned, collective and town/village enterprises in order to study their performance and the ensuing technology management issues of such joint ventures.

3) **The Development of China's High-Tech Industries: A Case Study Approach, Peter Ping Li,** California State University, Sch. of Bus. Admin., Turlock, CA 95382, ptpli@toto.csustan.edu

China has targeted high-tech industries as a top priority but has made limited progress. We explore the factors that facilitate or hinder the development of high-tech industries in China. We conclude that China has to change its institutional systems for the successful development of its high-tech industries.

4) **Creating High-Tech Incubators in the Developing Countries: A Comparative Study, Peter Ping Li,** California State University, Sch. of Bus. Admin., Turlock, CA 95382, ptpli@toto.csustan.edu

We explore the factors that have facilitated the success of Silicon Valley and Taiwan's Hsinchu Park as well as the factors that have hindered the success of Beijing's "electronic alley." We seek to provide empirical evidences for the theory-building about high-tech incubators in the developing countries.

**WA11 AI & OR****Cluster: Industrial Applications of Optimization****Invited Session**

**Chair:** Sesh Murthy, IBM, TJ Watson Research Ctr., Rte. 134 & Taconic, PO Box 218, Yorktown Heights, NY 10598, ssmurthy@us.ibm.com

1) **Cooperative Strategies for Solving the Bicriteria Sparse Knapsack Problem, Jayant Kalagnanam,** IBM, TJ Watson Research Ctr., Rte. 134, PO Box 218, Yorktown Heights, NY 10598, jayant@us.ibm.com, **Sesh Murthy, Sibel Salman**

We obtain non-dominated solutions for the sparse multiple knapsack problem with the objective of maximizing applied weight and minimizing waste. Such problems are computationally hard using conventional integer programming techniques. A cooperative organization of heuristics was used to solve real world hard (from steel) instances with surprising effectiveness.

2) **No Title Supplied, John N. Hooker,** Carnegie Mellon University, GSIA, Pittsburgh, PA 15213

No abstract supplied.

3) **No Title Supplied, Mark Boddy,** Honeywell Technology Center, Minneapolis, MN

No abstract supplied.

4) **No Title Supplied, Sarosh Talukdar,** Carnegie Mellon University, Dept. of ECE, Pittsburgh, PA 15213, talukdar@ece.cmu.edu

No abstract supplied.

**WA12 Empirical Game Theory Models**

**Sponsor:** College of Marketing  
Sponsored Session

**Chair:** Vrinda Kadiyali, Cornell University, Malott Hall, Ithaca, NY 14853

**1) Adoption of New Products in the Presence of Network Externalities: An Empirical Analysis of the Discover Card Launch, Vrinda Kadiyali, Cornell University, Malott Hall, Ithaca, NY 14853, Li Zheng**

In launching a product with network externalities, there is a chicken-and-egg issue of building an installed base to attract more customers, and getting more customers to build an installed base. We empirically explore this problem for the launch of the Discover credit card in the US. We estimate the chicken-and-egg dependence in the adoption of this credit card...

**2) Competition in the US Microprocessor Industry, Abhik Roy, Hong Kong Polytechnic University, Dept. of Business Studies, Hung Hom, Kowloon, Honk Kong, China, buroya@polyu.edu.hk, Jagmohan S. Raju**

We examine whether the competition between Intel and Motorola is in prices or quantities. We also examine whether changes in downstream industry had any impact on market conduct upstream.

**3) Investigating the Dynamics of Competitive Behavior, Sudhir Karunakaran, NYU, Vrinda Kadiyali, Pradeep Chintagunta**

Theories of dynamic games predict that firms switch between periods of cooperative pricing. We use a switching regression technique to infer the cooperative and competitive periods. We then test alternative theories of dynamic competitive behavior using data from a frequently purchased consumer goods category.

**WA13 Marketing III**

Contributed Session

**Chair:** Barry A. Pasternack, California State University, MSIS Dept., Fullerton, CA 92834, bpasternack@fullerton.edu, business.fullerton.edu/msis/bpasternack.htm

**1) The Impact of an Integrated Marketing & Manufacturing Innovation, Glen Schmidt, Georgetown University, McDonough Sch. of Bus., G-4 Old North, 37th & O St. NW, Washington, DC 20057, schmidt@msb.edu, Evan L. Porteus**

We investigate the market consequences of a new product, as a function of product design attributes and production costs. Two possible scenarios result: high-end encroachment, in which the new product attracts the best customers and low-end encroachment, in which the new product attracts fringe or lower-end customers.

**2) Developing a Strategic Merchandising Plan to Optimize Retail Profit, Suresh Divakar, Mitchell Madison Group, 9 West 57th St., 14th Floor, New York, NY 10019, divaks@mmgnet.com, Subir Bandyopadhyay**

We develop a dynamic optimization model that includes a retailer's merchandising activities, costs of merchandising, retail margin, manufacturer's trade promotions and revenue generated. We show how retailer's optimal allocation to different merchandising programs, i.e., features, displays or both, differs from the more intuitive solution of maximum merchandising coverage most of the time.

**3) Uniform Can be Better than Two-Part Pricing under Competition, Taeki Min, Management Research Lab., 206 Jungja-Dong, Bundang-Gu, SungNam-Si, Gyunggi-Do, 463-711, Korea, tkmin@kt.co.kr, tkmin@kgsm.kaist.ac.kr, Sang Yong Kim, Changhoon Shin, Minhi Hahn**

Nonlinear (2-part) pricing has been shown to yield greater profit than uniform pricing. However, most studies on nonlinear pricing have been done under a monopoly setting. We examine the effect of 2-part pricing in a competitive environment. Uniform pricing is the better strategy than 2-part pricing in a highly competitive environment.

**4) Using Revenue Sharing to Achieve Channel Coordination, Barry A. Pasternack, California State University, MSIS Dept., Fullerton, CA 92834, bpasternack@fullerton.edu, business.fullerton.edu/msis/bpasternack.htm**

We consider a newsboy type situation in which a vendor can either purchase the item it sells outright or obtain the item from the manufacturer on a revenue sharing basis. We show that while revenue sharing can be used to achieve channel coordination, the manufacturer's expected profit may actually decrease.

**WA29 Transportation Topics III**

Contributed Session

**Chair:** Barrett W. Thomas, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109, barrett@engin.umich.edu

**1) No Title Supplied, Baichun Xiao, Long Is University, 720 Northern Blvd., CW Post, Brookville, NY 11548, bxiao@liu.edu, Youyi Feng, Houmin Yan**

We study a revenue management problem encountered by truck companies. Customers requesting transportation services pay different prices based on the distances to various destinations. To optimize revenues, truck companies allocate capacity among customers. If necessary, they acquire additional capacity through outsourcing. We present a stochastic model and develop optimal policies.

**2) Heuristic Approaches in Production & Transportation Scheduling, Pan Chen, Cornell University, Sch. of OR/IE, Ithaca, NY 14853, pc36@cornell.edu, Peter L. Jackson**

Two heuristic approaches are proposed to integrate production and transportation scheduling without the presence of finished goods inventory. Constraints include order due dates, and production and vehicle capacities. Decisions include vehicle loading and routing, carrier choice and production date. Simulation results have shown improvements over human expert's solution.

**3) The Multiple Express Services Fleet Planning Problem, Cheng-Chang Lin, National Cheng Kung University, Dept. of Transport. & Comm. MS, 1 University Rd., Tainan, 704, Taiwan, cclin@mail.ncku.edu.tw**

The time-definite express carriers provide the same-day air and ground express services. The multiple-service fleet planning is to determine an integrated air and ground fleet to minimize the total cost while meeting the service time commitment. We develop an implicit enumeration algorithm to solve this integer program to its optimality.

**4) Anticipatory Tour Selection, Barrett W. Thomas, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109, barrett@engin.umich.edu, Chelsea C. White, III**

We present a Markov decision process model for determining routes that anticipate pick-up requests that may be made after the pick-up vehicle leave the depot, assuming the probability of customers requesting service is given and is a function of the time of day.

**WA30 Economics & Computation in Electronic Commerce**

**Sponsor:** INFORMS Computing Society

Sponsored Session

**Chair:** Vidyant Choudhary, Carnegie Mellon University, GSIA, Pittsburgh, PA 15213, veecee@cmu.edu

**1) Multi-Agent Systems, Mechanism Design & Institutions, Jeffrey MacKie-Mason, University of Michigan, Dept. of Economics, Lorch Hall, Sch. of Info., Ann Arbor, MI 48109, jmm@umich.edu**

Economically intelligent agents are central to much new research on multi-agent systems. Economic theories of mechanism design (e.g., auctions) have both motivated and informed the design of such systems. I examine the essential role for adaptive institutions to deal with computational and information complexity in these systems.

**2) Electronic Markets & Computational Models of Human Behavior, Alok R. Chaturvedi, Purdue University, Krannert Sch. of Mgmt., 1310 Krannert Bldg., West Lafayette, IN 47907, alok@mgmt.purdue.edu, Shailendra Mehta**

It is argued that a primary goal of electronic commerce is the creation of electronic markets where artificial agents and humans come together to conduct business spontaneously and efficiently. We present a methodology to computationally represent the models of behavior of different types of agents operating in the electronic marketplace.

**3) A Principal-Agent Approach to the Analysis of Contracts in Electronic Commerce-Enabled Supply Chain Management, Kerem Tomak, University of Texas, 2550 Yeager Rd. 16-9, West Lafayette, IN 47906, tomakk@expert.cc.purdue.edu**

We assess the effect of electronic commerce on a specific dimension of supply chain relationships. We study the shift in the supply chain relations that firms observe and the effect of changes in technology and network externalities on the type of contract that can be implemented between the vendor and the manufacturer.

**WA31 Service Reliability**

**Cluster:** Reliability Modeling  
Invited Session

**Chair:** Michael Tortorella, Bell Laboratories, 101 Crawford's Corner Rd., Holmdel, NJ 07733, mtortorella@lucent.com

**1) Service-Level Reliability & Availability Implications of Packet Networks, Michael G. Ketcham,** Motorola, Inc., 5555 North Beach St., MS TX1/ 4-1 D, Ft. Worth, TX 76137, mketchal@email.mot.com, **Norman A. Marlow**

Carrying telecommunications services over packet-switched networks (PSNs) introduces reliability and availability (R/A) issues that do not arise in circuit-switched networks. Failures of PSN elements cannot be assumed to be independent and the impact of outages on the user population is not well defined. We describe key PSN R/A issues and their implications for end-to-end service reliability.

**2) Reliability Assessment of Vendor-Provided Services: Field Trials, David A. Hoeflin,** AT&T Laboratories, 200 Laurel Ave., Middletown, NJ 07748, dhoeflin@att.com

We present a methodology to assess the reliability of services provided by a vendor based on an AT&T reliability study that may include reliability modeling, laboratory testing, and results from a field trial. The methodology uses a reliability growth model to model the different failure sources and a Bayesian analysis to combine prior information...

**3) Design Guidelines for Reliability of Services Delivered on a Broadband Network, Himanshu Pant,** Bell Laboratories Lucent Technologies, 101 Crawford's Corner Rd., WS 2L-532, Holmdel, NJ 07733, hpant@lucent.com, **Karen Ohl, Paul Wu**

We present network design guidelines for meeting service reliability objectives. We study a broadband network that supports diverse services. For a set of these services we study the network design and examine the various design options available. The presentation is not prescriptive but emphasizes the trade-offs available to the customer.

**WA32 Telecommunication System Operation & Design**

**Contributed Session**

**Chair:** Herbert B. Shulman, AT&T, 200 Laurel Ave., Middletown, NJ 07748, hshulman@att.com

**1) A Simulation Framework for QoS Performance of Asynchronous Transfer Mode Networks, O. Geoffrey Okogbaa,** University of South Florida, Dept. of IMSE, 4202 East Fowler Ave., Tampa, FL 33620-5250, okogbaa@eng.usf.edu, **Wei Hou**

ATM is the only transmission protocol to support broadband integrated services digital networks which is the medium that supports vast volumes of traffic serving multi-media applications. Performance prediction and reliability analysis of ATM systems are therefore extremely important in view of their ever expanding usage, multiplicity of their component parts and the complexity of their functioning....

**2) Resource Allocation in Tree Networks under Delay Constraints, Herbert B. Shulman,** AT&T, 200 Laurel Ave., Middletown, NJ 07748, hshulman@att.com, **Venkat Venkateswaran**

In telecommunications networks, higher bandwidth on links results in lower transmission delays. Link costs, however, are proportional to bandwidth. We solve special cases of the problem: given a tree, determine least cost bandwidth allocation to links to ensure that all node-to-node delays are within a specified limit.

**3) Routing Heterogeneous Traffic on Heterogeneous Networks: The Problem of Non-Conservative Flows, Florence Boyer,** France Telecom CNET, 905 rue Albert Einstein, Sophia-Antipolis, 06921, France, florence.boyer@cnet.francetelecom.fr, **Pascal R. Chanas, Sebastien Bertrand, Alexandre Laugier, Jean-Pierre Paris**

Interconnection networks have been improved over the past 20 years and the coexistence of various link protocols in one network implies considering new types of routing problems. We describe algorithms for finding minimum protocol changes paths and examine the complexity of these routing problems with non-conservative flows.

**4) Optimal Cost Stacked SONET/SDH Ring Design, Olga L. Raskina,** Columbia University, 330 Mudd Bldg., 500 West 120th St., New York, NY 10027, olga@ieor.columbia.edu, **Ramesh Nagarajan**

We have formulated the optimal cost stacked SONET/SDH ring design problem. We have proposed adapted bin-packing and LP column generation-based heuristics and a cost lower bound. In numerical studies, heuristics were observed to yield designs which were within 10% of the cost lower bound on average. We have also compared the run-time of the heuristics.

**WA33 Multivariate Statistics for Process Monitoring, Control & Adjustment**

**Sponsor:** Quality, Statistics & Reliability  
**Sponsored Session**

**Chair:** Darek Ceglarek, University of Michigan, 1031 H.H. Dow Bldg., Dept. of Mech. Eng., Ann Arbor, MI 48109-2136, darek@engin.umich.edu

**1) Analysis of Multivariate EWMA-Based Feedback Adjustment Techniques, Rankumar Rajagopal,** Pennsylvania State University, Dept. of IME, 207 Hammond Bldg., University Park, PA 16802, **Enrique del Castillo**

Feedback adjustment techniques based on the EWMA statistic have become popular for the quality control of semiconductor manufacturing processes. We will illustrate how these controllers can be extended to the multivariate (multiple input, multiple output) case. Stability results and recommendations for tuning the EWMA weight matrices will be discussed.

**2) EWMA Control Charts for the Process Sample Median & Sample Variance, Philippe Castagliola,** Ecole des Mines de Nantes, Dept. of Auto. Ctrl. & Prod., 4 rue Alfred Kastler, BP 20722, Nantes cedex 3, 44307, France, philippe.castagliola@emn.fr <http://www.emn.fr/castagliola>

If the properties and design strategies of the EWMA chart for the sample mean have been thoroughly investigated by Robinson & Ho (1978), Crowder (1987, 1989) and Lucas & Saccucci (1990), the use of the EWMA as a tool for monitoring other sample statistics has received little attention. We suggest methods extending the classic use of the EWMA chart to the sample median or the sample variance of a process.

**3) Real-Time Multivariate Process Monitoring & Adjustment, Di Xu,** Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, **Susan L. Albin**

Multivariate statistical process monitoring, such as PLS, indicates when process settings require adjustment. We have developed a mathematical program to determine optimal new settings for the process. The methodology is implemented in real-time to start up a batch production process characterized by multiple process and product variables.

**4) Measurement of Diameter of the Bone, Jacek Dmochowski,** SUNY, Div. of Biostatistics, 246 Farber Hall, 3435 Main St., Buffalo, NY 14214-3000, stjacek@buffalo.edu

An orthopedic experiment was performed to compare CT-scan and caliper measurements of the outside diameter of the femur bone. Difficulties connected with the statistical modeling of this measurement process will be presented. Plausible statistical models will be discussed and compared.

**WA34 Chaos & Complexity**

**Cluster:** State-of-the-Art in Information Technology  
**Invited Session**

**Chair:** Gregory Madey, Kent State University, College of Bus., Kent, OH 44242, gmadey@kent.edu

**1) On the Computational Complexity of Kauffman's NK Model for Studying Complex Systems with an Application in Team Building, Daniel Solow,** Case Western Reserve University, Weatherhead Sch. of Mgmt., 10900 Euclid Ave., Cleveland, OH 44106, dxs8@po.cwru.edu, **George L. Vairaktarakis, Sandy Kristin Piderit**

Kauffman's NK model for studying systems with complex interacting parts is described in the context of building an effective team in an organization. Certain versions of the resulting problem are shown to be polynomial while others are NP-complete. Heuristics and computational results are also presented.

**2) Generation of Uniform Random Numbers from a Large Family of Chaos Functions, Marvin D. Trout,** Kent State University, Dept. of Admin. Sci., Grad. Sch. of Mgmt., Kent, OH 44242, mtrout@bsa3.kent.edu, **Murali S. Shanker**

We consider generating uniform random numbers based on chaos functions. Using a recently developed theory called vertical density representation we derive conditions on the chaos function so that its orbit will be uniformly distributed in the unit interval. Some computational results will be discussed and hybrid approaches are proposed.

**3) Emergent Properties of the Internet, Gregory Madey,** Kent State University, College of Bus., Kent, OH 44242, gmadey@kent.edu, **Norman Johnson, Steen Rasmussen**

We examine the Internet as large system of interacting intelligent agents. We identify examples where emergent properties of this system are appearing and

discuss the mechanisms by which this emergence takes place.

### WA35 Developing Requirements for Models & Simulations

#### Cluster: Models & Simulations

##### Invited Session

**Chair:** Robert J. Might, Innovative Management Concepts, Inc., 45625 Willow Pond Plaza, Sterling, VA 20194, rmight@imcva.com

**1) Developing Good Requirements for Models & Simulations, Robert J. Might**, Innovative Management Concepts, Inc., 45625 Willow Pond Plaza, Sterling, VA 20194, rmight@imcva.com

In many respects, the requirements for a model or simulation are just the same as any set of sub-system requirements. However, there are some differences and failing to recognize these differences early in the development cycle can lead to disaster. We explore the basic hierarchy of requirements, from user requirements to representation requirements, for an M&S development...

**2) Working with Users to Develop Models & Simulations Requirements, Forrest Crain**, Defense Modeling & Simulation Office, 1901 North Beauregard Ave., Ste. 504, Alexandria, VA 22311, wcrain@dmsi.mil

Users sometimes know exactly what they need a future model or simulation to provide, but they don't always know how to express that need. At other times, users don't know what they will need in the future but they have some general ideas of what might help them...

**3) Developing Requirements for Modeling Human Behavior, Ruth Willis**, Defense Modeling & Simulation Office, 1901 North Beauregard Ave., Ste. 504, Alexandria, VA 22311, rpwillis@dmsi.mil

There is more demand on model and simulation developers to represent human activities, both cognitive and physical. In the past, researchers in the areas of cognitive science have led the effort to model human decision making. Military modelers have attempted to represent the impact of environmental factors on human physical activities but there is no systematic approach...

**4) Developing a Models & Simulation Requirements Process for Representing the Natural Environment, Donna Blake**, Core Processes, Inc., 1800 North Beauregard Ave., Alexandria, VA 22311-1708, dblake@coreprocesses.com

Users are aware that most M&S systems must incorporate environmental factors to provide necessary realism. Existing environmental information production centers, repositories and observing systems can provide vast amounts of data, sufficient to overwhelm a simulation developer. At the same time, the particular environmental factors needed for a given M&S application may not be available...

**5) A Comparison of Requirements Tools for Models & Simulations Developers, Scott Waite**, George Mason University, OR Dept., Fairfax, VA 22030

There are a number of systems engineering and requirements tools widely used in government and industry. Some are designed to only manage requirements, others are designed to help develop and manage requirements. There are comparisons of the tools readily available; however, there may be some unique aspects of M&S development and management that may make some tools better for this application...

### WA36 Multiobjective Programming

#### Contributed Session

**Chair:** Yupo Chan, AFIT, 2950 P St., Bldg. 640, WPAFB, OH 45433-7765, ychan@alum.mit.edu, http://www.afit.af.mil

**1) Intelligent Search Methods for Nonlinear Goal Programming Problems, Glenn W. Kuriger**, University of Oklahoma, 912 Schulze Dr., Norman, OK 73071, kuriger@ou.edu, **A. R. Ravindran**

Three methods were developed to solve the NLGP problem by adapting and extending the Nelder-Mead method, the complex search method and the Hooke & Jeeves pattern search method to account for multiple criteria. These modifications were largely accomplished by using goal programming, lexicographic ordering and partitioning concepts.

**2) A Weight Set Decomposition Algorithm for Generating All Efficient Extreme Points in the Outcome Set of a Multiple Objective LP Problem, Erjiang Sun**, University of Florida, Dept. of DIS, Gainesville, FL 32611, sune@chip.cba.ufl.edu, http://grove.ufl.edu/~sune

We present a new outcome space-based algorithm, the basic weight set decomposition algorithm, for finding the set of all efficient extreme points in the outcome space of a multiple objective mathematical programming problem.

**3) Piecewise Quadratic Approximation of the Nondominated Set for Bicriteria Programs, Margaret M. Wiecek**, Clemson University, Dept. of Math Sci., Clemson, SC 29634, wmalgor@clemson.edu, **Wei Chen, Jinhuan Zhang**

A procedure to approximate the nondominated set for bicriteria programs is proposed. The approximation is developed locally in a neighborhood of a nondominated point of interest, incorporates decision maker's preferences and gives an explicit description of the set.

**4) A Goal-Seeking Approach to Multi-Period Acquisition, Yupo Chan**, AFIT, 2950 P St., Bldg. 640, WPAFB, OH 45433-7765, ychan@alum.mit.edu, http://www.afit.af.mil, **Joseph P. DiSalvo, Michael W. Garrambone**

A goal-seeking model is constructed as an MIP consisting of 300 0-1 variables, 1000 continuous variables and 4000 constraints. This multicriteria optimization problem considers the diverse missions of the organization. We demonstrate how the inventory levels were affected as the priorities of each mission changed. Army helicopter acquisition over the 25 years was used to validate the model.

### WA37 Panel: The Ups & Downs of Multiple Site Student Collaboration Projects

#### Sponsor: INFORM-ED

##### Sponsored Session

**Chair:** Shawn P. Daly, Tiffin University, Mktg. Dept., 155 Miami St., Tiffin, OH 44883, sdaly@tiffin.edu

**1) Panel: The Ups & Downs of Multiple Site Student Collaboration Projects, Paul Arsenault**, West Chester University, Mktg. Dept., West Chester, PA 19383, parsenault@wcupa.edu, **Shawn P. Daly**, Tiffin University, Mktg. Dept., 155 Miami St., Tiffin, OH 44883, sdaly@tiffin.edu, **Susan H. Godar**, William Paterson University, Marketing & MS Dept., 300 Pompton Rd., Wayne, NJ 07470, godars@nebula.wilpaterson.edu, **Minna Mattila**, University of Jyväskylä, Sch. of Bus. & Economics, PO Box 35, Jyväskylä, 40351, Finland, mimaja@tase.jyu.fi, **Thomas Treadwell**, West Chester University, Psychology Dept., West Chester, PA 19383, ttreadwell@wcupa.edu

Continuing improvements in communications technology have made very long-distance teamwork a reality in business. As such, it has become increasingly important for faculty to provide students the experience of such collaborations (international project teams and long distance work groups). By sharing our adventures in a panel discussion, we hope to improve both the quality of the students' learning...

### WA38 Forecasting III

#### Contributed Session

**Chair:** Sandy D. Balkin, Ernst & Young LLP, 1225 Connecticut Ave. NW, Washington, DC 20036

**1) Probabilistic Scenarios to Support Decision Making in Telecommunications, Bartolomeo Sapio**, Fondazione Ugo Bordoni, Via Baldassarre, Castiglione 59, Rome, 00142, Italy, bsapio@fub.it, **Isabella Maria Palombini, Quirino Brindisi**

Probabilistic scenarios can be built with the help of optimization methods and used in strategic planning along different guidelines, such as focusing attention on the most probable scenario, protecting oneself in the light of the most menacing scenarios or proactively influencing future developments in the sector up to the establishment of a favorable scenario...

**2) Integrating Domain Knowledge & Statistical Methods for Forecasting, Xiao Ying Chen**, University of Tokyo, Tanmachi 1-11-2-405, Kanagawa-Ku, Yokohama, 221-0825, Japan, chenxy@cb.mbn.or.jp

Demand forecasting is the most critical part of new product introduction in order for higher customer satisfaction and lower logistical cost. Because there are not a lot of historical data for new products, time series and regression methods have little use in this situation. We developed an approach for new product forecasting by integrating domain knowledge and statistical methods...

**3) Stationarity Concerns when Forecasting with Neural Networks, Sandy D. Balkin**, Ernst & Young LLP, 1225 Connecticut Ave. NW, Washington, DC 20036

ANNs are known to be universal function approximators. We investigate the need for inducing stationarity in the mean and variance on univariate time series when forecasting using a neural network. This question will be evaluated via simulation and demonstrated on some benchmark time series.

**Wednesday 10:15-11:45****WB01 New Products & Technology Management**  
Contributed Session

**Chair:** Michael J. Armstrong, Royal Military College, Dept. of Bus. Admin., Box 17000 Station Forces, Kingston, Ontario, K7K 7B4, Canada, armstrong-m@rmc.ca

1) **Information Complements, Substitutes & Strategic Product Design**, *Marshall Van Alstyne*, University of Michigan, School of Info. 305D West Hall, 550 East University Ave., Ann Arbor, MI 48109-1092, mvanalst@umich.edu, <http://www.si.umich.edu/~nvanalst>, *Geoffrey G. Parker*

We consider when firms can increase profit by freely giving away products. We articulate an information product design strategy whereby information complements can raise profits while substitutes can lower competitor profits. We introduce an indirectly-paid joint-producer who adds value for consumers. This framework helps explain many recent information-firm strategies.

