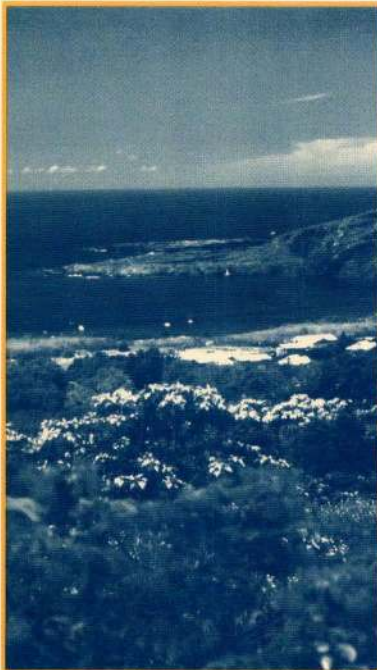


PROGRAM

informs Institute for Operations Research
and the Management Sciences

INFORMS International Hawaii **June 17-20, 2001**

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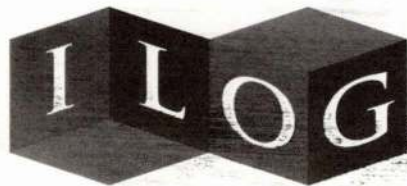
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*Hawaii
Organizing Committee*

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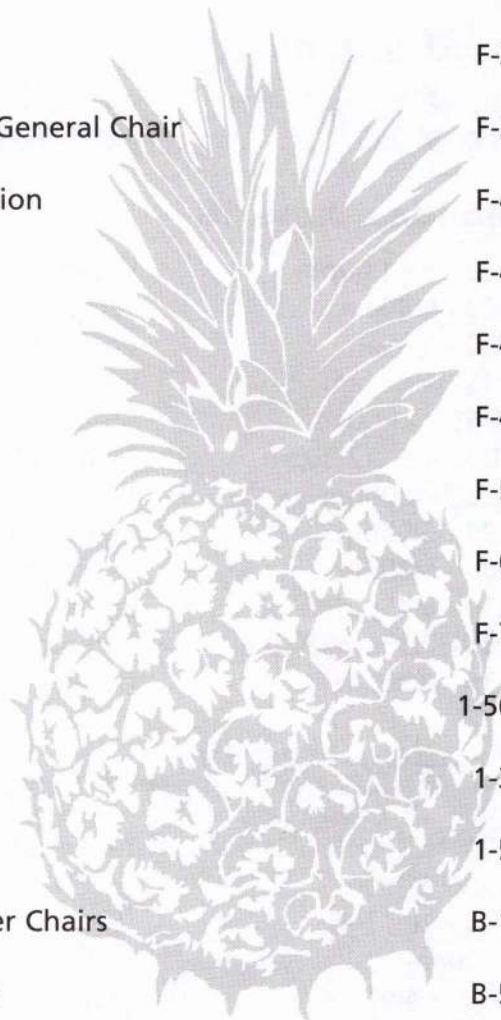
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Copies of papers abstracted in the program are available only from the authors. Requests for papers should be directed to the authors at the addresses shown in the program. Published by the Institute for Operations Research and the Management Sciences. Printed in the United States of America.

Program At A Glance

Innovative Daily Schedule

An innovative schedule of sessions has been planned to allow you to make the most of our Maui location. All sessions will be held at the Outrigger Wailea Resort. Technical sessions will be held in the mornings and again later in the day. This will leave much of the middle of the day free, allowing you to explore Maui between attending sessions.

Sunday, June 17

4:00 - 8:00pm	Registration
6:00 - 7:30pm	Welcome Reception

Monday, June 18

7:00am - 1:00pm	Registration
8:00 - 9:30am	Technical Sessions MA
9:30 - 9:45am	Coffee Break
9:45 - 10:45am	Invited Plenary: Louis Martin-Vega
10:45 - 11:00am	Break
11:00am - 12:30pm	Technical Sessions MC
12:30 - 4:00pm	Break - No Sessions
3:30 - 6:00pm	Registration
4:00 - 5:30pm	Technical Sessions MD
5:30 - 5:45pm	Break
5:45 - 7:15pm	Technical Sessions ME
7:30 - 9:30pm	General Reception

Tuesday, June 19

7:00am - 1:00pm	Registration
8:00 - 9:30am	Technical Sessions TA
9:30 - 9:45am	Coffee Break
9:45 - 10:45am	Omega Rho Plenary: William Pulleyblank
11:00am - 12:30pm	Technical Sessions TC
12:30 - 4:00pm	Break - No Sessions
3:30 - 6:00pm	Registration
4:00 - 5:30pm	Technical Sessions TD
5:30 - 5:45pm	Break
5:45 - 7:15pm	Technical Sessions TE

Wednesday, June 20

7:00 - 11:00am	Registration
8:30 - 10:00am	Technical Sessions WA
10:00 - 10:15am	Coffee Break
10:15 - 11:45am	Technical Sessions WB
11:45am - 12:00noon	Break
12:00noon - 1:30pm	Technical Sessions WC

INFORMS

The Institute for Operations Research and the Management Sciences, INFORMS, was created in January 1995 through the merger of the Operations Research Society of America, ORSA, and The Institute of Management Sciences, TIMS, both of which had been in existence for more than 40 years. Building on the foundation of the parent organizations, the merger has created a larger, stronger, more dynamic society of approximately 11,000 members dedicated to advancing the use of OR/MS methodologies. INFORMS' diverse membership base includes academics and practitioners from around the world, enabling both segments of the profession to interact with and learn from one another.

Through 10 leading professional journals, meetings, conferences and an online member service, INFORMS enables those working in OR, MS and related areas to keep up-to-date on a broad spectrum of research and application topics. Members working in quantitative disciplines such as decision systems and many other specialities are provided ample opportunity to research, discuss and publish in their area(s) of interest. They can also choose from among 36 special interest sections, 30 regional chapters and 45 student chapters. One annual INFORMS meeting a year, a new practitioner-oriented annual meeting, two international meetings every 3 years and a number of special interest meetings let INFORMS members stay current on research and practice in the dynamic OR/MS professions.

INFORMS

INTERNATIONAL HAWAII CONFERENCE
MAUI, HAWAII, USA · JUNE 17 - 20, 2001

June 17, 2001

Dear INFORMS Maui Attendees:

Let me be among the first to welcome you to the beautiful island of Maui: Aloha! I'll be greeting you personally at the Sunday evening Welcome Reception on the Pacific Terrace, the rooftop pavilion of the Outrigger Wailea Resort with a beautiful panoramic view of the Pacific Ocean.

The innovative scheduling, with sessions in the early morning and late afternoon, allows ample time for both work and play. We are very pleased to have both Louis Martin-Vega (from the National Science Foundation) and Bill Pulleyblank (from IBM Research) for our plenary speakers.

Our Monday evening General Reception, featuring foods with a tropical flavor, will be at the Luau Gardens, at the edge of the ocean. On Sunday, in addition to the late afternoon workshop by Paul Ranky, you can bike down Haleakala Mountain or hike around the rain forest or do many other things!

For the program committee, this is the culmination of all of our efforts. Please join me with great thanks to Zelda Zabinsky, Collette Coullard, Leon Lasdon, Jeff Arthur, and Ginni McGee. We are all particularly indebted to Ginni, without whom this meeting would not exist.

Sincerely,

Kathryn E. Stecke
General Chair, INFORMS Maui

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General Meeting Information

Audio-Visual Equipment

Each session room is set with an overhead projector and screen at no charge. Increasingly, speakers request computer projection (LCD panels) for Power-Point presentations. Because the rental cost for computer projectors is so expensive (about \$400 each), we must ask speakers to pay a discounted charge of \$45. The special AV equipment is moved from room to room based on advance orders. Arrangements for special equipment (slide projectors, computer projectors, etc.) should be made before the meeting. If you do order AV equipment on-site, please be aware that supplies are limited and some equipment may not be available. On-site requests for equipment cannot be honored at the discounted prices; speakers will be asked to pay full price.

Guidelines for Session Chairs

Each session lasts 90 minutes. The session chair should begin and end the session on time and let speakers know if time is running short. Each speaker should have an equal amount of time to present. If a speaker within your session is a "no show," the original time schedule should be adhered to rather than slide every talk forward. This allows for effective session jumping. Presentations should be made in the order listed in the program. A Session Attendance Form will be in each room. The session chair should fill out this form and leave it in the room.

Guidelines for Speakers

Pick up your final program, name badge and other registration materials at the INFORMS registration desk. Room names and the location of sessions will be listed in the final program only. Be on time for your session and check in with the session chair. Presentations should be limited to key issues with a brief summary. Bring clear, legible transparencies to use on the overhead projector. Time your presentation to fit within the designated time span, allowing for questions and audience participation. Speak clearly and be sure that you can be heard at the back of the room. Bring copies of your complete paper to distribute or provide a handout with details of your oral presentation.

Guests

All registered guests are invited to attend the Welcome Reception on Sunday evening and the General Reception on Monday evening.

Hospitality Desk

Drop by the hospitality desk in the registration area for information on local area restaurants, events or possible tours. It will be open from 4:00 - 8:00pm on Sunday and from 9:00am-1:00pm on Monday.

Registration

The registration fee includes admittance to all technical sessions, the Welcome Reception on Sunday evening, the General Reception on Monday and the Exhibit Area. Name badges must be worn to all INFORMS sessions and events. Lost badges can be replaced at the INFORMS registration desk. Meals are not included in the registration fee.

WORKSHOP

Virtual Concurrent and Multi-Lifecycle Engineering over the 3-D Internet

Paul G. Ranky, New Jersey Institute of Technology, Multi-Lifecycle Engineering Research Center
Sunday, June 17, 3:00-6:30pm
\$75

This optional, interactive workshop will present a virtual, collaborative, 3-D web-enabled concurrent engineering methodology, focusing on key processes, objects and their interactions. Dr. Ranky will also explore methods, tools and technologies that help to decide what information to disclose and in what format. Other topics include collaborative product commerce, an object-oriented requirements analysis method and an overview of virtual, collaborative software tool-sets that support developing virtual product demonstrations over the 3-D Web. Each workshop participant will receive 3 CD-ROMs and a learning pack with validated cases, examples and open source code.

Networking Social Events

Welcome Reception

Sunday, June 17, 6:00 - 7:30pm

The Pacific Terrace rooftop pavilion of the Outrigger Wailea hotel provides a spectacular setting for the Welcome Reception. Network with colleagues while taking in panoramic views of the Pacific Ocean.

General Reception

Monday, June 18, 7:30 - 9:30pm

This reception will feature foods with a tropical flavor and will take place on the Luau Gardens, right at the edge of the ocean.

A special feature of the Welcome Reception is a brief but informative and energetic island orientation, narrated by a native Islander, which will include the interesting history of beautiful Maui and the Hawaiian culture. You can learn a few Hawaiian words and get information on fun places to go, including nightlife, current activities, dining and sight-seeing suggestions.



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Duxbury/Thomson Learning publishes exclusively in the fields of statistics and quantitative methods for higher education and professional learners; includes textbooks and software for elementary and advanced study. Duxbury proudly announces new publications by Wayne Winston & S. Christian Albright, Robert Clemen & Terence Reilly, Jeremy Shapiro and S. Christian Albright.

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If you're looking for new opportunities to network with other OR/MS professionals, new tools for furthering your career or information on how to stay on the cutting edge of applications and research, stop by the INFORMS booth to talk with us about our current products and services. Find out about our latest offerings in local, national and international meetings, professional development, electronic and print media and more.

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On display will be our latest research books including Principles of Forecasting by J. Scott Armstrong and the new edition of the Encyclopedia of Operations Research and Management Science offered at a discount to attendees. Also on display will be sample copies of our prestigious journals including the new journal E-Commerce as well as Annals of OR and Queueing Systems. Please stop by!

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Chicago IL 60622
www.lindo.com

LINDO Systems will highlight recent solver enhancements and will announce our new callable library. We will also demonstrate LINDO - our powerful solver

Exhibitors

The exhibits will have a different look in Hawaii — we will have tabletop exhibits set up near both the INFORMS registration desk and the meeting rooms. The exhibit area will consist of a covered, open-air space — typical of Hawaii where you can work and be part of the tropical environment at the same time. The following companies will be onsite:

CIMware USA Inc.

226 Brookside Ave.,
Ridgewood NJ 07450
www.cimwareukandusa.com

Our exhibit will include Engineering Multimedia Case Studies for engineering, IT and management students and professionals, sponsored by more than 30 corporations. See the premiere of a multimedia sci-fi novel and the International Journal of CIM (Taylor & Francis). We are an IEE (London) endorsed professional engineering multimedia developer and an amazon.com Advantage Member Publisher.

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1515 Arapahoe St., #1311,
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Crystal Ball 2000 Professional Edition is a powerful, easy-to-use suite of risk analysis, optimization and time-series forecasting software that enhances your decision-making. Crystal Ball is a Microsoft Excel add-in that uses Monte Carlo simulation to manage uncertainty in spreadsheet modeling. Features include sensitivity and tornado analysis, correlation, distribution fitting to historical data and integration with optimization and time-series tools.

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Multistat, Inc.

One Pazzi, Irvine CA 92614;
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The Multistat exhibit includes 3 software products designed for multi-objective optimization, visualization and graphical analysis of multi-dimensional models: Optimizer™ is targeted for regression models and has model building functionality; ModelViewer™ is intended to analyze algebraic parenthetical expressions of any

complexity and ModelViewerBase™ is designed as a framework to visualize and optimize any numerical models.

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Plenary Presentations

Monday, June 18

9:45 - 10:45am Aulani Ballroom

PLENARY:

Engineering at the National Science Foundation

Louis A. Martin-Vega, NSF/Lehigh University
lmartinv@nsf.gov

Abstract: The presentation will provide an overview and update on the role of engineering at the NSF including its current guiding vision, major programs and new initiatives. The presentation will also provide a glimpse into the emerging technologies and concepts that are expected to have a major impact on engineering research and education over the next 20 years.



Biographical Sketch: Louis A. Martin-Vega is currently Acting Assistant Director for Engineering at the National Science Foundation (NSF) in Arlington, VA. With a budget of more than \$400 million, the Engineering Directorate at NSF supports a large variety of research and education programs across all the major engineering disciplines as well as many cross-disciplinary areas. Dr. Martin-Vega is currently on leave from

Lehigh University where he is a Professor in the Department of Industrial and Manufacturing Systems Engineering. He is a Fellow of the Institute of Industrial Engineers (IIE), a Fellow of the Society of Manufacturing Engineers (SME) and a member of INFORMS and ASEE. He also received the Albert Holzman Distinguished Educator Award from IIE in May 1999.

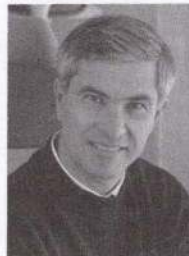
Tuesday, June 19

9:45 - 10:45am Aulani Ballroom

Omega Rho Distinguished Lecture: Parallel Computing & Integer Programming

William R. Pulleyblank, IBM Research,
wpr@watson.ibm.com

Abstract: The size of integer programming problems solvable on computers continues to increase, due to improvements in machine speed and size and also due to significant algorithmic improvements. Efficiently exploiting parallelism provides significant challenges, both for small-scale parallelism (tens of processors) and large scale parallelism (up to one million processors). This will be discussed with reference to several ongoing research activities, including the massive one petaflop Blue Gene computer, designed for completion in 2004.



Biographical Sketch: William R. Pulleyblank, the first International INFORMS Omega Rho speaker, is the Director of Exploratory Server Systems in IBM's Research Division and the Director of the IBM Deep Computing Institute. From 1995 to 2000 he was the Director of Mathematical Sciences. He has also served as the research relationship executive responsible for the financial services sector in IBM, the utility and energy services industry, and for the business intelligence group. Before joining IBM Research in 1990, Dr. Pulleyblank was the holder of the Canadian Pacific Rail/NSERC Chair of Optimization and Computer Applications at the University of Waterloo.

He is a member of the Mathematical Sciences Board of the NRC, the Board of Directors of iCORE, the External Advisory Board of DIMACS, the Advisory Council of the Pacific Institute for the Mathematical Sciences, the External Advisory Committee of the Center for Research on Parallel Computation, RUTCOR, Rutgers University International Conferences on Discrete Applied Mathematics and Operations Research International Advisory Board and member of the Scientific Advisory Panel of The Fields Institute for Research in Mathematical Sciences.

Dr. Pulleyblank's personal research interests are in OR, combinatorial optimization and applications of optimization. In addition to writing a number of scientific papers and books, he has consulted for several companies, including Mobil Oil on helicopter routing, Marks and Spencer on depot management, Statistics Canada on survey validation and CP Rail on train scheduling.



Invited Tutorials

MA11

Stochastic Integer Programming: Applications & Methods

Suvrajeet Sen,
University of Arizona, SIE Dept.,
Tucson, AZ 85721

SIP models are often used for tactical planning, i.e., scheduling, lot sizing, line balancing, etc. In recent years, there has been an increasing need to integrate strategic and tactical models. Because strategic decisions are often made before complete information is available, these integrated models often lead to SIP models. We will present several applications and discuss solution approaches.

MA19

So You Want to be an OR Consultant?

Harlan P. Crowder,
Hewlett-Packard Laboratories,
Palo Alto, CA 94304;
harlan_crowder@hp.com

An OR consultant needs two sets of skills and talents: those normally required by consultants such as client and communication skills and the analytic abilities to mathematically deconstruct and model complex business processes. We will see how the successful OR consultant intertwines these skills and talents to help solve client problems. Topics will include setting client expectations, value pricing and writing bullet-proof proposals.

MA21

Fixing an Ailing Air Traffic Control System

Norman T. Fujisaki,
Federal Aviation Administration, ASD-2,
Washington DC
norman.fujisaki@faa.gov

Current topics in ATC will be presented, including congestion and delays, system improvements and their efficacy and the outlook for future system performance and impact on the traveling public. A broad cross-section of current work and analytic capabilities will be summarized. Future obstacles and analytic challenges will be described.