2) **Knowledge Zones? New Product Development & the Institutional Investor**, *Susanna Khavul*, Boston University, Dept. of Mgmt. Policy, 595 Commonwealth Ave., 6th flr, Boston, MA 02215, skhavul@bu.edu

We look at the role of the institutional investors including venture capitalists in creating an environment where rapid new product development takes place. We interviewed the CEOs of high technology start-ups who have received institutional equity investment at the seed/start-up rounds to assess the depth and impact of knowledge transfer.

3) **withdrawn - author request of 10/11**, *Richard M. Schroder*, Monash University, Dept. of Mgmt., PO Box 197, Caulfield East, 3145, Victoria Australia, richard.schroder@buseco.monash.edu.au, *James Sarros, Amrik S. Sohal*

4) **Timing & Quality Decisions for Entrepreneurial Development**, *Michael J. Armstrong*, Royal Military College, Dept. of Bus. Admin., Box 17000 Station Forces, Kingston, Ontario, K7K 7B4, Canada, armstrong-m@rmc.ca, *Moren Levesque*

An entrepreneur is developing a new product and each period must decide whether to enter the market or to continue development. Our model allows funding, development success and competition to be random. We derive a stopping time and a target quality criteria for this decision model.

**WB02 Discrete Optimization Applications**  
Contributed Session

**Chair:** Marc Peeters, Katholieke Universiteit Leuven, Naamsestraat 69, Leuven, 3000, Belgium, marc.peeters@econ.kuleuven.ac.be

1) **Server Assignment to Customers**, *Mario Norbis*, Quinnipiac College, Mount Carmel Ave., Hamden, CT 06518, mnorbis@quinnipiac.edu, *Jose A. Gonzalez*

The problem of assigning identical servers to different customer classes is analyzed with the objective being to optimize customer service and utilize resources. A mathematical formulation of the problem is presented and a heuristic for the assignment of servers is developed. Numerical results are compared to other previously utilized methods.

2) **Fair Athletic Game Scheduling**, *Hyoung-Ro Lee*, Iowa State University, 205 Engineering Annex., MB 28, Ames, IA 50011, yulee@iastate.edu, *Douglas D. Gemmill*

When creating athletic game schedules, it is important for each team to perceive that the schedule is fair. We developed a fair athletic game scheduling algorithm which minimizes the variance of travel distances and minimizes maximum total distance traveled for the season by any team. The algorithm utilizes simulated annealing.

3) **A Branch & Logic Cut Framework for the Generalized Assignment Problem with Tabu Starting Solutions**, *Maria A. Osorio*, Autonomous University of Puebla, 1255 19th St. #2, Boulder, CO 80302, osorio@spot.colorado.edu, *Manuel Laguna*

We solve the classic generalized assignment problem with a maximization objective function and the assignment of one job to each agent, subject to capacity restrictions on the agents. The algorithm employs a tabu starting solution and logic cuts generated in linear time and is implemented in a B&C framework.

4) **Branch & Price Algorithms for the Dual Bin Packing Problem & the Maximum Cardinality Bin Packing Problem**, *Marc Peeters*, Katholieke Universiteit Leuven, Naamsestraat 69, Leuven,

3000, Belgium, marc.peeters@econ.kuleuven.ac.be, *Zeger Degraeve*

We present 2 efficient B&P algorithms with similar structure to solve the maximum cardinality and the dual bin packing problem. We compare the performance with existing B&B algorithms for both problems. Computational results indicate that B&P is faster.

**WB03 Restructured Power Markets**  
Contributed Session

**Chair:** Shishir K. Mukherjee, City of Palo Alto Utilities, 1174 Scotland Dr., Cupertino, CA 95014, smoraicon@igc.org

1) **Market Power Analysis for the Colombian Electricity Market**, *Alfredo Garcia*, Comision de Regulacion Energia, Calle 73 #7-06, Piso 5, Bogota, Colombia, agarcia@creg.gov.co

We present theoretical and empirical support to prove the potential for market power in the Colombian wholesale electricity market. A Cournot-type analysis is presented for long-term energy pricing. A Bertrand-type analysis is applied to analyze the exercise of market power during peak hours.

2) **Modeling Competitive Power Pools with Windows-Based Applications**, *Gregory P. Swinand*, London Economics, 350 Massachusetts Ave., Ste. 330, Cambridge, MA 02139, gswinand@londecon.com

Electricity restructuring around the globe gives new importance to modeling of competition in emerging power pools. The problem is formulated as an MIP. New optimization software such as MPL with CPLEX allows users to develop user friendly applications that can be used by nonexperts. We demonstrate a model that simulates optimal hourly electricity dispatch from a competitive power pool for an entire year.

3) **Transmission Pricing in a New Brazilian Regulatory Framework**, *Raul F. Ferreira*, SQN 216 Bl, Brasilia DF, 70875-100, Brazil, raul@aneel.gov.br

We discuss the complete history of the development of the Brazilian transmission pricing methodology and the regulatory acts. The regulatory agency, ANEEL, and the reasons that were used to define each point of the mathematic model to simulate the transmission system use are described. We present tariff values and examples.

4) **Electricity Industry Restructuring in California: An Assessment**, *Shishir K. Mukherjee*, City of Palo Alto Utilities, 1174 Scotland Dr., Cupertino, CA 95014, smoraicon@igc.org

The restructuring of the electricity industry in California was expected to create a competitive market and reduce electricity rates. The salient features of the new structure and experiences with the process will be discussed. The focus will be on policy issues and lessons to be learned by other states.

**WB04 Decision Support Applications & Prostate Cancer Screening & Treatment**

**Cluster:** Decision Technology  
**Invited Session**

**Chair:** Robert L. Nydick, Villanova University, Coll. of Commerce & Finance, Dept. of Decision & IT, Villanova, PA 19085

1) **Detecting & Assessing the Severity of Prostate Cancer**, *Arthur J. Swersey*, Yale School of Management, 135 Prospect St., New Haven, CT 06511-3729, *Albert Y. Ha*

We present probabilistic models for guiding prostate biopsy procedures and assessing the likely severity of the disease. We describe our results and discuss directions for future work.

2) **A Decision Support System for Men Considering Prostate Cancer Early Detection**, *Matthew J. Liberatore*, Villanova University, Coll. of Commerce & Finance, 800 Lancaster Ave., Villanova, PA 19085, liberatore@cf.faculty.vill.edu, liberator@ucis.vill.edu, *Robert L. Nydick*, *Ronald Myers*, *Elizabeth Kunkel*, *John O'Connor*, *Edward Christian*, *Desiree Burgh*, *Thomas Wolf*, *Janet Ohene-Frempong*

Prostate cancer is more prevalent among African-American men over 40 than in the general population. Currently, the medical community is divided on whether to recommend screening. We present the approach and preliminary results of a study of African-American men who are offered educational counseling with decision support based on the AHP.

3) **Decision Analytic Representation of Continuous Prostate-Specific Antigen Test Results**, *Sang-Won Kim*, Strategic Decision Group, 2440 Sand Hill Rd., Menlo Park, CA 94025-6900

The accuracy of PSA tests is characterized as a receiver operating characteristic

curve based on a single cutoff approach to define "normal" and "abnormal" PSA levels. I propose a decision thresholds approach where all possible follow-up actions are considered to preserve the decision analytic value of PSA tests.

#### WB05 Location Analysis

Contributed Session

**Chair:** Bryan A. Norman, University of Pittsburgh, 1048 Benedum Hall, Dept. of IE, Pittsburgh, PA 15232, banorman@engr.pitt.edu

1) **A Lagrangian/Dual Ascent-Based Branch & Bound Procedure for the Two-Echelon Capacitated Facility Location Problem**, *Li-Lian Gao*, Hofstra University, Dept. of Mgmt., 228 Weller Hall, Zarb School, Hempstead, NY 11549, li-lian.gao@hofstra.edu, *Powell E. Robinson, Jr.*

We propose an arborescent fixed-charge network model for the 2-echelon capacitated facility location problem and present a Lagrangian/dual ascent-based B&B solution procedure. We will present computational results.

2) **On the Solution of Large Capacitated Facility Location Problems: Insights from a Real-World Application**, *Jay Sankaran*, University of Auckland, MSIS Department, Private Bag 92019, Auckland, New Zealand, j.sankaran@auckland.ac.nz

We present insights on the solution of large, real-world capacitated facility location problems that we gleaned through a consultancy project on strategic distribution systems design that we undertook for an Indian utilities company. The salient results concern the aggregation of customers and the selective inclusion of variable-upper-bounding constraints.

3) **The Allocation & Scheduling of Trainers & Trainees to Sites & Sessions**, *Stephanie R. Earnshaw*, N. Carolina State University/Research Triangle Institute, 3040 Cornwallis Rd., PO Box 12194, Research Triangle Pk, NC 27709-2194, earnshaw@rti.org, *Salah E. Elmaghraby, Yahya Fathi*

We treat the problem of the optimal allocation/location/scheduling of trainers and trainees in face-to-face interview surveys. We propose an ILP model, which is efficiently solved via a branch-and-cut/heuristic algorithm. The computational results demonstrate the applicability of the proposed procedure to problems involving 20 trainers, 120 trainees and 36 candidate sites.

4) **A Genetic Algorithm Approach for the Input/Output Location Placement Problem in Facility Design**, *R. Aykut Arapoglu*, University of Pittsburgh, 1048 Benedum Hall, Dept. of IE, Pittsburgh, PA 15261, raast28+@pitt.edu, *Bryan A. Norman, Alice E. Smith*

We present solution methodologies for locating the I/O locations for departments in a facility layout. The shortest flowpath distance between I/O locations is considered and cases with multiple I/O points and with separate I/O locations are considered. Optimal and heuristic methods are presented and tested using problems from the literature.

#### WB06 Flexible Manufacturing

Contributed Session

**Chair:** Chulung Lee, Pennsylvania State University, Dept. of IME, 5562 Hobart St. #715, Pittsburgh, PA 15217, cxl222@psu.edu

1) **A Design Technique for Terminal Typed AGVs with the Consideration of Department Layout**, *Toshimitsu Narita*, Waseda University, 3-4-1 Okubo, Shinjyuku, Tokyo, 169-8555, Japan, narita@yoshi.mgmt.waseda.ac.jp, *Weerapat Sessomboon, Kazuho K. Yoshimoto*

The problem of AGVs is discussed. A number of research projects have been conducted on this problem; however, most of them do not consider a terminal, which is essential as a staging area for an idle AGV. We propose a design technique for AGVs with the consideration of a terminal.

2) **Tandem Loop With Multiple Vehicle Configuration for Automated Guided Vehicle Systems**, *Chulung Lee*, Pennsylvania State University, Dept. of IME, 5562 Hobart St. #715, Pittsburgh, PA 15217, cxl222@psu.edu, *Jose A. Ventura*

Conventional guide path layout approaches for automated guided vehicle systems are analyzed and the TLMV configuration is considered as a new and significant alternative. Simulation studies show that the TLMV configuration is effective. Some operational issues of this configuration are also discussed.

3) **Application of Agile Manufacturing: A Case Study**, *Angappa Gunasekaran*, University of Massachusetts, 285 Old Westport Rd., North Dartmouth, MA 02747-2300, agunsekar@umassd.edu

We present a case study conducted in GEC-Marconi Aerospace (GECMAe). The case study deals with the scope of agile manufacturing in a real life situation. A gap methodology using an agility audit questionnaire has been used for determining the current and future levels of agility. Some interesting views of the applicability of agile manufacturing have been expressed...

4) **Optimizing Manufacturing Cells using Simulation & Production Flow Analysis: A Case Study**, *Andrew Loudon*, University of Dundee, Dept. of APEME, Pert Rd., Dundee, DD1 5ER, Scotland, UK, a.loudon@dundee.ac.uk, *Sheik Meeran, Angus H. Thow*

We describe the implementation of group technology in a SME sheet metal company that deals with many different customers and low volume production. We optimized the manufacturing cells in this environment using production flow analysis techniques and discrete event simulation. The implementation paves the way for realizing the potential of cellular manufacturing in non-traditional areas.

#### WB07 Modeling Correlations in Performance Analysis

Cluster: Manufacturing & Logistics

Invited Session

**Chair:** Tayfur Altioek, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, altiok@rci.rutgers.edu

1) **The Impact of Correlation in Manufacturing Systems**, *Tayfur Altioek*, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, altiok@rci.rutgers.edu, *Benjamin Melamed*

We discuss simulation results showing the impact of dependence in demand inter arrival times, times to failure, repair time and lead times on the manufacturing performance measures. Dependence is measured by the autocorrelation function and incorporated into simulation via a TES process.

2) **Parallelization of Search Algorithms for Modeling Traffic Processes**, *Benjamin Melamed*, Rutgers University, School of Bus., Levin Bldg., Livingston, NJ 08854, melamed@rutcor.rutgers.edu, *Santok Singh*

Manufacturing processes may require modeling autocorrelated arrival processes. TES and QTES are new versatile classes of stochastic processes whose fitting algorithm calls for a time consuming heuristic search over a probability vector space. We describe a parallel search methodology that uses a partitioning algorithm based on the theory of circulants.

3) **A Large Deviation Approach to Queueing**, *Dave Jagerman*, Rutgers University, RUTCOR, 214 Rutgers Rd., Piscataway, NJ 08854, jagerman@worldnet.att.net

A simple development is presented leading to the determination of the critical decrement for number in system for a class of G/G/1 queues. An explicit approximation for the equilibrium distribution of number in system is extended to waiting time distribution.

4) **Vessel Arrival process in Seaports Handling Bulk Materials**, *Dave Jagerman*, Rutgers University, RUTCOR, 214 Rutgers Rd., Piscataway, NJ 08854, jagerman@worldnet.att.net, *Tayfur Altioek*

We study the point process representing the vessel arrivals in bulk ports. The vessel inter-arrival process is correlated and its generating function and important statistics are obtained. Using large deviation theory, we also obtain the asymptotic distribution of the number of vessels in the port and their waiting times.

#### WB08 Manufacturing Applications II

Contributed Session

**Chair:** Jay B. Ghosh, SQU, PO Box 20, Al-Khod Postal Code 123, Muscat, Oman, jghosh@squ.edu.com

1) **Sequence Changes in Production/Assembly Lines: Effects & Analysis**, *Fayez F. Boctor*, Laval University, Cite Universitaire, Pavillon DeSeve 1168, Ste.-Foy, Quebec, G1K 7P4, Canada, fayez.boctor@fsa.ulaval.ca, *Francois Danjou, Vincent Giard*

We show how to derive the probability function of rank change of a product unit as a result of a quality control test on an assembly line such as the assembly lines used by the motor car industry. Having the exact form of this function is a prerequisite for a better analysis of the rank change phenomenon, which is needed to make a better analysis of its economical impact.

2) **Increasing the Consistency of GRAI Results using a Guide of Manufacturing Decisions**, *Michalis A. Menicou*, University of Sheffield, 82 Parkside Rd., Sheffield, S6 2AA, UK, mep97mm@sheffield.ac.uk

GRAI constitutes a well-established enterprise modeling technique, modeling the decisional infrastructure of production management systems. However, it is

highly unstructured, leading to inconsistent results when various analysts model a particular organization. Thus, we introduce a guide of manufacturing decisions that can increase the consistency of GRAIs results.

**3) A Model to Predict the Yield of Printed Circuit Board Production Lines, Felipe Helo**, Virginia Tech., 108 NEB (0118), Blacksburg, VA 24061, fhelo@vt.edu, **John E. Kobza, Kimberly P. Ellis**

Recent developments in technological advances have given rise to circuit boards of increasing complexity. Customers of these products demand higher quality and more reliable items. A model was constructed that assists in providing information about this manufacturing process by looking at the yield of the production lines.

**4) New Heuristics for the Dynamic Layout Problem, Jay B. Ghosh**, SQU, PO Box 20, Al-Khod Postal Code 123, Muscat, Oman, jghosh@squ.edu.com, **John T. Simon**

The dynamic layout problem arises when material flows between facilities change over time. In such situations, relocating the facilities are expensive but may be warranted. The challenge is to find the initial layout and the sequence of relocations which will minimize the overall cost. The problem being NP-hard, we propose heuristic solutions.

**WB09 Supply Chains V**  
Contributed Session

**Chair:** Joseph M. Hall, Stanford University, Grad. Sch. of Bus., MC 5015, Stanford, CA 94305-5015, jhall@stanford.edu, <http://www.stanford.edu/~jhall>

**1) Enterprise Resource Planning Implementation Project Teams, Savas Ozatalay**, Widener University, 1 University Place, Sch. of Bus. Admin., Chester, PA 19013-5792, savas.ozatalay@widener.edu

Supply chain management (SCM) requires an integrated information system as an execution tool. ERP is the most popular system. Many companies are having difficulties in implementing ERP in their SCM activities. We propose a project management approach for such an implementation. Project team formation, task sequence and functional integration issues will be discussed.

**2) Modeling Information Sharing-Based Supply Chain Partnership, Zhenxin Yu**, Hong Kong Polytechnic University, Dept. of Management, Hong Kong, Hong Kong, 98900411r@polyu.edu.hk, **Hong Yan, T. C. Cheng**

We formulate supply chain partnership based on information sharing among suppliers, manufacturers and retailers. Three relationship integration levels, decentralized control, coordinated control and centralized control, are analyzed in the models and a Pareto improvement will be achieved with the increment of information sharing level.

**3) SCML: A Generalized Supply Chain Modeling Language, Dean C. Chatfield**, Pennsylvania State University, Dept. of MSIS, 303 Beam Bldg., University Park, PA 16802, dcc110@psu.edu, **Terry P. Harrison, Jack C. Hayya**

The inability to exchange information about the structure and characteristics of supply chains greatly hampers effective supply chain analysis and research. We discuss the SCML as a mechanism to address these information-sharing difficulties. SCML is an extensible XML-based language providing a generalized format for describing a supply chain's characteristics.

**4) Supply Chain Architectures for Information Goods, Joseph M. Hall**, Stanford University, Grad. Sch. of Bus., MC 5015, Stanford, CA 94305-5015, jhall@stanford.edu, <http://www.stanford.edu/~jhall>, **Evan L. Porteus**

We present a framework for studying the supply chain architecture for information goods, e.g., books, recorded music, and software. Our results provide insight into the value of "on-demand" services - that is, the ability to produce and distribute goods in direct response to consumer demands.

**WB10 Machine Learning Applications**

**Sponsor:** College on Artificial Intelligence  
Sponsored Session

**Chair:** Jackie Rees, Purdue University, Krannert Grad. Sch. of Mgmt., W. Lafayette, IN 47906, jrees@mgmt.purdue.edu

**1) Synthetic Environment for Analysis & Simulation, Alok R. Chaturvedi**, Purdue University, Krannert Sch. of Mgmt., 1310 Krannert Bldg., West Lafayette, IN 47907, alok@mgmt.purdue.edu, **Shailendra Mehta**

Synthetic environments for analysis and simulations (SEAS) translates agent-based economic algorithms to computational constructs thus giving it the ability to conduct very large-scale experiments and simulations. While research

on agent-based economies has been around for some years, SEAS implements many of crucial features of an agent-based economy for the first time...

**2) Using Adaptive Agents to Simulate Group Decision Making, Jackie Rees**, Purdue University, Krannert Grad. Sch. of Mgmt., W. Lafayette, IN 47906, jrees@mgmt.purdue.edu

Due to the inherent complexity of decision-making, few attempts have been made to simulate the decision-making processes in group support systems (GSS) use. We propose that GA-based adaptive agents can be designed which model decision-making processes of GSS users. Comparisons are drawn between actual GSS experimental results and simulation results for a production-planning task.

**3) Using Machine Learning & Decomposition to Solve Scheduling Problems, Haldun S. Aytug**, University of North Carolina, IOM Dept., Charlotte, NC 28223, haytug@email.uncc.edu, **Reha Uzsoy**

To successfully solve job shop and flow shop problems by decomposition, we must depend heavily on the problem data. Factors such as shop floor topology, processing time distributions, capacity, etc. affect the quality and speed of the algorithm. The order of sub problems solved also affects the performance of the algorithm...

**WB11 Optimization Applications to Supply Chain Management III**

**Cluster:** Industrial Applications of Optimization  
Invited Session

**Chair:** Shuchen Li, IBM Corporation, 522 South Rd., Poughkeepsie, NY 12601-5400, li@us.ibm.com

**1) Optimizing Multiple Initiatives across an Enterprise, William D. Randolph**, IBM, PO Box 670, Hollywood, MD 20636, wdrandol@us.ibm.com

In today's multi-divisional and multi-national business environment, organizations launch multiple initiatives seeking competitive advantage across a wide spectrum. These initiatives originate with decision-makers intent on achieving local optimal solutions. These initiatives interact on several business levels but their interrelationships are seldom recognized and rarely understood, leading to suboptimal enterprise solutions.

**2) A Capacity Allocation Algorithm for Semiconductor Planning, Keith Smith**, IBM Consulting Group, 16002 Pepper Rock Cove, Austin, TX 78717, keismith@us.ibm.com, **Chen-Chih Tien**

We summarize the state of the art of capacity allocation and planning in the semiconductor industry. Additionally, we discuss some of the pitfalls in the most common approaches. Finally, we discuss an algorithm developed for a large semiconductor company, and explore some potential improvements to the algorithm.

**3) Material Requirements Planning for Dairy Products, Naguib Attia**, IBM Corporation, 4839 Deanscroft Dr., Charlotte, NC 28226, nattia@us.ibm.com, **Randy Mastro Monaco**

Planning dairy raw material requirements is complex due to raw material price volatility, seasonality of milk supplies, and random impact of weather on milk supplies. We discuss an LP-based planning model that leverages current market conditions, flexibility in dairy product formulations, use of alternate raw materials and raw materials inventory.

**4) Matching Supply with Demand Globally & Optimally, Xueqing Tang**, IBM Consulting Group, 1808 Arabian Ave., Naperville, IL 60565, xtang@us.ibm.com, **Robert A. Orzell, Kejian Yang, Shuchen Li, Roger R. Gung**

A intelligent decomposition algorithm that uses linear programming and heuristic best can do technology has been deployed in IBM Microelectronic Division. It allows IMD to generate division plan weekly instead of monthly, and to optimally match supply with demand world-wide.

**5) Review of the Most Common Pitfalls of Supply Chain Inventory Management & their Symptoms, Mamnoon Jamil**, IBM, 1000 Atrium Way, Atrium 1, Mt. Laurel, NJ 08054, mamnoon@us.ibm.com

Supply chain environments are very complex. Many companies are vulnerable to the pitfalls described in this presentation. Pitfalls address problems related to information definition and supply chain management, operational problems, and strategic & design related problems. Opportunities for improving management & control are also discussed.

**WB12 Game Theory in the Lab**

**Sponsor:** College of Marketing  
Sponsored Session

**Chair:** Manish Kacker, Pennsylvania State University, 701 BAB, Smeal College of Bus., University Park, PA 16802

**1) Predatory Pricing & Anti-Predation Policies in Simulated Markets, Amy Kallianpur,** Michigan State University, Broad Grad. School of Mgmt., amy.kallianpur.wp99@wharton.upenn.edu

In spite of Harrison's results for multi-market contexts, it is not clear whether predatory pricing will be observed in laboratory markets. We design simulated markets that are favorable to predation and assess whether predatory outcomes can be generated. We also examine if anti-predation policies, despite their best intent, could have undesirable consequences.

**2) Economics of Strategy, Minna Mattila,** University of Jyväskylä, Sch. of Bus. & Economics, PO Box 35, Jyväskylä, 40351, Finland, mimaja@tase.jyu.fi

This "economics of strategy" -style research illuminates the competitive reaction behavior of the marketing managers by studying motives, goals and market structure. From economic theory optimal reaction strategy models will be developed based on game-theory and optimal control theory. The models will be estimated and tested by using scanner-data.

**3) Optimal Organizational Estimation: How Many Informants & How Best to Combine Them, Gerrit H. Van Bruggen,** Erasmus University of Rotterdam, Rotterdam Sch. of Mgmt., PO Box 1738, Rotterdam, 3000 DR, The Netherlands, **Manish Kacker, Gary L. Lilien**

Organizational researchers often collect retrospective data from single or multiple informants. Multiple informants often differ in their responses, leading to questions about how best to aggregate those responses. If it is possible to use the data from multiple respondents to improve the quality of the data, several questions arise...

#### WB13 Marketing IV Contributed Session

**Chair:** Julian R. Poetzl, University of St. Gallen, Inst. for Technology Mgmt., c/o ITEM HSG, Unterstrasse 16, St. Gallen, CH 9000, Switzerland, julian.poetzl@unisg.ch, <http://www.item.unisg.ch/>

**1) Multicriteria Decision Making under a Stochastic Frontier with an Application to TV Advertising, Eiji Takeda,** Osaka University, Grad. School of Econ., 1-7 Machikanayama, Toyonaka, Osaka, 560-0043, Japan, takeda@econ.osaka-u.ac.jp, **Katsuaki Tanaka, Yueming Gao**

We address a multicriteria decision problem under a stochastic frontier where the functional form of each objective function is unknown. We present an approach based on the data envelopment approximation using sufficient empirical data. The rationale of this procedure is discussed as well as an application to TV advertising.

**2) Price Endings for Catalogs, Retail Stores & Websites: For Private & Manufacturer Labels, Robert W. Shoemaker,** NYU, Stern School, 44 West 4th St., New York, NY 10012, rshoemak@stern.nyu.edu, **Samantha Wang**

Prior research on price endings shows a strong tendency for retail prices to end in odd numbers such as \$x.99. A theory to predict how price endings will vary for private labels vs. manufacturer labels is presented and partially tested with data from catalogs, other retail outlets and a few websites.

**3) Marketing Trends in the Third Millennium: Indian Scenario, Suresh Kumar Devineni,** Nagarjuna University, ANR College, Gudivada, Andhra Pradesh, 521301, India, anrcollege\_gdv@hotmail.com

India, aptly called the land of "dream potential billion," poses problems to herself in marketing goods and services. We present an analytical discussion on the marketing scenario covering a wide range of consumer goods and services at the beginning of the third millennium characterized by digital and knowledge economy.

**4) Increasing Consumer Loyalty through Efficient Promotions, Julian R. Poetzl,** University of St. Gallen, Inst. for Technology Mgmt., c/o ITEM HSG, Unterstrasse 16, St. Gallen, CH 9000, Switzerland, julian.poetzl@unisg.ch, <http://www.item.unisg.ch/>, **Daniel Corsten**

It has often been considered that promotions do not create consumer loyalty. Research in the European Union has proven that, if efficiently planned and managed, promotions can create consumer value and thus increase the consumer's loyalty. Data mining and statistical analysis techniques have been used to facilitate the process.

#### WB29 Optimization Applications I Contributed Session

**Chair:** Sadan Kulturel Konak, Auburn University, Dept. of ISE, 207 Dunstan Hall, Auburn, AL 36849, sadan@eng.auburn.edu

**1) Application of a Linear Programming-Based Economic Index to the Analysis of the Evolution of the Costs of Foodstuffs, Marcos E. Lins,** Federal University of Rio de Janeiro, Rua Belizario Tavora 80 ap 506, Laranjeiras, Rio de Janeiro, 22245-070, Brazil, estellit@iis.com.br, **Solange F. Lucas**

We develop an LP model able to yield optimal basic foodstuff shopping lists to match the nutritional needs and consumption habits of urban workers. The results obtained are used to introduce and evaluate an index with which it was possible to analyze the evolution of foodstuff costs in the municipality of Rio de Janeiro.

**2) Process Mapping for Business Process Reengineering, Lotfi K. Gaafar,** Kuwait University, PO Box 5969, Kuwait, Safat, 13060, Kuwait, gaafar@kuc01.kuniv.edu.kw

We provide a structural definition of the redesign search space using the number of employee types and the number of activities. A systematic approach that combines some LP tools with unique BPR principles is then proposed to support the technical redesign of the current process through the generation of alternative process maps...

**3) A Survey of the Optimization Techniques Being Used in the Industry, Vivek D. Pinto,** NCSA, 2301 Fox Dr., Champaign, IL 61820, vpinto@uiuc.edu, **William Pottinger, Tilt Tompkins**

The US Air Force has of late been coming under severe pressure to reduce expenditure in the form of reductions in budgetary allocations. We survey some of the optimization techniques currently in use in attempt to analyze the strengths and weaknesses inherent in them and their applicability to a military operation.

**4) Application of Tabu Search to the Unequal Area Facility Layout Problem, Sadan Kulturel Konak,** Auburn University, Dept. of ISE, 207 Dunstan Hall, Auburn, AL 36849, sadan@eng.auburn.edu, **Alice E. Smith, Bryan A. Norman**

We implement a TS for the unequal area facility layout problem where there is a maximum aspect ratio for each department. We demonstrate test results for different problems of varying degrees of constraint from the literature and examine different TS methodologies.

#### WB30 Tutorial: Data Warehousing & OLAP for Decision Support

**Sponsor:** INFORMS Computing Society  
**Sponsored Session**

**Chair:** Anindya Datta, Georgia Institute of Technology, DuPree Coll. of Mgmt., 755 Ferst Dr., Atlanta, GA 30332, adatta@cc.gatech.edu

**1) Tutorial: Data Warehousing & OLAP for Decision Support, Anindya Datta,** Georgia Institute of Technology, DuPree Coll. of Mgmt., 755 Ferst Dr., Atlanta, GA 30332, adatta@cc.gatech.edu

DWH and OLAP and decision support technologies enable organizations to obtain competitive advantage by exploiting the vast quantities of information accumulated in corporate databases. Over the past few years, these technologies have experienced explosive growth, with virtually all database vendors (and, increasingly, all the ERP vendors) throwing their hat in the OLAP arena...

#### WB31 Statistical Inference for Multiple Change Point Models

**Cluster:** Reliability Modeling  
**Invited Session**

**Chair:** Lynn Kuo, University of Connecticut, Statistics Dept., Storrs, CT 06269-3120, lynn@stat.uconn.edu

**1) Marginal Likelihood from the Metropolis-Hasting Output, Siddhartha Chib,** Washington University, Olin Sch. of Bus., 1 Brookings Dr., CB 1133, St. Louis, MO 63130, chib@simon.wustl.edu

We provide a unified framework for estimating the marginal likelihood for the purpose of Bayesian model comparisons. The approach overcomes the problems associated with the presence of intractable full conditional densities. To illustrate, we consider applications to models for correlated binary data and longitudinal count responses with multiple random effects.

**2) Bayesian Analysis of Binomial Time Series with Structural**

**Changes, Leonhard Knorr-Held**, University of Munich, Inst. of Statistics, Ludwigstr. 33, Munich, D-80539, Germany, leo@stat.uni-muenchen.de, **Guenter Rasser**

We consider binomial time series data with an unknown number of abrupt changes. Our goal is to estimate the sequence of the success probabilities and to detect the change points. We compare a hierarchical t-dynamic model with a change-point model with an unknown number of change points. The methodology is illustrated through an analysis of time series data, known in the literature.

**3) Bayesian Binary Segmentation Procedure for Detecting Multiple Change Points of a Poisson Process, Lynn Kuo**, University of Connecticut, Statistics Dept., Storrs, CT 06269-3120, lynn@stat.uconn.edu, **Tae Young Yang**

A Bayesian binary segmentation method is explored to detect multiple change points and to estimate the corresponding failure rates of a nonhomogeneous Poisson process. The method is implemented with a Markov chain Monte Carlo algorithm. A numerical example with a real data set is given.

## WB32 Telecommunication System Design I

### Contributed Session

**Chair:** Jeffrey J. Blessing, University of Wisconsin, 1025 North Broadway, Milwaukee, WI 53202-3109, blessing@msoe.edu, http://www.msoe.edu/~blessing

**1) Time-Relaxed Optimal c-Broadcast Networks, Shiwoo Lee**, Northeastern University, Dept. of MI/ME, 334 Snell Engineering Ctr., Boston, MA 02115, lee@coe.neu.edu, **Jose A. Ventura**

A minimal c-broadcast network is a communication network in which c-broadcasting from any node can be completed in minimum time. The sparsest possible graphs, where c-broadcasting can be accomplished in slightly more than the minimum time, are called time-relaxed optimal c-broadcast networks. A general procedure to compute tight upper bounds for the size of these networks is proposed...

**2) A Generalized Cross Decomposition Algorithm for the Communication Network Design Problems, Gyunghyun Choi**, Hanyang University, Dept. of IE, 17 Haengdang-Dong Seongdong-Ku, Seoul, 133-791, Korea, ghchoi@email.hanyang.ac.kr

We present a generalized cross decomposition algorithm for large-scale communication network design problems. The algorithm is designed by using convex combination strategies to improve the convergence for solving the communication network expansion and change problems.

**3) Efficient Network Design using Heuristics, Simulated Annealing & Genetic Algorithms, Jeffrey J. Blessing**, University of Wisconsin, 1025 North Broadway, Milwaukee, WI 53202-3109, blessing@msoe.edu, http://www.msoe.edu/~blessing

A comparison of methods used to address the network design problem is presented, which include heuristics, SA and GAs. Empirical results are used to point out the strengths and weaknesses of the various approaches to this NP-hard problem.

## WB33 Statistics Applications

### Contributed Session

**Chair:** Michael J. Wood, University of Portsmouth, Business Sch., Dept. of AMS, Locksway Rd., Milton, Southsea, Hants, PO4 8JF, England, UK, michael.wood@port.ac.uk, www.pbs.port.ac.uk/~woodm/

**1) An Application of Adaptive Non-Parametric Kernel Density Estimation, Ahmed M. Sultan**, Egyptian Air Force, 94 Wassef St., Ahmed esmat St. Ain Shams, Cairo, Egypt, aasultan@hotmail.com, **Mohamed A. Sultan**

A new non-parametric kernel estimator is introduced by varying the window width in each tail portion of the sample. The method uses separately the sample percentile ratios as a measure of each tail length. The kernel parameter for the tail sample values is chosen using sample percentile ratios for that tail...

**2) Using Genetic Algorithms to Design Intelligent Decision Trees, Zhiwei Fu**, University of Maryland, Smith Sch. of Bus., College Park, MD 20742, zfu@rhsmith.umd.edu, **Bruce L. Golden**, **S. Lele**, **S. Raghavan**, **Edward A. Wasil, Jr.**

Decision trees are widely used in data mining. However, scalability, accuracy and efficiency are significant concerns. We propose a GA to design intelligent decision trees which addresses these problems. Our approach combines statistical sampling, a GA and a standard decision tree algorithm. To date, computational results seem promising.

**3) Mixed Model Designs for Screening Experiments, Eswar Sivaraman**, Oklahoma State University, 322 Engineering North, Stillwater, OK 74078, seswar@okstate.edu, http://www.okstate.edu/cocim/members/eswar, **Kenneth E. Case**

We focus on a new methodology called the method of symmetric constructions for developing mixed model screening designs. Additionally, the ease of incorporating any user-specified factor combination should encourage the creation and use of mixed model design plans for industrial experimentation.

**4) Bootstrapped Confidence Intervals & Sample Size Recommendations: A Practical Approach, Michael J. Wood**, University of Portsmouth, Business Sch., Dept. of AMS, Locksway Rd., Milton, Southsea, Hants, PO4 8JF, England, UK, michael.wood@port.ac.uk, www.pbs.port.ac.uk/~woodm/

We present an approach to bootstrapped confidence intervals and sample size recommendations, using the metaphor of multiple possible worlds. The approach can be implemented on a spreadsheet or simpler software and is appropriate for the analysis of messy survey data by novices.

## WB34 Web Commerce

**Cluster:** State-of-the-Art in Information Technology

### Invited Session

**Chair:** Fatemeh Mariam Zahedi, University of Wisconsin, School of Bus. Admin., PO Box 742, Milwaukee, WI 53201, zahedi@uwm.edu

**1) Product Attributes, Consumer Information Processing Style & Information Presentation in Web-Based Commerce: A Proposed Model, Jungjoo Jahng**, University of Wisconsin, School of Bus. Admin., PO Box 742, Milwaukee, WI 53201, jahng@uwm.edu, **Hemant K. Jain**, **K. Ramamurthy**

Most existing EC applications are passive and link-oriented and they do not seem to adapt to users' varying levels of product-information needs, sophistication and information processing styles. We propose a model to argue that a "fit" between product attributes, information richness of the EC application and users' information processing capabilities can trigger favorable consumer behavior.

**2) Web Intermediaries: Supplier-Based vs. Buyer-Based, Don Chrusciel**, University of Wisconsin, School of Bus. Admin., PO Box 742, Milwaukee, WI 53201, chruscid@uwwvax.uww.edu, **Fatemeh Mariam Zahedi**

We discuss the benefits that the Web intermediaries provide. The emphasis is on the benefits attributed to the brokering function linking the supplier and buyer for the Web commerce. We investigate the differences in the benefits provided by the supplier-based and buyer-based web intermediaries.

**3) The Role of Pricing Policies in the Web Market Strategies, Jaeki Song**, University of Wisconsin, School of Bus. Admin., PO Box 742, Milwaukee, WI 53201, jaeki@uwm.edu, **Fatemeh Mariam Zahedi**

With the increasing expansion of the commerce on the Internet, insights regarding different Web market strategies would be of interest to companies wishing to do business on the Web. We define 2 Web market strategies and report on our empirical analysis regarding the critical role that various pricing policies play in the determination of such strategies.

## WB35 Tutorial: Preference Function Modeling

### Invited Session

**Chair:** Jonathan Barzilai, Dalhousie University, Dept. of IE, PO Box 1000, Halifax, Nova Scotia, B3J 2X4, Canada, barzilai@is.dal.ca

**Co-Chair:** Ernst Grundke, Dalhousie

University, Dept. of IE, PO Box 1000, Halifax, Nova Scotia, B3J 2X4, Canada

**1) Tutorial: Preference Function Modeling: A New Methodology for Preference Measurement, Jonathan Barzilai**, Dalhousie University, Dept. of IE, PO Box 1000, Halifax, Nova Scotia, B3J 2X4, Canada, barzilai@is.dal.ca, **Ernst Grundke**

PFM is a new methodology for the measurement of preferences on interval scales. It has a built-in mechanism for reconciling inconsistent assessment and is a new, intuitive, easy-to-use but powerful decision paradigm based on a rigorous mathematical theory. The tutorial will introduce the software implementation of PFM and the underlying theory.

**WB36 Multiobjective Applications & Theory****Contributed Session**

**Chair:** Bertrand M. Mareschal, Universite Libre de Bruxelles, Blvd. du Triomphe, CP 210/01, Brussels, 1050, Belgium, bmaresc@ulb.ac.be

1) **A Fuzzy Programming Approach for Scheduling Repetitive Projects with Multiple Objectives**, *Abdallah S. Al-Azzaz*, King Saud University, Quant. Methods Dept., College of Bus. & Economics, Malida Qasseem, Saudi Arabia, q16q010@ksu.edu.sa, *Waiel F. A. El-Wahed*

Some construction projects such as highway, pipeline and high-rise buildings are characterized by repetitive construction activities. Analytical, graphical and single objective optimization approaches have been suggested to plan, schedule and monitor such projects. Although these approaches possess obvious advantages, they also endure some disadvantages...

2) **A Model for Selecting Quality Control Instruments: Combining the Analytical Hierarchy Process & Goal Programming**, *Masood Badri*, United Arab Emirates University, Fac. of Bus. & Economics, BOX 17555, Al-Ain, United Arab Emirates, masood@uaeu.ac.ae

Five sets of quality measures are accurately and consistently weighted through the AHP. The priority weights are, in turn, incorporated in a goal programming model to help select the "best" set of quality control instruments for customer data collection purposes. A real world class case study illustrates the application of the combined model.

3) **A New & Efficient Multi-Objective Optimization Algorithm based on Hammersley's Sequence Sampling Technique**, *Yan Fu*, Carnegie Mellon University, Dept. of Eng. & Public Policy, 5000 Forbes Ave., Pittsburgh, PA 15213, yfu@andrew.cmu.edu, http://www.andrew.cmu.edu/~yfu, *Urmila Diwekar*

Multi-objective optimization involves the solution of a large number of optimization problems. We present a new algorithm based on Hammersley's sequence sampling technique. This new algorithm overcomes the major bottleneck of the computational intensity involved in solving a large number of optimization problems. Results show that this new algorithm is superior to the existing algorithm in terms of efficiency and accuracy.

4) **Multicriteria Evaluation of Urban Waste Management Systems**, *Bertrand M. Mareschal*, Universite Libre de Bruxelles, Blvd. du Triomphe, CP 210/01, Brussels, 1050, Belgium, bmaresc@ulb.ac.be, *Virginie van de Kerchove*

A multicriteria model, including economic as well as social and environmental criteria, is developed to evaluate the efficiency of urban waste management systems. Actual data from 5 European cities are used for validation. The model is based on a specifically adapted version of the PROMETHEE multicriteria method. Results are discussed.

**WB37 Optimization Theory IV****Contributed Session**

**Chair:** Luis Gouveia, Universidade de Lisboa, DEIO, Bloco C/2, Campo Grande, Lisboa, 1700, Portugal, lgouveia@fc.ul.pt

1) **OPTQUEST/GRG: Combining Scatter Search & GRG for Global Optimization**, *Leon S. Lasdon*, University of Texas, MSIS Dept., College of Bus. Admin., Austin, TX 78712-1175, lasdon@mail.utexas.edu, *Zsolt Ugray*, *Manuel Laguna*

We describe efforts to combine a scatter search algorithm implemented in the OPTQUEST software, with a local NLP solver, LSGRG2. OPTQUEST provides trial starting points to LSGRG2 which finds a local minimum. OPTQUEST receives this solution, updates its populations and suggest a new point. Computational results are presented.

2) **Lift & Project: Improving the Cut Generation Process**, *Michael Perregaard*, Carnegie Mellon University, GSIA, Schenley Park, Pittsburgh, PA 15213, michael4@andrew.cmu.edu, *Egon Balas*

We present a new normalization of the cut generating LP in L&P with better defined theoretical properties than presently used. Another property we identify and successfully exploit is that the variables of the CGLP exhibit complementarity. This allows us to significantly reduce the CGLP without sacrificing cut strength.

3) **Solving Multicommodity Flow Problems by Approximation Methods**, *Jorge U. Villavicencio*, Universidad Catolica de Chile, Dept. of Math., Vicuna Mackenna 4860, Santiago, Chile, jvillavi@puc.cl

We will present our computational results on solving minimum cost

multicommodity flow problems by logarithmic potential reduction-based approximation methods. Large-scale computational results and comparisons on the performance of our methods will be presented.

4) **Modeling & Solving the Diameter Constrained Spanning Tree Problem**, *Luis Gouveia*, Universidade de Lisboa, DEIO, Bloco C/2, Campo Grande, Lisboa, 1700, Portugal, lgouveia@fc.ul.pt, *Thomas L. Magnanti*

We discuss the problem of finding a least cost spanning tree problem subject to a bound on the number of edges in the tree between any pair. We formulate the problem as simultaneously finding a root node or root edge and using it as the source for the commodities in a directed tree. Computational results show that the new models improve considerably on previous traditional models with a commodity for every node pair.

**WB38 Tutorial: Recent Performance Improvements in CPLEX**

**Sponsor:** INFORMS Computing Society  
**Sponsored Session**

**Chair:** Irv Lustig, ILOG CPLEX Division, 889 Alder Ave., Ste. 200, Incline Village, NV 89451, irv@ilog.com

1) **Tutorial: Recent Performance Improvements in CPLEX**, *Ed Rothberg*, ILOG, 1080 Linda Vista Ave., Mountain View, CA 94043, rothberg@ilog.com

In March 1999, ILOG released a new version of CPLEX that offers significant improvements in LP and MIP performance. This is a result of a concentrated research and development effort over an 18-month period. For the CPLEX Mixed Integer Optimizer, a wealth of new MIP features have been added...

**Wednesday 12:30-14:00****WC03 Fossil Fuel Applications****Contributed Session**

**Chair:** Hisham M. Choueiki, PUCO, 180 East Broad St., 3rd Floor, Columbus, OH 43215, hisham.choueiki@puc.state.oh.us

1) **A Pioneering Approach for Managing the Quality in the Supply Chain of the Brazilian Oil Industry**, *Edmar Diniz de Figueiredo*, E&P Petrobras SEAL/GELOG/GEMAT, Rua Acre 2504, Bloco B, Aruja SE, 48080, Brazil, edmar@ep-seal.petrobras.com.br, *Maria Aparecida Cavalcanti Netto*

Next century survival reinforces the need for a revision of strategies and renewable commitment with environmental concerns and rational use of natural resources. Leading companies must guarantee the achievement of quality levels by their supply chain members. The state-owned Brazilian Oil Company has embraced a pioneering approach based on efficiency-driven network management.

2) **Planning & Assessing New Petrochemical Technology**, *Ghanima Al-Sharrah*, University of Kuwait, Chemical Eng. Dept., PO Box 5969, Safat, 13060, Kuwait, ghannimak@kuc01.kuniv.edu.kw, *Ali Elkamel*, *Erdogen Alper*

An existing mathematical programming model is used for planning and assessing the petrochemical industry in Kuwait. The installation of new processes, the import and export of materials and environmental impact are evaluated by the model. The model was also used to evaluate a number of scenarios of potential future developments.

3) **ERP Models for the Hydro Carbon Processing Industry**, *G. G. Rajan*, Cochin Refineries Ltd., DGM R&D, Ambalamugal PO, Cochin, Kerala, 682301, India, ggr@md2.vsnl.net.in, http://www.techsoftin.com

All industries consume 4 resources: men, machine, materials and money. The financial performance and profitability are ultimately determined by how effectively these resources are utilized. The evaluation is extremely complex as the financial performance is linked to the productivity of labor, machine, material and capital. These resources are inter-convertible and could be optimized using LP/NLP/Hybrid models...

4) **A Weighted Least Squares Training Procedure for Forecasting the Monthly Natural Gas Consumption in Ohio using Neural Nets**, *Hisham M. Choueiki*, PUCO, 180 East Broad St., 3rd Floor, Columbus, OH 43215, hisham.choueiki@puc.state.oh.us

We investigate the use of a WLSP to train a neural network to forecast the monthly consumption of gas in Ohio. Our results indicate that the WLSP should be further studied by gas utilities which face significant temporal cost variabilities when purchasing gas from the spot market.

**WC04 DSS Applications****Contributed Session**

**Chair:** Ching-Tai Shih, College of New Jersey, Engineering Dept., PO Box 7718, Ewing, NJ 08628, ctshih@tcnj.edu

1) **Decision Support for Dementia Family Caregivers, Sarah Wackerbarth**, University of Kentucky, Martin School, 435 Patterson Office Tower, Lexington, KY 40506-0027, sbwack0@pop.uky.edu

This research involves the design of DSS for dementia family caregivers. The design is based on a dynamic model of caregiving decision-making and decision styles. IE and behavioral research is combined to provide support to take on the role of decision-maker, plan for the future and make informed decisions.

2) **A Decision Support System for Course Allocation, Vincent R. Celeste**, Quinnipiac College, Mt. Carmel Ave., Hamden, CT 06518, vceleste@quinnipiac.edu, **Mario Norbis**

A DSS utilizing mixed integer goal programming was designed to allocate course-sections, room availability and faculty course and time preferences. A program interface reduces the number of required (0-1) variables to a manageable level. A GUI provides direct interaction with data and optimization results.

3) **Comparison of Statistical Data Mining Software Packages, Edward Mulrow**, Ernst & Young LLP, 1225 Connecticut Ave. NW, Washington, DC 20036, edward.mulrow@ey.com, **Linghua Peng, Wendy Rotz**

Three data mining packages are compared against the standard statistical software packages and their add-on in several areas such as cost, algorithms covered, timing, usability and diagnostics. The data set used in the timing comparison is KDD Cup 98 data. We also compared the modeling result using a sample of the KDD data with that of the whole data.

4) **Stock Volatility & Trading Strategies Analysis, Ching-Tai Shih**, College of New Jersey, Engineering Dept., PO Box 7718, Ewing, NJ 08628, ctshih@tcnj.edu

Categorical and quantitative information is utilized for stocks prediction. It is difficult to combine assorted data and make sound decisions consistently. Simulation approach is employed to find favorable trading strategies as decision-supporting tools. Historical data are used to evaluate stock volatility. Relationships between risk factors and strategies are investigated.

**WC05 Tardiness Modeling****Contributed Session**

**Chair:** Cerry M. Klein, University of Missouri, Dept. of Ind. & Mfg. Systems, Columbia, MO 65211, kleinc@missouri.edu

1) **An Exact Procedure for the Resource-Constrained Weighted Earliness-Tardiness Project Scheduling Problem, Mario Vanhoucke**, Katholieke Universiteit Leuven, Operations Mgmt. Group, Naamsestraat 69, Leuven, 3000, Belgium, mario.vanhoucke@econ.kuleuven.ac.be, **Erik L. Demeulemeester, Willy S. Herroelen**

Project activities have a deterministic due date, an earliness as well as a tardiness penalty cost and renewable resource requirements. We present a B&B procedure for which the objective is to schedule the activities in order to minimize the total weighted earliness-tardiness penalty cost of the project.

2) **Machine Scheduling with the Objective of Minimizing Total Late Work, Bahram Alidaee**, University of Mississippi, Sch. of Business, University, MS 38677, alidaee@bus.olemiss.edu, **Bryan Kethley**

We are concerned with single and multiple machine scheduling with the objective of minimizing total weighted (and unweighted) late work. A space smoothing meta-heuristic is designed for the solution of the problem. Various simple scheduling rules are also applied and extensive computational experiments are reported.

3) **New Dominance Rules to Minimize Total Weighted Tardiness, Selim Akturk**, Bilkent University, Dept. of IE, Ankara, 06533, Turkey, akturk@bilkent.edu.tr, www.bilkent.edu.tr/~akturk

We present new dominance rules by considering the time dependent orderings between each pair of jobs for the single machine total weighted tardiness problem with equal or unequal release dates. These rules provide a sufficient condition for local optimality and can be implemented in a local search or an exact algorithm.

4) **Scheduling Stochastic Jobs so as to Minimize the Expected Number of Tardy Jobs, Cerry M. Klein**, University of Missouri, Dept. of Ind. & Mfg. Systems, Columbia, MO 65211, kleinc@missouri.edu, **Wooseung Jang**

We present results related to the scheduling of stochastic jobs on single and multiple production machines so as to minimize the expected number of tardy jobs. The processing time of each job is a random variable that follows an arbitrary distribution. Sufficient conditions for optimality are given and 2 heuristic approaches discussed, with computational results presented.

**WC06 Multiple Machines****Contributed Session**

**Chair:** Ali Allahverdi, Kuwait University, Dept. of MIE, College of Eng., PO Box 5969, Safat, 13060, Kuwait, allahverdi@kuc01.kuniv.edu.kw

1) **Branch & Bound Algorithms for Capacitated Lot-Sizing in Parallel Machines, Vinicius Armentano**, Universidade Estadual de Campinas, FEEC-UNICAMP-CP 6101, Campinas Sao Paulo, 13083-970, Brazil, vinicius@densis.fee.unicamp.br, **Franklina B. Toledo**

We address the capacitated lot-sizing problem involving the production planning of multiple items on unrelated parallel machines with finite capacity in order to minimize the sum of production, setup and inventory costs. B&B algorithms based on linear and Lagrangian relaxation are developed and computational tests are reported.

2) **The Parallel Machine Scheduling Problem with Tool Switches, Kim Y. Woodson**, 2225 North St. NW #231, Washington, DC 20037, kwoodson@econsys.com, **Yahya Fathi**

We address the problem of scheduling a set of jobs with given processing times and tool requirements on a set of identical parallel machines with limited tool capacities with the objective of minimizing the makespan. We prove that this is an NP-hard problem and develop several heuristic procedures for solving it. Results of a limited computational experiment are presented.

3) **A Polynomial-Time Algorithm for Continuous-Time Scheduling of Parallel Machines, Konstantin Kogan**, Holon Ctr. for Tech. Education, Dept. of Computer Systems, Golomb 52, Holon, 58102, Israel, kogan@wine.cteh.ac.il

We analyze a system of parallel machines producing 1 product-type in response to demand. The objective is to determine machine production rates so that the inventory, backlog and production costs are minimized. With the aid of the maximum principle, the continuous-time scheduling problem is reduced to a combinatorial problem...