MC12

Extended Enterprise Integration

Thomas Gullledge,
George Mason University, MS 2E4,
Fairfax, VA 22030-4444
gullledge@gmu.edu

The extended enterprise includes customers, suppliers and partners. This tutorial examines extended enter-



prise integration from an "engineering implementation consulting" perspective, focusing on technologies, standards and solutions. The presentation provides visibility into research areas that provide new problems and data for decision support models. To view the extended abstract, go to <http://www.eep.gmu.edu/presentations>.

MC19

OR/MS Tutorials on the WWW: An Overview of the IFORS tutORial Project

Moshe Sniedovich,
University of Melbourne, Dept. of Mathematics &
Statistics, Parkville, VIC, 3052, Australia,
m.sniedovich@ms.unimelb.edu.au

The WWW provides a tempting platform for the development of educationally rich and highly interactive teaching/learning tools for OR/MS subjects. However, such a development is beyond the reach of most individuals and departments. The IFORS tutORial project (www.ifors.org/tutorial/) addresses this issue. This presentation features a live demonstration of the project.

ME05**Collaborative Planning & Scheduling in Supply Chains in the Digital Economy***Michael Pinedo,*

NYU, Stern School of Business,
40 West 4 St., New York, NY 10012
mpinedo@stern.nyu.edu

Internet technology has had a fundamental impact on the way operations are conducted in supply chains. The optimization of operations in supply chains is now done on a more global scale. We discuss the problems that arise in the collaborative planning and scheduling of successive stages in supply chains.

TA05**Dynamic Pricing Strategies to Improve Supply Chain Performance***David Simchi-Levi,*

MIT, Dept. of Civil & Environmental Engineering,
77 Massachusetts Ave., Rm. 1-171,
Cambridge, MA 02139-4307
dslevi@mit.edu

Dynamic pricing techniques such as yield management have been successfully applied to a variety of industries, e.g., airlines or rental car agencies, with a focus on those that have perishable inventory. In this tutorial, we extend dynamic pricing techniques to a more general supply chain setting with nonperishable inventory. The focus is on coordinating pricing, production and distribution decisions in a multi-period environment.

TA18**The Logical Analysis of Data***Peter L. Hammer,*

Rutgers University, RUTCOR,
640 Bartholomew Rd., Piscataway, NJ 08854-8003
hammer@rutcor.rutgers.edu

LAD is a new combinatorial optimization and Boolean function theory-based methodology for data analysis. We shall present its theoretical foundations, describe an implementation and various applications, including a recent joint study with cardiologists from the Cleveland Clinic on mortality risk prediction for cardiac patients.

TC05**Inside Discrete-Event Simulation Software: How it Works & Why it Matters***Thomas J. Schriber,*

University of Michigan, School of Business,
Ann Arbor MI 48109-1234
schriber@umich.edu

This tutorial describes how discrete-event simulation software works. Topics include discrete-event systems;

entities, resources, control elements and operations; and entity management. The implementation of a generic model in several commercial languages is discussed. Examples are given of "why it matters" for modelers to know how their models work "deep down."

TC11**Constraint Programming for Math Programmers***Robert Fourer*

Northwestern University, Dept. of IE/MS,
2145 Sheridan Rd., Evanston, IL 60208-3119;
4er@iems.nwu.edu; <http://www.iems.nwu.edu/~4er/>

The commercial development of constraint logic programming methods is changing the way that people approach optimization modeling, especially for highly combinatorial problems. This survey addresses the implications of CLP from the standpoint of potential users whose backgrounds are in OR and whose experience is with conventional mathematical programming systems.

TC17**Storage Area Network Design**

Julie Ward & Mike O'Sullivan &
Troy Shahoumian & John Wilkes,
Hewlett Packard,
1501 Page Mill Rd., MS 4U-1
jward@hp.com

The SAN fabric design problem is to find a network of links, hubs and switches connecting hosts to storage devices to support data flow requirements between host-device pairs. This is a network design problem confounded by degree constraints and other technological issues. We describe several approaches to this problem.

TC20**Dynamic Programming: A Multi-Faceted View***Augustine O. Esogbue,*

Georgia Institute of Technology,
Intelligent Systems & Controls Lab., Sch. of ISyE,
Atlanta, GA 30332-0205
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We present dynamic programming from its multifarious aspects, starting with its inception to its modern day developments. We utilize a states space approach in unfolding both the fundamentals and computational aspects. We include dynamic programming models of the novel type such as non-serial, fuzzy and neuro-dynamic programming. Some fascinating applications are also briefly reviewed.

Monday 08:00-09:30**MA01 Optimizing Configure-to-Order Supply Chains**

Cluster: End-to-End Supply Chain Management
Invited Session

Chair: Grace Lin, IBM, TJ Watson Research Ctr., Rte. 134, Yorktown Heights, NY 10598, gracelin@us.ibm.com

1) **Advanced Demand Planning for Configure-to-Order Supply Chain in the Personal Computer Industry**, *Roger R. Gung*, IBM Corporation, TJ Watson Res. Ctr., Rte. 134, Yorktown Heights, NY 10598, rgung@us.ibm.com, *Akira Tajima*, *Grace Lin*

In response to the phenomenal change in the market environment of the PC industry, we developed an advanced demand planning system to project the demand statements of PC commodities. We developed a top-down approach to project the demand of both systems and building blocks. We incorporated correlation factors among building blocks, product life cycle information, parameters search algorithms, etc...

2) **Resource Allocation Models for the Configure-to-Order Product Environment**, *Thomas R. Ervolina*, IBM Corporation, TJ Watson Res. Ctr., Rte. 134, Yorktown Heights, NY 10598, ervolina@us.ibm.com

We present a formulation of the implosion problem for a CTO product environment. We also discuss special cases of the model to address varying degrees of product complexity. We focus on robustness and solvability of the models in a practical setting.

3) **Inventory-Service Optimization in a Configure-to-Order System**, *Markus Ettl*, IBM Corporation, TJ Watson Research Ctr., Rte. 134, Yorktown Heights, NY 10598, msctl@us.ibm.com, *Feng Cheng*, *Grace Lin*

We consider a CTO system in which customized products are assembled from a set of components that are built-to-stock. We develop a non-linear optimization model with multiple constraints to determine the best inventory policy to support different service level agreements for different customer segments. Numerical results are presented to investigate trade-offs between inventory and service levels across customer segments.

4) **Supply & Demand Planning in a Configure-to-Order Environment**, *Turgut Aykin*, IBM Global Services, 27 Commerce Dr., Cranford, NJ 07016, taykin@us.ibm.com

n manufacturing highly configurable products (e.g. data/voice networks), the set of components as well as the number of each component needed to build a product change from one order to another. We present a multivariate approach for forecasting and supply planning in a CTO system. The approach develops forecasts of orders, then determines the inventory requirements to meet the desired order fill rate target (specified by management)...

MA02 Models Arising from Manufacturing & Retailing Operations

Cluster: Supply Chain Management
Invited Session

Chair: Christopher S. Tang, UCLA, Anderson School, 110 Westwood Plaza, B501, Los Angeles, CA 90095, chris.tang@anderson.ucla.edu

1) **Inventory Allocation at a Semiconductor Company: Modeling & Optimization**, *Alexander O. Brown*, Vanderbilt University, Owen Grad. Sch. of Mgmt., 401 21st Ave. South, Nashville, TN 37203, alex.brown@owen.vanderbilt.edu, *Markus Ettl*, *Grace Lin*, *David D. Yao*

We develop a multi-echelon, multi-item inventory allocation model for use in the semiconductor industry. The problem is formulated as a constrained NLP so as to find the safety stock targets that optimizes a system-wide service measure subject to constraints on allowable inventory holding cost by echelon. We develop an efficient algorithm that finds the optimal solution.

2) **Distribution Strategies for Managing Direct & Store Sales Channels**, *Aydin Alptekinoglu*, UCLA, Anderson Sch., 110 Westwood Plaza, B501, Los Angeles, CA 90095, aalpteki@anderson.ucla.edu, *Christopher S. Tang*

Consider a retailer's problem of designing and managing a distribution system that delivers products to stores as well as to direct channel customers in an efficient manner. We model and analyze two alternative strategies where the demand fulfillment processes for the store and direct channels are either integrated or separated.

3) **Designing Supply Contracts: Contract Type & Information**

Asymmetry, *Charles J. Corbett*, UCLA, Anderson Sch. of Mgmt., 110 Westwood Plaza, B501, Los Angeles, CA 90095, charles.corbett@anderson.ucla.edu, *Christopher S. Tang*, *Deming Zhou*

We investigate a supplier's pricing problem when the buyer's cost structure is not known, the supplier can generally not achieve first-best. We compare obtaining additional information about the buyer's cost structure and offering more general (2-part or nonlinear) contracts. We also formally study the effect of allowing either side to break off the transaction if it is not sufficiently profitable.

4) **A Planning Tool for Brand Reconfiguration**, *Juin Kuan Chong*, National University of Singapore, Dept. of Dec. Sci., Fac. of Bus. Admin., Singapore, Singapore, jbacjk@nus.edu.sg, *Teck Ho*, *Christopher S. Tang*

We model how brand configuration affects brand choice in order to design a tool for the category manager to develop superior configurations for high-margin brands. We illustrate how a category manager can use our model to reconfigure a selected brand in order to achieve a higher brand share.

MA03 FMS & Supply Chain Flexibility

Cluster: Flexible Manufacturing Systems
Invited Session

Chair: Martin Starr

, mkstarr@attglobal.net

1) **Capacity & Inventory Sharing for Flexibility in a Supply Network**, *Amiya K. Chakravarty*, Tulane University, akc@tulane.edu, *Jun Zhang*

A supplier with spare capacity/inventory may trade with other suppliers at different geographical locations, who have unfilled demand. We consider a collaboration-agreement for increasing decision flexibility, where the parties trade capacity ex-ante and inventory ex-post. We characterize its equilibrium in terms of exchange prices and amount of capacity/inventory traded.

2) **Who Let the Cogs Out? (From Fitting Horseshoes to Flitting through Cyberspace)**, *Peter Norden*

What are the parameters of change in today's emerging manufacturing dynamics? Are we dealing merely with changes in the coefficients of traditional production models? Or are there fundamental differences in today's practices, processes, relationships, ownership, and limits? And what are the resulting challenges implied for the future?

3) **The Nucleus of an Application Service Provider in Telemanufacturing**, *Layek Abdel-Malek*, NJIT, Dept. of IME, Newark, NJ 07102, malek@adm.njit.edu

Lately, we have witnessed an unprecedented growth in the use of the Internet. Numerous activities have been facilitated utilizing the Web. Nevertheless, the e-shift has not been sufficiently implemented in manufacturing. Here, we present the nucleus of such an infrastructure. The application service provider of this infrastructure can be visited at www-ec.njit.edu/telemfg/.

4) **Toward a Decision Support System for Workflow Modeling using Petri Nets**, *Cheickna Sylla*, NJIT, Sch. of Mgmt., University Heights, Newark, NJ 07950, sylla@adm.njit.edu, *Mahmoud Yousseff*

Correct planning of workflow insures the efficient execution of operations during implementation. We present workflow planning at the early stages and its formulation using a Petri nets-type graph. We propose an algorithm to examine and minimize the effects of the system's disturbances and a framework for its implementation into a DSS.

MA04 Auctions in Scheduling

Sponsor: MSOM

Sponsored Session

Chair: Wedad Elmaghraby, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, welmaghr@isye.gatech.edu

1) **Winner Determination in Bandwidth Exchanges**, *Marta Eso*, IBM TJ Watson Research Center, Research Division, PO Box 704, Yorktown Heights, NY 10598, martaeso@us.ibm.com, *Yunyan G. Li*, *Jayant Kalagnanam*

We investigate the allocation problem faced by the market maker in a sealed bid exchange with periodic clearing, where the product traded has time as an attribute in addition to price and quantity. We consider several objectives for the market maker, including maximizing profit and/or traded volume.

2) **Distributed Resource Scheduling via Complex Auctions**, *Erhan Kutanoglu*, University of Arkansas, 4207 Bell Eng. Ctr.,

Fayetteville, AR 72701, erhank@engr.uark.edu

Distributed resource scheduling is an example of problems requiring coordination of several decision makers (agents). We illustrate how different auction schemes can be used to achieve this coordination. Starting with the generalized Vickrey-Groves-Clarke auctions, we analyze issues such as existence of equilibrium, incentive compatibility and budget balancing.

3) An Evolutionary Games Analysis of Bidding Strategies in a Scheduling Auction, Jeff MacKie-Mason, University of Michigan, Ann Arbor, MI 48109, jmm@umich.edu, **Michael P. Wellman**

When auctions are applied to complex scheduling problems, optimal bidding strategies typically cannot be found analytically. However, performance of the auction must be evaluated relative to bidding strategies. We develop an evolutionary game method to find successful strategy sets and evaluate proposed auctions against these strategies.

MA05 Factory Operations Research Center Program

Cluster: Semiconductor Manufacturing

Invited Session

Chair: John W. Fowler, Arizona State University, IE Dept., PO Box 875906, Tempe, AZ 85287-5906, john.fowler@asu.edu, www.eas.asu.edu/~masmlab/fowler/

1) An Overview of the Factory Operations Research Center (FORCe) Program, John W. Fowler, Arizona State University, IE Dept., PO Box 875906, Tempe, AZ 85287-5906, john.fowler@asu.edu, www.eas.asu.edu/~masmlab/fowler/

The Semiconductor Research Corporation (SRC) and International SEMATECH (ISMT) recently partnered to jointly sponsor the ISMT/SRC Factory Operations Research Center (FORCe). An overview of this program and the initial set of projects will be discussed.

2) Scheduling of Semiconductor Wafer Fabrication Facilities, Scott J. Mason, University of Arkansas, 4207 Bell Eng. Ctr., Fayetteville, AR 72701, mason@uark.edu, **John W. Fowler, Matt Carlyle**

The primary goal of our research effort is to develop solution methodologies for scheduling wafer fabrication facilities. We develop a disjunctive graph formulation of a complex job shop problem with extensions such as reentrant flows and batching. We also discuss subproblem solution procedures and rescheduling approaches.

3) New Approaches for Simulation of Wafer Fabrication, Gerald T. Mackulak, Arizona State University, Tempe, AZ 85287, **John W. Fowler, Lee Schruben**

Most fab simulations use a "job-driven" worldview. The speed of these simulations is a function of the number of wafers in the factory. Modeling resources as active and wafers as passive significantly reduces execution speed, but also reduces output resolution. We discuss limitations and performance metrics of this approach.

4) Incorporating Production Planning into Preventive Maintenance Scheduling in Semiconductor Fabs, Xiaodong Yao, University of Maryland, College Park, MD 20742, **Michael C. Fu, Steven I. Marcus, Emmanuel Fernandez**

PM is a vital activity in semiconductor manufacturing, crucial for maximizing wafer throughput in the fab. We propose a mathematical model for optimizing PM scheduling. A discrete-event simulation model is used to compare the policy derived from the model with currently implemented heuristic policies.

MA06 Scheduling Problems

Cluster: Production Scheduling

Invited Session

Chair: Chelliah Sriskandarajah, University of Texas at Dallas, Sch. of Mgmt., PO Box 830688, JO4.7, Richardson, TX 75083-0688, chelliah@utdallas.edu

1) Fast Algorithms for Scheduling Advertisements on a Web Page, Chelliah Sriskandarajah, University of Texas at Dallas, Sch. of Mgmt., PO Box 830688, JO4.7, Richardson, TX 75083-0688, chelliah@utdallas.edu, **Milind W. Dawande, Subodha Kumar**

Many web sites, e.g. Hotmail, Yahoo, etc., provide free services to users while generating revenue from advertising. Advertising revenue is, therefore, critical for these sites. The problem that these sites need to address is, in a given planning horizon, how to schedule advertisements at their site to maximize (or minimize) certain performance measures...

2) A Hybrid Genetic Algorithm for the Economic Lot Scheduling Problem, Ilkyeong Moon, Pusan National University,

Dept. of IE, Pusan, 609-735, Korea, ikmoon@hyowon.pusan.ac.kr, **Edward A. Silver, Sangjin Choi**

The ELSP is an important production scheduling problem that has been intensively studied over 40 years. Numerous heuristic algorithms have been developed since the problem is NP-hard. We provide a hybrid GA based on the time-varying lot sizes approach. Numerical experiments show that the hybrid GA outperforms Dobson's heuristic, which has been regarded as the best in its performance.

3) Workforce Planning in Synchronous Production Systems, George L. Vairaktarakis, Case Western Reserve University, Dept. of Operations, Cleveland, OH 44106, gxv5@po.cwru.edu, **Xiaoqiang Cai, Chung-Yee Lee**

We consider paced job shops where jobs are chains of operations, each processed by a specified work center and a known number of workers. The production horizon length is P ; a decision variable. We seek a schedule that minimize the linear function of costs associated with workforce size and length P of the horizon.

4) An Inventory Model for a Two-Stage Random-Yield Supply Chain, Metin Cakanyildirim, University of Texas at Dallas, Sch. of Mgmt., PO Box 830688, JO 47, Richardson, TX 75083-0688, metin@utdallas.edu, **Xiaong Yue**

We study a 2-stage supply chain under random yields in the upstream and random demands in the downstream. We provide a formulation to minimize the discounted expected costs and discuss the type of optimal policy and some monotonicity results.

MA07 Tutorial: The Principal-Agent Paradigm & its Applications in Operations Management

Cluster: Competition & Incentives in Operations Management

Invited Session

Chair: Stefanos Zenios, Stanford University, Grad. Sch. of Business, Stanford, CA 94305, stefzen@leland.stanford.edu

1) Tutorial: The Principal-Agent Paradigm & its Applications in Operations Management, Stefanos Zenios, Stanford University, Grad. Sch. of Business, Stanford, CA 94305, stefzen@leland.stanford.edu

The principal-agent paradigm, in which the principal has a primary stake in the performance of a system but delegates operational control of that system to an agent, has many natural applications in OM. We will review the classic static principal-agent model and provide a taxonomy of the main tensions captured by this model. Then we will present several dynamic extensions and present applications in supply chain management and service operations.

MA08 Enhancing Global Optimization Models & Algorithms

Cluster: Global Optimization

Invited Session

Chair: Hanif D. Sherali, Virginia Polytechnic Institute & State University, Dept. of ISE, 0118, Blacksburg, VA 24061-0118, hanifs@vt.edu

1) Enhancing RLT Relaxations via a New class of Semidefinite Cuts, Barbara M. P. Fraticelli, Virginia Polytechnic Institute & State University, Dept. of ISE, MC 0118, Blacksburg, VA 24061, **Hanif D. Sherali**

We propose a mechanism to tighten RLT-based relaxations for solving nonconvex problems by importing concepts from semidefinite programming, leading to a new class of semidefinite cutting planes. These cuts produce enhanced higher-dimensional LP relaxations. We illustrate this technique on a nonconvex quadratic program and provide promising computational results.

2) Global Optimization in Design under Uncertainty, C. A. Floudas, Princeton University, Dept. of Chemical Eng., Princeton, NJ 08544-5263, floudas@titan.princeton.edu, **Z. Gumus, M. G. Ierapepitroutou**

We present deterministic global optimization approaches for the feasibility test and the flexibility index problems for design under uncertainty. The bilevel nonlinear problems are transformed into single level ones by applying the basic principles of the B&B global optimization method. Several illustrative engineering design examples are presented.

3) Global Optimization of Two-Stage Stochastic Integer Programs, Shabbir Ahmed, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332, sahmed@isye.gatech.edu, **Mohit Tawarmalani, Nikolaos V. Sahinidis**

The highly non-convex nature of stochastic integer programs motivates the need for global optimization approaches. We develop a B&B-based global optimization algorithm for 2-stage stochastic integer programs with discretely distributed parameters. We devise specialized lower bounding and branching strategies and discuss finiteness issues.

4) Alternative Formulations & New Solution Algorithms for the Facility Layout Problem, Faiz A. Al-Khayyal, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, faiz@isye.gatech.edu, www.isye.gatech.edu/~faiz, *Marc Goetschalckx, Timothy Van Voorhis*

To avoid unrealistically long and narrow departments in the conceptual facilities design or block layout problem, nonconvex quadratic constraints are added to the standard linear mixed-integer formulation. We present several reformulations and linearization techniques so that the global optimal layout is found for much larger instances than previously reported.

MA09 Advances in Nonlinear Optimization

Cluster: Nonlinear Optimization
Invited Session

Chair: Michael L. Overton, NYU Courant Institute, 251 Mercer St., New York, NY 10012, overton@cs.nyu.edu, www.cs.nyu.edu/cs/faculty/overton/

1) On the Convergence of a New Levenberg-Marquardt Method, Ya-xiang Yuan, Chinese Academy of Sciences, Comp. Math & Sci/Eng. Comp., PO Box 2719, Beijing, 100080, PR China, yyx@lsec.cc.ac.cn, http://lsec.cc.ac.cn/~yyx, *Jin-Yan Fan*

We propose a new way to choose the parameter in the Levenberg-Marquardt method for solving systems of nonlinear equations. Under the assumption that the normal of residuals is bounded below by the distance from the solution set, we prove the method converges to a solution quadratically.

2) On the Implicit Filtering Method for Optimization Problems with Noise Terms, Jason J. Z. Zhang, City University of Hong Kong, Dept. of Math., Tat Chee Ave., Hong Kong, Hong Kong, mazhang@cityu.edu.hk, *Naihua Xiu*

Recently, Kelley et al proposed and studied theory and applications of an implicit filtering method for solving a box constrained optimization problem in which the objective function includes a noise term. We shall show further convergence properties of the method and discuss how to accelerate the method. convergence properties of the method and discuss how to accelerate the method.

3) Minimizing the Robust Spectral Abscissa: A Highly Nonconvex Nonlinear Programming Case Study, Michael L. Overton, NYU Courant Institute, 251 Mercer St., New York, NY 10012, overton@cs.nyu.edu, www.cs.nyu.edu/cs/faculty/overton/, *James V. Burke, Adrian Lewis*

The robust spectral abscissa is a Lipschitz, nonsmooth, nonconvex function defined by a parameter δ in $(0,1)$. As δ approaches 1, the function is convex in the limit, and as δ approaches 0, the function is non-Lipschitz in the limit. It makes a challenging case study for NLP algorithms.

MA10 Data Analysis in Reliability

Sponsor: QSR
Sponsored Session

Chair: Paul Kvam, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, pkvam@isye.gatech.edu

1) Statistical Predictions based on Censored Life Data, William Q. Meeker, Iowa State University, Dept. of Stats., 304C Snedecor Hall, Ames, IA 50011, wqmeeker@iastate.edu

Prediction intervals are important for quantifying prediction uncertainty. We describe simulation-based methods for using censored life data to construct prediction intervals for future outcomes. Examples include a prediction for the number of future failures in a specified period beyond the observation period, motivated by a warranty prediction problem.

2) The Roles of Total Positivity of Order Two on Preventive Maintenance & Statistical Decisions, Kazuyuki Suzuki, University of Electro-Communications, Dept. of Systems Eng., 1-5-1 Chofugaoka, Chofu-City, Tokyo, 182-8585, Japan, suzuki@se.uec.ac.jp

TP2 plays important roles in decision theories. TP2 is known as a sufficient condition that the optimum policy is given by "monotone procedure." We apply this result to the condition monitoring maintenance. The role of TP2 and its relationship with a necessary condition of "monotone policy" is discussed.

3) Comparing Reliability using Stochastic Precedence, Paul

Kvam, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, pkvam@isye.gatech.edu

Nonparametric statistics are important in reliability inference when parametric models are in doubt. We introduce a new stochastic relationship, stochastic precedence, and show how it distinguishes between two reliability samples where other inequalities, e.g., stochastic dominance, cannot. We focus on estimating reliability distributions under the stochastic precedence constraint.

MA11 Tutorial: Stochastic Integer Programming: Applications & Methods

Invited Session

Chair: Suvrajeet Sen, University of Arizona, Dept. of SIE, Tucson, AZ 85721

1) Tutorial: Stochastic Integer Programming - Applications & Methods, Suvrajeet Sen, University of Arizona, Dept. of SIE, Tucson, AZ 85721

SIP models are often used for tactical planning, i.e., scheduling, lot sizing, line balancing, etc. In recent years, there has been an increasing need to integrate strategic and tactical models. Because strategic decisions are often made before complete information is available, these integrated models often lead to SIP models. We will present several applications and discuss solution approaches...

MA12 Virtual Collaborative Design, Manufacturing, Engineering Management & Education

Cluster: Virtual Collaborative Design, Mfg., Eng. Mgmt. & Education
Invited Session

Chair: Paul G. Ranky, NJIT, Multilifecycle Eng. Res. Ctr., NJ, ranky@njit.edu

Co-Chair: William W. Swart, Old Dominion University, Coll. of Eng. & Tech., 102 Kaufman Hall, Norfolk, VA 23529, wswart@odu.edu

1) 3DVR Component-Based User Requirements Analysis Methods & Software Tools for Collaborative Multi-Lifecycle Engineering, Paul G. Ranky, NJIT, Multilifecycle Eng. Res. Ctr., NJ, ranky@njit.edu

The methodology of this project is a balanced blend of object-oriented system modeling, enterprise resource management, design, manufacturing and software engineering. We research, analyze and analytically model the needs for all key processes, then develop the comprehensive underlying system model. The presentation will include live software demonstrations.

2) E-Engineering Education Models & Experiences for the Global Engineering & Management Environment at Old Dominion University, David A. Dryer, Old Dominion University, Norfolk, VA, ddryer@odu.edu, *Derya A. Jacobs, William W. Swart*

Old Dominion University is initiating changes in its College of Engineering & Technology towards an "e-engineering" curriculum. This transformation requires cultural, organizational and procedural changes and explorations of distributed collaboration technologies. The pilot implementation of a multidisciplinary freshman engineering course that teaches basic e-engineering skills and practice guidelines is highlighted.

3) A Model for the Industry & University Virtual Collaborative Engineering Center, Charles B. Keating, Old Dominion University, Norfolk, VA

The focus of the Center for Virtual Collaborative Engineering in partnership with industry is to enable effective design, implementation, operation and sustainment of advanced collaborative engineering environments. It will provide organizations facilities for testing proposed collaborative engineering strategies, including a Collaborative Engineering Network.

4) An Object-Oriented Model & Cases of Design, Manufacturing & IT Knowledge Management over 3D-Enabled Web & Intranets with Demos, Paul G. Ranky, NJIT, Multilifecycle Eng. Res. Ctr., NJ, ranky@njit.edu

Our model and system enables "knowledge sellers" and team members to collaboratively demonstrate their knowledge and products in a 3D interactive fashion and "knowledge buyers," including product design, manufacturing and marketing engineers to review, analyze and act over the web. As a result, the competitive advantage gained is enormous.

MA13 Quality Issues in Manufacturing

Cluster: Issues in Manufacturing & Service Quality Management
Invited Session

Chair: Amit Mitra, Auburn University, Coll. of Bus., Ste. 516, Auburn, AL 36849-5240, mitra@business.auburn.edu

1) Multiple-Die Stamping Process Monitoring using Total Tonnage Measurement, Judy Jin, University of Arizona, Dept. of ISE, Tucson, AZ 85721-0020, jhjin@sie.arizona.edu

A new method is proposed for multiple-die stamping processes monitoring using total tonnage measurements. T2 control charts are developed for each die condition monitoring based on the decomposed individual die force in total tonnage measurements. The associated Type I error is studied to consider the interaction effects among all dies.

2) Nearly Optimal Policies to Reduce the Bullwhip Effect, Kwok-Leung Tsui, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332, ktsui@isye.gatech.edu, **H. Liu, F. Tsung**

The bullwhip effect is caused by information distortion and variation amplification along a supply chain. We propose a class of order-up-to policies and develop a nearly optimal policy to reduce the bullwhip effect. The proposed policy can significantly reduce the order variance up to 50% while keeping the expected cost nearly optimal.

3) A Multi-Objective Model for Process Optimization, Amit Mitra, Auburn University, Coll. of Bus., Ste. 516, Auburn, AL 36849-5240, mitra@business.auburn.edu

Decision-makers often face the task of selecting process parameters under a variety of objectives. These objectives may be ranked in preference order and a desirable goal value might be specified for each. A lexicographic programming approach is proposed to determine parameter settings such as process mean and variability.

MA14 Information Technology & Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Robin Dillon, Virginia Tech, Pamplin Coll. of Bus., 7045 Haycock Rd., Falls Church, VA 22043, dillon@vt.edu

1) Decision Analysis, Smart Agents & Mobile Agents, James S. Dyer, University of Texas, Dept. of MSIS, Grad. Sch. of Bus., Austin, TX 78712-1175, j.dyer@mail.utexas.edu

We discuss the use of mobile agents to augment the specification and operation of business processes through a dynamic, modular approach to software design and development. Mobile agents are software agents that physically travel across a network and allow executable code to travel and interact with multiple databases, file systems, information services and other agents...

2) Technology Standards Decisions, Laura J. Kornish, Duke University, Fuqua Sch. of Business, Box 90120, Durham, NC 27708, kornish@duke.edu

Choosing a technology standard is a classic game theoretic problem in which all parties recognize that the other parties' choices affect the value they ultimately realize. We compare game theoretic and decision theoretic models of standards choices, drawing on telecommunications standards decisions for illustration.

3) Informing Mental Models for Strategic Decision Making: Simulator-Based Experiments of a Wireless Telco using EVA & the Balanced Score, James L. Riechie-Dunham, University of Texas, Dept. of MSIS, 3615 Aspen Creek Parkway, Austin, TX 78749, jimrd@sdsu.com

The information that guides much strategic decision making today is processed by information systems and filtered by strategic frameworks. We present a theory and simulator-based experimental results to explain how information processing and selection affect the executive's mental model of the decision context and subsequent decision making performance.

4) Including Programmatic Risks in the Explicit Management of Resource Allocations for IS Projects, Robin Dillon, Virginia Tech, Pamplin Coll. of Bus., 7045 Haycock Rd., Falls Church, VA 22043, dillon@vt.edu

Information systems projects are still plagued by budget overruns, schedule delays, performance shortfalls and rejection by the intended users. We present a decision and risk framework that identifies project-specific risk factors and models explicitly the effects of decision making concerning project resources on the utility of the possible project outcomes.

MA15 Markov Modeling

Sponsor: Applied Probability
Sponsored Session

Chair: Winfried K. Grassmann, University of Saskatchewan, Dept. of Comp. Sci., 57 Campus Dr., Saskatoon, SK, S7N 5A9, Canada, grassman@cs.usask.ca

1) Stochastic Automata Networks, Brigitte Plateau, IMAG, Campus Universitaire, BP 53, Grenoble, France, brigitte.plateau@imag.fr

SANs have been discussed in the literature for over a decade. It has been observed that they provide a natural means of describing parallel and distributed systems under Markovian assumption. The transition matrix of the chain is automatically derived using tensor algebra operators, under a format that involves a very limited storage cost. The emphasis here is on SAN with a discrete time-scale.

2) Ergodicity of the MMAP[K]/G[K]/1/LCFS Preemptive Repeat Queue & the M/G/1 Type Markov Chains with a Tree Structure, Qi-Ming He, Dalhousie University/DalTech, IE Dept., Halifax, Nova Scotia, B3J 2X4, Canada, qi-ming.he@dal.ca, **Hui Li**

We study the stability of the MMAP[K]/G[K]/1/LCFS preemptive repeat queue. We introduce an embedded Markov chain of matrix M/G/1 type with a tree structure and identify conditions for the Markov chain to be ergodic. Three approaches are taken. We first use a classic approach, then we use the mean-drift method to derive an LP problem whose solution provides a sufficient condition for stability of the queuing system...

3) Accounting for Dynamic Queuing Effects in Employee Scheduling, Armann Ingolfsson, University of Alberta, Fac. of Business, Edmonton, Alberta, T6G 2R6, Canada, armann.ingolfsson@ualberta.ca, **Edgar Cabral**

Optimal employee scheduling models and models of queues with time-varying parameters are concerned with the same physical situation but researchers do not usually combine the two approaches. We describe computational experience with a method that uses tabu search to search for good schedules and the randomization method to evaluate schedules.

4) A Closed-Form Solution of Tandem Queues with Movable Servers, Winfried K. Grassmann, University of Saskatchewan, Dept. of Comp. Sci., 57 Campus Dr., Saskatoon, SK, S7N 5A9, Canada, grassman@cs.usask.ca

In a queuing system, Poisson arrivals first join exponential server 1 and upon completion of service, continue to join a second queue, provided the second queue has a length of less than some fixed number N. Otherwise, customers leave the system. The second server also has exponential service times. Moreover, once the first server is idle, it can move to help the second server...

MA16 New Models in DEA

Cluster: Data Envelopment Analysis
Invited Session

Chair: Wade D. Cook, York University, Schulich Sch. of Bus., 4700 Keele St., Toronto, Ontario, M3J 1P3, Canada, wcook@ssb.yorku.ca, wcook@schulich.yorku.ca

1) DEA Step Method, Gabriel Tavares, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854-8003, gtavares@rutcor.rutgers.edu, **Carlos H. Antunes**

A new approach to obtaining alternative DEA targets is presented. This technique is based on the MOLP step method (STEM). STEM is an interactive method that allows the decision maker to get different efficient points, one in each step, according to his structure of preferences.

2) Models for Identifying Critical Measures, Yao Chen, Merrimack College, Dept. of Mgmt., Sch. of Bus. & Intl. Commerce, North Andover, MA 01845, ychen@merrimack.edu, **Joe Zhu**

Since performance measures have complicated and often indiscernible relationships with each other, multiple measures are always necessary to fully capture business units' performance. Once a set of measures is given, it is important to identify both the performance frontier and the critical measures. While DEA has been proven an effective tool for estimating the performance frontiers...

3) Theoretical vs. Achievable Targets in DEA: Modeling Output Deterioration, Wade D. Cook, York University, Schulich Sch. of Bus., 4700 Keele St., Toronto, Ontario, M3J 1P3, Canada, wcook@ssb.yorku.ca, wcook@schulich.yorku.ca, **Joe Zhu**

In most practical applications of DEA, it is recognized that in, say, the standard input-oriented model, there is a gap between the theoretical maximum reduction in inputs, 1-0, vs. what is actually achievable. We examine this in the context of productivity measurement of highway maintenance crews. Maintenance supervisors estimate the maximum achievable reduction in resources without impacting the outputs from the process...

MA17 Network Routing Algorithms**Sponsor:** Telecommunications**Sponsored Session****Chair:** Anwar Elwalid, Bell Labs. Lucent Technologies, 600 Mountain Ave., Rm. 2C-324, Murray Hill, NJ 07974, anwar@lucent.com

1) **Network Simple Paths & their Orderless Connectivity**, *Paul T. R. Wang*, The MITRE Corporation, 1820 Dolley Madison Blvd., F48/W273, McLean, VA 22102-3480, pwang@mitre.org, *Leone C. Monticone*

Attempting to resolve whether or not NPC is also P, we identify a network signature that can be computed recursively in polynomial time for all simple paths. Elegant relationships among subfamilies of simple paths are revealed to demonstrate the computational complexity of a generalized Hamiltonian path problem.

2) **A Genetic Algorithm for Setting Weights in Open Shortest Path First Routing**, *Mauricio G. C. Resende*, AT&T Labs Research, 180 Park Ave., Bldg. 103, Rm. C241, Florham Park, NJ 07932, mgrcr@research.att.com, *Marten Ericsson*, *Panos M. Pardalos*

Open shortest path first (OSPF) is the most used intra-domain Internet routing protocol. Link weights determine how traffic flow is routed. A GA for optimizing the weights in OSPF routing is proposed. This heuristic is compared to a multi-commodity flow-based lower bound and other commonly used heuristics.