4) **Three-Machine No-Wait Flowshop with Setup & Removal Times, Ali Allahverdi**, Kuwait University, Dept. of MIE, College of Eng., PO Box 5969, Safat, 13060, Kuwait, allahverdi@kuc01.kuniv.edu.kw, **Tariq Aldowaisan**

A 3-machine flowshop scheduling problem is addressed with respect to total completion time criterion where setup and removal times are considered as separate from processing times. Optimal solutions are obtained for special cases and heuristics are developed for the generic case. Computational experience shows that the heuristics are quite effective.

**WC07 Performance Analysis of Manufacturing Systems****Cluster: Manufacturing & Logistics****Invited Session**

**Chair:** Tayfur Altioik, Rutgers University, Dept. of IE, 96 Frelinghuysen Rd., Piscataway, NJ 08854, altioik@rci.rutgers.edu

**Co-Chair:** Benjamin Avi-Itzhak, Rutgers University, RUTCOR, Fac. of Mgmt., 640 Bartholomew Rd., Piscataway, NJ 08854-8003, aviitza@rutcor.rutgers.edu

1) **Buffer Requirements & Servers Ordering in a Tandem Queue with Correlated Service Times, Benjamin Avi-Itzhak**, Rutgers University, RUTCOR, Fac. of Mgmt., 640 Bartholomew Rd., Piscataway, NJ 08854-8003, aviitza@rutcor.rutgers.edu, **Hanoeh Levy**

We analyze the intermediate buffer requirements in a tandem queue where service times of each customer are deterministically correlated between the servers and arbitrarily distributed customers. The major issue at hand is determination of intermediate buffer sizes assuring no blocking when the arrivals pattern is arbitrary and unpredictable.

2) **Optimal Resource Allocation in Closed Finite Queueing Networks with Blocking after Service, James MacGregor Smith**, University of Massachusetts, Dept. of MIE, Amherst, MA 01003, jmsmith@ecs.umass.edu, **Edgar Gonzales**

The simultaneous optimal allocation of buffers and the population in closed,

finite queuing networks is examined with the objective of optimizing a nonlinear cost function that integrates system throughput, cycle time, population and number of buffer spaces in the network. Complex arrangements of series, merge and splitting topologies are examined and computational results are reported.

**3) Modeling Work in Process vs. Production Constraints for Efficient Supply Chain Planning: Convexity Issues, Michael Caramanis**, Boston University, Dept. of Mfg. Engineering, 15 Saint Mary's St., Boston, MA 02215, mcaraman@bu.edu, **Osman M. Anli**

Dynamic lead time modeling in the production planning of stochastic multiple-cell production systems results in significant inventory and backlog cost reductions relative to MRP based models. Convexity violations of the feasible region defined by associated WIP constraints on production are discussed and their impact on solution algorithms investigated.

**4) Performance of the Control Point Policy, Stanley B. Gershwin**, MIT, 77 Massachusetts Ave., Rm. 35-331, Cambridge, MA 02139, gershwin@mit.edu

The control point policy is a real-time scheduling policy for manufacturing systems. We describe simulation experiments with this policy. We review comparisons with other policies, sensitivities to parameters, experience in real factories and accuracy of analytical decomposition approximations to its performance.

**5) Modeling Continuous-Flow Manufacturing Systems, Unsal Ozdogru**, Rutgers University, RUTCOR, 241 Rutgers Rd., Piscataway, NJ 08854, ozdogru@rutcor.rutgers.edu, **Tayfur Altioik**

Motivation of our work comes from an existing bauxite mine. Machinery involved includes train dumpers, stacker/reclaimers used in yard operations, conveyers, driers and ship loaders. The system is studied as a liquid flow system consisting of various valves and delivery and loading points. Results will be discussed.

## WC08 Plant Layout

### Contributed Session

**Chair:** Rasaratnam Logendran, Oregon State University, Dept. of IME, 118 Covell Hall, Corvallis, OR 97331-2407, logendrr@engr.orst.edu

**1) Manufacturing Cell Design using GPSS/H & PROOF Animation, Swaminathan Balachandran**, University of Wisconsin, One University Plaza, Dept. of IE, Platteville, WI 53818-3099, balachas@uwplatt.edu

We present the design of a manufacturing cell using GPSS/H simulation language and PROOF Animation software. The manufacturing cell activities are first described, then the design of the cell and improvement of material flow within the cell are discussed using a simulation model in GPSS/H and PROOF Animation.

**2) withdrawn - author request of 9/21, Zeger Degraeve**, Katholieke Universiteit Leuven, Dept. of Applied Econ., Naamsestraat 69, Leuven, 3000, Belgium, zeger.degraeve@econ.kuleuven.ac.be, **Raf Jans, Willy Gochet**

**3) The Machine Layout Problem with Location Preferences & Restrictions, Massoud Bazargan-Lari**, Embry-Riddle Aeronautical University, Dept. of Bus. Admin., 600 South Clyde Morris Blvd., Daytona Beach, FL 32114, bazargam@cts.db.erau.edu

A major concern to the manufacturers when transforming from existing shop floor layout to a more efficient one is the location of some of their facilities. They either restrict the relocation or impose designated areas for possible location of such facilities. We introduce an approach to address this specific problem...

**4) Impact of Automated Guided Vehicles in the Design of Cellular Systems, Rasaratnam Logendran**, Oregon State University, Dept. of IME, 118 Covell Hall, Corvallis, OR 97331-2407, logendrr@engr.orst.edu, **Yunan Karim**

We investigate the problem of designing manufacturing cells when AGVs are used to transport parts. Linearization techniques are used to transform the original binary-general integer NLP model into a binary-integer and LP model in an attempt to identify optimal solutions for small problems. An efficient higher-level search algorithm is also reported...

## WC09 Scheduling Applications

### Contributed Session

**Chair:** Anita Lee-Post, University of Kentucky, DS/IS Area, Gatton Bldg., Lexington, KY 40506-0034, dsanita@ukcc.uky.edu

**1) Penalty-Based Sequencing Strategy Implemented within a Knowledge-Based System, Douglas J. Renn**, Bethlehem Steel Corp., Homer Labs., Bldg. C, Bethlehem, PA 18016, rdjr1@bsco.com, **Kenneth L. Stott, Jr., Francis J. Vasko**

We will discuss the logic used in a knowledge-based sequencing system for a hot dip coating line (HDCL). We will discuss how the original knowledge-based system logic was modified to include a penalty function approach and heuristic sequencing strategy that resulted in much-improved HDCL coil sequences.

**2) A Vector Sequencing Approach for the Steel Manufacturing Process Scheduling, S. Y. Chang**, POSTECH, Dept. of IE, San 31, Hyoja-dong, Pohang, Kyungbuk, 790-784, Korea, syc@postech.ac.kr, **Kangbok Lee, Cho Taegyun**

Several scheduling problems in the steel manufacturing processes are formulated as the problems of partitioning a set of vectors under some restrictions. To handle the formulated problems, an efficient algorithm is proposed and evaluated for checking whether a set of vectors can be sequenced in compliance with the given restriction.

**3) Tire Production Scheduling at Solideal, Raf Jans**, Katholieke Universiteit Leuven, Dept. of Applied Econ., Naamsestraat 69, Leuven, 3000, Belgium, raf.jans@econ.kuleuven.ac.be, **Zeger Degraeve**

Solideal is a tire manufacturer in Sri Lanka, producing several hundreds of different industrial tires. The production process can be modeled as a capacitated lot-sizing model with set-up times. We propose a column generation algorithm with the capacity as the linking constraint and a subproblem for every...

**4) A Survey of Current Production Scheduling Practices in Wisconsin, Anita Lee-Post**, University of Kentucky, DS/IS Area, Gatton Bldg., Lexington, KY 40506-0034, dsanita@ukcc.uky.edu, **Chon-Huat Goh**

We present findings from a survey designed to study the current practices of production scheduling in Wisconsin. Research efforts directed to address the scheduling needs and requirements of Wisconsin manufacturers will be discussed. A congenial interaction between academia and industry to stimulate opportunities for industry-university linkages will be sought.

## WC10 Artificial Intelligence Applications

**Sponsor:** College on Artificial Intelligence

### Sponsored Session

**Chair:** Siddhartha Bhattacharyya, University of Illinois, Info./Dec. Sci., Coll. of Bus., 601 South Morgan St., MC 294, Chicago, IL 60607, sidb@uic.edu

**1) Genetic Algorithm-Based Feature Selection using Hausdorff Distance Measure, Selwyn Piramuthu**, University of Pennsylvania, Wharton Sch., Dept. of OPIM, 1300 SH-DH, 3620 Locust Walk, Philadelphia, PA 19104-6366, selwyn@wharton.upenn.edu, **Riyaz Sikora**

Feature selection is an important problem when dealing with a large number of input variables in any learning application. Among learning methods, GAs have performed quite well for classification problems, among others. We present a framework for feature selection using GA and the Hausdorff distance measure. We illustrate performance of this framework using several classification data sets.

**2) Knowledge Modeling for Audit Risk Assessment, Roman Wong**, Southern Illinois University, Dept. of Mgmt., Coll. of Bus. Admin., Carbondale, IL 62901, rwong@siu.edu, **Siddhartha Bhattacharyya**

This research demonstrates the application of the Task-Structures approach to model the knowledge, at the task-level, for inherent audit-risk-assessment. The essence of the approach is to identify the knowledge components required for accomplishing a given task. The benefits of the approach include better-guided knowledge acquisition and enhanced portability of knowledge.

**3) Improving Performance of Learned Rules through Recombination, Kumar Mehta**, University of Illinois, 601 South Morgan St., MC 294, Chicago, IL 60607, kmehta1@uic.edu

Recent focus in machine learning has been on integrating multiple pieces of knowledge acquired through instance or search space partitioning to improve the efficiency of learning. Integration seeks to mutually complement the different learnt rules and effectively reduce the space of incorrect classifications. We investigate such integration of genetic algorithm learnt rules for the time series predictions as in the S&P500 index.

**WC11 Operations Management V****Contributed Session**

**Chair:** David A. Johnston, York University, Schulich School of Bus., 4700 Keele St., Toronto, Ontario, M3J 1P3, Canada, [daj@sympatico.ca](mailto:daj@sympatico.ca), [www3.sympatico.ca/daj](http://www3.sympatico.ca/daj)

1) **Spare Parts Management for Technical Systems: Resupply of Spare Parts under Limited Budgets**, *Jan Willem Rustenburg*, Eindhoven University of Technology, Marga Klompelaan 44, Beverwijk, 1945 ZL, The Netherlands, w.d.rustenburg@capitolonline.nl, *W. H. M. Zijm*, *Geert-Jan van Houtum*

We study the availability of a system. Failed components are condemned and replaced by new ones. However, there is only a limited resupply-budget available to keep stocks at the desired levels. Different operational strategies are developed, and tested by simulation, that support investment-decisions during each year.

2) **A Theory of Product Introduction under Competition**, *Gilvan C. Souza*, University of North Carolina, Kenan-Flagler Bus. Sch., McColl Bldg., CB 3490, Chapel Hill, NC 27599-3490, [gilvan\\_souza@unc.edu](mailto:gilvan_souza@unc.edu), <http://www.bschool.unc.edu/phd/souzag>

We propose and solve a competitive model for computing a firm's optimal renewal strategy - when to replace an existing product. Given potential obsolescence for products at any time, production decisions are jointly optimized. This model, an abstraction of competition in high tech industries, is formulated as a Markov decision process.

3) **Is Cooperation Strategic in Supply Chain Relationships**, *David A. Johnston*, York University, Schulich School of Bus., 4700 Keele St., Toronto, Ontario, M3J 1P3, Canada, [daj@sympatico.ca](mailto:daj@sympatico.ca), [www3.sympatico.ca/daj](http://www3.sympatico.ca/daj), *Hazel A. Kerwood*

Increased cooperation between buyer and suppliers in supply chains is frequently mentioned as strategic to both party's interests. This cooperation is expressed in longer contracts, increased operational coordination and systems integration and identified by terms such as...

**WC12 Marketing V****Contributed Session**

**Chair:** Hao Zhao, Rutgers University, 180 University Ave., Newark, NJ 07102, [haozhao@andromeda.rutgers.edu](mailto:haozhao@andromeda.rutgers.edu)

1) **Development of Business Games for Marketing Decision Making**, *Hiroyuki Takahashi*, NTT Data Corp., Shinjuku Park Tower 24th Fl, 3-7-1 Nishi-Shinjuku 3-Chome, Shinjuku-ku, Tokyo, 163-1024, Japan, [takahasi@riss.nttdata.co.jp](mailto:takahasi@riss.nttdata.co.jp), <http://www.nttdata.co.jp>, *Keiichiro Nakagawa*, *Naoyuki Tsunematsu*, *Takashi Namatame*

We developed the Business Game, in which a player can learn practical data analyses for better decisions in marketing. Our game, unlike other business games, generates an outcome for each individual consumer according to the decision by a player. The player can analyze the generated data for the second-round decision.

2) **On Ranking Marketing Journals: Some New Insights**, *Chaim Meyer Ehrman*, Loyola University, 820 North Michigan Ave., Marketing Dept., Chicago, IL 60611

The Journal of Marketing Education has ranked marketing journals. Unfortunately, recent journals have not been rated highly because of the "recency" effect. Using a small sample, we polled academics from key universities to gain insights on the rating procedures.

3) **A Probabilistic Model for Product Line Expansions**, *Goker Aydin*, Purdue University, Dept. of IE, 1287 Grissom Hall, West Lafayette, IN 47907, [aydin@ecn.purdue.edu](mailto:aydin@ecn.purdue.edu), *Jennifer K. Ryan*

We consider the problem of whether or not to expand a product line under cannibalization. Through the use of a probabilistic consumer choice model, the effect of pricing decisions on the profitability of product line expansions is investigated.

4) **Product Upgrades When There Are Network Externalities & a Secondhand Market**, *Hao Zhao*, Rutgers University, 180 University Ave., Newark, NJ 07102, [haozhao@andromeda.rutgers.edu](mailto:haozhao@andromeda.rutgers.edu), *Sharan Jagpal*

We consider a monopoly firm introducing a low-quality good in the first period and a high-quality good in the second. We try to answer the following: Should the firm offer an upgrade discount to the users of the old good? Do network externalities affect the firm's upgrade policy? Does the secondhand market hurt the firm's profitability?...

**WC29 Optimization Applications II****Contributed Session**

**Chair:** Elliot H. Levy, US Department of Commerce, 2220 Herbert C. Hoover Bldg., Washington, DC 20230, [elliott\\_levy@ita.doc.gov](mailto:elliott_levy@ita.doc.gov)

1) **A Branch & Bound Algorithm for Minimizing Total Tardiness in a Flowshop with No Intermediate Buffer**, *Debora P. Ronconi*, Cid Universaria, Dept. de Engenharia de Prod., Av Prof. Almeida Prado 531, Sao Paulo, 05508-900, Brazil, [debora@densis.fee.unicamp.br](mailto:debora@densis.fee.unicamp.br), *Vinicius Armentano*

We address the scheduling of jobs in a flowshop without intermediate buffer storage between machines in order to minimize the total tardiness. Based on a graph representation of the problem we develop a lower bound on the total tardiness which is used in a B&B algorithm. Computational tests are reported.

2) **Machine Purchasing Strategies under Uncertain Demand**, *Metin Cakanyildirim*, Cornell University, School of OR, 294 Rhodes Hall, Ithaca, NY 14853, [metin@orie.cornell.edu](mailto:metin@orie.cornell.edu), *Robin O. Roundy*, *Samuel C. Wood*

We model and illustrate an optimal strategy for a capacity expansion problem. A single product family experiences stochastic demand. The product family requires various operations on different machine groups. The cost of machinery, "floor space" and "shell space" expansions are all captured.

3) **Risk-Sensitive Optimal Allocation Problems**, *Emmanuel Fernandez*, University of Arizona, SIE Dept., Tucson, AZ 85721-0020, [emmanuel@sie.arizona.edu](mailto:emmanuel@sie.arizona.edu), *Guadalupe Avila-Godoy*

We present countable state-controlled Markov chains models under (exponential) total and discounted risk-sensitive cost criteria. General (dynamic programming) results for the finite and infinite horizon cases are obtained. A set of general conditions is presented to obtain monotonicity properties of value functions and optimal policies, via submodularity analysis. An optimal resource allocation problem is then treated.

4) **ISO Prediction Yardsticks via Dynamic Programming**, *Elliot H. Levy*, US Department of Commerce, 2220 Herbert C. Hoover Bldg., Washington, DC 20230, [elliott\\_levy@ita.doc.gov](mailto:elliott_levy@ita.doc.gov)

Usage of deterministic dynamic programming to show what on-site selling vendors were maximizing commissions of a fund raising activity for a prototype company recreation association. In this dynamic recursive process, the top vendors stayed the same to judge their future dominant continuity.

**WC30 Computational Advances in Discrete & Non-Convex Optimization**

**Sponsor:** INFORMS Computing Society

**Sponsored Session**

**Chair:** Sanjay Mehrotra, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, [mehrotra@iems.nwu.edu](mailto:mehrotra@iems.nwu.edu)

1) **Using a Dual Scaling Algorithm to Approximate Large Maximum Cover Problems**, *Steven J. Benson*, Argonne National Laboratory, 9700 South Cass Ave., Bldg. 221, Argonne, IL 60439-4844, [benson@mcs.anl.gov](mailto:benson@mcs.anl.gov), *Yinyu Ye*

We implement a dual scaling algorithm and apply it to the positive semidefinite relaxation of maximum cover problems. A randomized algorithm is then used to approximate solutions to problems with over 5000 edges.

2) **Computational Results of Successive Convex Relaxation Methods for Nonconvex Programs**, *Akiko Takeda*, Tokyo Institute of Technology, Dept. of Math. & Comp. Sci., 2-12-1 Oh-Okayama, Meguro-ku, Tokyo, 152-8552, Japan, [takeda@is.titech.ac.jp](mailto:takeda@is.titech.ac.jp), *Yang Dai*, *Mitsuhiro Fukuda*, *Masakazu Kojima*

The successive convex relaxation technique was proposed for nonconvex quadratic programs by Kojima & Tuncel, and recently, the technique was extended to a wide class of nonconvex programs. We discuss implementation issues and report numerical results of the successive convex relaxation for some types of nonconvex programs.

3) **D-MIPO: A Distributed, Disjunctive Mixed-Integer Program Optimizer**, *Sebastian Ceria*, Columbia University, Grad. Sch. of Business, 417 Uris Hall, New York, NY 10027, [sebas@cumparsita.gsb.columbia.edu](mailto:sebas@cumparsita.gsb.columbia.edu), *Gabor Pataki*, *Stefan Schmieta*

We present the latest version of MIPO that includes the ability to handle disjunctive constraints and the generation of general lift-and-project codes. D-MIPO can be executed in a distributed environment. We will present computational results on multi-processor platforms.

4) **Experimental Results on using General Disjunctions in**

**Branch & Bound, Sanjay Mehrotra**, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, mehrotra@iems.nwu.edu, **Jonathan H. Owen**

Typical implementations of B&B for integer LPs choose to branch on single variables. We explore the use of general disjunctions for branching. We give computational results that show that the size of the enumeration tree can be greatly reduced by branching on such disjunctions.

### WC31 Nonparametric Reliability Models

**Cluster:** Reliability Modeling

**Invited Session**

**Chair:** Jason R. W. Merrick, Virginia Commonwealth University, Dept. of Math Sciences, 1015 West Main St. Box 842014, Richmond, VA 23284-2014, jrmerrick@saturn.vcu.edu

1) **A Bayesian Analysis of the Reliability of Machine Tools using a Semi-Parametric Proportional Hazard Model, Jason R. W. Merrick**, Virginia Commonwealth University, Dept. of Math Sciences, 1015 West Main St. Box 842014, Richmond, VA 23284-2014, jrmerrick@saturn.vcu.edu, **Refik Soyer**

Some problems with previously proposed Bayesian approaches will be discussed and an alternative approach developed using the mixture of Dirichlet process prior. The technique is demonstrated using machine tool failure and operating data and the predictive ability of the model is compared to a fully parametric analysis.

2) **Bayesian Non-Parametric Inference for Non-Homogeneous Poisson Processes, Lynn Kuo**, University of Connecticut, Statistics Dept., Storrs, CT 06269-3120, lynn@stat.uconn.edu, **Sujit Ghosh**

Non-parametric priors (the gamma process, the beta process, and the extended gamma process) are employed to model the rate of occurrence of failures for the non-homogeneous Poisson process used in software reliability and in repairable systems. Sampling-based methods are developed for Bayesian inference. Numerical comparisons among the 3 classes are performed on a real software failure data set.

3) **Semi-Parametric Models for Accelerated Life Tests, Refik Soyer**, George Washington University, Monroe Hall 403, MS Dept., 2115 G St. NW, Washington, DC 20052, soyer@gwu.edu, **Alaattin Erkanli, Jason R. W. Merrick**

We consider models for accelerated life tests where parametric assumptions on failure rate are relaxed. These models account for component specific effects as well as the effect of the testing environment on failure behavior. We present Bayesian methods for inference using these models.

### WC32 Telecommunication System Design II

**Cluster:** Telecommunication System Design II

**Chair:** Beth S. Munson, AT&T Labs., 200 Laurel Ave., Rm. D5-3C25, Middletown, NJ 07748, bsmunson@att.com

1) **A Comparative Study for Survivable Local Loop Network Design Models, Moon-Gil Yoon**, Hankuk Aviation University, 2001 Hwajun-dong, Koyang-shi, Kyunggi-do, 412-791, Korea, mgyoon@mail.hankong.ac.kr, mslab.hankong.ac.kr/~mgyoon, **Heeyong Hurr**

With the ever increasing spread of optical fiber systems, the network survivability has become an important issue in designing a broadband communication network. We focus on the analysis of effects of survivable network design plans for a broadband LAN when the demand and network element cost are varied...

2) **A Comparison of Two Modern Heuristics for Designing Local Access Networks, Bernard T. Han**, Western Michigan University, Dept. of Bus. Info. Sys., Haworth Coll. of Bus., Kalamazoo, MI 49024, bernard.han@wmich.edu, http://141.218.104.12/han, **V. T. Raja**

Two modern heuristics - Gaussian machine and GRASP are employed to optimally design a N-node, M-site star-star LAN. Computational results are compared on solving randomly-generated test problems.

3) **An Approach to Robust Network Design, Beth S. Munson**, AT&T Labs., 200 Laurel Ave., Rm. D5-3C25, Middletown, NJ 07748, bsmunson@att.com, **John G. Klinecicz**

When designing a telecommunications network to meet future demands, designers are often hindered by the limited accuracy of market forecasts. While overall growth estimates may be reasonably accurate, forecasting where the demands will actually appear is difficult. We describe an alternative approach for network design that involves both a hierarchical architecture and a more

robust algorithm.

### WC33 Statistical Quality Control

**Cluster:** Statistical Quality Control

**Chair:** P. Krishnan, University of Delaware, 212 Townsend Hall, 531 South College Ave., Newark, DE 19717, baba@udel.edu

1) **Optimal Adaptive Control Policy for Joint Machine Maintenance & Product Quality Control Problems, Yarin Kuo**, Ntl. Yunlin University of Science & Technology, Dept. of IE&M, 123 Sec 3 University Rd., Touliu, Yunlin, 640, Taiwan, ROC, kuoyl@pine.yuntech.edu.tw

We study a finite horizon batch production system with a Markovianly deteriorating machine. Under the assumptions that the actions available to control the system are no action, inspect the machine, repair the machine and sample the batch with variable sample size, we formulate the problem as a partially observable Markov decision process and derive an algorithm to find the optimal control policy.

2) **withdrawn - author request of 10/5, Hancong Liu**, HKUST, Dept. of IEEM, Clear Water Bay, Hong Kong, Hong Kong, hcliu@ust.hk

3) **A Methodology for Using Statistical Methods in Health Care Laboratories in Brazil, Paulo A. Dasilva**, Military Institute of Engineering, Praca General Tiburcio, 80-DE/9-Urca, Rio de Janeiro, 22290-270, Brazil, paulo@taurus.ime.br, http://www.estatistica.eng.br

ISO Guide 43 includes some statistical methods in the proficiency testing of laboratories. Regarding medical care, it is necessary to go a step ahead, selecting a statistical quality control procedure for detecting important errors. We suggest a training methodology for using statistical methods in health care laboratories in Brazil.

4) **Improvement of Chemical Spray Application Using Statistical Process Control, P. Krishnan**, University of Delaware, 212 Townsend Hall, 531 South College Ave., Newark, DE 19717, baba@udel.edu, **Nishant Tiwary**

We evaluate the quality of chemical spraying process. We studied spraying process capabilities using 8004 fan nozzle. Then we applied reliability techniques to analyze failure distribution and change in failure rate during life of nozzle. Finally, we developed process control charts under specific operating conditions.

### WC34 INFORMS Members in the Press

**Cluster:** INFORMS Members in the Press

**Invited Session**

**Chair:** Barry G. Silverman, University of Pennsylvania, Dept. of Systems Eng., Philadelphia, PA 19104, barryg@seas.upenn.edu

1) **IBM's Successful Stories of Using the Asset Management Tool, Grace Lin**, IBM Corporation, TJ Watson Research Ctr., PO Box 218, Yorktown Heights, NY 10598, gracelin@us.ibm.com, **Markus Ettl**

2) **Anticipatory Impression Management by Organizations: Tactics for Averting Expected Controversies, Kim Elsbach**, University of California, Grad. School of Mgmt., 1 Shields Ave., Davis, CA 95616, kdelsbach@usdavis.edu

### WC35 Tutorial: Supply Chain Design & Analysis using the SCOR Method

**Cluster:** Supply Chain Design & Analysis

**Chair:** Herbert Heinzl, Siemens Business Systems & Supply Chain Council, herbert.heinzl@mch20.sbs.de

1) **Tutorial: Supply Chain Design & Analysis using the Supply Chain Operations Reference Method, Herbert Heinzl**, Siemens Business Systems & Supply Chain Council, herbert.heinzl@mch20.sbs.de

The SCOR method has been designed and developed for effective communication among supply chain partners and in networks. As a de facto industry standard, it helps management focus across inter-company supply chains. The model can be used to describe, measure and evaluate supply chain configurations. Standard process definitions allow virtually any supply chain to be configured...