3) **Adaptive Traffic Engineering in the Internet**, *Anwar Elwalid*, Bell Labs. Lucent Technologies, 600 Mountain Ave., Rm. 2C-324, Murray Hill, NJ 07974, anwar@lucent.com

We consider adaptive MPLS traffic engineering in the Internet. The goal is to avoid network congestion by balancing the load among multiple paths based on measurement and analysis of path congestion. We derive a class of algorithms and prove their convergence. Simulations and practical implementation techniques are described.

MA18 Diagnosis & Disease Control**Cluster:** Health & Medical Applications**Invited Session****Chair:** Amy R. Wilson, University of Minnesota, Health Services Res. & Policy, 420 Delaware St. SE, MMC 729, Minneapolis, MN 55455, amy.r.wilson-1@umn.edu

1) **Sequential Decision Models for Minimizing Misclassification Cost under Information Acquisition Cost Constraint: Application of Medical**, *Parag C. Pendharkar*, Pennsylvania State University at Harrisburg, Harrisburg, PA, paragp@psu.edu, *James A. Rodger*

We develop a classification and regression tree algorithm-based procedure for designing medical diagnosis classifiers that minimize misclassification cost and satisfies total information acquisition cost constraint. The procedure uses a computationally efficient local and sequential search for generating classification trees that lower misclassification costs and don't exceed a user defined total information acquisition cost.

2) **Impact of Inter-Hospital Transfers on Risk-Adjusted Mortality Rates**, *Ramesh K. Shukla*, Virginia Commonwealth University, Dept. of Health Admin., Richmond, VA 23298, shukla@hsc.vcu.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. About 40% of APR-DRGs did not meet the test for the monotonic scaling properties. Discriminative power and predictive validity were also significantly different by monotonic scaling property.

3) **A System for Real-Time Teleultrasound**, *Mark J. T. Smith*, Georgia Institute of Technology, Sch. of ECE, Atlanta, GA 30332, mark.smith@ece.gatech.edu, *Joe Monaco*, *Alen Docef*, *Hong Man*

We consider the problem of transmitting digital ultrasound video over conventional telephone and ISDN lines in real-time. The difficulty is that such lines do not have sufficient bandwidth to support real-time transmission. To overcome this barrier, we introduce a model-based method for compression and transmission.

4) **Targeting Interventions to Prevent Infectious Disease**, *Amy R. Wilson*, University of Minnesota, Health Services Res. & Policy, 420 Delaware St. SE, MMC 729, Minneapolis, MN 55455, amy.r.wilson-1@umn.edu

Targeting interventions for infectious disease to high-risk populations and to infected populations can increase intervention effectiveness. We develop simple

analytic models to explore the conditions under which targeting one subpopulation yields better results than targeting another when the objective is to minimize the overall transmission rate in the entire population.

MA19 Tutorial: So You Want to be an OR Consultant?**Invited Session****Chair:** Harlan Crowder, Hewlett-Packard Laboratories, 1501 Page Mill Rd., Palo Alto, CA 94304, harlan_crowder@hp.com

1) **Tutorial: So You Want to be an OR Consultant?**, *Harlan Crowder*, Hewlett-Packard Laboratories, 1501 Page Mill Rd., Palo Alto, CA 94304, harlan_crowder@hp.com

An OR consultant needs 2 sets of skills and talents: those normally required by consultants such as client and communication skills and the analytic abilities to mathematically deconstruct and model complex business processes. We will see how the successful OR consultant intertwines these skills and talents to help solve client problems. Topics include setting client expectations, value pricing and writing bullet-proof proposals.

MA20 Modeling Distributed Generation in Large-Scale Energy Systems Modwls**Sponsor:** ENRE**Sponsored Session****Chair:** Robert T. Eynon, US Department of Energy, Energy Info. Admin., 1000 Independence Ave SW, Washington, DC 20585, reynon@eia.doe.gov

1) **A Customer-Centered Approach to Modeling the Diffusion of Distributed Generation**, *Chris Marnay*, Berkeley National Laboratory, MS 90-400, Berkeley, CA 94720-0001, c_marnay@lbl.gov

Future development and operation of the power system may become more decentralized, with installation and control of generation managed by local "microgrids," operating semi-autonomously from the "macrogrid." The design and operation of microgrids would be driven by varied "customer" preferences for service type and quality and would not necessarily be consistent with wider objectives for the macrogrid...

2) **Modeling Distributed Generation in the National Energy Modeling System**, *Andy S. Kydes*, US Department of Energy, Energy Info. Admin. EI-800, 1000 Independence Ave. SW, Washington, DC 20585, andy.kydes@eia.doe.gov, *Steven Wade*, *Daniel Skelly*, *Alan Beamon*

Modeling the diffusion of distributed generation in a large, integrated, energy-economy model of the US presents special problems because the deployment of distributed generation is typically a "local" decision (based on unique customer needs) while the National Energy Modeling System (NEMS) represents regional energy demand at the Census Division level - far from a local representation...

3) **The Use of the MARKAL Modeling System to Evaluate the Potential of Distributed Energy Resources**, *Buddy Garland*, US Department of Energy, 1000 Independence Ave. SW, Washington, DC 20585, buddy.garland@ee.doe.gov, *John Lee*, *Phillip Tseng*

The Annual Energy Outlook 2001 projects US energy consumption growing from 98.3 to 127 quadrillion btu from 2000 to 2020. Additionally, natural gas demand will increase by more than 50%, while carbon emissions will rise by over 35%. This consumption will strain the energy supply, the distribution infrastructure and the environment...

4) **Analysis of Multi-Pollutant Strategies in Energy Markets**, *Robert T. Eynon*, US Department of Energy, Energy Info. Admin., 1000 Independence Av SW, Washington, DC 20585, reynon@eia.doe.gov

We report impacts of proposed legislation addressing several pollutants from electric generators on energy markets including generating technology choice, fuel consumption patterns and prices to consumers. Options to comply with proposed legislation include fuel switching, retrofits with emission control technology, replacements of generators with less polluting plants and conservation.

MA21 Tutorial: Fixing an Ailing Air Traffic Control System**Invited Session****Chair:** Norman T. Fujisaki, Federal Aviation Administration, ASD 2, ASD 2, Washington, DC, norman.fujisaki@faa.gov

1) **Tutorial: Fixing an Ailing Air Traffic Control System**, *Norman T. Fujisaki*, Federal Aviation Administration, ASD 2, ASD 2, Washington, DC, norman.fujisaki@faa.gov

Current topics in ATC will be presented, including congestion and delays, system improvements and their efficacy and the outlook for future system performance and impact on the traveling public. A broad cross-section of current work and analytic capabilities will be summarized. Future obstacles and analytic challenges will be described.

MA22 New Product Development
Contributed Session

Chair: Willow A. Sheremata, Tulane University, 817 Old Metairie Place, Metairie, LA 70001, willow.sheremata@tulane.edu

1) **Search for Problems in New Product Development under Time Pressure**, *Willow A. Sheremata*, Tulane University, 817 Old Metairie Place, Metairie, LA 70001, willow.sheremata@tulane.edu

Projects developing new products under time pressure are prone to crises, problems that threaten high-stakes goal attainment. This study gathered data from projects developing software products under time pressure to investigate problem-identification processes and their effects. Results indicate search for problems increases the probability of meeting schedule and quality goals.

2) **A Study of Effective Consensus-Based Decision-Making Models to Evaluate Conceptual Design**, *Manabu Sawaguchi*, Waseda University, Dept. of IMSE, Sch. of Sci/Eng, Ohno Lab. 3-4-1 Okubo Shinjuku, Tokyo, 169-8555, Japan, sawaguchi_manabu@hj.sanno.ac.jp, *Takahiro Ohno*

Recently, product development activities have been based on task force projects in most manufacturers. Therefore, we suggest the consensus-based decision-making model to select high-valued conceptual design rationally from the point of view in the project team's consensus.

3) **New Product Awards & the Incentive to Invest in R&D**, *Pek H. Soh*, National University of Singapore, Business Sch., 15 Law Link, Singapore, 117591, Singapore, fbashohph@nus.edu.sg, *Ishtiaq P. Mahmood*

The use of early market signal as a justification for R&D investments is important in industries where shortened product development cycles are prevailing. Our results suggest that new product awards might act as a signal of market acceptance of the products introduced within a year and management uses this to justify for investments in the following year.

4) **Analysis on the Relationship between the Image & Impression Dimensions using Path Analysis**, *Sang W. Hong*, POSTECH, HCI Lab., Dept. of IE, San 31 Hyoja-dong, Nam-gu, Pohang, Kyungbuk, 790-784, Korea, hsw@postech.ac.kr, *Sung H. Han*

The emotional requirements of users are so complex that it is difficult to clarify how their attitudes towards a product are formed. We suggest the users' emotional structure that consists of image/impression dimensions and their relations. Path analysis was conducted to verify the emotional perception system of users based on user perception survey data.

Monday 09:45-10:45

MP04 Plenary: Engineering at the National Science Foundation
Invited Session

Chair: Kathryn E. Stecke, University of Michigan Business School, 701 Tappan St., Ann Arbor, MI 48109-1234, kstecke@umich.edu

1) **Invited Plenary: Engineering at the National Science Foundation**, *Louis A. Martin-Vega*, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230, lmartinv@nfs.gov

This presentation will provide an overview and update of the role of engineering at the National Science Foundation, including its current guiding vision, major programs and new initiatives. The presentation will also provide a glimpse into the emerging technologies and concepts that are expected to have a major impact on engineering research and education over the next 20 years.

Monday 11:00-12:30

MC01 Dynamic Pricing

Cluster: End-to-End Supply Chain Management
Invited Session

Chair: Markus Ettl, IBM Corporation, TJ Watson Research Ctr., Rte. 134, Yorktown Heights, NY 10598, msettl@us.ibm.com

1) **Decision Analysis of Supply Contracts with Volume Flexibility, Uncertain Price & Information Revisions**, *Sitong Tan*, Nankai University, Dept. of Comp. & Systems Sci., Tianjin, 300071, PR China, *Hua Xiang, Houmin Yan*

We analyze a volume flexibility contract with uncertain spot market price and demand information revisions. With such a supply contract, the buyer is able to purchase materials from both the contract and the spot market. We construct the optimal policies for both perfect/worthless demand information revisions. We also explore the implications of the volume flexible contract.

2) **Using Options to Manage Demand Uncertainty**, *Dailun Shi*, IBM TJ Watson Research Center, PO Box 218, Yorktown Heights, NY 10598, *William Grey, Richard Daniels*

We present a model for using options to manage demand uncertainty. We develop optimal policies for suppliers and buyers to coordinate production through both firm commitments and options. The value of options in managing the risk associated with demand uncertainty is also reported.

3) **Price Negotiations for Procurement of Direct Inputs**, *Jayant Kalaganam*, IBM TJ Watson Research Center, Research Division, PO Box 218, Yorktown Heights, NY 10598, jayant@us.ibm.com, *Andrew J. Davenport*

We present two winner determination problems that arise in the context of auctions for procurement of direct inputs. The first mechanism allows suppliers to submit volume discount bids and the optimal bid selection is modeled and solved as a multiple choice knapsack problem with side constraints. The second allows bundled bids and the winner determination is modeled and solved the winner determination problem as a set-covering problem with side constraints.

4) **Dynamic Pricing in Bandwidth Management via Chance Constraint Programming**, *Xin Guo*, IBM, TJ Watson Research Ctr., Rte. 134, PO Box 218, Yorktown Heights, NY 10598, *John A. Tomlin*

We present a model for pricing of bandwidth (for Internet access) which incorporates nonlinear price-demand data directly into an optimization model. This is accomplished through a chance-constrained programming formulation, leading to an equivalent nonlinear deterministic model.

MC02 E-Commerce & Supply Chain Strategy: Research Opportunities

Cluster: Supply Chain Management
Invited Session

Chair: Morris A. Cohen, University of Pennsylvania, The Wharton School, Philadelphia, PA 19104-6366, cohen@wharton.upenn.edu

1) **Coordination in the Electronic Market Driven Supply Chain**, *S. David Wu*, Lehigh University, Dept. of IMSE, 200 West Packer Ave., Bethlehem, PA 18015-1582, david.wu@lehigh.edu

We consider incentives and coordination mechanisms for the supply chain in the context of electronic markets. An overview of our research in this area will be given, including internal market capacity coordination, coalition formation and profit distribution and supply contracting.

2) **Volume-Buying on the Web: Quantity Discounts & the Coordination Problem**, *Krishnan S. Anand*, University of Pennsylvania, The Wharton Sch., 1311 SH-DH, 3620 Locust Walk, Philadelphia, PA 19104-6366, anandk@wharton.upenn.edu, *Ravi Aron*

Quantity (or volume) discounting mechanisms have been extensively studied in the operations literature in the context of transactions between businesses (B2B). We analyze a web-based B2C volume-buy scheme as a combination of traditional quantity discounts and a coordination problem among consumers and compare it with other price discovery mechanisms.

3) **After-Sales Service Supply Chains & E-Commerce**, *Naren Agrawal*, Santa Clara University, 323 Kenna Bldg., 500 El Camino Real, Santa Clara, CA 95053-0382, nagrawal@scu.edu, *Vipul Agrawal, Morris A. Cohen*

Delivery of after-sales services requires asset deployment and support through service supply chains. Such supply chains face more stringent response standards and require considerable investment in infrastructure and inventory. We consider the transformation of these supply chains through adoption of e-commerce practices and technologies. A research agenda is proposed.

MC03 Panel: Flexibility in Non-Traditional FMSs

Cluster: Flexible Manufacturing Systems

Invited Session

Chair: Martin Starr

, mkstarr@attglobal.net

1) Panel: Flexibility in Non-Traditional FMSs, *Amiya K. Chakravarty*, Tulane University, akc@tulane.edu, *Peter Norden*, *Layek Abdel-Malek*, NJIT, Dept. of IME, Newark, NJ 07102, malek@adm.njit.edu, *Cheickna Sylla*, NJIT, Sch. of Mgmt., University Heights, Newark, NJ 07950, sylla@adm.njit.edu

We will expand the definition of FMSs to include electronic-enabled, distributed manufacturing networks (DMN). Precise production schedules with exact quality specifications operating at a distance require new technology as well as different organizational structures. Such systems are at work in various parts of the world in ways unique to the country culture. We will explore FMS interactions with supply chain management...

2) Internet Procurement to Enhance Manufacturing Flexibility, *Martin Starr*

Companies can substitute Internet procurement for capital investment where formerly "make" decisions would prevail over "buy" decisions. Better prices can result. Also, greater control can now be exercised over suppliers organized as dispersed manufacturing networks. The dominating factor is flexibility to change designs as technological and competitive conditions shift.

MC04 Health Care Operations

Sponsor: MSOM

Sponsored Session

Chair: Sarah Stock Patterson, MIT, 1 Amherst St., E40-123, Cambridge, MA 02139, sarahsp@mit.edu

1) Managing Patient Flows at the Division of Medical Oncology & Transplantation at the Duke University Medical Center, *Marie Matta*, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, mem11@mail.duke.edu, *Sarah Stock Patterson*

This study focuses on the management of patient flows through an outpatient cancer clinic. A simulation model of the oncology clinic is described. Using this model, causes of patient delay are identified, resource utilization is quantified, and new operational strategies are tested. Recommendations for process and staffing modifications are made.

2) Scheduling Doctors' Appointments: Optimal & Empirically-Based Heuristic Policies, *Lawrence W. Robinson*, Cornell University, Johnson Grad. Sch. of Mgmt., Ithaca, NY 14853-6201, lwr2@cornell.edu, *Rachel Chen*

Patient appointment times should be set to balance patient waiting times against the doctor's idle time. We use the structure of the optimal solution as the basis for an atheoretic closed-form heuristic for setting appointment times, which averages within 2% (and generally within 0.5%) of the optimal policy.

3) Incentives for Disease Management, *Stefanos Zenios*, Stanford University, Grad. Sch. of Business, Stanford, CA 94305, stefzen@leland.stanford.edu

We develop a principal-agent model to identify efficient reimbursement systems for disease management. The model assumes both principal (regulator) and agent (disease management organization) are risk-neutral. The agent treats a patient suffering from a chronic disease. The patient is in one of two possible disease-stages, only observable by the agent.

MC05 Scheduling & Dispatching in Semiconductor Manufacturing

Cluster: Semiconductor Manufacturing

Invited Session

Chair: Scott J. Mason, University of Arkansas, 4207 Bell Eng. Ctr., Fayetteville, AR 72701, mason@uark.edu

1) Framework for Planning, Scheduling & Dispatch in Semiconductor Manufacturing, *Shekar Krishnaswamy*, Motorola, *Scott J. Mason*

We will discuss planning, scheduling and dispatching in the semiconductor operations control framework, describe their interdependencies, their time horizons and outlooks and the requirements and granularity of the information

required to drive each. We will also address systems/data requirements and user acceptance of each of these components.

2) Repair-Based Algorithms for Full-Fab Scheduling & Rescheduling, *Don Rosenthal*, PRI Automation, *Mark Johnston*

We summarize an approach to near-real-time rescheduling of semiconductor fabs. A variant of a technique originally developed for the US space program, repair-based scheduling can generate 24 hours worth of schedule for the processing of every active lot on every tool in the fab, in a few minutes of processing.

3) Scheduling of Batch Processing Machines to Minimize Total Weighted Tardiness, *Matt Carlyle*, Arizona State University, Dept. of IE, PO Box 875906, Tempe, AZ 85287-5906, mcarlyle@asu.edu, www.public.asu.edu/~mcarlyle/, *Amit Devpura*, *John W. Fowler*

We discuss approaches for scheduling batch-processing machines to improve on-time delivery performance, as represented by a total weighted tardiness objective. We discuss heuristics for forming and sequencing batches and indicate performance gains provided by local improvement.