**WC36 Decision Support Systems****Contributed Session**

**Chair:** Barin N. Nag, Towson University, Dept. of Mgmt., Coll. of Bus., Towson, MD 21252, bnag@towson.edu

1) **An Object-Oriented Model-Base: A Basic Building Block of Intelligent Decision Support Systems**, *Rashmi Malhotra*, St. Joseph's University, Dept. of MIS, 5600 City Ave., Philadelphia, PA 19131

With the growing popularity of DSSs, an extensive model-base management system that can focus on a variety of organizational models has become an important area of research. The use of AI offers significant research opportunities to enhance the major functions of the model-base management systems. We illustrate the use of an object-oriented paradigm...

2) **The Software Architecture of a Collaborative, Optimization-Based Decision Support System**, *Yadran Eterovic*, Catholic University of Chile, Casilla 306, Correo, Santiago, 22, Chile, yadran@ing.puc.cl, *Sergio V. Maturana*

We describe the software architecture of an optimization-based DSS and of the software platform designed to support the collaborative execution of the system. The platform provides specialized data access control and function sharing modules that interact with the DSS's server and client modules through simple, well-defined software interfaces.

3) **Framework for an Intelligent Hybrid System**, *Michael W. Varano*, Villanova University, Coll. of Commerce & Finance, Dept. of Dec. & Info. Tech., Villanova, PA 19085, mvarano@email.vill.edu, <http://www.villanova.edu/~mvarano>, *Sohail S. Chaudhry*

It is becoming more common in applications for managers to use some form of intelligent hybrid systems to assist them in decision-making. We present a framework for an intelligent hybrid system. This system supports 3 classes of hybrid systems as presented in the literature. Examples are provided.

4) **Agent Management Architectures**, *Barin N. Nag*, Towson University, Dept. of Mgmt., Coll. of Bus., Towson, MD 21252, bnag@towson.edu, *Walter Truszkowski*

In an automated environment, remote control technology and problem solving capabilities are implemented by agents. Management of the agent community is performed by managing agents. We discuss the architecture of the agent community and the characteristics and capabilities of virtual managers.

**WC37 Enterprise Wide Project Control Techniques**

**Sponsor:** College on Simulation

**Sponsored Session**

**Chair:** Kassa Seyoum, University of Maryland, 6585 Autumn Wind Circle, Clarksville, MD 21029, seyouk@co.mo.md.us, seyoum@wam.umd.edu

1) **Integrated Project Control & Performance Linked to Enterprise Mission**, *Kassa Seyoum*, University of Maryland, 6585 Autumn Wind Circle, Clarksville, MD 21029, seyouk@co.mo.md.us, seyoum@wam.umd.edu, *Chung-Li Tseng*

Integrated project control methodology linked to the project objectives and overall enterprise mission and goals will result in delivery of cheaper, faster, better and successful project with minimum risk. Optimization of project objectives will be accomplished through trade-off of values such as benefit/performance, cost, reliability, safety/risk, maintenance and operational support.

2) **Project Management Techniques to Successfully Manage Schedules & Budgets & Avoid Litigation**, *Frank J. Baltz*, ShawPittman, 1676 International Dr., McLean, VA 22102-4835

We will focus on the state-of-the-art techniques to effectively control project schedule and budget from inception through final completion. Analysis will be provided to identify techniques, which have been proven to be successful. The paper is based on review of recent accounts of disputes and claims on construction projects.

3) **No Title Supplied**, *Howard Green*, PricewaterhouseCoopers, 1301 Av of the Americas, New York, NY 10019, howard.green@us.pwcglobal.com

No abstract supplied.

4) **Developing Enterprise-Wide Project Cost & Risk Management Software Systems**, *Kenneth Karr*, Achates Systems, Inc.

We deal with design and development of software for project cost controls & risks management. The system provides multi source data entry, performance and variance analysis, expenditure tracking, and exception reports based on parameters set by the user. The system is designed to integrate with an

enterprise business process.

**WC38 Optimization Modeling in Practice I**

**Sponsor:** INFORMS Computing Society

**Sponsored Session**

**Chair:** Bjarni Kristjansson, Maximal Software Inc., 2111 Wilson Blvd., Ste. 700, Arlington, VA 22201, bjarni@maximal-usa.com

1) **e-Optimization: Internet Applications using Optimization**, *Harlan Crowder*, ILOG, Inc., 1901 Landings Dr., Mountain View, CA 94043, crowder@ilog.com

As the Internet continues to enable new ways of doing business, an old problem is reoccurring online: people want to allocate scarce and previous resources to competing demands. We will review some of the ways that optimization is enhancing Internet applications.

2) **Using the OptiMax 2000 Component Library to Easily Create Integrated End-User Applications**, *Bjarni Kristjansson*, Maximal Software Inc., 2111 Wilson Blvd., Ste. 700, Arlington, VA 22201, bjarni@maximal-usa.com

The Optimax 2000 is a new object-oriented Automation Component Library that allows the model developer to easily create customized end-user applications to solve real-world optimization problems. We will demonstrate how it can be used to seamlessly integrate the MPL modeling language and any commercial solver with VBA for Excel/Access, Visual Basic, Delphi, HTML/WWW or Visual C++.

3) **Distributon Network Analysis & Design**, *Alan J. Kosansky*, Profit Point, Inc., 713 Dover Rd., Wynnewood, PA 19096-4045, alan@profitpt.com

A major lubricants manufacturer must decide which products should be made at which production facilities, which production facilities should service which warehouse and distribution centers and which warehouses should service which customers. Production and packaging occur at both company facilities and toll manufacturers. Considerations include production costs, transportation rates, cost of inventory and customer service requirements...

**Wednesday 14:15-15:45****WD03 Complementary Models of Gas & Electricity Markets**

**Sponsor:** Energy, Natural Resources & the Environment

**Sponsored Session**

**Chair:** Yves Smeers, Universite Catholique de Louvain, CORE, 34 Voie du Roman Pays, Louvain la Neuve, 1348, Belgium, smeers@core.ucl.ac.be

1) **Modeling & Solving Stochastic Equilibrium Models in Energy Markets**, *Gul Gurkan*, Tilburg University, Ctr. for Economic Research, PO Box 90153, Tilburg, 5000 LE, The Netherlands, ggurkan@kub.nl, *A. Yonca Ozge*, *Stephen M. Robinson*

We present a stochastic equilibrium model for the European gas market, using nonlinear price-demand relations in a stochastic variational inequality. Numerical solutions, using simulation and sample-path methods, yield prices and quantities of gas for specific markets from different producers over multiple time periods. We also discuss possible extensions.

2) **Modeling Strategic Pricing in Bilateral & Poolco Electricity Markets: A Nash-Cournot Approach with Applications to US Eastern Inconnection**, *Udi Helman*, Federal Energy Regulatory Commission, 888 First St. NE, Rm. 61-58, Washington, DC 20426, udi.helman@ferc.fed.us, *Benjamin F. Hobbs*

We present an application to the US Eastern Interconnection of 2 models which adopt a Nash-Cournot framework and which represent transmission constraints. The models are formulated as linear complementarity problems. We show the impact on electricity prices of different hypothetical mergers between firms (without revealing the firms' identities).

3) **Modeling the Electricity & Green Certificates Markets with MCP**, *Klaus Skytte*, Riso National Laboratory, Systems Analysis, PO Box 49, Roskilde, DK 4000, Denmark, klaus.skytte@risoe.dk

The interest in new market designs for electricity has recently been extended to markets for green certificates, where renewable energy producers receive an additional payment for their clean power on competitive conditions. We set up a mixed complementarity programming model that is solved using GAMS.

4) **Pricing Reliability in Competitive Electricity Markets**, *Yves Smeers*, Universite Catholique de Louvain, CORE, 34 Voie du

Roman Pays, Louvain la Neuve, 1348, Belgium, smeers@core.ucl.ac.be, *Olivier Daxhelet*

We formulate a model of competitive electricity markets where power traders need to procure reliability (and other transmission) services to conduct their transactions. These services are defined on the basis of the standard n-1 security constraints. The model is formulated as a variational inequality problem with recourse constraints.

#### WD04 Economics Applications II

##### Contributed Session

**Chair:** Dietrich Chen, Cornell University, 292 Rhodes Hall, Sch. of OR/IE, Ithaca, NY 14853-3801, didi@orie.cornell.edu

**1) Market Share Equilibrium & Competitive Interaction: The Impact of Temporary, Gradual & Structural Changes in Price, Shuba Srinivasan,** University of California, AGSM, 205 Anderson Hall, Riverside, CA 92521, shuba.srinivasan@ucr.edu, **Peter Popkowski, Frank M. Bass**

Our major focus is on the role of competitive policies in the maintenance of market share equilibrium in response to temporary, gradual and structural changes in price and competitive price, and in determining the level of market share as a function of equilibrium levels of competitive variables. We distinguish between 2 kinds of long-term changes in price...

**2) The Battle for Attention: The Implications of Consumer Information Search Behavior on the Internet, Anil Peter,** IBM, TJ Watson Research Ctr., Rte. 134, Yorktown Heights, NY 10598, apeter@us.ibm.com, **William Tulskie**

Through an analytical model, we try to indicate how a consumer allots his limited time resources in searching for information between multiple information sources on the Internet. The model suggests that the average time to finding information and the search efficiency of the source are the basis for the consumer's decision.

**3) Incentive-Compatibility of Undifferentiated Pricing in Processor Sharing Systems, Albert Y. Ha,** Yale University, Sch. of Mgmt., 135 Prospect St., New Haven, CT 06511-3729, albert.ha@yale.edu

We consider the incentive problem of a congestion-prone service system where customers choose sub-optimal admission rates and service requirements due to externalities. We show that under processor sharing, undifferentiated pricing can induce the system-wide optimal solutions for customers with heterogeneous characteristics.

**4) Competition & Collusion in Revenue Management, Dietrich Chen,** Cornell University, 292 Rhodes Hall, Sch. of OR/IE, Ithaca, NY 14853-3801, didi@orie.cornell.edu, **Peter L. Jackson**

Classic revenue management literature deals with revenue maximization for a single supplier of perishable products. We take competition and collusion into account and consider equilibrium models within a revenue management framework.

#### WD05 Portfolio Analysis II

##### Contributed Session

**Chair:** Dominique P. Berta, Conoco Inc., 600 North Dairy Ashford, DU 2082, Houston, TX 77079, dominique.p.bertha@usa.conoco.com

**1) Optimization of Conditional Value-at-Risk, Stanislav Uryasev,** University of Florida, Dept. of ISE, PO Box 116595, 303 Weil Hall, Gainesville, FL 32611-6595, uryasev@ise.ufl.edu, http://www.ise.ufl.edu/uryasev, **R. Tyrrell Rockafellar**

A new approach for optimization or hedging of a portfolio of finance instruments to reduce the risks of high losses is suggested and tested with several applications. As a measure of risk, the expected loss exceeding VaR is used. This measure is called conditional VaR, mean excess loss, mean shortfall or tail VaR...

**2) A Novel Method to Optimize a Complex Portfolio in a Very Fluid & Demanding Operational Environment, Dominique P. Berta,** Conoco Inc., 600 North Dairy Ashford, DU 2082, Houston, TX 77079, dominique.p.bertha@usa.conoco.com, **Dexter A. Burleigh**

We will show how we have managed to optimize a portfolio of 1500 opportunities over the next 7 years using various optimization criteria while at the same time satisfying business objectives. We will present the novel IT (software and databases) that we have designed to realize this job.

#### WD06 Supply Chains V

##### Contributed Session

**Chair:** Youxun Shen, Hewlett Packard Company, 3404 East Harmony Rd., Ft. Collins, CO 80525, youxun\_shen@hp.com

**1) An Integrated Supply Chain to Achieve Concurrent Optimization, Sudhir Mallya,** i2 Technologies, 600 Lanidex Plaza, Parsippany, NJ 07058, sudhir\_mallya@i2.com

We examine a decentralized approach to a production planning strategy throughout the supply chain. It is driven by an LP model that considers raw material supply, weekly sales forecasts and safety stock. Total cost minimization is the objective constrained by individual plants. System bottlenecks are determined and inventory turnover rates are increased.

**2) Value of Information to Improve Supply Chain Management of Perishables, Michael E. Ketzenberg,** University of North Carolina, Kenan Flagler Bus. Sch., CB 3490, McColl Bldg., Chapel Hill, NC 37599-3490, mketz@aol.com

We investigate the value of information sharing to improve supply chain management of perishables. In 3 echelons, we use stochastic modeling to compare the performance of facilities that utilize down-stream supply and demand information in their replenishment decisions with facilities that only utilize their own internal information.

**3) A Two-Echelon Perishable Inventory System, Emre Berk,** Bilkent University, Isletme Fakultesi, Fac. of Bus. Admin., Ankara, 06533, Turkey, eberk@bilkent.edu.tr, http://www.bilkent.edu.tr/~eberk

We consider a 2-echelon perishable inventory system operating under the one-for-one ordering policy. We derive the operating characteristics of the system and discuss sensitivity issues.

**4) Inter-Stage Coordinator of Local Priorities, Katariina M. Kemppainen,** Helsinki School of Economics, Runeberginkatu 14-16, POB 1210, Helsinki, 00101, Finland, kakemppa@hkkk.fi, **Ari P. Vepsalainen**

Within the context of supply chains, we study how orders can be coordinated through different stages with priority indices based on lead-time estimates, load information and relative importance of orders.

**5) Challenges Faced & Lessons Learned in Supply Chain Planning Software Implementation, Youxun Shen,** Hewlett Packard Company, 3404 East Harmony Rd., Ft. Collins, CO 80525, youxun\_shen@hp.com, **Brian Van Buskirk**

The Integrated Circuits Business Division of Hewlett Packard Co. has recently successfully implemented a state-of-the-art supply chain planning software on time and under budget. Based on our extensive supply chain planning system implementation experiences, we discuss the best practices and common pitfalls of supply chain planning software implementations.

#### WD07 Logistics III

##### Contributed Session

**Chair:** Narasimhan Ravichandran, Indian Institute of Management, Wing 3, Ahmadabad Gujarat, 380015, India, nravi@iimahd.ernet.in

**1) Maximizing Throughput & Space Utilization of a Dual-Shuttle Automated Storage & Retrieval System at Caterpillar, Inc., Debbie D. Conklin,** Caterpillar, Inc., Logistics Research, 500 North Morton Ave., Morton, IL 61550, dconklin@cat.com, **Erdem Eskigun**

Maximizing the throughput value and the number of empty spaces are conflicting objectives in a dual-shuttle ASRS. Heuristic algorithms have been developed to maximize these objectives simultaneously. A simulation model has been written in C to test the heuristics and results are compared with the system's actual output.

**2) Determining an Optimal Recommended Storage Quantity at Caterpillar, Inc., Erdem Eskigun,** Purdue University, 1287 Grissom Hall, Sch. of IE, West Lafayette, IN 47907, eskigun@ecn.purdue.edu, **Muduli K. Prakash**

An NILP model has been developed to determine an optimal RSQ for each part number at Caterpillar Distribution Centers. Since it is very difficult and time consuming to obtain exact results for an NILP model, a heuristic algorithm has been developed to obtain quick, near-optimal results.

**3) From Channel Separation to New Industrial Divide, Ari P. Vepsalainen,** Helsinki School of Economics, Runeberginkatu 14-16, POB 1210, Helsinki, 00101, Finland, vepsalai@hkkk.fi, **Jukka K. Kallio, Timo O. Saarinen**

Enhanced communication among firms and customers has split the conventional distribution processes into separate channels for physical transfer, promotion

and value-added services. We discuss how the proliferation of services and the realignment of customer relationships within the channels may eventually result in a new division of organizations across industries.

**4) Lean Logistics: An Operational Framework, Narasimhan Ravichandran**, Indian Institute of Management, Wing 3, Ahmadabad Gujarat, 380015, India, nravi@iimahd.ernet.in

Based on several case studies, we develop a framework to design an effective logistics system. The framework integrates the role of inventory flow in the system role of IT and business process.

## WD09 General Decision Analysis

Contributed Session

**Chair:** Robert L. Armacost, University of Central Florida, Dept. of IE & Mgmt. Systems, PO Box 162450, Orlando, FL 32816-2450, armacost@mail.ucf.edu

**1) Problem Formulation in Planning & Design: Suggestions for Reducing the Type-III Error, Guldal Sakman**, Marmara Universitesi, Goztepe Kampusu, Dept. of IE, kadikoy Istanbul, 81040, Turkey, sakman@mutek.org.tr

Effectiveness of problem structuring contributes greatly to the success of the decision making process by minimizing the type-III error (solving the wrong problem). We introduce a model of measuring this effectiveness and propose a method for reaching the right problem definition by individuals or groups. We also discuss a case where the method is implemented.

**2) Using OR for Managing Change & Improvement, Dan Trietsch**, University of Auckland, Dept. of MSIS, Private Bag 92019, Auckland, New Zealand, d.trietsch@auckland.ac.nz, **John A. Buzacott**

OR's core mission is to achieve improvements. But there are competing improvement methods that often yield more dramatic results. We embed an OR module within a hierarchical cybernetic framework to coordinate and prioritize improvement by any method. This involves monitoring and balancing service levels hierarchically and focusing on gaps.

**3) Intertemporal Choice under Uncertainty: A Behavioral Perspective, Ayse Onculer**, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, ayse.onculer@insead.fr

We explore the relationship between delay and uncertainty in risky intertemporal decision-making. The findings suggest that the simultaneous presence of delay and uncertainty leads to a higher discounting of risky future outcomes than predicted by either effect separately.

**4) An Analytic Hierarchy Process Approach to Performance Indicators for Waterways, Robert L. Armacost**, University of Central Florida, Dept. of IE & Mgmt. Systems, PO Box 162450, Orlando, FL 32816-2450, armacost@mail.ucf.edu, **Julia Pet-Armacost**

The US Coast Guard is responsible for safety, mobility and protection of natural resources in US navigable waterways using various aids to navigation and vessel traffic management systems. We use AHP to develop performance indicators for waterways that can be used to direct performance improvement activities.

## WD10 Product Optimization

Contributed Session

**Chair:** Vinai Trichur, University of Maryland, 211 Lakeside Dr., Apt. T-2, Greenbelt, MD 20770, vtrichur@isr.umd.edu, http://www.isr.umd.edu/~vtrichur

**1) Flexible Machine Layout in a Job Shop Environment, Paul Corry**, Queensland University of Technology, Sch. of Math Sci., GPO Box 2434, Brisbane, Queensland, 4001, Australia, p.corry@fsc.qut.edu.au, **Erhan Kozan**

The component flow in a job shop is analyzed and total flow cost minimized. The problem is formulated as a mixed integer non-linear model. Since the problem is NP-hard, solutions are obtained by heuristics. The ant system heuristic is applied to an industrial application originating from a foundry machine shop.

**2) A Petri Net Model to Determine Optimal Assembly Sequences with Assembly Operation Constraints, Shang-Tae Yee**, National Human Genome Center, 2216 6th St. NW, Ste. 205, Washington, DC 20059, styee@hotmail.com, **Jose A. Ventura**

A Petri net obtained from the and/or graph of a product can be formulated as a 0-1 integer LP that minimizes the total assembly time or cost while satisfying 3 assembly operation constraints, namely, ease of component handling, ease of component joining and tool changes. A Lagrangian dual formulation is then

developed to obtain a lower bound...

**3) A New Lot-Sizing Problem with an Application to Paint Production, Vinai Trichur**, University of Maryland, 211 Lakeside Dr., Apt. T-2, Greenbelt, MD 20770, vtrichur@isr.umd.edu, http://www.isr.umd.edu/~vtrichur, **Sridhar Bashyam**

We present a multi-period production scheduling problem that differs from traditional lot-sizing models in a variety of ways. We develop a mixed-integer programming formulation, establish NP-hardness, develop heuristics, establish their worst-case behavior and study their computational performance on a large sample of test problems derived from real-world data.

## WD11 Optimization Theory & Application

Contributed Session

**Chair:** Richard T. La Salle, Eastern Kentucky University, 450 North Keeneland Dr. 503, Richmond, KY 40475, lasalle@oregon.uoregon.edu

**1) Algorithms for Hybrid MIL/CLP Models for a Class of Optimization Problems, Ignacio E. Grossmann**, Carnegie Mellon University, Dept. of Chem. Engineering, Pittsburgh, PA 15213, grossmann@cmu.edu, **Vipul Jain**

We consider optimization problems where some constraints are better suited for MIP and the others by CLP. We present decomposition and B&B algorithms that exploit the complimentary strengths of MIP and CLP methods to solve hybrid MIP/CLP problems where the CLP part reduces to a feasibility problem.

**2) A Stochastic Programming Approach for Products End of Life Planning, Pano Santos**, Hewlett-Packard Co., 1501 Page Mill Rd., M/S 4U-1, Palo Alto, CA 94304-1126, santos@hpl.hp.com, **Dirk M. Beyer, Fereydoon Safai**

In the PC business, as a family of products approaches the end of its lifecycle, costly excess inventory might be generated as a consequence of a mismatch between demand forecast and material supply. We discuss a prototype tool developed at HPLabs. We present a stochastic programming approach and promising experimental results using Monte Carlo simulation.

**3) Solving Computationally Difficult Set Covering Problems, Gerald L. Thompson**, Carnegie Mellon University, GSIA, 5000 Forbes Ave., Pittsburgh, PA 15213-3890, gt04@andrew.cmu.edu

A new method for generating zero-one matrices related to Steiner triple system is discussed. These can be used to define set covering problems. I discuss the solution of such problems using my integral simplex method.

**4) Generalized Optimization Utilizing Expert Testimony & Neural Networks, Richard T. La Salle**, Eastern Kentucky University, 450 North Keeneland Dr. 503, Richmond, KY 40475, lasalle@oregon.uoregon.edu

A method is presented for optimizing functions which are computationally expensive to evaluate by iteratively approximating the function using local 'experts'. Experts may include neural nets, n-polynomials, or my mother. An expert-based global approximator is then searched in lieu of the true function. The entire learn-search process is iterative.

## WD12 Technology & Innovation Management III

Contributed Session

**Chair:** Jonathan Linton, NJIT, 423 Cullimore, Newark, NJ 07102-1982, linton@adm.njit.edu

**1) Equipment-Related Improvements in Semiconductor Manufacturing & the Locus of Information, Paolo Palezzato**, University of California, Dept. of IE/OR, 4135 Etcheverry Hall, Berkeley, CA 94720-1435, palezzat@ieor.berkeley.edu

A preliminary analysis of the utilization of lithographic equipment in semiconductor manufacturing suggests that information intensive activities at the chip manufacturer level are conducive to the identification of improvements, but that solutions often require the cooperation with equipment suppliers. That's why we set to study the role of sticky information and the locus of problem solving...

**2) The Evolving Model of Leadership for Contemporary Organizations, A. D. Amar**, Seton Hall University, Sch. of Business, South Orange, NJ 07079, amaramar@shu.edu, pirate.shu.edu/~amaramar

We model standard, contemporary leadership behavior and its drawbacks and list the reasons making it unfit for organizations of the 21st century. An alternative model of leadership that enhances creativity in organization is presented. This model is designed with particular needs of organizations in high tech and research industries.

**3) Research Trends in Technology Assessment, Tugrul U. Daim**,

Intel Corporation, 2529 NW Overlook Dr., Ste. 222, Hillsboro, OR 97124, tugrul.u.daim@intel.com

We review research trends during the last decade in the field of technology evaluation and assessment. The major areas researched are identified and the number of publications in each area are identified. The change in numbers over the years have been analyzed to observe the trends over time. The journals where these publications appeared were also tracked and ranked.

**4) Implementation of Involuntary Innovation, Jonathan Linton, NJIT, 423 Cullimore, Newark, NJ 07102-1982, linton@adm.njit.edu, David A. Johnston**

In most cases organizations may abandon an innovation if they are dissatisfied with its performance. However, in many cases abandonment of the innovation is not an alternative. Innovations that are either legislated or perceived as being required to remain viable in an industry are not abandoned. This peculiarity results in different behavior...

## WD29 Management of Technology

### Contributed Session

**Chair:** J. Todd Hamill, AFIT, AFIT/ENS, Bldg. 640, 2950 P St., WPAFB, OH 45433-7765, jonathan.hamill@afit.af.mil

**1) Barriers to Successful Flexible Manufacturing Systems Implementation, Viorica M. Franza, University of Kentucky, DS/IS Area, Gatton Bldg., Lexington, KY 40506-0034, Anita Lee-Post, Anthony W. Potts**

FMSs are not adopted as widely as predicted since their introduction 3 decades ago. Through literature review, factory visits and interviews with human resources, sales, marketing personnel and plant managers, the barriers to a successful implementation of FMSs are identified and discussed.

**2) Considerations in Modeling Information Assurance: Some Preliminary Results & Questions, J. Todd Hamill, AFIT, AFIT/ENS, Bldg. 640, 2950 P St., WPAFB, OH 45433-7765, jonathan.hamill@afit.af.mil, Richard F. Deckro, Jack M. Kloeber, Jr.**

We are increasingly dependent upon information, information systems and information processes. A need exists for the identification and scoping of information assurance issues. As part of an ongoing project, we will report on some preliminary attempts to model information assurance. One of our goals is to stimulate discussion.

## WD30 Forecasting II

### Contributed Session

**Chair:** Dilek Onkal-Atay, Bilkent University, Fac. of Bus. Admin., Ankara, 06533, Turkey, onkal@bilkent.edu.tr, http://www.bilkent.edu.tr/~onkal

**1) Forecasting Trend & Seasonality by Geometric Smoothing, Win G. Liu, Portland State University, 1705 Carver Square, Salisbury, MD 21801, winliu@yahoo.com, win.liu.com**

A new approach, geometric smoothing, to forecasting the trend and seasonality in time series data, is presented. This approach is based on the approximate geometric relationship exhibited in the historical and forecasted data. Using this approach, 3 forecasting methods, 1 for trend and 2 for seasonal data have been developed, which exhibit fairly good adaptability and accuracy...

**2) Replacement Parts Management: The Value of Information, Ronald S. Tibben-Lembke, University of Nevada, Dept. of Managerial Science, MS 028, Reno, NV 89557, rt@unr.edu, unr.edu/homepage/rtl, Henry N. Amato**

Exponential smoothing (and similar methods) are popular because they are simple. For forecasting replacement parts demand, knowledge of failure rates (from field data or destructive testing), when combined with sales data, should allow much better forecasts. When does the benefit of this information outweigh the cost of collecting it?