4) An A Posteriori Evaluation Technique for Bi-Criteria Parallel Machine Scheduling Algorithms, *Esma S. Gel*, Arizona State University, Dept. of IE, PO Box 5906, Tempe, AZ 85287-5906, esma.gel@asu.edu, *Matt Carlyle*, *John W. Fowler*, *Bosun Kim*

We introduce the measure of integrated convex preference (ICP) for comparing the performance of two solution techniques for bi-criteria parallel machine scheduling problems in semiconductor manufacturing. We show that ICP is an efficient and robust measure for comparing sets of Pareto optimal solutions and discuss further extensions.

MC06 Flow-Shop Scheduling

Cluster: Production Scheduling

Invited Session

Chair: Funda Sivrikaya-Serifolgu, Abant Izzet Baysal University, Bolu, Turkey, fss@ibu.edu.tr

1) The Ant Colony System for No-Wait Flow-Shop Scheduling, *B. M. T. Lin*, Ming Chuan University, Dept. of CS, Kwei-Shan, 333, Taiwan, ROC, mtlin@mcu.edu.tw, *P. Y. Yin*, *S. J. Shyu*

The ACS is a metaheuristic proposed to derive quality solutions for computational hard problems by emulating the natural behaviors of ants. Couples of successful applications have been reported for graph-based optimization problems, such as the VRP and the TSP. We propose an application of the ACS to a flow-shop problem without intermediate storage so as to minimize the total flow time...

2) A Genetic Algorithm Approach for Hybrid Flow-Shops, *Funda Sivrikaya-Serifolgu*, Abant Izzet Baysal University, Bolu, Turkey, fss@ibu.edu.tr, *Gunduz Ulusoy*

A hybrid flow-shop with k stages, each with M_k machines, is treated by a GA to minimize the makespan. Besides the general case, the special case with 2 stages where there is only one machine in one stage and multiple machines in the other stage is also treated.

3) The Sequencing & Scheduling of Mixed Flow-Shop Problems, *Erhan Kozan*, Queensland University of Technology, Sch. of Math Sci., GPO Box 2434, Brisbane, Queensland, 4001, Australia, e.kozan@qut.edu.au

Three variations of the mixed flow-shop-sequencing problems, the intermediate storage, no-intermediate storage and no-wait cases, have been thoroughly investigated and characterized in this study. A number of alternative mathematical programming models have been developed as well as numerical approaches for the scheduling of operations within such an environment. Solution techniques are also presented.

4) Flow-Shop Scheduling with Two Criteria: Maximum Earliness & Makespan, *V. Berkin Toktas*, University of Washington, Dept. of IE, Box 352650, Seattle, WA 98195-2650, berkin@u.washington.edu, *Suna Kondakci*, *Meral Azizoglu*

We address the problem of minimizing makespan and maximum earliness simultaneously in a 2-machine flowshop environment. We develop a B&B algorithm with several lower and upper bounding schemes that generates all efficient solutions. We also propose a heuristic procedure that generates approximate efficient solutions.

MC07 Competition & Incentives in Supply Chains

Cluster: Competition & Incentives in Operations Management

Invited Session

Chair: Scott Carr, UCLA, AGSM, B408 Anderson Complex, 110 Westwood Plaza, Box 951481, Los Angeles, CA 90095, scott.carr@anderson.ucla.edu

1) Configuring the Supply Chain: Impact of Product & Process Modularity on Outsourcing Decisions, Jovan Grahovac, Tulane University, Freeman Sch. of Bus., New Orleans, LA 70118-5669, jovan.grahovac@tulane.edu, **Geoffrey G. Parker**

The rate of technological change and the complexity of products and production processes in many industries are rapidly increasing. Due to the enormous costs involved in keeping up with the pace, no single company can do it all in-house. We investigate how the ability to separate a product or process module from the whole impacts outsourcing decisions and the structure of the supply chain.

2) Information Complements, Substitutes & Strategic Product Design, Geoffrey G. Parker, Tulane University, Freeman Sch. of Bus., New Orleans, LA 70118-5669, gparker@tulane.edu, **Marshall Van Alstyne**

We introduce a formal model of cross-market externalities that leads to novel strategies such as an eagerness to enter into Bertrand price competition and distribute free information goods. This combination helps to explain many recent firm strategies such as those of Microsoft, Netscape (AOL), Sun, Adobe and ID.

3) When do Fools Rush In? Market Entry under Uncertainty, Scott Carr, UCLA, AGSM, B408 Anderson Complex, 110 Westwood Plaza, Box 951481, Los Angeles, CA 90095, scott.carr@anderson.ucla.edu

We investigate the manner in which market structure is determined by firms' beliefs of market size. These beliefs may include uncertainty and potential market entrants may have different beliefs.

4) Strategic Incentives in Operations, Sudheer Gupta, University of Michigan Business School, 701 Tappan, Ann Arbor, MI 48109, sudheer@umich.edu

Most studies of incentives and coordination in OM assume gains from coordination among decision makers and focus on designing contracts to align incentives of different players. We consider a series of situations where strategic incentives play a significant role and show that coordination and perfect alignment of incentives is not always the optimal firm strategy.

MC08 Nonconvex Optimization Problems

Cluster: Global Optimization
Invited Session

Chair: Panos M. Pardalos, University of Florida, ISE Dept., 303 Weil Hall, Gainesville, FL 32611, hearn@ise.ufl.edu

1) Methods for Second Best Toll Pricing in Traffic Networks, Donald W. Hearn, University of Florida, ISE Dept., 303 Weil Hall, Gainesville, FL 32611, hearn@ise.ufl.edu, **Mehmet B. Yildirim**

We propose a mathematical programming formulation for the determination of tolls in traffic assignment problems where tolling is only allowed on certain network links. It generalizes the existing models in the literature and leads to a toll pricing framework that permits the numerical solution of larger problems than previously considered.

2) A Hybrid GRASP with Perturbations for the Steiner Problem in Graphs, Celso Ribeiro, Catholic University of Rio de Janeiro, Dept. of Computer Sci., Rio de Janeiro, 22453-900, Brazil, celso@research.att.com, **Eduardo Uchoa, Renato F. Werneck**

We present a hybrid GRASP heuristic for the Steiner problem in graphs. Several construction heuristics are combined with a weight perturbation strategy using intensification and diversification elements. Local search circularly explores two different neighborhoods. A post-optimization adaptive path-relinking technique is applied to a set of elite solutions.

3) Heuristics for Large-Scale Nonconvex Piecewise Linear Network Problems, Panos M. Pardalos, University of Florida, ISE Dept., 303 Weil Hall, Gainesville, FL 32611, hearn@ise.ufl.edu

We present recent applications and computational approaches for solving large-scale minimum concave cost network optimization problems. In particular, we consider fixed charge and concave piecewise linear network flow problems.

4) Solving Nonconvex NLPs & MINLPs using OptQuest/GRG, Leon S. Lasdon, University of Texas, MSIS Dept., Coll. of Bus. Admin., Austin, TX 78712, lasdon@mail.utexas.edu, **Zsolt Ugray, John Plummer**

OptQuest/GRG is designed for problems with many constraints and variables. It uses OptQuest, a global optimizer, to provide starting points for GRG, a local NLP solver. GRG seeks a local solution from a subset of these points, holding discrete variables fixed. Computational results include 140 GAMS problems due

to Floudas.

MC09 Large-Scale Constrained Optimization Algorithms

Cluster: Nonlinear Optimization
Invited Session

Chair: Richard Byrd, University of Colorado, Comp. Science Dept., Boulder, CO 80309, richard@cs.colorado.edu

1) Methods for Solving Very Large Nonlinear Programs, Jorge Nocedal, Northwestern University, ECE Dept., Evanston, IL 60208-3118, nocedal@ece.nwu.edu

We discuss methods for identifying the optimal active set for problems with a very large number of variables and constraints. We also discuss techniques for preconditioning the conjugate gradient method for solving reduced systems. We conclude with some observations about a filter mechanism for determining when optimization steps are acceptable.

2) Local Convergence Property of a Primal-Dual Interior Point Method for Degenerate Nonlinear Optimization Problems, Hiroshi Yabe, University of Tokyo, Dept. of IMES, 1-2 Kagurazaka, Shinjuku-ku, Tokyo, 162, Japan, yabe@ms.kagu.sut.ac.jp, **Hiroshi Yamashita**

We consider local convergence of a primal-dual IPM for problems, where linear independence of the active constraint gradients is replaced by a weaker condition. We show that the distance from the current iterate to the solution set is related to the residual of the KKT conditions. Under appropriate assumptions our method converges quadratically.

3) Reliability of Nonlinear Optimization Algorithms, Richard Byrd, University of Colorado, Comp. Science Dept., Boulder, CO 80309, richard@cs.colorado.edu

We discuss the degree to which optimization algorithms may be relied on to perform as intended. The value of the guarantees provided by global convergence theory is assessed. We examine several examples of mathematical failure of algorithms as well as observed examples of software failure in relation to the theoretical results.

MC10 Optimization Models for the Reserve Site Selection Problem

Cluster: Optimization Models for the Reserve Site Selection Problem
Invited Session

Chair: Jeffrey L. Arthur, Oregon State University, Dept. of Statistics, Kidder Hall 44, Corvallis, OR 97331-4606, arthur@stat.orst.edu

1) Delineating Optimal Habitat Locations for Inclusion in Migratory Flyways, Justin C. Williams, JHU, Dept. of Geog. & Environ. Eng., 3400 North Charles St., Baltimore, MD 21218, jcwjr@jhunix.hcf.jhu.edu, **Daniel J. Bain, Charles ReVelle, John J. Boland**

A directed conditional covering model is developed for augmenting/enhancing flyways for migratory birds. Objectives of maximizing geographic coverage and aggregate habitat quality are addressed. The model is applied to the US portion of the Atlantic Flyway (Maine to Florida). A greedy adding heuristic is used to find approximate non-inferior solutions.

2) Dynamic Reserve Selection & Maintenance: The Elliott Forest Plan, John Sessions, Oregon State University, Dept. of Forest Eng., Corvallis, OR 97331-5706, john@sessions.cof.orst.edu, **Pam Overhulser**

The 93,000-acre Elliott State Forest is managed by the Oregon Department of Forestry under a mandate to provide income for schools while following the laws and regulations under the Endangered Species Act. The agency is considering various management options that may include both static and dynamic reserves for wildlife.

3) Natures Reserve Site Selection to Maximize Expected Species Covered, Jeffrey D. Camm, University of Cincinnati, QAOM Dept., Cincinnati, OH 45221-0130, jeff.camm@uc.edu, **Susan K. Norman, Stephen Polasky, Andrew R. Solow**

We analyze the problem of maximizing the expected number of species in a nature reserve network, subject to a constraint on the number of sites in the network, given probabilistic information about species occurrences. We develop a linear integer programming approximation that may be solved with standard integer programming software.

4) A Monte Carlo Comparison of Two Models for the Probabilistic Reserve Site Selection Problem, Jeffrey L. Arthur, Oregon State University, Dept. of Statistics, Kidder Hall 44, Corvallis, OR 97331-4606, arthur@stat.orst.edu, **Robert G. Haight,**

Claire Montgomery, Stephen Polasky

Two approaches to formulating the reserve site selection problem when species occurrence data is probabilistic were solved for terrestrial vertebrates in a small set of potential reserve sites in Oregon. The expected coverage approach yielded solutions that covered more species on average in Monte Carlo simulations than the threshold approach.

MC11 Applications of Stochastic Programming

Cluster: Stochastic Programming

Sponsor: Optimization

Sponsored Session

Chair: Joyce Yen, University of Washington, Dept. of IE, Box 352650, Seattle, WA 98195-2650, joyceyen@u.washington.edu

1) The Optimal Design of a SONET Network with Uncertain Demands, J. Cole Smith, University of Arizona, Dept. of ISE, PO Box 210020, Tucson, AZ 85721-0020, cole@sie.arizona.edu, **Andrew J. Schaefer, Joyce Yen**

We consider the design of a telecommunications network in which the network demands are to be wholly satisfied among a set of SONET rings. This study differs from prior research endeavors in two significant ways. First, instead of assuming deterministic demands, we consider a 2-stage problem in which the current demands are known, but the future second-stage demands are uncertain...

2) An Application of Stochastic Programming to the Problem of Groundwater Remediation, Sergio Lucero, University of California, Dept. of Math, Davis, CA, sergio@math.usdavis.edu

An in-depth study of the important problem of the remediation of contaminated aquifers reveals that stochastic programming is needed to make a realistic model, given the uncertainty in measuring the soil coefficients that are present in the PDEs governing flow and transport of contaminants. A full study with numerical results for the 3-D case is presented.

3) Stochastic Network Interdiction of Nuclear Material Smuggling, Feng Pan, University of Texas, Grad. Program in OR, Austin, TX 78712-1063, fpan@math.utexas.edu, **David P. Morton, Bill Charlton**

The US Department of Energy collaborates with the Russian Federation State Customs Committee to help strengthen the overall capability of preventing the illicit trafficking of nuclear materials, equipment and technology across the Russian border. We describe a stochastic network interdiction model designed to help select sites for installing detection equipment.

MC12 Tutorial: Extended Enterprise Integration

Invited Session

Chair: Thomas R. Gullledge, George Mason University, Public Policy Ctr., MS 2E4, Fairfax, VA 22030-4444, gullledge@gmu.edu

1) Tutorial: Extended Enterprise Integration, Thomas R. Gullledge, George Mason University, Public Policy Ctr., MS 2E4, Fairfax, VA 22030-4444, gullledge@gmu.edu

The extended enterprise includes customers, suppliers and partners. This tutorial examines extended enterprise integration from an "engineering implementation consulting" perspective, focusing on technologies, standards and solutions. The presentation provides visibility into research areas that provide new problems and data for decision support models. To view the extended abstract, go to <http://www.eep.gmu.edu/presentations>.

MC13 The Role of E-Commerce in Manufacturing & Service Quality

Cluster: Issues in Manufacturing & Service Quality Management

Invited Session

Chair: Michael J. Savoie, University of Dallas, 1845 East Northgate Dr., Irving, TX 75062-4736, msavoie@gsm.udallas.edu

1) Leveraging Supply Chain Management for Manufacturing & Service Quality Excellence: A Strategic Perspective, Mahesh Raisinghani, University of Dallas, Grad. Sch. of Mgmt., 1845 East Northgate Dr., Irving, TX 75062-4736, mraising@gsm.udallas.edu

For professionals working in the manufacturing and service quality field, it is essential to become intimately familiar with the corporate mission and determining how supply chain processes can help achieve that mission. We explore the best practices in SCM and discuss the payoffs and implications for management and research.

2) Using the World Wide Web to Manage the Value Chain: Its Effect on Total Quality, Michael J. Savoie, University of Dallas, 1845 East Northgate Dr., Irving, TX 75062-4736, msavoie@gsm.udallas.edu

We examine the effect of the Internet/WWW on the management of the value chain and its subsequent effect on total quality. Issues include utilizing the web to enhance the effectiveness of inter-company lean manufacturing, quality issues of industry exchanges and strategic alliances and 6-sigma process management across organizational boundaries.

3) SERVQUAL's Dimensionality Revisited: Limitations in Evaluating the Core Component of Service Delivery, Rajeev Sawhney, Western Illinois University, Dept. of Mgmt., Macomb, IL 61455-1390, rsawhney@wiu.edu

SERVQUAL (Parsuraman et al., 1985, 1988) was developed to measure gaps in a service firm's quality. We argue that SERVQUAL, by design, is limited in evaluating service quality because of the way their core and peripheral components are embedded. We conclude with some cautions/suggestions in using SERVQUAL.

MC14 Advances in Decision Analysis

Sponsor: Decision Analysis

Sponsored Session

Chair: L. Robin Keller, University of California, 350 Grad. Sch. of Mgmt., Irvine, CA 92697-3125, lrkeller@uci.edu

1) Group Decisions with Multiple Criteria, Manel Baucells, IESE Business School, Ave. Pearson 21, Barcelona, 08034, Spain, baucells@iese.edu, **Rakesh K. Sarin**

We consider a decision problem where a group of individuals evaluate multi-attribute alternatives. We explore minimal required agreements that are sufficient to specify the group utility function. A surprising result is that, under some conditions, a bilateral agreement among pairs of individuals on a single attribute is sufficient to derive the multi-attribute group utility.

2) A Measure of Loss Aversion & Reference-Dependent Models, Jianmin Jia, Chinese University of Hong Kong, Dept. of Mktg., Shatin, NT, Hong Kong, jjia@cuhk.edu.hk

Following Tversky & Kahneman's (1991) work, we propose a formal measure of loss aversion and an alternative framework for modeling the effects of reference-dependence and loss aversion on multi-attribute choice. We consider two types of relative gains and losses: one is based on a difference structure and the other is a ratio scale, e.g., percentage changes...

3) Discounting Measures of Effectiveness, James C. Felli, Naval Postgraduate School, DRMI (64FL), 1522 Cunningham Rd., Monterey, CA 93943-5201, jcfelli@nps.navy.mil, **Kent D. Wall**

We consider the effectiveness of a system from a production perspective and discount marginal changes over time to determine a discounted measure of system effectiveness. We argue that this measure is better suited to cost-effectiveness analysis than traditional effectiveness measures, particularly when alternatives are perishable or have different procurement schedules.

4) Valuing Lives Lost over Time, L. Robin Keller, University of California, 350 Grad. Sch. of Mgmt., Irvine, CA 92697-3125, lrkeller@uci.edu, **Jeffery L. Guysie**

We experimentally examine preferences for time sequences involving different levels of mortality at different times and compare them with prior results on income, health, and air and ocean water quality. We then discuss whether temporal discounting models are appropriate for representing the value people place on environmental outcomes.

MC15 Some Recent Single Server Queuing Models

Sponsor: Applied Probability

Sponsored Session

Chair: Percy H. Brill, University of Windsor, Dept. of Math & Stats., Dept. of MS, Windsor, Ontario, N9B 3P4, Canada, brill@uwindsor.ca

1) The Generality of the Discrete-Time Single-Server Queues with Interruptions, Atahuru S. Alfa, University of Windsor, Dept. of IMSE, 401 Sunset Ave., Windsor, Ontario, N9B 3P4, Canada, alfa@uwindsor.ca

We show that the single-server queue with interruptions is a general model that represents several single-server queues studied in the literature. The matrix-geometric method is used to analyze this system. We extend the results to include the case with discrete IPH as interarrival and service time distributions.

2) Transient Probabilities for the Single Server Queuing

System having Finite Capacity, Alan Krinik, California State Polytechnic University, Dept. of Math, 3801 West Temple Ave., Pomona, CA 91768, ackrinik@csupomona.edu, **Gerardo C. Rubino**

Analytic expressions for the transient probabilities of the M/M/1/K queueing system are derived via randomization and lattice path combinatorics. We make use of an elegant equality involving transient probability functions and busy time distributions of the dual process. Related problems, M/M/1 and generalizations to M/M/c/K are discussed as time allows.

3) Transient Analysis of the Loss Process Associated with a Finite Capacity Queue, Gerardo C. Rubino, IRISA/INRIA, Rennes, 35402, France, rubino@irisa.fr

We analyze the "number of losses on [0,T]" and evaluate its distribution. We show the relationship of this problem to the computation of the distribution of the maximum backlog of a queue on [0,T]. We discuss extensions to the analysis of the joint process "(number arrived, number lost) on [0,T]".

4) Some Variations of M/G(a,b)/1 Queues & their Analysis, Percy H. Brill, University of Windsor, Dept. of Math & Stats., Dept. of MS, Windsor, Ontario, N9B 3P4, Canada, brill@uwindsor.ca, **Mei Ling Huang**

We analyze the steady state distribution of the waiting time, when service times depend on: service group size, time to form a service group and there are server vacations. A 2-class priority variation is also analyzed. A computational method for the distribution is presented.

MC16 New DEA Applications

Cluster: Data Envelopment Analysis
Invited Session

Chair: Antreas D. Athanassopoulos, ALBA & London Business School, Athinas Av. & Areos Str. 2A, 166 71, Greece, athan@bpm.gr

1) DEA as Applied to Price-Cap Settings of NTT, Kaoru Tone, National Graduate Institute for Policy Studies, 2-2 Wakamatsu-cho, Shinjuku-ku, Tokyo, 162-8677, Japan, tone@grips.ac.jp

Price-settings of public utilities, e.g., telecommunications, electricity and water supply, are crucial societal matters. As a part of the deregulation promotion policy in Japan, the Ministry of Posts and Telecommunications has set forth a price-cap system for telecommunication utilities that began October 1, 2000. We describe how the cap was determined by referring to an analytical tool called DEA.

2) Europe & the US: Two Models of Development of the Multimedia Industry - An Analysis based on DEA Methods, Patrick-Yves Badillo, EJCM, 21 rue Virgile Marron, Marseille, 13005, France, badillo@ejcm.univ-mrs.fr, **Dominique Badillo**

Concerning the new emerging multimedia industry 2 topics are treated: comparison of the economic performances of the European and American actors and comparison between the European actors and the American actors from the point of view of the multi-diffusion performance, in terms of traditional media and new media.

3) Efficient Player Payrolls in Major League Baseball: A Data Envelopment Analysis, Karl Einolf, Mount St. Mary's College, Dept. of Bus. Acct. & Econ., Emmitsburg, MD 21727, einolf@msmary.edu

The range of player payrolls for Major League Baseball teams has become extremely wide over the last decade. We use DEA to determine the relative efficiency of MLB franchises. Comparisons are made to the National Football League to determine whether increased revenue sharing in MLB will be appropriate.

4) Assessing the Efficiency in Operations of Bank Branch Networks using DEA: An Application to a Specialized Mortgage Bank, Antreas D. Athanassopoulos, ALBA & London Business School, Athinas Av. & Areos Str. 2A, 166 71, Greece, athan@bpm.gr, **Dimitris Giokas**

Financial services are nowadays in the spotlight of development and considerable changes. Primary concern of these changes has been, heretofore, issues of strategy, information technology, product innovation and management of change. Relatively little attention has been given to publicize issues of operations management since they either focus on the interior of individual banks or little attention is given by individual bankers...

MC17 Design of Survivable Networks

Sponsor: Telecommunications
Sponsored Session

Chair: John G. Klinecicz, AT&T Labs., 200 South Laurel Ave., Rm. D5-3C06, Middletown, NJ 07748, klinecicz@att.com

1) Survivable Telecommunications Network Design under Different Types of Failures, Hanan Luss, Telcordia Technologies, 33 Knightsbridge Rd., PY4-4N227, Piscataway, NJ 08854, hluss@telcordia.com, **Richard T. Wong**

The design of survivable networks has received significant attention in recent years. We review important issues and concepts for network restoration. We then discuss models for network restoration under a partial link failure, a complete link failure and a node failure. We provide heuristic methods that design a survivable network by augmenting network capacities through various tree and ring structures.

2) Distributed Selection of Restoration Paths in Optical Networks, Robert D. Doverspike, AT&T Labs-Research, 180 Park Ave., Bldg. 103, Florham Park, NJ 07932-0971, rdd@research.att.com, **Guangzhi Li**

The telecommunications industry is standardizing distributed control for the newly emerged optical layer. A difficult issue is restoration of optical connections in response to network failures. We present a heuristic method that chooses efficient, capacity-sensitive restoration paths without the need for centralized intervention or inventory flooding to update capacity requirements.

3) Efficiency & Availability Tradeoffs in Optical Network Design, Gheorghe Spiride, Nortel Networks, Global Professional Services, 2400 lakeside Dr., Richardson, TX 75081, gspiride@nortelnetworks.com, **Augustyn Ortynski, Ra'ed Awdeh**

Over the past few years, we have developed design tools for survivable optical networks given traffic requirements. We discuss design approaches for planning optical networks through a comparison of ring- and mesh-based restoration schemes from the perspective of capacity requirements and network availability in the context of realistic networks and traffic levels.

4) Constructing Paths with Diversely-Routed Segments, John G. Klinecicz, AT&T Labs., 200 South Laurel Ave., Rm. D5-3C06, Middletown, NJ 07748, klinecicz@att.com

We consider a problem in which it is necessary to construct a path between a designated pair of nodes in a network. This path must be decomposed into segments, such that, for each segment, there exists a diversely-routed path. We discuss possible solution procedures based on varying the end points of the segments.

MC18 Scheduling in Health Care

Cluster: Health & Medical Applications
Invited Session

Chair: Margarida Moz, Universidade Tecnica de Lisboa, Dept. de Matematica, Inst. Superior de Economia, Lisboa, Portugal, mpato@iseg.utl.pt

1) Scheduling Patient Operations to Minimize Post Anesthesia Care Unit Cost, Vernon Hsu, Hong Kong University of Science & Technology, Dept. of IE & EM, Hong Kong, vhsu@ust.hk, **Renato E. de Matta, Chung-Yee Lee**

We present an approach to optimize patient schedules in the operating rooms to minimize the nursing cost in the postanesthesia care unit of an ambulatory surgical center. We formulate the patient scheduling problem as new variants of the no-wait, 2-stage process shop scheduling problem and obtain some computational complexity results. We develop a TS-based heuristic solution algorithm to solve the problem...

2) Optimal Grouping for a Nuclear Magnetic Resonance Scanner, Nico J. Vandaele, University of Antwerp, Operations Mgmt., Prinsstraat 13, Antwerpen, 2000, Belgium, nico.vandaele@ufsia.ac.be, **Inneke Vannieuwenhuysse, Sascha Cupers**

We develop a single-server, multi-class queueing model with setups and optimize for the lot sizes minimizing weighted patient lead-time. This enables management to set guidelines for a daily schedule, to analyze responsiveness, to plan staffing/operation times and to incorporate downtime. We illustrate with real life data.

3) Re-Rostering of Nurse Schedules, Margarida Moz, Universidade Tecnica de Lisboa, Dept. de Matematica, Inst. Superior de Economia, Lisboa, Portugal, mpato@iseg.utl.pt, **Margarida Vaz Pato**

The re-rostering of nurse schedules arises whenever one (or more) nurse is unable to attend previously assigned shifts. A mathematical model formulated for this problem will be presented as well as computational results regarding instances from a Lisbon state-owned hospital obtained by using standard software and a constructive heuristic.

MC19 IFORS Tutorial: OR/MS Tutorials on the WWW: An Overview of the IFORS Tutorial Project
Invited Session

Chair: Moshe Sniedovich, University of Melbourne, Dept. of Math. & Stats., Parkville, Vic, 3052, Australia, m.sniedovich@ms.unimelb.edu.au

1) **IFORS Tutorial: OR/MS Tutorials on the WWW - An Overview of the IFORS Tutorial Project, Moshe Sniedovich**, University of Melbourne, Dept. of Math. & Stats., Parkville, Vic, 3052, Australia, m.sniedovich@ms.unimelb.edu.au

The WWW provides a tempting platform for the development of educationally rich and highly interactive teaching/learning tools for OR/MS subjects. However, such a development is beyond the reach of most individuals and departments. The IFORS tutorial project (www.ifors.org/tutorial/) addresses this issue. This presentation features a live demonstration of the project.

MC20 Optimization & Equilibrium Modeling in Energy

Sponsor: ENRE

Sponsored Session

Chair: Steven A. Gabriel, University of Maryland, Dept. of Civil & Environ. Eng., 1143 Martin Hall, College Park, MD 20742, sgabriel@eng.umd.edu

1) **Nash-Cournot Equilibria in Power Markets on a Linearized DC Network with Arbitrage: Formulations & Properties, Jong-Shi Pang**, JHU, Dept. of Math Sci., Baltimore, MD, jsp@viep1.mts.jhu.edu, **Benjamin F. Hobbs, Carolyn B. Metzler**

Extending a prior arbitrage-free model of Hobbs (2001), we present 2 models of an electric power market with arbitrage on a linearized DC network with affine price functions. The models differ in how arbitrage is handled. In the first, the producers anticipate the effect of arbitrage upon prices at different locations (Stackelberg assumption) and therefore treat the arbitrage amounts as decision variables in their profit maximization problems...

2) **The Retail Electrical Power Marketer's Problem, Steven A. Gabriel**, University of Maryland, Dept. of Civil & Environ. Eng., 1143 Martin Hall, College Park, MD 20742, sgabriel@eng.umd.edu, **S. Balakrishnan**

We model optimal decision making for third party marketers who set up contracts to purchase electricity from generators or other sources and then sell to end-users. These retail marketers assume a huge risk of uncertain load and prices in order to enjoy high profits.

3) **The Flaw of Averages & the Risk of Ranking: Two Pitfalls in Managing Energy Assets, Sam L. Savage**, Stanford University, 417 Terman Engineering, Stanford, CA 94305-4026, www.stanford.edu/~savage/

"Best guesses" of uncertain outcomes and "cherry picking" of projects ignore the theories of options and portfolios respectively. Simple spreadsheet explanations of these topics can be useful in getting top managers to buy in to these proven, but unfortunately, seldom used tools of analysis.

4) **Extended Pricing to Deal with Disequilibrium & Multiple Solutions in Unit Commitment-Based Electricity Power Pool Auctions, Marcelino Madrigal**, Instituto Tecnológico de Morelia, Av. Tecnológico 1500, Morelia, Mexico, mmadriga@ieee.org, **Victor H. Quintana**

The existence of multiple optimal or near-optimal solutions is considered an unfavorable characteristic of unit-commitment (UC) models used to implement electricity auctions. Delicate conflicts of interest are considered to appear when particular optimization techniques select one or the other optimal (or near-optimal) solution to the UC auction...

5) **A Method to Decompose Energy Models by Commodity, William S. W. Chung**, City University of Hong Kong, Dept. of MS, Kowloon Tong, Hong Kong, mswchung@cityu.edu.hk

We discuss a new decomposition method for solving multi-commodity energy equilibrium models (non-optimization models). The new decomposition method, based on Dantzig-Wolfe decomposition principle, decomposes and solves the original multi-commodity model by commodity, like linear programming decomposition principles for large-scale models. An illustration is included.

MC21 Transportation in the Airline Industry

Contributed Session

Chair: Amit Mukherjee, United Airlines, 1200 East Algonquin Rd., Elk Grove Village, IL 60007, amit.mukherjee@ual.com

1) **Development & Implementation of Advanced Flight Planning**

Systems, Amit Mukherjee, United Airlines, 1200 East Algonquin Rd., Elk Grove Village, IL 60007, amit.mukherjee@ual.com

Flight planning is a complex process of determining the most optimal route, altitude profile and speed for a flight given a route network, weather and payload data. The objective is to minimize fuel and time costs. We present an overview of an innovative 4-dimensional optimization model that uses network theory and dynamic programming techniques for flight plan optimization. We focus on the complexities in implementing the system in actual airline operations.

2) **Investigating the Impacts of Information Sharing & Strategic Alliances on International Operations of the Airline Industry, Chialin Chen**, Wilfrid Laurier University, Sch. of Bus. & Economics, Waterloo, Ontario, N2L 3C5, Canada, cchen@wlu.edu, **Chia-Yu Chen**

The impacts of different alliance strategies on international operations of the airline industry are investigated and analyzed. A major finding shows that parallel code sharing can help major airlines in risk pooling, which is an advantage that cannot be achieved by complementary code sharing.

3) **Some Advances in Crew Scheduling Optimization, Motakuri V. Ramana**, United Airlines, 1200 East Algonquin Rd., Elk Grove Village, IL 60007, motakuri.ramana@ual.com, **Connie Chen, Sriniramaswamy**

While crew scheduling is a mature area of applied optimization, the problems still remain quite difficult. As the computational efficiency and the effectiveness of the underlying algorithms are pushed further, new doors are opened with respect to the scale of the problems solved as well as new modeling opportunities. We will present some recent advances made on the algorithmic front of crew scheduling.

4) **A Study on an Optimization Model for Revenue Management in the Hospital Industry: An Application for Airline Industries, Dae-Young Jung**, 21-53 Ui-dong, Kangbuk-ku, Seoul, 142-871, Korea, kite72@hanmail.net, **Hye-Young Lee, Moon-Gil Yoon**

Revenue management can help a firm sell the right inventory unit to the right customer at the right time for the right price. It guides the decision of how to allocate undifferentiated units of limited capacity to available demand in a way that maximizes profit or revenue, that is, the objective in revenue management is to maximize profit through price segmentation and inventory control...

MC22 Project Management

Contributed Session

Chair: Ted D. Klastorin, University of Washington, Dept. of MS, Box 353200, Seattle, WA 98195-3200, tedk@u.washington.edu

1) **A Risk Handling Pattern of a Large-Scale Construction Project, Neng-Pai Lin**, Public Construction Commission, Executive Yuan, 9F No. 4, chunghsaio West Rd., Taipei, 100, Taiwan, ROC, nengpai@mail.pcc.gov.tw, **Miao Fan**

There are two different types of risk handling - adaptive and preventive are defined here. Based on a case study, the factors that influence the risk handling selection are explored. After analyzing several risk events of construction projects, a framework describing the risk handling pattern is developed. There are 4 research propositions generated from the framework, which concluded the research.

2) **Choices in Project Management based on Multicriteria Aid, Caroline M. G. Miranda**, UFPE, CP 7462, Recife PE, 50722-970, Brazil, gpsidsup@npd.ufpe.br, **Reive B. Santos, Adiel T. Almeida**

Cost and time have been the main objectives considered in project management. However, in some cases, deadlines cannot be accomplished with cost minimization. We present a multicriteria approach in order to support the management and planning of project under conflicting objectives, involving criteria such as cost, deadline, commitment, quality and flexibility.

3) **Project Planning & Catastrophic Events: The Value of Perfect Information, Ted D. Klastorin**, University of Washington, Dept. of MS, Box 353200, Seattle, WA 98195-3200, tedk@u.washington.edu

We consider a project planning problem when there is a possibility of a catastrophic event, (e.g., earthquake) occurring during the project. We consider the following two questions: should a project manager consider the possibility of this event when planning and what is the value of perfect information?

4) **withdrawn - chair request of 5/3, Sichong Guan**, Adexa, Inc., 1080 Holcomb Bridge Rd., Bldg. 100, Roswell, GA 30076, sguan@adexa.com, **Edward J. Lawton**

Monday 16:00-17:30**MD01 Supply Chain Optimization in Practice I**

Cluster: End-to-End Supply Chain Management
Invited Session

Chair: Mamnoon Jamil, IBM Integrated Supply Chain, 1000 Atrium Way, Atrium 1, Mt. Laurel, NJ 08054, mamnoon@us.ibm.com

1) Data-Driven Simulation for Optimization of a Class of Discrete Processes, Ramakrishna Desiraju, IBM, 598 Quaker Rd., Chappaqua, NY 10514, ramki@us.ibm.com, James Brom

Data driven simulation provides a good tradeoff between flexibility and modeling efficiencies when a class of processes can be abstracted as a model template driven by parameterized data. We focus on the lessons learned in the application of such techniques to a real-life project.

2) Collaboration in E-Markets & its Impact on the Supply Chain, Alberto Castano-Pardo, IBM Global Services, 10800 State Hwy 151, # 821, San Antonio, TX 78251, acastano@us.ibm.com, Amir Kazemi

Public e-markets bring together many buyers and suppliers and even logistic providers. In an effort to deliver value, e-markets also offer collaboration applications with the potential for having collaborations among many to many. We discuss the practical issues of developing such a scenario and their impact on the supply chain.

3) A Coordinated Production Planning Model with Capacity Expansion & Inventory Management, Jayashankar Swaminathan, University of North Carolina, Kenan-Flagler Bus. Sch., Chapel Hill, NC 27599-3490, msj@unc.edu, Sampath Rajagopalan

We study a firm producing multiple items in a multi-period environment where demand for items is known but varies over time with long-term growth and possible short-term fluctuations. We develop a mathematical programming model and an effective solution approach to determine the optimal capacity acquisition, production and inventory decisions over time and provide computational insights.