**3) An Exploratory Study on Judgmental Currency Forecasting, Dilek Onkal-Atay, Bilkent University, Fac. of Bus. Admin., Ankara, 06533, Turkey, onkal@bilkent.edu.tr, http://www.bilkent.edu.tr/~onkal**

We aim to examine various dimensions of predictive accuracy of judgmental forecasts given for foreign exchange rates. Using multiple forecast horizons, currency forecasts are elicited from undergraduate and graduate business students. Participants' comparative performances for point forecasts, interval predictions, and directional probability forecasts are analyzed.

## WD31 Postal & Parcel Systems Planning

### Cluster: Postal & Parcel Systems Planning

#### Invited Session

**Chair:** Peter M. Hahn, University of Pennsylvania, Dept. of Systems Eng., 220 South 33 St., Philadelphia, PA 19104-6315, peter\_hahn@compuserve.com

**1) Discrete Event Simulation of Postal Automation, John W. Brown, US Postal Service Engineering, 8403 Lee Hwy, Merrifield, VA 22082-8145, jbrown1@email.usps.gov, Frederick R. Glickman**

The US Postal Service uses discrete-event simulation to research and validate concepts for new and existing equipment, systems and operational methods. Simulation is used to define requirements, capacities and design parameters throughout the development cycle. We describe the simulation process and the benefits derived from several recent applications.

**2) Genetic, Strategic Design & Operational Options in Nested Vehicular Cargo Systems, Edward K. Morlok, University of Pennsylvania, Dept. of Systems Eng., 220 South 33 St., Philadelphia, PA 19104-6315, morlok@seas.upenn.edu**

We identify generic design options for freight transportation systems and relate these qualitatively to levels of service and costs. Given the service required, this then provides a framework for identifying the types of designs and operations plans that would be appropriate and the major trade-offs that will impact costs.

**3) Web-Based Simulation & Decision Support System for Bulk Mail Network Planning, Chun-Hung Chen, University of Pennsylvania, Dept. of Systems Eng., Towne Bldg., Rm. 270, Philadelphia, PA 19104-6315, chchen@seas.upenn.edu, Edward K. Morlok, J. Liu, Peter M. Hahn**

We describe a Web-based simulation of the USPS bulk mail network, which can be run using any Web browser, such as Netscape or Internet Explorer, on a local or remote computer. Graphical animation enables decision-makers to examine detailed scenarios. Further, future system changes can be studied before any physical changes to the actual system are implemented.

**4) Benchmarking Parcel Delivery Offices for Deutsche Post, Scott A. Malcolm, Planmatics, Inc., 15200 Shady Grove Rd., Ste. 450, Rockville, MD 20850, malcolm@udel.edu, Joachim Wessels, Gene Klein**

Postal operations are national in scope. However, individual processing and delivery centers may operate under a wide array of environmental conditions, making relative performance assessment a challenge. We describe our experience in developing internal benchmarking techniques for the German Post for the purpose of identifying best practice centers and performance targets.

## WD32 Models in Telecom Services Management

### Cluster: Telecommunications

#### Invited Session

**Chair:** Lakshman P. Sinha, Telcordia Technologies, Dept. of Applied Research, 445 South St., Morristown, NJ 07860, lsinha@research.telcordia.com

**1) Optimal Fill-Time Prediction of Coin Boxes, Siddhartha Dalal, Telcordia Technologies, Info Analysis & Services Res., 445 South St., Morristown, NJ 07860, sid@research.telcordia.com, Ranjan Maitra**

Optimal fill-time prediction for coin boxes is important in a range of applications, such as payphones. We develop a Bayesian approach for predicting fill-times for such coin boxes. The methodology consists of postulating common priors over the average daily fill-rate and standard deviation for each phone. Extensions are considered.

**2) Some Insights into Key Network Architecture Design Decisions for IP Networks, Ronald A. Skoog, Telcordia Technologies, Network Studies & Analysis, 331 Newman Springs Rd., Red Bank, NJ 07701, rskoog@research.telcordia.com**

One of the key questions in IP network architecture design is whether to use a core ATM network to interconnect backbone IP routers. We describe some simple models that identify key parameters and produce simple curves that show whether a core ATM network or direct IP/SONET (or IP/WDM) links between routers should be used.

**3) Optimal Economic State-Based Pricing for E-Commerce, Vipul Kashyap, Telcordia Technologies, Info. Analysis & Services Res., 445 South St., Morristown, NJ 07860, kashyap@research.telcordia.com**

Technological changes are transforming retail enterprises into e-commerce enterprises. Telcos will provide bandwidth and QoS guarantees to facilitate e-commerce transactions. Telcos tariff structures that might relate facilities

availability to e-commerce demand can help maximize revenue. E-commerce growth introduces novel possibilities for dynamic economic state-based tariff structures.

**4) Modeling Market Share Dynamics & Some Applications, Lakshman P. Sinha**, Telcordia Technologies, Dept. of Applied Research, 445 South St., Morristown, NJ 07860, [lsinha@research.telcordia.com](mailto:lsinha@research.telcordia.com)

We will present a system theoretic model for estimating the dynamic behavior of market share in a competitive environment based on a set of system parameters. Some applications will be presented. This work was done while the author was at AT&T and cleared by AT&T for presentation.

### WD33 Telecommunication Topics II

#### Contributed Session

**Chair:** Dennis C. Dietz, US WEST Advanced Technologies, Math. & Stats. Modeling, 4001 Discovery Dr., Boulder, CO 80303, [dxdiet2@uswest.com](mailto:dxdiet2@uswest.com)

**1) A Simple Technique to Estimate Variance of Call Center Service Time from Aggregated ACD Data, Thomas A. Grossman**, University of Calgary, Fac. of Mgmt., 2500 University Dr. NW, Calgary, Alberta, T2N 1N4, Canada, [grossman@ucalgary.ca](mailto:grossman@ucalgary.ca), **Sherry L. Oh**

Call center simulation uses talk time data from ACDs which generally report only the aggregated time block mean, not individual call lengths. We present a simple technique for using time block means to estimate the variance of the talk time distribution. We discuss alternatives to the widely used exponential distribution for simulating talk time.

**2) The Bandwidth Allocation & Packing Problem, Ali Amiri**, Oklahoma State University, 210 Coll. of Business, Stillwater, OK 74078, [amiri@okway.okstate.edu](mailto:amiri@okway.okstate.edu)

We study the bandwidth allocation and packing problem in a telecommunications network. This problem is one of assigning a capacity to each link in the network and selecting calls, from a list of requests, to be routed in the network in order to maximize total profit. An efficient Lagrangean relaxation-based heuristic procedure for finding bounds and solutions to the problem is demonstrated...

**3) A Genetic Algorithm for Cost Minimization Applied to Networks with Threshold-Based Discounting, Hrvoje Podnar**, SUNY, Engineering Sch., Dept. of Applied. Math & Stats, Stony Brook, NY 11795-3600, [podnar@ams.sunysb.edu](mailto:podnar@ams.sunysb.edu), <http://www.ams.sunysb.edu/~podnar>, **Jadranka Skorin-Kapov**

The network model assumes that every 2 nodes can communicate and offers incentives to combine flow from different sources. A heuristic algorithm based on genetic strategy is developed and applied to a benchmark set of problems. The results are compared with former B&B results using CPLEX.

**4) Optimal Expansion Scheduling for Telecommunication Central Offices, Dennis C. Dietz**, US WEST Advanced Technologies, Math. & Stats. Modeling, 4001 Discovery Dr., Boulder, CO 80303, [dxdiet2@uswest.com](mailto:dxdiet2@uswest.com), **Paul A. Katz**

We develop and implement a MIP approach toward optimal job scheduling. Attributes of pending jobs include release date, due date, required person-hours and lateness penalty. We schedule available personnel (internal and contracted) over a specified time horizon such that combined job completion costs and lateness penalties are minimized.

### WD34 Applied Probability & Stochastic Processes

#### Contributed Session

**Chair:** Mor Armony, NYU, Dept. of Op. Mgmt., Stern Sch. of Bus., 40 W 4th, New York, NY 10012-1118, [marmony@stern.nyu.edu](mailto:marmony@stern.nyu.edu)

**1) A Method for a Serial Production Line with Finite Buffers & Machine Failures, Shigemichi Suzuki**, Chiba Institute of Technology, 2-17-1 Tsudanuma, Narashino Chiba, 275-0016, Japan, [p03suzuk@cc.it-chiba.ac.jp](mailto:p03suzuk@cc.it-chiba.ac.jp), **Li Qui**

This system is modeled as a queueing network. A balance equation of such systems easily becomes huge as the number of stages and buffer sizes increase. To reduce the virtual size of the transition rate matrix, we exploit the detailed structure in addition to the block triangularity of the matrix.

**2) A Heuristic Algorithm for Stochastic Root Finding, Huifen Chen**, Chung Yang Christian University, Dept. of IE, Chung Li, 320, Taiwan, [huifen@mail.ie.cycu.edu.tw](mailto:huifen@mail.ie.cycu.edu.tw), **Hungshen Chen**

We propose a heuristic algorithm for SRF problems, solving a system of equations using only the function estimates. This algorithm applies the

deterministic Broyden's method into the framework of retrospective approximation, a generic SRF algorithm. Simulation results are shown to evaluate the algorithm performance.

**3) Dynamic Cone Policies for Queueing Networks with Interacting Resources, Mor Armony**, NYU, Dept. of Op. Mgmt., Stern Sch. of Bus., 40 W 4th, New York, NY 10012-1118, [marmony@stern.nyu.edu](mailto:marmony@stern.nyu.edu), **Nicholas Bambos**

Consider multiclass queueing systems whose service facility can be in one of M configurations. Choosing a service configuration corresponds to specifying the service rate that the different classes receive. Dynamic cone policies are studied that continuously update the service configuration according to the value of the workload processes at each time point...

### WD35 Operations Management VI

#### Contributed Session

**Chair:** Yves Pochet, Universite Catholique de Louvain, Place des Doyens 1, Louvain-la-Neuve, 1348, Belgium, [pochet@prod.ucl.ac.be](mailto:pochet@prod.ucl.ac.be)

**1) Quality Management in Electronic Consumer Services, Gregory R. Heim**, University of Pennsylvania, Dept. of Mktg., 1400 SH-DH, Philadelphia, PA 19104, [heim@mktgmail.uwharton.upenn.edu](mailto:heim@mktgmail.uwharton.upenn.edu), **Kingshuk K. Sinha**

Using taxonomies representing product and process structures of a product-process matrix for electronic consumer services, we analyze the fit between service quality and matrix positions and paths. Using data from 255 electronic food retailers, we find evidence supporting several propositions related to the delivery of service quality.

**2) The Optimality of the Hedging Base-Stock Policies for the Two-Part-Type Systems, Shaoxiang Chen**, Nanyang Technological University, B2A-30 SAB, Nanyang Ave., Singapore, 639798, Singapore, [aschen@ntu.edu.sg](mailto:aschen@ntu.edu.sg)

We study the 2-item, single facility, periodic review production system. It proves that the hedging base-stock policy is optimal for both finite and infinite time horizon systems. This result applies to both continuous and discrete demand cases as the optimality proof makes no assumption on the strictness of the convexity of the 1-period expected cost function or on its smoothness.

**3) The Impact of Cross-Training on the Performance of Call Centers, Philippe Chevalier**, Universite Catholique de Louvain, Place des Doyens 1, Louvain la Neuve, 1348, Belgium, [chevalier@qant.ucl.ac.be](mailto:chevalier@qant.ucl.ac.be), **Nathalie Tabordon**

We study call centers serving different types of calls. Using operators cross-trained to handle more than 1 type of call can be an effective way to improve the performance of call centers. We evaluate the benefit of cross-trained operators using Markovian models.

**4) Design & Performance Analysis of a Heavily Loaded Material-Handling AGV System, Yves Pochet**, Universite Catholique de Louvain, Place des Doyens 1, Louvain-la-Neuve, 1348, Belgium, [pochet@prod.ucl.ac.be](mailto:pochet@prod.ucl.ac.be), **Philippe Chevalier, Laurence Talbot**

We consider the design, dimensioning and performance analysis of a heavily loaded material-handling AGV system on a loop. The objective is to determine the number of AGVs and to design the dispatching rules to achieve a given waiting time performance. We use a combination of inventory control and queueing models to predict performance and validate our results with simulation.

### WD36 Project Scheduling & Analysis

#### Contributed Session

**Chair:** Julia Pet-Armacost, University of Central Florida, Dept. of IE & Mgmt. Systems, PO Box 162450, Orlando, FL 32816-2450, [jedwards@mail.ucf.edu](mailto:jedwards@mail.ucf.edu)

**1) Simulation & Sensitivity of Learning-Based Decisions in Project Management, Sungbin Cho**, George Washington University, James Monroe Hall, 2115 G St. NW, Ste. 403, Washington, DC 20052, [sung@gwu.edu](mailto:sung@gwu.edu), **Zvi Covaliu**

We review a framework for learning-based decisions in project management, which allows for dependency among activity durations. Through simulation and sensitivity analysis, we show that our sequential approach to optimal crashing and scheduling results in lower expected projected costs than decisions based on CPM or PERT.

**2) Data Envelopment Analysis with Missing Data, Timothy R. Anderson**, Portland State University, Dept. of EMP, Portland, OR 97207-0751, [tima@emp.pdx.edu](mailto:tima@emp.pdx.edu), **Gerald H. Williams**

A DEA model allowing for missing ordinal data with an illustrative application from the construction industry is developed.

**3) Resource Constrained Project Scheduling with Stochastic Task Insertions, Basma Selim**, University of Central Florida, Dept. of IE & Mgmt. Systems, PO Box 162450, Orlando, FL 32816-2450, brs70056@pegasus.cc.ucf.edu, **Julia Pet-Armacost, Robert L. Armacost**

The problem of inserting tasks into an existing schedule is an important issue in many scheduled maintenance operations. The occurrence of such unplanned tasks may, however, be predictable and thus included in the scheduling process. We examine the problem of resource constrained project scheduling with stochastic task insertions.

### WD37 Energy & Environment Optimization

Contributed Session

**Chair:** Alex Orman, University of Southampton, Maths Dept., Highfield, Southampton, SO17 1BJ, UK, ajo@soton.ac.uk

**1) A Benders Decomposition Approach to Solving Distributed Resource Planning Problems, Susan A. McCusker**, Johns Hopkins University, 3400 North Charles St., Ames Hall - Dogee, Baltimore, MD 21218, mccusker@jhuvms.hcf.jhu.edu, **Benjamin F. Hobbs**

We apply Benders decomposition to optimally coordinate bulk and local utility planning and production models in determining the value of DRs. DRs include small generation/storage options that can be dispersed throughout a utility system; comparing DR costs to avoided bulk system costs determines their value.

**2) A Decomposition Approach to Multi-Regional Electricity Scheduling, Zhijun Xie**, Boston University, Ctr. for Energy & Environ., 675 Commonwealth Ave., Boston, MA 02215, zxie@bu.edu, **Marija Ilic**

We propose a methodology for the multi-regional market scheduled based on Benders decomposition principle. The system is represented by an inter-regional network and several intra-regional networks with exchanging tie-line flows and nodal prices between 2 level markets. Case studies with a system of China are discussed.

**3) Optimization Tools for Membrane Filtration Plant Design & Cost Minimization, Erica Z. Klampfl**, Rice University, CAMM MS 134, 6100 Main St., Houston, TX 77005-1892, zimmer@caam.rice.edu, <http://www.caam.rice.edu/~zimmer/>, **John E. Dennis**

Many water treatment plants today use filtration processes that do not meet specified EPA requirements. Although membrane filtration systems can meet these requirements, it is not known how to build these large-scale plants cost efficiently. We present a cost model of the plant and techniques to solve this MINLP.

**4) A Tool for Planning Gas Pipelines, Alex Orman**, University of Southampton, Maths Dept., Highfield, Southampton, SO17 1BJ, UK, ajo@soton.ac.uk

Long-term planning is quite normal in the gas industry. Supply and demand fluctuate, thus effective network planning is essential to ensure robust pipeline configurations. We present a user friendly gas network planning tool. Through a case study, we show how clients are able to experiment with varying pipeline configurations and realise substantial cost savings.

### WD38 Optimization Modeling in Practice II

**Sponsor:** INFORMS Computing Society

Sponsored Session

**Chair:** Bjarni Kristjansson, Maximal Software Inc., 2111 Wilson Blvd., Ste. 700, Arlington, VA 22201, bjarni@maximal-usa.com

**1) Production Planning in a Deregulated Electric Power Environment, Raghu Sethuraman**, Praxair, Inc., 175 East Park Dr., Tonawanda, NY 14515-0044, rms1@eng.buffalo.edu, **Matthew F. Kebllis, Mark H. Karwan**

Praxair has developed a mathematical programming model to optimize the operation of its plants in an environment where there is real time pricing of electricity. The MIP is run by plant operators every hour to determine how to load the plant. We review the use and benefits of this program.

**2) Modeling Competition in Electricity Markets using Mixed Integer Programming Techniques, Gregory P. Swinand**, London Economics, 350 Massachusetts Ave., Ste. 330, Cambridge, MA 02139, gswinand@londecon.com

A model of electric generation competition is developed. Although the economic

theory of competitive markets and optimization programming is not new, the application of MIP techniques to markets with complicated structures has perhaps lagged. Older dispatch models relied on heuristic solutions or large hardware investments. New desktop software technology allows economists to optimize MIP models with 30,000+ variables.

**3) The Government Office Location Model, Dennis M. Hunter, Jr.**, Jacobs Facilities, Inc., Sverdrup CRSS, 1300 Wilson Blvd., Arlington, VA 22209, hunterdm@sverdrup.com

The government office location model is a system to assist executives of a government agency in selecting sites for new offices. It includes a demographic database with complete data to the 5-digit zip code level, a GIS to provide graphical input and output and an MIP to analyze feasible regions and select the optimal zip code for locating offices.

- Aardal, Karen SC02  
 Abdelghany, Ahmed F. SD20  
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 Abdurahiman, Vakulathil SA04  
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 Al-Sharrah, Ghanima WC03  
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 Altiok, Tayfur WB07, WC07  
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 Anderson, Edward G. TA06, TC09  
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 Angehrn, Albert SA35  
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 Ankenman, Bruce A. MA33  
 Anli, Osman M. TD07, WC07  
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 Arabib, Claudio TD06, TE06, WA06  
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 Askin, Ronald G. MD38, SD07, TA09  
 Asvanund, Atip MA34, MD32  
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 Avi-Itzhak, Benjamin MD04, WC07  
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 Aviles, Ana I. MA33  
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 Ayhan, Hayriye SA26, TE03  
 Aykin, Turgut SA08  
 Aytug, Haldun S. WB10  
 Azizoglu, Meral TC17  
 Ba, Sulin SB30  
 Babayan, Astghik K. MD38  
 Bacon, Lynd D. TD12  
 Badawy, Michael K. MC15, MD15  
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 Todd-Malmlov, April TD24  
 Toh, Kim C. SA10  
 Toledo, Franklina B. WC06  
 Tomak, Kerem WA30  
 Tomar, Russell H. SA01  
 Tomastik, Robert TD07  
 Tombak, Mihkel M. TD35  
 Tomoko, Fukuzawa TE27  
 Tompkins, Tilt WB29  
 Tone, Kaoru SB36  
 Topaloglu, Huseyin SD21  
 Toptal, Aysegul MD17  
 Tortorella, Michael WA31  
 Townsend, W. P. SB08  
 Tra, Niem-Trung L. TD17  
 Trafalis, Theodore B. MA25  
 Traub, Rodney TA03  
 Treadwell, Thomas WA37  
 Treharne, James T. MA06  
 Trichur, Vinai WD10  
 Trick, Michael A. TE11  
 Trietsch, Dan TE26, WD09  
 Tripp, Robert TA08  
 Tripsas, Mary MA14, MD14  
 Trock, Bruce J. SA01  
 Trosset, Michael W. MD33  
 Trotter, Les E. TE18  
 Troutt, Marvin D. MD25, TE34, WA34  
 Troxell, Denise Sakai MD27  
 Truskowski, Walter WC36  
 Tsao, Hsiao-Shen TC20  
 Tsay, Andy A. TA03  
 Tseng, Chung-Li MC36, SB23, TC16, WC37  
 Tseng, Paul Y. TE38  
 Tseng, Phillip TD23  
 Tsitsiklis, John N. SB26, TA27  
 Tsui, Kwok-Leung SD31, TA33  
 Tsunematsu, Naoyuki MD27, WC12  
 Tsung, Fugee TC33  
 Tucci, Christopher MA14  
 Tulsiek, William WD04  
 Turcanu, Anca SA14  
 Turetken, Ozgur TD30  
 Turkey, Metin TA11  
 Tuttle, Mark E. SD11  
 Tutuncu, Reha H. SA10, TD38  
 Tuzhilin, Alex MA34  
 Tuzun, Dilek TE07  
 Tyagi, Rajeev MC12  
 Tyworth, John E. SA34  
 Tzeng, G. H. SB05  
 Tzur, Michal TA17  
 Ugray, Zsolt WB37  
 Ulrich, Karl SC03  
 Ulusoy, Gunduz TC04  
 Umlauf, Michael S. MA08  
 Urban, Timothy L. TE36  
 Uryasev, Stanislav WD05  
 Usowicz, Thaddeus W. SA28  
 Uster, Halit TA25  
 Utterback, James MD14  
 Uzsoy, Reha TD17, WB10  
 Vairaktarakis, George L. MC02, WA34  
 Vakharia, Asoo J. SB29  
 Vakhutinsky, Andrew MC18  
 Vakili, Pirooz MA27, SC27, SD27  
 Valente, Thomas W. TC13  
 Valenzuela, Jorge WA03  
 Valverde, Rene TD33  
 van Ackere, Ann TA24  
 Van Aerde, Michel W. TE21  
 Van Alstyne, Marshall TC34, WB01  
 Van Bruggen, Gerrit H. WB12  
 Van Buskirk, Brian WD06  
 van de Kerchove, Virginie WB36  
 Van den Bulte, Christophe TC13  
 Van Der Duyn Schouten, Frank A. TA31  
 van der Mei, R. D. MA26  
 Van Dorp, J. Rene TC31  
 Van Hentenryck, Pascal SB11, SC19, TE30  
 van Houtum, Geert-Jan WC11  
 van Keulen, F. TA33  
 Van Mieghem, Jan A. SA03, SB26  
 Van Nuffelen, Cyriel WA02  
 van Ooijen, H. P. G. SA17  
 Van Oyen, Mark P. MD06  
 Van Roy, Benjamin TA27  
 van Ryzin, Garrett J. MA03, SB06, TE03, TE16  
 Van Wassenhove, Luk N. MC36  
 van Wezel, Wout SD17  
 Vance, Pamela H. SD07  
 Vandaele, Nico J. TE24, WA08  
 Vande Vate, John SB26, TE19  
 Vanderbei, Robert J. TC38  
 Vang, Kaosong TE24  
 Vanhonnacker, Wilfried R. MA12  
 Vanhoucke, Mario WC05  
 Vanneste, Stephan G. TA31  
 Varaiya, Pravin P. TA32

- Varano, Michael W. WC36  
 Vasantharajan, Sriram SD18, TA11  
 Vasko, Francis J. WA08, WC09  
 Vasquez-Urbano, Pedro M. WA03  
 Vasser, Ellen MC24  
 Vassilaras, Spyridon MA32  
 Vasudeva, Sandeep TE05  
 Vazirani, Vijay SC02  
 Veatch, Michael H. SD02  
 Vecchietti, Aldo TA11  
 Veiga, Geraldo MD19  
 Veinott, Jr., Arthur F. MC35  
 Vempala, Santosh MA02  
 Venkatasubramanian, Narayan TD11  
 Venkateswaran, Venkat WA32  
 Venkatraman, Krishna TD02  
 Venner, Steve MC23  
 Ventosa, Mariano SC23  
 Ventura, Jose A. WB06, WB32, WD10  
 Vepsalainen, Ari P. MD13, WD06, WD07  
 Vercelli, G. SC17  
 Vereen, Bradley MC31  
 Verma, Devesh TE14  
 Verma, Rohit MC17, SA29  
 Vernon, Mary WA06  
 Verter, Vedat TD05, WA05  
 Vieira, Guilherme E. SC07  
 Vikas, Shree MA23  
 Vilcassim, Naufel TD13  
 Villalobos, J. Rene TA07  
 Villavicencio, Jorge U. WB37  
 Vining, G. Geoffrey SA33, TC33  
 Vinze, Ajay MC34, TA34  
 Vision, T.J. SB02  
 Visudhiphan, Poonsaeng SD23  
 Viswanathan, S. MC04  
 Voelkel, Joseph O. MA33  
 Voessner, Siegfried TD02  
 von Winterfeldt, Detlof TA01, TC01  
 Vrtiprah, Vesna TC04  
 Vuchic, Vukan R. SA20  
 Wackerbarth, Sarah WC04  
 Waechter, Andreas TD38  
 Wagelmans, Albert P. M. SA25  
 Wagner, Janet M. SB37, TA04  
 Wagner, Michael TD38  
 Wagner, William TD04  
 Wainer, Alexis MC19  
 Waite, Scott WA35  
 Wallace, Mark G. SA19  
 Waller, S. Travis MC20, SA21, SB21, SC21  
 Walster, G. William SB11  
 Walther, John D. SB04  
 Wan, Yat-Wah MD04  
 Wang, Cheng-Shuo TD17  
 Wang, Chung-Hsiao WA03  
 Wang, Daniel TD07  
 Wang, Hongzhou MA31, SD31  
 Wang, Jin MD30  
 Wang, Qian TA05  
 Wang, Qinan MC04  
 Wang, Qiong MC26  
 Wang, Renyou SB04  
 Wang, Samantha WB13  
 Wang, Sheng-Pen MA04  
 Wang, Shou-Jiun SC29, TC05  
 Wang, Xiaopei TC02  
 Wang, Xiubin MC08  
 Wang, Yanwen TE16  
 Wang, Yun SC29  
 Wansink, Brian SB13, SC13  
 Ward, James E. TE05  
 Ward, Julie A. TD02  
 Warners, Joost P. SD19  
 Warsing, Donald P. TC08  
 Wasil, Jr., Edward A. WB33  
 Watson, Noel TC03  
 Waxman, Jerry MA30  
 Wayne, Kevin MD18  
 Weatherford, Larry R. TD16  
 Webb, Kent TD19  
 Weber, Elke U. MD01  
 Weber, Martin MC05, MD01  
 Webster, Scott T. TC17  
 Wee, Kwan E. TA09  
 Wegman, Edward J. TE31  
 Wei, Chi-Ping SA24  
 Wei, Kuang C. TD19  
 Weigelt, Mikael TA16  
 Wein, Lawrence M. MA03  
 Weintraub, Andres MC19  
 Weiser, Mark TD32  
 Weiss, Allen TE12  
 Weiss, Doug TD01  
 Weitzman, Don TD21  
 Welch, Steve MA18, MC23, SD18  
 Wellman, Michael P. SA05  
 Wemmerlov, Urban TE14  
 Wen, Jiang SD15  
 Wen, Joseph H. TC19  
 Weng, Michael X. MA17  
 Weng, Willie SB34  
 Wenger, Andrea D. MC24  
 Wensley, Robin SC29  
 Wesolowsky, George O. TE05  
 Wessaly, Roland TC21  
 Wessels, Joachim WD31  
 Westcombe, Mark TE21  
 Westort, Peter TA04  
 Whang, Seungjin MA03, MD03, TD03  
 Whinston, Andrew B. SB30, SD04  
 White, III, Chelsea C. TD08, TE27, WA29  
 Whitney, Daniel E. TE22  
 Whitt, Ward MC26  
 Wiecek, Margaret M. WA36  
 Wijeratne, Ajith B. MC39  
 Wijngaard, Jacob SA17  
 Wilemon, David SB24  
 Wiley, Mark TC29  
 Wilkes, John TD02  
 Willemain, Thomas R. SA27  
 Willems, Sean P. WA07  
 Williams, Gerald H. WD36  
 Williams, Terry TE21  
 Williamson, David SC02  
 Willis, Ruth WA35  
 Wilson, Amy R. TD24  
 Wilson, Doug TA07  
 Wilson, John G. TC31  
 Wilson, Rick L. TD32  
 Wilson, Simon TD31  
 Wind, Jerry MD12  
 Windsperger, Josef MA04  
 Winer, Larry SC12  
 Winston, Wayne L. SB37, SC37  
 Witherspoon, Patricia D. SA15  
 Wohler, Kathy L. SA15  
 Wolf, Floyd E. WA08  
 Wolf, Thomas WB04  
 Womer, Keith TA37  
 Wong, Eric MA31  
 Wong, Jonathan TC28  
 Wong, Roman WC10  
 Wood, Frances TD23  
 Wood, Michael J. WB33  
 Wood, R. Kevin TD02  
 Wood, Samuel C. WC29  
 Woodall, W. H. SD31  
 Woodson, Kim Y. WC06  
 Wray, Barry A. TC22  
 Wright, Gordon P. SB13  
 Wright, Ronald H. SB37  
 Wright, Stephen J. MA10, MC10  
 Wu, Donghui TD10  
 Wu, Dongjun TC06, TC19, WA09  
 Wu, Jia Hao MD20  
 Wu, Jianan MD13  
 Wu, Paul WA31  
 Wu, S. David SA07, TA07, TC07  
 Wu, Yujing SB27  
 Xiang, Hua TE08  
 Xiao, Baichun WA29  
 Xie, Jinhong TC12  
 Xie, Zhijun WD37  
 Xu, Di WA33  
 Xu, Li-an MA33  
 Xu, Susan H. SD26  
 Xue, Mei SB36  
 Yaman, Hande TE25  
 Yan, Hong WB09  
 Yan, Houmin MD07, TD08, TE08, WA29  
 Yang, Baiyu SC21  
 Yang, Jian WA02  
 Yang, Kai SD33  
 Yang, Kejian WB11  
 Yang, Rachel WA09  
 Yang, Shitao MC09  
 Yang, Tae Young WB31  
 Yang, Ta-Hui SB21  
 Yannou, Bernard MD33  
 Yano, Candace A. MA08, MC07, TA03  
 Yao, David D. ME41  
 Yappadanavar, Vinay MC21  
 Yassine, Ali A. TE22  
 Ye, Hengqing SB26  
 Ye, Yinyu SB10, SD10, WC30  
 Yee, Shang-Tae WD10  
 Yeh, Arthur B. TE33  
 Yeh, Vivian SA29  
 Yen, Joyce W. TC20  
 Yeung, David K. TA20  
 Yildirim, Emre A. MA25  
 Yildirim, Mehmet B. TD21  
 Yoo, B. J. MA26  
 Yoon, Moon-Gil WC32  
 Yoshimoto, Kazuho K. WB06  
 Young-Helou, Stephanie SD12  
 Yu, P. L. SB05  
 Yu, Rui SD27  
 Yu, Zhenxin WB09  
 Yuan, Bruce H. SA08  
 Yucesan, Enver MC27  
 Yudhbir, Lalit MD23  
 Yun, Myung Hwan TE33  
 Yunes, Talys Hoover SA19  
 Yurttan, Hande TC38  
 Zabinsky, Zeldia B. MA11, SD11  
 Zaccaria, Renato SC17  
 Zaccour, Georges SA13  
 Zahedi, Fatemeh Mariam TE31, WB34  
 Zeng, Amy Z. SA34  
 Zenger, Todd R. SD14  
 Zeni, Richard H. MD16, TA19  
 Zenios, Stefanos SD06, TD03  
 Zhang, Ding TA14  
 Zhang, Han SB30  
 Zhang, Hui MC32  
 Zhang, Jin WA09  
 Zhang, Jinhuan WA36  
 Zhang, Jun J. TD22  
 Zhang, Mei TE16  
 Zhang, Rachel Q. MA07, SD08, TE03  
 Zhang, Shao-Liang SB10  
 Zhang, Xiaohui TD07  
 Zhang, Xuemei MA31, SD31  
 Zhao, Hao WC12  
 Zhao, Hongxin WA10  
 Zhao, Shaoping TA22, TC22  
 Zhao, Wen SB06  
 Zhao, Yonggan SA16  
 Zheng, Charles SC04  
 Zheng, Li WA12  
 Zheng, Yu-Sheng SB06  
 Zhong, Jiangfan MD04  
 Zhou, Xunyu SA16  
 Zhou, Yongpin MC06, TC26  
 Zhu, Joe SA36  
 Zhu, Wanshan MD25  
 Ziembra, William T. SA16, SD16, TC10  
 Zijm, W. H. M. SA17, WC11  
 Ziliaskopoulos, Athanasios MA21, MC20, SA21, SB21, SC20, SC21  
 Zils, Markus TD15  
 Zimmerman, Brenda SB09, SC09  
 Zions, Stanley SC36  
 Zobian, Assef SD23  
 Zotteri, Giulio TC03  
 Zusman, Gil TE36

**Sunday 08:30-10:00**

- SA01 Medical Decision Making  
 SA02 Issues in Network Optimization  
 SA03 Information, Incentives & Coordination  
 SA04 Simulation Applications I  
 SA05 Decision Analysis & Computational Challenges  
 SA06 Very Large-Scale Neighborhood Search  
 SA07 Panel: Research Directions in Manufacturing Logistics  
 SA08 Modeling the Supply Chain at Lucent Technologies:  
 Practitioners View of the Supply Chain Problem  
 SA09 AI Applications  
 SA10 Semidefinite Programming  
 SA11 Discrete & Nonconvex Optimization Applications  
 SA12 Decision Making  
 SA13 Distribution Channels  
 SA14 Technology & Networks  
 SA15 Knowledge Management in the Contemporary Firm  
 SA16 Portfolio Analysis  
 SA17 The Role of Information in Various Forms of Scheduling  
 SA18 Combinatorial Optimization Solutions for Applications in  
 Industry  
 SA19 Hybrid Algorithms  
 SA20 Applications for Urban Transit Systems  
 SA21 Dynamic Traffic Assignment I  
 SA22 Negotiation Fundamentals  
 SA23 Decomposition Methods & Applications  
 SA24 Management Issues in Telemedicine  
 SA25 Vehicle Scheduling & Routing  
 SA26 Queueing Systems  
 SA27 Scenario Generation for Simulation Inputs  
 SA28 Tutorial: Fulbright Scholarships: What are They & How  
 to Get One  
 SA29 Operations Management I  
 SA30 Internet & Supply Chain Management  
 SA31 Reliability Research  
 SA32 Telecommunication Topics  
 SA33 Panel: Emerging Issues & Directions in Quality, Statistics  
 & Reliability - Editors' Point of View  
 SA34 Achieving Efficient Supply Chain Management  
 SA35 Tutorial: Leveraging the Internet in Business Applications  
 SA36 Data Envelopment Analysis  
 SA37 Panel: The Art & Tools of Teaching Decision Analysis

**Sunday 10:15-11:45**

- SB01 Insights from Past Lives of Decision Analysis Practitioners  
 SB02 Combinatorial Approaches to Linear Programming  
 Problems  
 SB03 Supply Chain Management  
 SB04 Simulation Applications II  
 SB05 Decision Analysis I  
 SB06 Yield Management Applications  
 SB07 Panel: Research Opportunities & New Initiatives at the  
 National Science Foundation  
 SB08 Improving the Provisioning Process at Lucent  
 Technologies  
 SB09 Panel: New Directions in Group Decision & Negotiation I  
 SB10 Semidefinite Programming & its Applications I  
 SB11 Verified Global Optimization  
 SB12 Sales Force Models  
 SB13 Measurement & Modeling Issues in Consumer Behavior  
 SB14 Technology & Organizational Economics  
 SB15 International Aspects of Technological Development  
 SB16 Finance Applications  
 SB17 Workload Control in Job Shops  
 SB18 Network Design & Applications  
 SB19 Constraint-Based Scheduling  
 SB20 Using Bus Location Information in Public Transit  
 SB21 Dynamic Traffic Assignment II

- SB22 Current Developments in IT Outsourcing  
 SB23 Valuation of Real Options in Competitive Electricity  
 Markets  
 SB24 Management Issues in Health Care Technology  
 Management I  
 SB25 Routing  
 SB26 Fluid & Queueing Networks  
 SB27 Perturbation Analysis & Simulation I  
 SB28 Mathematical Applications Applied to a Social Agenda  
 SB29 Operations Management II  
 SB30 Agents, Brokers & Intermediaries  
 SB31 Quality & Reliability Engineering Applications  
 SB32 Distributed Computing & Network Design Problems in  
 Telecommunications  
 SB33 Panel: Quality Improvement & Reliability - Emerging  
 Trends  
 SB34 Tutorial: Electronic Business Process Optimization:  
 Enabling a New Era of Business Intelligence  
 SB35 Tutorial: Industry Clockspeed  
 SB36 DEA I  
 SB37 Panel: Integrative Cases for Teaching OR/MS in the MBA  
 Curricula

**Sunday 13:15-14:45**

- SC01 Asking the Right Questions: Experiences Teaching &  
 Learning about Decision Analysis Practice  
 SC02 Approximation Algorithms for Problems in Combinatorial  
 Optimization  
 SC03 Coordination Issues in Design & Development  
 SC04 Price Formations in Auctions  
 SC05 Decision Analysis II  
 SC06 Supply Chain Economics  
 SC07 Scheduling, Logistics & Facilities Design I  
 SC08 Supply Chain Management in the Semiconductor Industry  
 SC09 Panel: New Directions in Group Decision & Negotiation II  
 SC10 Eigenvalue Optimization  
 SC11 Recent Developments in Global Optimization  
 SC12 Marketing on the Internet  
 SC13 Product Assortments  
 SC14 Coping with Complexity & Interdependence  
 SC15 Technology & Innovation Management I  
 SC16 Credit Customers  
 SC17 Methodological Issues of Planning  
 SC18 Innovations & Applications of Integer Programming  
 SC19 Constraint Programming Languages  
 SC20 Traffic Detection & Management Algorithms  
 SC21 Path Algorithms & Routing  
 SC22 Negotiating a Y2K Outsourcing Agreement Case  
 SC23 Longer-Run Issues in Electricity Restructuring  
 SC24 Management Issues in Health Care Technology  
 Management II  
 SC26 Queueing Networks  
 SC27 Perturbation Analysis & Simulation II  
 SC28 Rigorous Qualitative Analysis  
 SC29 Public Policy Applications  
 SC31 Aviation System Safety & Risk Analysis  
 SC32 High-Speed Networks  
 SC33 Predictive & Proactive Maintenance: Models & Methods  
 SC34 The Theory & Applications of Supply Chain Management  
 SC35 Tutorial: Generalized Hill Climbing Algorithms in  
 Optimization  
 SC36 DEA II  
 SC37 Integrating OR/MS & Finance in the Classroom

**Sunday 15:00-16:30**

- SD01 Utilities for Groups & Corporations  
 SD02 Dynamic Routing  
 SD03 Learning & Testing in Product Development  
 SD04 Multi-Unit Auctions

- SD05 Knowledge Representation in DA  
SD06 Financial Decision Making in Health Care  
SD07 Scheduling, Logistics & Facilities Design II  
SD08 Game Theoretic Models in OM  
SD09 Group Decision & Negotiation  
SD10 Semidefinite Programming & its Applications II  
SD11 Advances in Global Optimization  
SD12 Promotion Strategy  
SD13 Marketing Applications of Statistical Models  
SD14 Organization Science  
SD15 Technology & Innovation Management II  
SD16 The Stochastic Programming Approach to Hedge Fund Disaster Protection  
SD17 Cognitive Aspects of Planning & Scheduling Support I  
SD18 Industrial Applications of Integer Programming  
SD19 Telecommunications  
SD20 Traveler Behavior Models  
SD21 Flows on Dynamic & Probabilistic Networks  
SD22 Moderated IT Outsourcing Negotiation  
SD23 Long-Term Aspects of Power Industry Performance under Competition  
SD24 Organization Science  
SD26 Queueing Models  
SD27 Simulation & Decision Making I  
SD28 Impact of Social Variables on Organizations Productivity  
SD30 Tutorial: New Advances Combining Optimization & Simulation  
SD31 System Reliability Engineering  
SD32 Topological Network Design Problems in Telecommunications  
SD33 Reliability & Quality Improvement  
SD34 Convex Optimization & Network Flows  
SD35 Tutorial: Using Commercial Software & Experiential Learning to Teach the First MS Course  
SD36 Panel: OR/MS Women on their Way to Administrative Roles  
SD37 Soft OR & Education  
SD40 Software Demonstration I

**Sunday 16:45-18:00**

- SO41 Omega Rho Distinguished Plenary: Aviation Safety in Numbers

**Monday 08:15-09:45**

- MA01 Decision Analysis Society Practice Award Finalist Presentations  
MA02 Combinatorial Optimization & Integer Programming  
MA03 Supply Chain Games  
MA04 Economic Theory  
MA05 MCDM I  
MA06 Managing Supply Chain Inventory under Demand Uncertainty  
MA07 Forecasting & Logistics Efficiency  
MA08 Optimization of Freight & Fleet Management I  
MA09 Inventory Management I  
MA10 Using Metacomputing Environments to Solve Optimization Problems  
MA11 Tutorial: Stochastic Methods for Practical Global Optimization  
MA12 Modeling Repeat Purchases  
MA13 Corporate Image & Social Responsibility  
MA14 Technological Disruption, Destruction & Dislocation  
MA15 Best Dissertation Award Winners  
MA16 No Title Supplied  
MA17 Job Scheduling  
MA18 Discrete Optimization  
MA19 New Developments in Discrete Optimization  
MA20 Traffic Flow Theory & Prediction  
MA21 Dynamic Traffic Assignment III

- MA22 IT Outsourcing Negotiation Debrief  
MA23 Issues in Natural Gas  
MA24 Health Care Management  
MA25 Optimization Theory I  
MA26 Web Server Performance  
MA27 Simulation & Decision Making II  
MA28 The Operations Research Paradigm & Social Sciences  
MA29 Software Demonstration II  
MA30 Theoretical & Experimental Analysis of Scheduling Problems  
MA31 Software Reliability Research  
MA32 Pricing Telecommunications Networks  
MA33 Statistical Experimental Design for Industrial Applications  
MA34 No Title Supplied  
MA35 Tutorial: Medical Informatics  
MA36 Operations Management III  
MA37 A Roundtable Discussion on Academic Centers for Applied OR/MS  
MA39 Modal Perspectives on Transportation Logistics  
MA42 Dantzig Dissertation Award Finalist Presentations

**Monday 10:45-11:45**

- MP41 Plenary: The New Frontier: OR for Next Generation Telecommunications

**Monday 13:15-14:45**

- MC01 Risk & Preferences in Space Missions  
MC02 Deterministic Machine Scheduling  
MC03 Emerging Research on Environment & Operations  
MC04 Game Theory  
MC05 MCDM II  
MC06 Research Related to Telephone Call Centers  
MC07 Product Variety Management  
MC08 Optimization of Freight & Fleet Management II  
MC09 Inventory Management II  
MC10 Complementarity Problems & Applications  
MC11 Tutorial: Deterministic Global Optimization: Algorithms & Applications  
MC12 Marketing Applications of Economic Models  
MC13 Modeling Consumer Demand  
MC14 Modularity  
MC15 Advances in Technical Entrepreneurship & Innovation Management  
MC16 Robust Methods for Decision Making with Asset Modeling Systems  
MC17 Production Planning & Worker Scheduling  
MC18 Applications of Discrete Optimization  
MC19 Mixed Integer Programming & its Applications  
MC20 Static Traffic Assignment I  
MC21 Modeling Dynamic Networks  
MC22 Litigation & Litigation Avoidance in IT Outsourcing Contracts  
MC23 Petroleum Logistics I  
MC24 Risk-Adjusted Outcome Assessment of Provider Performance  
MC25 Optimization Theory II  
MC26 Queueing Models for Communication Systems  
MC27 New Developments in Simulation & Applications  
MC29 Software Demonstration III  
MC30 Loosely Coupled Components Project: Map-Based Military Planning  
MC31 Quality Management I  
MC32 Control of Priced Telecommunications Networks  
MC33 Optimizing Multiple Quality Characteristics  
MC34 Information Systems Outsourcing: Factors & Effects  
MC35 Dantzig Fest I  
MC36 Operations Management IV  
MC37 INFORMS Case & Teaching Materials: Dialog with Instructors & Prospective Authors

**MC39 Rail Operations Planning****Monday 15:00-16:30**

- MD01 As Time Goes By: Environmental Decision Analysis Models with Intertemporal Components  
 MD02 Approximating Integer Packing & Covering Problems  
 MD03 E-Commerce & Supply Chain Management  
 MD04 Economics & Game Theory Applications  
 MD05 Wagner Prize  
 MD06 Work-Sharing Systems  
 MD07 Scheduling & Optimization in Manufacturing Logistics  
 MD08 Retail Supply Chain Management  
 MD09 Inventory Management III  
 MD10 Analytic Central Paths for Linear Programming & Complementarity  
 MD11 Tutorial: Continuous Approaches to Discrete Optimization Problems  
 MD12 Marketing Plenary: Marketing Science - Accomplishments & Challenges in the Global Information Age  
 MD13 Marketing I  
 MD14 Distinguished Speaker Session  
 MD15 Publishing in Technology Management Journals: Editors Forum I  
 MD16 Airline Passenger Revenue Management  
 MD17 Production Planning I  
 MD18 Network Flows: Techniques & Applications  
 MD19 Combinatorial Optimization Problems  
 MD20 Static Traffic Assignment II  
 MD21 Routing, Control & Planning Algorithms for Transport Systems  
 MD22 Internet Applications  
 MD23 Petroleum Logistics II  
 MD24 Managing Hospital Operations: Capacity, Cost-Effectiveness, Inventory & Scheduling  
 MD25 Optimization Theory III  
 MD26 Markov Decision Processes  
 MD27 Spreadsheets & OR/MS  
 MD28 Decision Technology in SCM in Semiconductor Industry Applications: Best Can Do  
 MD29 Software Demonstration IV  
 MD30 Simulation Applications II  
 MD31 Quality Management II  
 MD32 Intelligent Agents in Electronic Markets  
 MD33 Metamodels for Computer-Based Design I  
 MD34 No Title Supplied  
 MD35 Dantzig Fest II  
 MD36 Effectiveness of University-Industry Cooperative Research  
 MD37 INFORMS' First Case Competition: An Introduction to the Competition Rules  
 MD38 Production Planning V  
 MD39 Cognitive Aspects of Planning & Scheduling Support II

**Monday 16:45-18:00**

- ME41 Edelman Plenary: Extended Enterprise Supply Chain Management at IBM Personal Systems Group & Other Divisions

**Tuesday 08:15-09:45**

- TA01 Decision Analysis Awards  
 TA02 Methods for 0-1 Programming Problems  
 TA03 Buyer-Supplier Interactions in a Supply Chain  
 TA04 Economics Applications  
 TA05 Location Models I  
 TA06 System Dynamics in Service & Operations Management  
 TA07 Manufacturing Logistics Applications  
 TA08 Military Logistics  
 TA09 Inventory Management IV  
 TA10 Simulation-Based Optimization  
 TA11 Applications of Optimization in the Process Industry

- TA12 Marketing Strategy  
 TA13 Structural Models  
 TA14 Evolving Issues of New Technologies  
 TA15 Publishing in Technology Management Journals: Editors Forum II  
 TA16 Airline Forecasting & Cargo Revenue Management  
 TA17 Production Planning II  
 TA18 Boolean Functions & Generalizations  
 TA19 Transportation Forecasting  
 TA20 Space Shuttle Upgrades  
 TA21 Airline Crew Scheduling  
 TA22 Information Systems  
 TA23 Modeling Competition in Electricity Supply  
 TA24 Modeling Health Care Operations  
 TA25 Optimization Theory Potpourri  
 TA26 Queues with Heavy-Tailed Input and/or Service  
 TA27 Dynamic Programming Approximations  
 TA28 Core Techniques to Match Assets with Demand in the IBM Microelectronics SCM Process  
 TA29 Software Demonstration V  
 TA30 Tutorial: Collaboration Mechanisms for Autonomous Software Agents  
 TA31 Stochastic Maintenance & Production/Inventory Models  
 TA32 Pricing Data Communication Networks  
 TA33 Metamodels for Computer-Based Design II  
 TA34 No Title Supplied  
 TA35 Tutorial: Maximizing Shareholder Wealth for Large Financial Companies: Integrated Financial Planning  
 TA36 Teamwork & Innovation Management  
 TA37 Panel: Philosophies of Teaching OR/MS in MBA Programs  
 TA42 Threats to Life & Limb

**Tuesday 10:00-11:30**

- TP41 Plenary: The Next Era of Medical Education & Health Care

**Tuesday 13:00-14:30**

- TC01 Panel: Decision Analysis: Where do We Go from Here?  
 TC02 Discrete Optimization: Theory & Applications  
 TC03 Retail Operations  
 TC04 Industry Studies  
 TC05 Location Models II  
 TC06 Panel: Industry-University Partnerships in Enterprise Resource Planning  
 TC07 Distributed & Game Theoretic Models in Manufacturing Logistics  
 TC08 Planning & Scheduling Models for Supply Chain Management  
 TC09 Supply Chains I  
 TC10 Tutorial: Financial Applications of Stochastic Optimization  
 TC11 Optimization Applications to Supply Chain Management I  
 TC12 Product Strategy  
 TC13 Disaggregate Models of Innovation Diffusion  
 TC14 Advances in Business Gaming Simulations  
 TC15 Genetic & Neural Programming  
 TC16 Energy Revenue Management  
 TC17 Production Planning III  
 TC18 Binary Optimization  
 TC19 Forecasting Applications  
 TC20 Airline Delays  
 TC21 Transportation Planning  
 TC22 Information Systems Applications  
 TC23 Designing Electricity Auction Markets  
 TC24 Efficiency Measurement in Health Care  
 TC25 Combinatorial Optimization Applications  
 TC26 Applied Probability Numerical Algorithms for Telecommunication Systems  
 TC27 Applications of Adaptive Markovian Decision Processes

- TC28 Demand Forecasting Applications & Decision Technology  
 TC29 Software Demonstration VI  
 TC30 Tutorial: Intelligent Agents for Routing & Scheduling Problems  
 TC31 Life Testing & Inspection  
 TC32 Pricing Communication Networks  
 TC33 Recent Work in Statistical Process Control  
 TC34 Electronic Commerce  
 TC35 Tutorial: An Introduction to SAP R/3  
 TC36 Knowledge Transfer across Boundaries  
 TC37 Panel: What do Practitioners Want in New or Recent Graduates?  
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**Tuesday 14:45-16:15**

- TD01 Decision Engines & their Drivers  
 TD02 Industrial Applications of Discrete Optimization  
 TD03 Incentives in Operations Management  
 TD04 Web-Enabled Organizational Decision Environment  
 TD05 Location Models III  
 TD06 Sequencing in Flexible Flow Systems  
 TD07 Planning & Coordination of Design, Manufacturing & Overhaul Activities  
 TD08 Logistics I  
 TD09 Supply Chains II  
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 TD14 Building Technological Capabilities Multiple Perspectives  
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 TD20 Some Graphical Interfaces for Mathematical Programming  
 TD21 Transportation Topics I  
 TD22 Global Inventory & Logistics: Industry Issues  
 TD23 Energy & Environmental Policy Modeling  
 TD24 Modeling Health Applications  
 TD25 Global Optimization  
 TD26 Stochastic Processes Applications I  
 TD27 DP Methodology  
 TD28 Core Techniques to Match Assets with Demand in the Chesapeake Decision Sciences Toolkit  
 TD29 Software Demonstration VII  
 TD30 Information Technology Support for Knowledge Networking  
 TD31 Fatigue & Reliability of Materials  
 TD32 Network Analysis & Design  
 TD33 Statistical Control for Industrial Systems  
 TD34 Uncertainty in IT  
 TD35 Tutorial: Management of Technology: What has Been (& Can Be) Learned from Research in Industrial Organization?  
 TD36 The Role of Managerial Accounting in Managing R&D/New Product Development Processes  
 TD37 Panel: Best Cases  
 TD38 SQP Methods for Nonlinear Programming

**Tuesday 16:30-18:00**

- TE01 Decision Analysis Arcade  
 TE02 Discrete Optimization Methodology I  
 TE03 Issues in Production & Inventory Control  
 TE04 Tutorial: Theory & Application of the AHP  
 TE05 Location Models IV