4) Optimal Order Fulfillment in an (s,S) Inventory System with Stochastic Customer Demand, Rajan Batta, SUNY, Dept. of IE, Buffalo, NY 14260-2050, batta@acsu.buffalo.edu, Geetika Rana, Robert J. Szczerba

We will present results on optimal order fulfillment strategies in an (s,S) inventory system. A large-scale simulation experiment is performed with numerous test factors and CPLEX is used to solve the resultant MIP problems when customer orders arrive. The batching of orders is explicitly modeled in our analysis.

MD02 Supply Contracts: Issues & Models

Cluster: Supply Chain Management
Invited Session

Chair: Candace A. Yano, University of California, IE/OR Dept., 4135 Etcheverry Hall, Berkeley, CA 94720-1777, yano@ieor.berkeley.ca

1) A Strategic Framework for Organizing Markets & Relationships in Business-to-Business Transactions, Moti Levi, Tulane University, Freeman Sch. of Mgmt., New Orleans, LA 70118, mlevi@tulane.edu, Paul R. Kleindorfer

Various conceptual frameworks have been proposed to explain a rational structure for industrial procurement and supplier management. We review the contributions of earlier approaches and suggest several extensions to these in the context of e-commerce. We present empirical evidence from a major chemical company to test the proposed framework.

2) Optimal Procurement Strategies with Supply Quantity Flexibility & Demand Forecast Updates, Feng Cheng, IBM Corporation, TJ Watson Research Ctr., Rte. 134, Yorktown Heights, NY 10598, fcheng@us.ibm.com, Grace Lin

We consider a periodic replenishment problem under supply contracts with quantity flexibility. The buyer may adjust outstanding order quantities within a given range and time limit. A nonlinear stochastic optimization model is developed to derive optimal procurement strategies. An empirical study based on real-world examples will be presented.

3) Modeling Capacity Allocation & Commitment Decisions in Capacity-Constrained Industries, Candace A. Yano, University of California, IE/OR Dept., 4135 Etcheverry Hall, Berkeley, CA 94720-1777, yano@ieor.berkeley.ca, Elizabeth C. Junqueira, J. George

Shanthikumar

We model a supplier's problem of committing and allocating capacity among multiple buyers. The supplier incurs penalties if he does not commit capacity to match customer forecasts and if he does not deliver on previous commitments. We discuss properties of the optimal solution and related managerial insights.

4) To Make or To Buy? That is the Question, Stefanos Zenios, Stanford University, Grad. Sch. of Business, Stanford, CA 94305, stefzen@leland.stanford.edu, Ananth V. Iyer, Lee Schwarz

Consider a manufacturer who wants to procure a critical component. The manufacturer has 3 options: design and produce the component in-house, design the component in-house but outsource the production or outsource both the design and production. We develop a principal-agent model to identify scenarios under which each of the 3 arrangements is optimal.

MD03 FMS Planning & Scheduling Models

Cluster: Flexible Manufacturing Systems
Invited Session

Chair: Kathryn E. Stecke, University of Michigan Business School, 701 Tappan St., Ann Arbor, MI 48109-1234, kstecke@umich.edu

Co-Chair: Narayan Raman, Lucent Technologies Bell Laboratories, 101 Crawfords Corner Rd., Rm. 3M-316, Holmdel, NJ 07733, narayanraman@lucent.com

1) Capacity & Inventory Sharing for Flexibility in a Supply Network, Tom Schmitt, University of Washington, Box 353200, Seattle, WA 98195, glennsch@u.washington.edu

In recurrent construction, firms process component and subassembly orders for common and unique items in batches. Major material expenses, significant penalties for late deliveries and long makespans motivate choosing a schedule that maximizes the net present value of cash flows. Our scheduling approach compares favorably with other work release methods in solution quality. Computation times exhibit near linear growth in problem size.

2) Scheduling of Printed Wiring Board Assembly by Mixed Integer Programming, Tadeusz J. Sawik, University of Mining & Metallurgy, Faculty of Mgmt., Al. Mickiewicza 30, Krakow, 30-059, Poland, tsawik@wzn4.zarz.agh.edu.pl

New MIP formulations are presented for scheduling PWB assembly in surface mount technology lines with finite intermediate buffers and limited machine availability. The objective is to determine the shortest assembly schedule for a mix of board types. Numerical examples and computational results illustrate applications of the proposed models.

3) Development of a Systematic Procedure for Productivity Improvement of Assembly Lines, M.-H. Herman Shen, Ohio State University, Aerospace Eng. & Aviation, 2036 Neil Ave., Rm. 328, Columbus, OH 43210, shen.1@osu.edu

The analysis and design of an optimum auto body shop assembly line is investigated. Several process parameters, i.e., individual station maintainability, product mix variation, buffer size and location and line layout, etc., are analyzed to improve overall productivity of an assembly process. Simulation results indicate that taking such parameters into consideration can be of significant interest for optimum assembly line design purposes.

4) Network Modeling for Data Integration in Flexible Manufacturing, Oleg Gusikhin, Ford, MD 2122, 2101 Village Rd., Dearborn, MI 48124, ogusikhi@ford.com

We propose a Petri nets-based modeling technique for the integration of plant data in a flexible manufacturing environment. A feature of the proposed modeling is that it allows for compensation of potential incomplete and inaccurate data. A case study illustrates its application at an automotive manufacturing facility.

MD04 OR Methods in Logistics Planning

Sponsor: MSOM

Sponsored Session

Chair: Jian Yang, NJIT, Dept. of IME, Newark, NJ 07102, yang@adm.njit.edu

1) Production Planning with Storable Supply, Layek Abdel-Malek, NJIT, Dept. of IME, Newark, NJ 07102, malek@adm.njit.edu, Jian Yang

The framework of a production planning problem where raw material can be stored for future use is displayed. The storability of raw material poses as one more dimension of complexity to decision making. Firms in the industries of

food, metal, metal products and petroleum refining face problems of this kind.

2) **A Multi-Products Dynamic Lot-Size Problem with Substitution**, *Vernon Hsu*, Hong Kong University of Science & Technology, Dept. of IE & EM, Hong Kong, vhsu@ust.hk, *Chung-Lun Li, Wen-Qiang Xiao*

We consider a dynamic lot size problem with multiple products of different grades. The higher grade product can be used to substitute the demand of lower grade product at some converting cost. We present dynamic programming solutions to the problem and discuss its applications in the real world.

3) **A Concave-Cost Production Planning Problem with Remanufacturing Options**, *Jian Yang*, NJIT, Dept. of IME, Newark, NJ 07102, yang@adm.njit.edu, *Boaz Golany, Gang Yu*

We study a concave-cost production planning problem with remanufacturing. We find a dynamic programming solution method for it based on decomposition of the planning horizon. Then we identify situations in which the problem is polynomially solvable. We also find a set of conditions under which one situation can be realized.

4) **Optimization of Dynamic Bus Routing Problems with Genetic Algorithms**, *Steven Chien*, NJIT, Dept. of Civil Eng., Newark, NJ 07102, chien@megahertz.njit.edu, *Zhaowei Yang*

Under the environment of advanced public transportation systems (APTS), a dynamic cost model is developed for optimizing a feeder bus route location and its headway considering realistic street patterns and heterogeneous demand. A GA demonstrates its effectiveness to search the optimal solution.

MD05 Modeling & Analysis of Semiconductor Manufacturing

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Matt Carlyle, Arizona State University, Dept. of IE, PO Box 875906, Tempe, AZ 85287-5906, mcarlyle@asu.edu, www.public.asu.edu/~mcarlyle/

1) **Optimal Opportunistic Maintenance Policies for Semiconductor Manufacturing**, *J. George Shanthikumar*, University of California, Dept. of IE/OR, Berkeley, CA 94720-1777, jgshant@ieor.berkeley.edu, *Esma S. Gel*

We investigate a novel opportunistic preventive maintenance (OPM) policy that schedules the PMs in coordination with the system workload, so that the yield is maintained at a high level without sacrificing the cycle time. Specifically, we formulate the as a Markov decision process and identify the optimal OPM policy structure.

2) **An Object-Oriented Model for Multiple-Site Semiconductor Manufacturing Enterprises**, *Ben Rodriguez*, Nimble NV, ben.rodriguez@nimble.com, *Joel Goossens*

We present a generic information model for globally distributed semiconductor enterprises using an object-oriented modeling approach. We discuss the rationale and the advantages of using this approach. Our aim is to create an unencumbered description for understanding the complexity of such organizations, improving their operations and building decision support applications.

3) **Semiconductor Manufacturing Supply Network Research**, *John W. Fowler*, Arizona State University, IE Dept., PO Box 875906, Tempe, AZ 85287-5906, john.fowler@asu.edu, www.eas.asu.edu/~masmlab/fowler/, *Matt Carlyle*

In the semiconductor industry, the majority of emphasis has traditionally been on wafer fabrication operations. Only recently have most semiconductor companies realized how important it is to manage the entire semiconductor supply network. We will discuss deterministic and stochastic models for modeling/analysis of semiconductor manufacturing supply networks.

4) **Triggers for Adaptive Rescheduling in Complex Job Shops**, *George Runger*, Arizona State University, Tempe, AZ 85287-5906, *Michele E. Pfund*

We discuss the characteristics of decision rules that trigger an opportunistic time to reschedule an operation. These rules will provide an adaptive rescheduling strategy that is based on the current agreement between actual and predicted schedule performance.

MD06 Production & Scheduling Applications

Contributed Session
Chair: Yeong-Dae Kim, KAIST, Dept. of IE, 373-1 Kusong-Dong, Yusong-Gu, Daejeon, 305-701, South Korea, ydkim@convex.kaist.ac.kr, http://ie1.kaist.ac.kr/~ydkim/ydkime.html

1) **Effects of Processing Time Variability & Equipment Downtimes on Various Scheduling Approaches for Printed Wiring Board Assembly**, *Michele E. Pfund*, Arizona State University, IE Dept., PO Box 875906, Tempe, AZ 85287-5906, michele.pfund@asu.edu, *Lian Yu, Matt Carlyle, John W. Fowler*

We consider a real multi-objective problem of scheduling a group of unrelated parallel machines within a Japanese electronics manufacturing line. This line is subject to processing time variability and equipment breakdowns. The performance of optimization and heuristic approaches is compared to determine where tradeoffs exist under various levels of uncertainty.

2) **Simulation-Based Real-Time Scheduling in a Semiconductor Wafer Fabricating Facility**, *Yeong-Dae Kim*, KAIST, Dept. of IE, 373-1 Kusong-Dong, Yusong-Gu, Daejeon, 305-701, South Korea, ydkim@convex.kaist.ac.kr, http://ie1.kaist.ac.kr/~ydkim/ydkime.html, *Sang-Oh Shim, Eun-Young Lee*

A simulation-based real-time scheduling method is suggested for wafer fabs that produce multiple product types with distinct due dates. Using this method, production scheduling rules are varied dynamically based on results of simulation. Three techniques are suggested to reduce the time required to respond to unexpected events.

3) **Efficient Algorithms for Automated Staff Scheduling**, *Marc Uetz*, TU Berlin, MA 6-1, Str. des 17 Juni 136, Berlin, 10623, Germany, uetz@math.tu-berlin.de, www.math.tu-berlin.de/~uetz/

We report on the realization of an automated staff scheduling module which we designed and implemented in cooperation with the ATOSS Software AG, a developer of software for work and time management. We combine classic network flow approaches with local search techniques to compute staff assignments according to individual objectives, using very little computational resources. (Joint work with F. Stork)

MD07 Contracting, Coordination, Information Sharing & Optimization in Supply Chains

Cluster: Competition & Incentives in Operations Management
Invited Session

Chair: Shanling Li, McGill University, Faculty of Mgmt., 1001 Sherbrooke St. West, Montreal, Quebec, H3G 1A5, Canada, li@management.mcgill.ca

1) **Optimal Division of a Project among Suppliers**, *John A. Buzacott*, York University, Schulich Sch. of Bus., 4700 Keele St., Toronto, Ontario, M3J 1P3, Canada, jbzacot@schulich.yorku.ca, *Steve Peng*

An aircraft manufacturer contracts with suppliers before actual orders are known. Suppliers can have contracts with other manufacturers. We develop a model to help the manufacturer divide the project among several suppliers to optimize the sharing of risk and value so as to attract appropriate commitment from the suppliers.

2) **Supply Chain Coordination & Cooperation: A Case Study of the Gujarat Cooperative Milk Marketing Federation**, *Pankaj Chandra*, Indian Institute of Management, Vastrapur, Ahmedabad, 380015, India, chandra@iimahd.ernet.in, *Devanath Tirupati*

We present an extensive case study on supply chain management at GCMFF. We focus on issues relating to mechanism of coordination and the roles of cooperation in effectively managing large supply chains under constraints of perishability and guaranteed purchase of raw material.

3) **Inventory, Channel Coordination & Bargaining in Manufacturer-Retailer Supply Chains**, *Xiaotian Li*, Adelphi University, School of Bus., Garden City, NY 11554, susan@panther.adelphi.edu, *Zhimin Huang*

Substantial research literature has been developed over the years on the subject of inventory in supply chain management. We develop a framework that integrates inventory control with non-constant demand and the economic relationship between consumer demand and retail price using a full information-sharing rule.

4) **Supply Chain Optimization for High-Tech Products**, *Jen S. Shang*, University of Pittsburgh, Katz Grad. Sch. of Bus., Pittsburgh, PA 15260, shang@katz.pitt.edu, *Shanling Li, Pandu Tadikamalla*

We develop a hybrid approach that incorporates simulation. Taguchi techniques and response surface methodology to examine the interactions among the factors and search for the combinations of factor levels that achieve the best performance in a supply chain. Our results show that in an ideal SC, capacity can be maintained at a normal level...

MD08 Topics in Global Optimization**Cluster:** Global Optimization

Invited Session

Chair: Immanuel M. Bomze, University of Vienna, Dept. of ISDS, Universitaetsstrasse 5, Wien, A-1010, Austria, immanuel.bomze@univie.ac.at

1) **withdrawn - author request of 5/2, Albert Ferrer Biosca**, Universitat Politècnica de Catalunya, Dept. de Matemàtica Aplicada I, EUPB, Campus SUD, Barcelona, Spain, albert@ma1.upc.es

2) **Downward Sets & their Separation & Approximation Properties, Ivan Singer**, Institute of Mathematics of the Romanian Academy, PO Box 1-764, Bucharest, RO-70700, Romania, isinger@stoilow.imar.ro, **Juan Enrique Martínez-Legaz, A. M. Rubinov**

We develop a theory of downward subsets of R^n (i.e., which contain, along with each element, all smaller elements). We introduce and study their plus-Minkowski gauges. We discuss duality for them, based on multiplicative and additive min-type functions and corresponding separation and approximation properties. We study best approximation by downward sets.

3) **withdrawn - author request of 5/3, Juan Enrique Martínez-Legaz**, Universitat Autònoma de Barcelona, Dept. D'Economia & Hist. Econ., Bellaterra, 08193, Spain, juanenrique.martinez@uab.es, **A. Danilidis, N. Hadjisavvas**

4) **On Co-Positive Programming & Standard Quadratic Optimization Problems, Immanuel M. Bomze**, University of Vienna, Dept. of ISDS, Universitaetsstrasse 5, Wien, A-1010, Austria, immanuel.bomze@univie.ac.at, **Mirjam Duer, Etienne de Klerk, Tamas Terlaky**

A standard quadratic problem (StQP) consists of finding (global) maximizers of a quadratic form over the standard simplex. StQPs have diverse direct real-life applications like the maximum clique problem. The usual semi-definite programming approach is enlarged to reformulate a StQP into a conic linear programming problem.

5) **Approximation of the Stability Number of a Graph via Co-Positive Programming, Etienne de Klerk**, Delft University of Technology, Delft, 2628CD, The Netherlands, **D. V. Pasechnik**

Stability numbers of undirected graphs can be computed as solutions of conic linear programs over the cone of copositive matrices. We show how to approximate the co-positive cone via linear and semi-definite programs (liftings) and estimate the maximal order of a lifting necessary to compute the stability number.

MD09 Computational Methods for Some Nonlinear Problems**Cluster:** Nonlinear Optimization

Invited Session

Chair: Jason J. Z. Zhang, City University of Hong Kong, Dept. of Math., Tat Chee Ave., Hong Kong, Hong Kong, mazhang@cityu.edu.hk

1) **An Analytic Center Cutting Plane Method for Semidefinite Feasibility Problems, Jie Sun**, National University of Singapore, Dec Sci/Singapore/MIT Alliance, 10 Kent Ridge Crescent, Singapore, 119620, Singapore, jsun@nus.edu.sg, **K. C. Toh, G. Y. Zhao**

We study an analytic center cutting plane algorithm for semi-definite feasibility problems. At each iteration, the algorithm computes an approximate analytic center of a working set defined by the cutting-plane system generated in previous iterations. The algorithm has a worst case complexity of m^3/ϵ^2 on the total number of cuts.

2) **Convergence Properties of the Inexact Levenberg-Marquardt Method under Local Error Bound Conditions, Nobuo Yamashita**, Kyoto University, Applied Math & Physics, Grad. Sch. of Informatics, Sakyo-ku, Kyoto, 606-8501, Japan, nobuo@amp.i.kyoto-u.ac.jp, **H. Dan, Masao Fukushima**

We consider convergence properties of the Levenberg-Marquardt method for solving nonlinear equations. We show that the inexact Levenberg-Marquardt method, which does not require computing exact search direction, has a superlinear rate of convergence under the local error bound assumption.

3) **A Homotopy-Like Simplicial Algorithm for Computing an Integer Point of a Class of Polytopes, C. Y. Dang**, City University of Hong Kong, Dept. of ME/EM, Hong Kong, mecdang@cityu.edu.hk

We propose a homotopy-like algorithm for computing an integer point of a

polytope satisfying the max-closed property. The algorithm assigns to each integer point of the space an integer of either 0 or from $1, \dots, n+1$, and subdivides the space into simplices. Starting with an integer point of the space, the algorithm follows a finite simplicial path.