- TE06 Investment Decisions in Flexible Manufacturing Systems  
 TE07 Industrial Manufacturing Logistics Problems  
 TE08 Logistics II  
 TE09 Supply Chains III  
 TE10 Optimization Prize for Young Researchers  
 TE11 Computational Mixed Integer Programming  
 TE12 Marketing Plenary: Fundamental Issues & Directions for Marketing  
 TE13 Marketing II  
 TE14 Managing New Product Development  
 TE15 Artificial Neural Net Applications  
 TE16 New Frontiers in Revenue Management  
 TE17 Replenishment Problems  
 TE18 Combinatorial Optimization Potpourri  
 TE19 Fluid Models  
 TE20 Military Aviation Applications  
 TE21 Transportation Topics II  
 TE22 Product & Process Development: Methods & Models  
 TE23 Environment  
 TE24 Health Applications  
 TE25 Network Flows  
 TE26 Stochastic Processes Applications II  
 TE27 DP Applications  
 TE28 Changing Decision Technology Paradigms as a Result of E-Business  
 TE29 Software Demonstration VIII  
 TE30 Modeling Systems for Constraint Logic Programming  
 TE31 Visualization of Reliability Data  
 TE32 Knowledge Networking for Telecommunications Management  
 TE33 Recent Advances in Statistical Quality Improvement  
 TE34 Knowledge Management  
 TE35 Tutorial: Retail Operations  
 TE36 Probability Distributions & Stochastic Processes Applications  
 TE37 Integrating OR/MS & Marketing in the Classroom  
 TE38 Nonlinear Programming & Complementarity Problems

**Wednesday 08:30-10:00**

- WA01 Tutorial: Design System Failure Away with Systems Engineering & Decision Analysis  
 WA02 Discrete Optimization Methodology II  
 WA03 Power Generation under Restructuring  
 WA04 The Future of Decision Computation  
 WA05 Location Models V  
 WA06 FMS Issues  
 WA07 Planning for Nonstationary Uncertain Demand  
 WA08 Manufacturing Applications I  
 WA09 Supply Chains IV  
 WA10 Technology Management Issues in China  
 WA11 AI & OR  
 WA12 Empirical Game Theory Models  
 WA13 Marketing III  
 WA29 Transportation Topics III  
 WA30 Economics & Computation in Electronic Commerce  
 WA31 Service Reliability  
 WA32 Telecommunication System Operation & Design  
 WA33 Multivariate Statistics for Process Monitoring, Control & Adjustment  
 WA34 Chaos & Complexity  
 WA35 Developing Requirements for Models & Simulations  
 WA36 Multiobjective Programming  
 WA37 Panel: The Ups & Downs of Multiple Site Student Collaboration Projects  
 WA38 Forecasting III

**Wednesday 10:15-11:45**

- WB01 New Products & Technology Management  
 WB02 Discrete Optimization Applications

WB03 Restructured Power Markets  
 WB04 Decision Support Applications & Prostate Cancer  
 Screening & Treatment  
 WB05 Location Analysis  
 WB06 Flexible Manufacturing  
 WB07 Modeling Correlations in Performance Analysis  
 WB08 Manufacturing Applications II  
 WB09 Supply Chains V  
 WB10 Machine Learning Applications  
 WB11 Optimization Applications to Supply Chain Management  
 III  
 WB12 Game Theory in the Lab  
 WB13 Marketing IV  
 WB29 Optimization Applications I  
 WB30 Tutorial: Data Warehousing & OLAP for Decision  
 Support  
 WB31 Statistical Inference for Multiple Change Point Models  
 WB32 Telecommunication System Design I  
 WB33 Statistics Applications  
 WB34 Web Commerce  
 WB35 Tutorial: Preference Function Modeling  
 WB36 Multiobjective Applications & Theory  
 WB37 Optimization Theory IV  
 WB38 Tutorial: Recent Performance Improvements in CPLEX

### Wednesday 12:30-14:00

WC03 Fossil Fuel Applications  
 WC04 DSS Applications  
 WC05 Tardiness Modeling  
 WC06 Multiple Machines  
 WC07 Performance Analysis of Manufacturing Systems  
 WC08 Plant Layout  
 WC09 Scheduling Applications  
 WC10 Artificial Intelligence Applications  
 WC11 Operations Management V  
 WC12 Marketing V  
 WC29 Optimization Applications II

WC30 Computational Advances in Discrete & Non-Convex  
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 WC31 Nonparametric Reliability Models  
 WC32 Telecommunication System Design II  
 WC33 Statistical Quality Control  
 WC34 INFORMS Members in the Press  
 WC35 Tutorial: Supply Chain Design & Analysis using the  
 SCOR Method  
 WC36 Decision Support Systems  
 WC37 Enterprise Wide Project Control Techniques  
 WC38 Optimization Modeling in Practice I

### Wednesday 14:15-15:45

WD03 Complementary Models of Gas & Electricity Markets  
 WD04 Economics Applications II  
 WD05 Portfolio Analysis II  
 WD06 Supply Chains V  
 WD07 Logistics III  
 WD09 General Decision Analysis  
 WD10 Product Optimization  
 WD11 Optimization Theory & Application  
 WD12 Technology & Innovation Management III  
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 WD30 Forecasting II  
 WD31 Postal & Parcel Systems Planning  
 WD32 Models in Telecom Services Management  
 WD33 Telecommunication Topics II  
 WD34 Applied Probability & Stochastic Processes  
 WD35 Operations Management VI  
 WD36 Project Scheduling & Analysis  
 WD37 Energy & Environment Optimization  
 WD38 Optimization Modeling in Practice II

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**SALT LAKE CITY**  
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## (HOW TO GET THE MOST VALUE) FROM AN INFORMS MEETING

Welcome to the INFORMS Meeting. We describe how you can get the most value from an INFORMS meeting and from this program. It is designed for first-time attendees at an INFORMS meeting but others should also find it useful. INFORMS meetings and this program can be confusing and the INFORMS and local meetings committees want the meeting to be a rewarding experience for you.

### Why People Attend

The primary activity at an INFORMS meeting is to present professional work. We offer suggestions on how to get the most value out of the sessions. There are other reasons to attend the meeting and we describe how to make the meeting as valuable as possible for these purposes, which may include: networking with colleagues; recruitment; meeting with colleagues in a specialty (subdivision); displaying or exploring exhibits; meeting with a small number of colleagues on a specific topic; learning from other types of sessions, i.e., tutorials and panels; other activities, i.e., plant tours.

### Networking

**Informal Discussions:** Networking is probably the major reason why many people attend an INFORMS meeting. The major means of networking are informal discussions in the common areas between sessions, during the lunch break and after the daily set of sessions. There are usually one or two areas at the conference where attendees mingle, usually near the registration area or near the exhibits. Our members will often spend time in these areas for the simple purpose of finding colleagues. Other networking locations are around the coffee break locations.

**General Reception:** Another major means to network is at the General Reception on Monday

night, the major social meeting of conference. Generally, at least half of the attendees come to the general reception. Hors d'oeuvres are served buffet style and cash bars are set up with ample space to mingle and speak with friends and colleagues.

**Business Meetings:** The business meetings are another means to network. These are the meetings of INFORMS subdivisions, such as Manufacturing and Service Operations Management. Within these subdivisions, members develop strong professional relationships. The subdivision business meetings are held Sunday, Monday and Tuesday after the regular sessions and are a combination of business and socializing. The meetings provide an excellent way to meet colleagues with mutual interests and to join the "loop" of the subdivision.

### Exhibits

The exhibit hall offers the chance to see recent publications and software. Vendors are eager to provide promotional copies and support to academics who are thinking about using their materials in their courses.

### Program

Of course, the most important part of an INFORMS meeting is the professional program, and it is important to understand how the sessions and program are put together. Most meetings have a professional theme that many of the sessions are aligned with. Building on this theme, the local committee puts together a professional program based on three primary types of sessions: invited sessions, sponsored sessions and contributed sessions. Invited sessions are planned by the local programming committee and can be geared towards the theme of the meeting. Sponsored sessions are organized by the subdivisions; these can also be considered invited in that a session chair appointed by the committee invites each

## **INFORMS Philadelphia**

speaker. Finally, contributed sessions consist of papers submitted by authors directly to the INFORMS office in response to the Call for Papers. All papers are accepted for these sessions.

Invited sessions are organized into groups of sessions known as clusters. The clusters are generally related topics and are the basis from which the meeting planners develop the professional program. These clusters are in turn related to the theme. The clusters are of interest to attendees as they define topic areas that they may be interested in. To facilitate planning, individual sessions from these clusters are scheduled in one or more tracks. A track is a collection of sessions that meet in the same room throughout the conference. To find out more about the availability of sessions in a cluster, refer to the Master Track Schedule to determine the days and times during which a cluster is scheduled and the number(s) of track(s) containing the cluster of interest.

While there are many sessions at the conference, popular sessions such as some tutorials may fill up quickly. It is best to arrive early. The technical sessions are also an excellent place to network, as there is time after each session to speak with presenters and request papers. It is a good idea to bring an ample supply of business cards with you.

### **Master Track Schedule (Matrix)**

The Master Track Schedule is an overall view of the program. Tracks are listed in the left-hand column; regular session times are listed across the top. Each regular session lasts approximately 90 minutes. There is one track per room. There can be one or more cluster topic per track. One can see from the track schedule which tracks and their corresponding topics might be of interest. While a track might consist of more than one topic and some related topics can appear in different tracks, the tracks are a useful way to navigate the program.

### **Special Sessions**

The program includes a number of special sessions. A plenary talk is given on a topic of broad interest to the membership and is the only presentation scheduled for a particular time period. Every meeting also has a number of tutorials, usually with a single speaker, devoted to a single topic. A tutorial gives an overview of the topic with a focus on the state-of-the-art knowledge or practice in the area. They are generally popular and well attended. A panel is developed to topics for discussion with several experts. They can involve or any other topic where the interaction will be useful to attendees.

### **Session Codes**

The main body of the program lists the details of the tracks in chronological order. Each session is identified by a code to identify the day, session time and slot. A paper is referred to by this code and indicates the order it is to be presented in the session. For example, MA02.3 is the Monday session, time slot A, track 02 and the third presentation. This code appears directly before the paper title and is also used to identify presentations in the Participant Index at the back of the program.

In the body of the program, sessions are listed by day and time with the title of the session, the sponsor or cluster, the type of session and the room where the session is held. The session chair's name, affiliation, mailing address and email address are then indicated, followed by the title and authors of each presentation. The lead author's information will include affiliation, mailing address and email address and co-authors are listed by name only.

### **Front Material**

Many of the special sessions, such as the tutorials and plenary or keynote presentations, are described in further detail in the front material pages. It is useful to review this material. The front material also contains subdivision meeting schedules, details about the host city and hotel and information on the social functions. A hotel floor plan is included in the final program; this is crucial in navigating your way through the meeting.

### **Indexes**

The program includes a participant index listing the speakers alphabetically and giving the session codes for each of their presentations. There is also a program index listing each session title for its particular session time.

### **Addendum**

Be aware that there are a number of late changes to the program. The final program is sent to the printer several weeks before the meeting to allow time for printing and shipping to the meeting site. Additions, changes and withdrawals received after the final program is printed are listed in chronological order in the addendum that is distributed with registration materials.

### **INFORMS Online**

The meetings programs are also available on INFORMS Online (<http://www.informs.org>). You can identify specific sessions and print them out in an individual, customized program, search sessions using keywords and in general, map out your

particular meeting plans at a more sophisticated level. It is important to try to plan as much as possible before you arrive at the meeting. Like many other endeavors, the value you get out of a

meeting will depend on the effort you put into it. To this end, we recommend reviewing the program and technical sessions in advance. Navigating the meeting will then be an easy task.

**CALENDAR OF FUTURE INFORMS MEETINGS**

**JANUARY 5 – 7**

**INFORMS Computing Society**

**Westin Regina Cancun**

Cancun, Mexico

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**MARCH 5 – 8**

**INFORMS Telecommunications Conference**

**Sheraton Boca Raton**

Boca Raton, Florida

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**MAY 7 – 10**

**INFORMS Salt Lake City Spring 2000**

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**JULY 3 – 7, 2000**

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**NOVEMBER 5 – 8, 2000**

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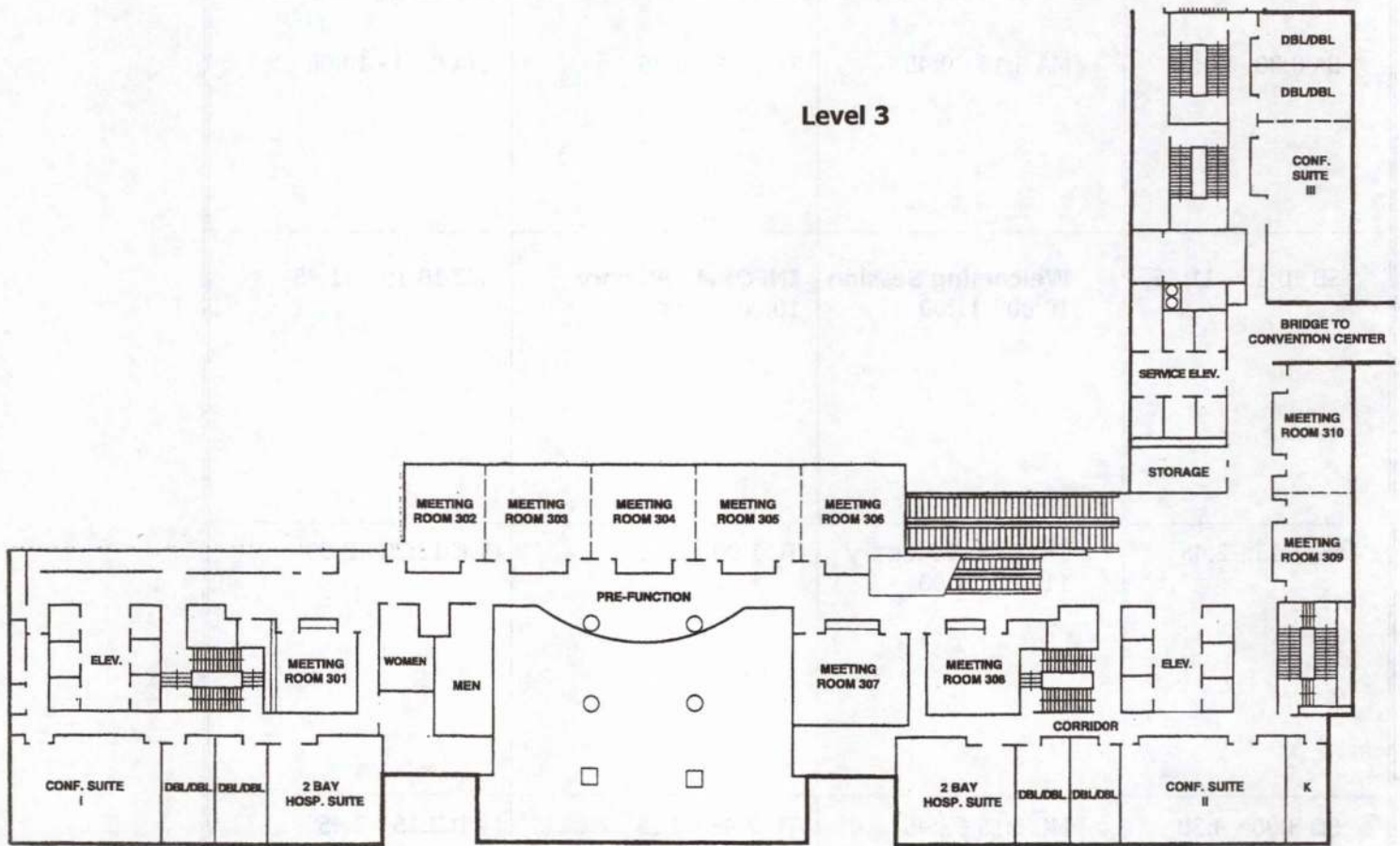
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SUNDAY	MONDAY	TUESDAY	WEDNESDAY
SA 8:30 - 10:00	MA 8:15 - 9:45	TA 8:15 - 9:45	WA 8:30 - 10:00
SB 10:15 - 11:45	<b>Welcoming Session</b> 10:00 - 11:00	<b>INFORMS Plenary</b> 10:00 - 11:30	WB 10:15 - 11:45
SC 1:15 - 2:45	<b>INFORMS Plenary</b> 11:00 - 12:00	TC 1:00 - 2:30	WC 12:30 - 2:00
SD 3:00 - 4:30	MC 1:15 - 2:45	TD 2:45 - 4:15	WD 2:15 - 3:45
<b>Omega Rho Plenary</b> 4:45 - 6:00	MD 3:00 - 4:30	TE 4:30 - 6:00	
	<b>Edelman Prize Plenary</b> 4:45 - 6:00		

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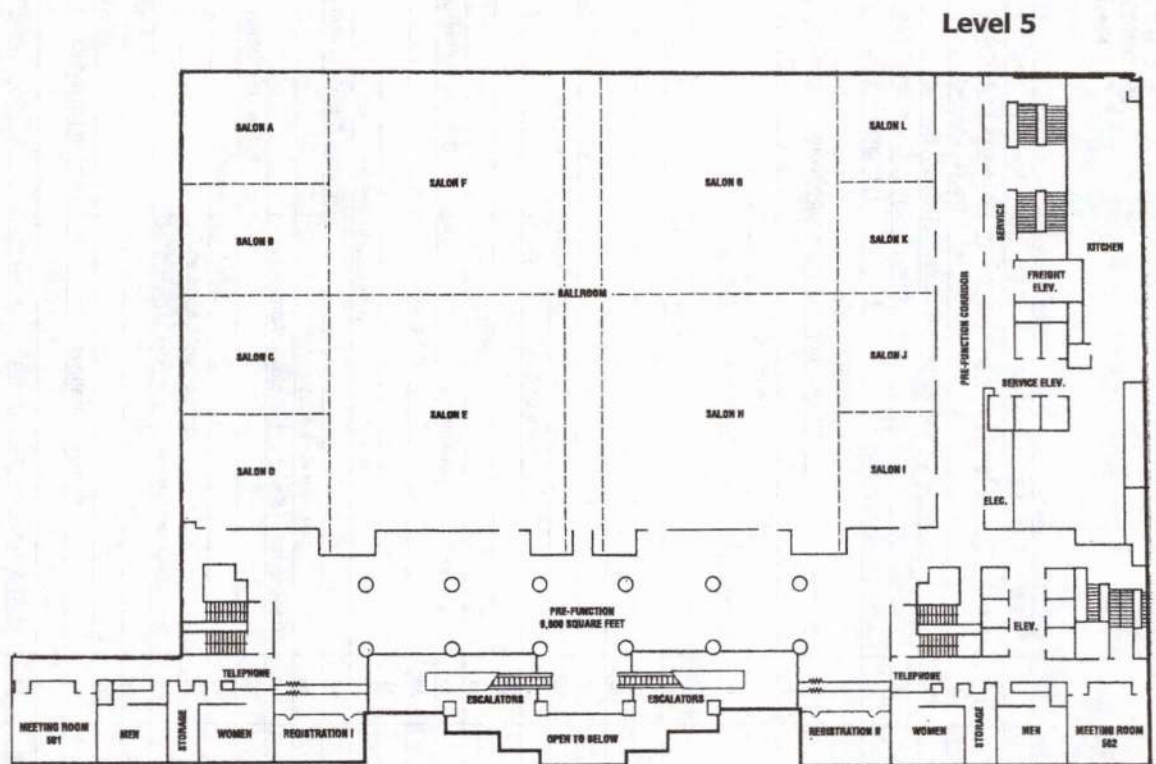
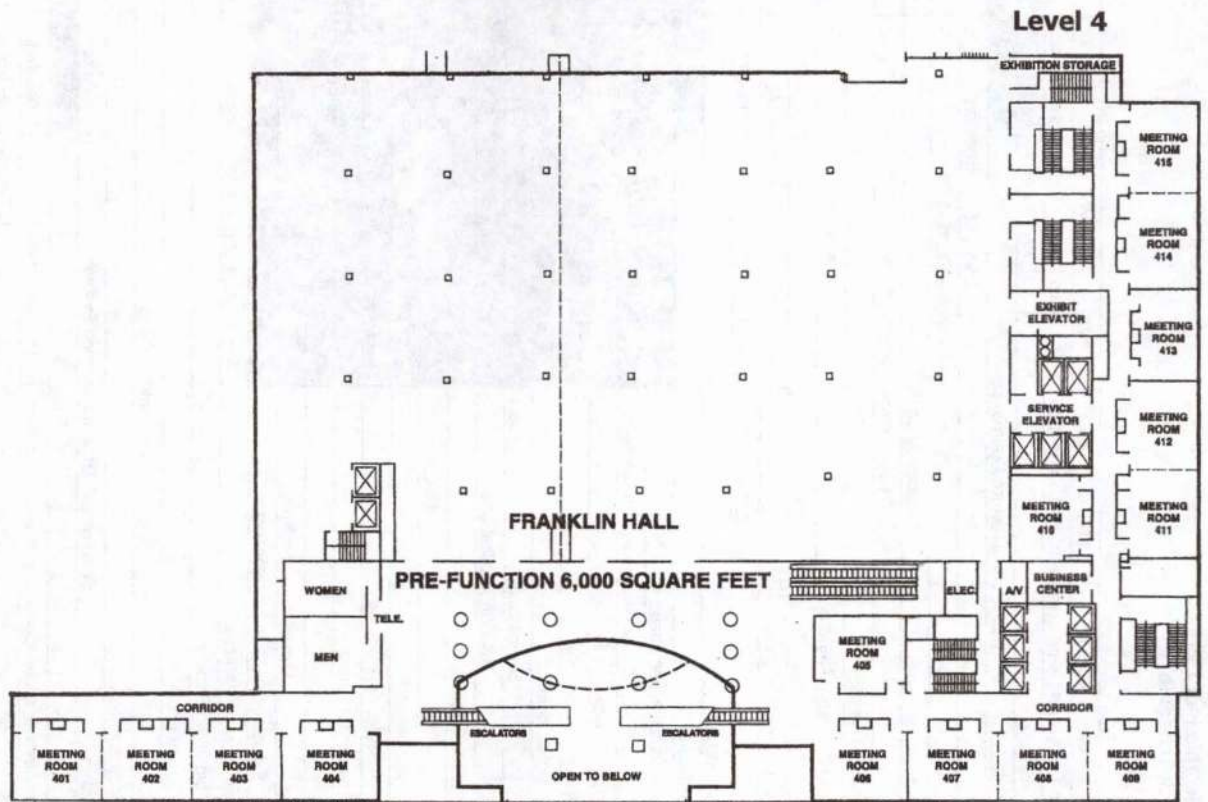


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Room	Track
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**INFORMS Philadelphia Fall 1999  
Master Track Schedule**

Room	Track	SA 8:30-10:00	SB 10:15-11:45	SC 1:15-2:45	SD 3:00-4:30	MA 8:15-9:45	MC 1:15-2:45	MD 3:00-4:30	TA 8:15-9:45	TC 1:00-2:30	TD 2:45-4:15	TE 4:30-6:00	WA 8:30 - 10:00	WB 10:15 - 11:45	WC 12:30 - 2:00	WD 2:15-3:45			
Salon I	1	Decision Analysis												New Products					
Salon J	2	Combinatorial Optimization & Network Flows						Discrete Optimization											
Salon K	3	Manufacturing & Service Operations Management						Energy & Environment											
301	4	Simulation Applications	Economic & Game Theory						Decision Technology & Support Systems						Econ. Apps.				
302	5	Decision Analysis						Tutorial	Location Analysis						P&S	Portfolios			
303	6	Discrete Opt.	Manufacturing & Service Operations Management						Flexible Manufacturing Systems						P&S	MSOM			
304	7	Manufacturing Logistics												Logistics					
305	8	Manufacturing Logistics			Logistics in Inventory Analysis						Manufacturing								
306	9	AI Apps.	Group Decisions & Negotiations			Logistics in Inventory Analysis						P&S	DA						
307	10	Applications of Optimization II						Tech. Mgmt.	College on AI			Opt. Apps.							
308	11	Global Optimization						Applications of Optimization I						Op. Mgmt.	Opt. Theory				
309	12	Marketing												TIM					
310	13	Marketing																	
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402	15	Technology & Innovation Management						Genetic Programming & Neural Nets											
403	16	Finance & Financial Services						Revenue Management											
404	17	Planning & Scheduling																	
405	18	Discrete Optimization																	
406	19	Constraint Programming			Discrete Optimization			Forecasting			Fluid Models								
407	20	Transportation Science						Aviation Applications											
408	21	Transportation Science																	
409	22	Information Systems						MSOM											
410	23	Energy & Environment																	
411	24	Health Care Management			Org. Sci.			Health Applications											
412	25	Transportation Science	Railroad Applications			Optimization (General)													
413	26	Applied Probability																	
414	27	Simulation Systems						Spreadsheets	Dynamic Programming										
415	28	Social Science Applications						E-Business & DT I Semiconductors											
502	29	Operations Management	Public Policy			Software Demonstrations						Transport.	Optimization Applications	Mgmt. of Tech.					
Salon C	30	INFORMS Computing Society												Forecasting					
501	31	Reliability & Quality Engineering												P&P					
Salon G	32	Telecommunications			Telecom Economics			Comp. Sci.			Telecommunications								
Salon L	33	Quality, Statistics & Reliability												Telecomm.					
Salon EF	34	Manufacturing Information Systems			Network Flow			College on Information Systems			State-of-the-Art in Information Systems			Press	App. Prob.				
Salon H	35	Tutorials						Dantzig Fest			Tutorials						Op. Mgmt.		
Salon A	36	DEA			Women			Operations Management			R&D Technology & Knowledge Management			App. Prob.	Decision Analysis	Dec. Tech.	Applications		
Salon D	37	INFORM-ED												Opt. Theory	Simulation	Opt. Apps.			
Salon B	38							Prod. Plng			CPMS			NLP			Forecasting	Computing Society	
203*	39							RR Applications			P&S								
Exhibit Hall	40							Soft. Demo											
Conference 1	42							Dantzig			Public Policy								

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