MD10 Advances in Discrete Optimization Methods**Cluster:** Computational Mixed Integer Programming

Invited Session

Chair: J. Cole Smith, University of Arizona, Dept. of ISE, PO Box 210020, Tucson, AZ 85721-0020, cole@sie.arizona.edu

1) **Simultaneous Generalized Hill Climbing Algorithms for Addressing Sets of Discrete Optimization Problems, Diane E. Vaughan**, University of Illinois, Dept. of MIE, 1206 West Green St., MC 244, Urbana, IL 61801, **Sheldon H. Jacobson**

SGHC algorithms are introduced for addressing sets of related discrete optimization problems. SGHC algorithms probabilistically move between problems according to a problem generation probability function. The problem generation probability function is shown to be a stochastic process that satisfies the Markov property. Computational results are presented.

2) **Fast Algorithms for Multi-Target Tracking, J. Cole Smith**, University of Arizona, Dept. of ISE, PO Box 210020, Tucson, AZ 85721-0020, cole@sie.arizona.edu, **Moustafa Elshafei, Hanif D. Sherali**

In a multi-function radar, the maximum number of targets that can be managed or tracked is an important performance measure. Interleaving algorithms developed to operate radars exploit the dead-times between the transmitted and the received pulses to allocate new tracking tasks that might involve transmitting or receiving pulses, thus increasing the capacity of the system...

3) **Approximation Algorithms for the SONET Edge-Partition Problem, Eli V. Olinick**, SMU, Dept. of Comp. Sci. & Eng., Box 750122, Dallas, TX 75275-0122, olinick@engr.smu.edu, www.engr.smu.edu/~olinick, **Olivier Goldschmidt, Dorit S. Hochbaum**

We consider the problem of partitioning a graph's edges into subsets that contain at most k edges with the objective of minimizing the total number of vertices in the induced subgraphs. We present linear-time approximation algorithms for this NP-hard problem that has applications to the design of SONET-based telecommunication systems.

4) **Complete Local Search with Memory, Diptesh Ghosh**, University of Groningen, PO Box 800, Groningen, 9700AV, The Netherlands, d.ghosh@eco.rug.nl, http://www.eco.rug.nl/medewerk/ghosh, **Gerard Sierksma**

Neighborhood search heuristics such as local search and its variants are some of the most popular approaches to solve discrete optimization problems. Most of these heuristics are memoryless. We present a new neighborhood search heuristic that makes effective use of memory structures in a way different from conventional tabu search.

MD11 Applied Stochastic Programming**Cluster:** Stochastic Programming**Sponsor:** Optimization

Sponsored Session

Chair: Urmila Diwekar, Carnegie Mellon University, CUSTOM, Civil & Environ. Eng., Pittsburgh, PA 15213, urmila@cmu.edu

1) **Multi-Product, Risk-Based Integration of Strategic & Tactical Capacity Planning, Sunder Kekre**, Carnegie Mellon University, GSIA, Pittsburgh, PA 15213, **Uday S. Rao, Samarth Sarthi, Jinxin Yi**

Capacity planning under uncertain, seasonal demand is of strategic and tactical importance to companies faced with long-term choices (number of production lines installed) and short-term decisions (per-period production, inventory and subcontracting). We develop a scenario-based, stochastic program incorporating return and risk (variance and cost-upside). We present properties, a decomposition-based solution approach and computational results.

2) **Optimization of Cure Cycles for Thermosetting Composites Fabrication under Uncertainties, A. Mawardi**, University of Connecticut, Dept. of Mech. Eng., 191 Auditorium Rd., Unit 3139, Storrs, CT 06269-3139, **R. Püchmani**

We address the problem of determining the optimum cure temperature cycles for the fabrication of polymeric composites in the presence of operational and material parameter uncertainties. A stochastic optimization scheme is implemented, wherein the parameter uncertainties are represented as Gaussian distributions. The studies are presented for fabrication using the autoclave and

the pultrusion processes.

3) Solvent Selection under Uncertainty: A Stochastic Linear Programming Problem, *Ki-Joo Kim*, Carnegie Mellon University, Civil & Environ. Eng. Dept., Pittsburgh, PA 15213, *Urmila Diwekar*

Solvent selection is an important step in chemical and pharmaceutical industries. Computer-aided molecular design approach provides a promising tool for solvent selection. However, uncertainties inherent in these techniques and associated models are often neglected. We present a new approach to solvent selection under uncertainty based on stochastic integer programming.

MD12 Financial & Economic Analysis of Online Businesses

Sponsor: E-Commerce

Sponsored Session

Chair: Arvind Rangaswamy, Pennsylvania State University, Smeal Coll. of Bus. Admin., 707G BAB, University Park, PA 16802-3007, arvindr@psu.edu

1) Valuation Models for Dot Com Companies, *Prakash L. Dheeriyaa*, California State University at Dominguez Hills, Finance & Quant. Methods, Carson, CA 90747, pdheeriyaa@soma.csudh.edu

Many stock market investors have expressed concern over the extremely high valuations placed on new, internet companies which have no track record of profitability or liquidity. Emphasis seems to be focus on new indicators such as number of eyeballs, unique customers, page hits, etc., rather than profit margins, return on assets and other measures of liquidity...

2) Business & Community Gateways: A Sustainability Model Urgently Needed, *Ian Martinus*, Edith Cowan University, Econ. & E-Bus. Development, Wanneroo, Australia, ian.martinus@wanneroo.wa.gov.au

Business and community gateways are beginning to become standard operating equipment across regions. They are driven by government, business and community collaboration. This type of knowledge repository has some in-built flaws that may eventually lead to failure. The blend and consistency of people and machinery may prove in the medium to longer term as being incompatible...

3) Are Peer-to-Peer Networks Natural Monopolies? A Stochastic Differential Equation Model, *Srikant Vadali*, Pennsylvania State University, 701C BAB, University Park, PA 16802-3007, sxv163@psu.edu, *Gary L. Lilien*

We investigate long run market outcomes in markets such as peer-to-peer networks where positive network externalities exist along with consumer switching behavior. We find that the long run market outcomes depend upon how strong the effect of network externality is and on the relative preference of consumers between the two networks.

4) Impact of the Internet on a Firm's Cost of Capital: An Analysis, *Prakash L. Dheeriyaa*, California State University at Dominguez Hills, Finance & Quant. Methods, Carson, CA 90747, pdheeriyaa@soma.csudh.edu, *Ted Azarmi*

New technologies have significantly changed the way companies raise capital. Geographical and time constraints are not obstacles anymore. Participants in financial markets react swiftly to latest data, regardless of its geographical location. The Internet makes it possible for even small companies to tap potentially thousands of investors all over the globe. We investigate cases of companies...

MD13 International Quality Issues

Cluster: Issues in Manufacturing & Service Quality Management

Invited Session

Chair: Placido Rogerio Pinheiro, University of Fortaleza, Almirante Abner Vasconcelos St, Brazil, placido@unifor.br

1) ELEQUAL: A Multi-Criteria Approach for Classification of Service Quality Problems, *Andre L. P. Freitas*, Universidade Estadual do Norte Fluminense, CEFET Campos, Av. Albetto Lamego 2000, Campos RJ, 28015-620, Brasil, policani@uenf.br, *Helder Gomes Costa*

Multi-criteria methodologies are employed for sorting and classifying service quality in appropriate categories. Specifically, the ELEQUAL approach is structured to permit the application of ELECTRE III, a method traditionally used in ranking problems. After conducting an illustrative experiment, we present the results of the application of this approach.

2) A Stochastic Linear Programming Model for the Production of Welfare Services, *Roselita C. Bastos*, Social Welfare, Andre Dallolio St., Brazil, roselita@fortalnet.com.br, *Placido Rogerio*

Pinheiro

We propose an application of stochastic linear programming for optimizing the services offered by social foresight in the executive agency. The results obtained will be used for planning the services lending procedures to improve the quality of work of the Brazilian social foresight system user.

3) A Model for Analyzing Service Activity through Elements of a Quality System, *Denise D. de Medeiros*, UFPE/CTG/DEP/PPGEP, Av. Academico Helio Ramos s/n, Recife, PE, 50740-530, Brazil, ddm@npd.ufpe.br, *Giovanilza M. P de Oliveira, Gisele C. S. da Silva*

In order to become competitive, organizations need to know their customers and satisfy their needs with quality products. We present a model to analyze service activity through the elements of a quality system, according to Gianesi & Correa (1996), Bergamo (1999), Juran Trilogy (1995) and ISO 9000 (1994).

MD14 Behavioral Issues in Decision Theory

Sponsor: Decision Analysis

Sponsored Session

Chair: Martin Weber, Universitat Mannheim, Lehrstuhl fuer Bankbetriebs., L5 2, Mannheim, 68131, Germany, weber@bank.bwl.uni-mannheim.de

1) Partition Dependence in Probability Judgment, *Craig R. Fox*, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, cfox@mail.duke.edu, *Robert T. Clemen*

We present evidence that judged probabilities depend crucially on how the event space is partitioned. Our results suggest that judgments are biased toward the "ignorance prior" probability of $1/n$ for each elementary event in the partition, even for partitions of dimensional spaces (e.g., future stock price) and among expert analysts.

2) The Impact of Feedback Frequency on Risk Taking: How General is the Phenomenon?, *Thomas Langer*, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, tlanger@mail.duke.edu, *Martin Weber*

Gneezy & Potters (1997) present experimental evidence for the impact of feedback frequency on individual risk taking behavior in repeated investment decisions. We provide theoretical arguments and experimental evidence to demonstrate that the reported phenomenon is not robust to changes in the risk profiles of the given investment options.

3) Detecting Regime Shifts: A Study of Over- & Under-Reaction, *George Wu*, University of Chicago, Grad. Sch. of Bus., 1101 East 58th St., Chicago, IL 60637, george.wu@gsb.uchicago.edu, *Cade Massey*

Detecting regime shifts is critical for managerial success. We consider whether individuals are able to do so, investigating when individuals are more likely to over-react and under-react. We present two studies that show evidence for a system neglect hypothesis: individuals are insufficiently sensitive to the environmental system governing the change.

4) To Buy or Not to Buy: Information Acquisition in a Process of Sequential Information Aggregation with a Continuous Action Space, *Martin Weber*, Universitat Mannheim, Lehrstuhl fuer Bankbetriebs., L5 2, Mannheim, 68131, Germany, weber@bank.bwl.uni-mannheim.de, *Carlo Kraemer*

Individuals exhibit a tendency to acquire an excessive amount of private information if information can only be communicated through a small and discrete action space. Based on a cascade setting, we investigate demand for information when the action space is continuous controlling for participants probability judgments.

MD15 Control of Queues

Sponsor: Applied Probability

Sponsored Session

Chair: Donald P. Gaver, Naval Postgraduate School, Dept. of OR, 1411 Cunningham, Monterey, CA 93943, dgaver@wpossmtpl.nps.navy.mil

1) Average Optimal Policies in a Controlled Queueing System with Dual Admission Control, *Mark E. Lewis*, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, melewis@engin.umich.edu

Consider an M/M/1 queueing system where customers may be subject to two potential rejections. We show the structure of an average reward optimal policy is that of a "generalized" monotone switching curve. Applications include call centers with delayed classifications and manufacturing systems when the server is responsible for multiple tasks.

2) **Scheduling a Multi-Class M/M/1 Queue with Convex Holding Costs**, *Kevin D. Glazebrook*, University of Newcastle Upon Tyne, Dept. of Stats., Newcastle Upon Tyne, NE1 7RU, UK, kevin.glazebrook@newcastle.ac.uk, *Marilyn O'Keefe, Jose Nino-Mora*

We model a multi-class M/M/1 queue with increasing, convex holding costs as a restless bandit. We demonstrate that the model is indexable and give closed forms for the index. We describe a numerical approach to the development of suboptimality bounds for the index policy.

3) **Stabilization & Control of Impatient Uncertain Tasks**, *Donald P. Gaver*, Naval Postgraduate School, Dept. of OR, 1411 Cunningham, Monterey, CA 93943, dgaver@wposmtp.nps.navy.mil, *Patricia A. Jacobs, Glen Takahara*

We analyze the probability that a task is successfully served, controlling by optimally truncating service durations in an M/G/1 illustration. Situational examples occur in the military and in emergency medicine and disaster relief.

4) **An Empirical Approach to Quality & Reliability Improvement of the Service Industry**, *M. F. Ramalhoto*, Technical University of Lisbon, Dept. of Math, Av. Rovisco Pais, Lisbon, 1049-001, Portugal, d554@alfa.ist.utl.pt

We present a methodology to incorporate quality management concepts of customer's satisfaction into the queuing system design. A new concept to obtain relevant data, the manager's tetrahedron, is proposed. A total-quality-queue-management framework, based on the manager's tetrahedron and on adequate queuing theory and decision making techniques, is outlined and discussed. A very simple method to obtain approximations for relevant time-dependent probabilities is introduced.

MD16 Regulatory DEA Models

Cluster: Data Envelopment Analysis

Invited Session

Chair: Per J. Agrell, Universite Catholique de Louvain, CORE, Voie de Roman Pays 34, Louvain-la-Neuve, B-1348, Belgium, agrell@core.ucl.ac.be

1) **Auctions & DEA Yardstick Competition in Regulation**, *Per J. Agrell*, Universite Catholique de Louvain, CORE, Voie de Roman Pays 34, Louvain-la-Neuve, B-1348, Belgium, agrell@core.ucl.ac.be, *Peter Bogetoft*

A comprehensive regulatory model is proposed for concessions, building on a DEA yardstick model for operating expenditure during the concessionary period and a second price auction for capital expenditure. The novel construction introduces competition in 2 ways: allowing multiple providers in the concession area and providing optimal cost norms for operating expenditure...

2) **Testing for Productive Efficiency with Errors-in-Variables**, *Thierry Post*, Erasmus University Rotterdam, H14-11, PO Box 1738, Rotterdam, 3000 DR, The Netherlands, gtpost@few.eur.nl, *Timo Kuosmanen, Stefan Scholtes*

We develop a nonparametric test of productive efficiency that accounts for the possibility of errors-in-variables. The test allows for statistical inference based on the extreme value distribution of the E L norm. In contrast to the test proposed by Varian (1985), our test can be computed using simple enumeration algorithms or LP. An empirical application for the Dutch electricity sector illustrates the proposed test procedure.

3) **Dynamic DEA Regulation under Asymmetric Information**, *Per J. Agrell*, Universite Catholique de Louvain, CORE, Voie de Roman Pays 34, Louvain-la-Neuve, B-1348, Belgium, agrell@core.ucl.ac.be, *Peter Bogetoft*

We extend results in Bogetoft (2000) on DEA and activity planning to explicitly take the regulatory dynamics into account. The gradual revelation of ex post information opens 3 strategies: blueprint planning, sequential updating and optimal adaptive control. The application of these regimes affect the asymmetric nature of regulation, where excessive gains are reduced whereas losses are not...

MD17 Network Topology & Dimensioning

Sponsor: Telecommunications

Sponsored Session

Chair: June S. Park, Samsung SDS, 707-19 Yoksam-2-dong, Kangnam-ku, Seoul, 135-080, Korea, jpark0@samsung.co.kr

1) **Dimensioning Multi-Service Networks for Multi-Cast Services**, *Amaro F. de Sousa*, Universidade de Aveiro, Inst. de Telecomunicacoes, Aveiro, 3810-193, Portugal, asou@det.ua.pt, *Rui Valadas, Luis Gouveia*

We address the problem of physical network dimensioning for multicast services. We present MIP models considering two alternatives for the logical network topology: full mesh and tree topology. For small networks, the models are solved through a B&B algorithm and show that tree topology requires lower costs physical networks.

2) **SONET Rings Design for Centralized Traffic**, *June S. Park*, Samsung SDS, 707-19 Yoksam-2-dong, Kangnam-ku, Seoul, 135-080, Korea, jpark0@samsung.co.kr, *Byung Ha Lim, Larry J. LeBlanc*

We develop a binary integer linear program and simulated annealing-based Lagrangian heuristics for the problem of designing stackable, unidirectional SONET rings to support centralized traffic that arises in such applications as feeder transport networks, Internet service networks and multimedia service networks.

3) **Capacity Assignment & Routing for Interactive Multimedia Service Networks**, *Byung Ha Lim*, University of San Francisco, McLaren Sch. of Bus., San Francisco, CA 94117, limb@usfca.edu, *June S. Park*

A binary integer linear program is formulated for the problem of expanding the capacity of a fiber optic network and routing the traffic to deliver new interactive multimedia services. A 2-phase Lagrangian dual search procedure is developed that first searches an aggregate dual space and then a disaggregate one.

MD18 Integer Programming Techniques to Medical Applications

Cluster: Health & Medical Applications

Invited Session

Chair: Eva K. Lee, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, eva.lee@isye.gatech.edu, www.isye.gatech.edu/~evakylee

1) **Integer Programming Applied to External Beam Radiation & its use in Intensity-Modulated Radiation Therapy in Cancer Treatment Planning**, *Eva K. Lee*, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, eva.lee@isye.gatech.edu, www.isye.gatech.edu/~evakylee

Integer programming models for external beam radiation and intensity-modulated radiation therapy for cancer treatment planning are described. Computational strategies and empirical results using real patient cases will be analyzed.

2) **Cutting-Plane Algorithms for HP-Lattice Protein Folding**, *Joel S. Sokol*, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332, jsokol@isye.gatech.edu

The HP-lattice protein folding problem is theoretically and computationally hard current techniques can only solve instances an order of magnitude smaller than the average protein. We present several cutting plane algorithms for the problem, show preliminary computational results and use the comparisons to identify promising directions for future research.

3) **Using an Integer Programming Model to Determine the Price of Combination Vaccines for Childhood Immunization**, *Sheldon H. Jacobson*, University of Illinois, Dept. of MIE, 1206 West Green St., MC 244, Urbana, IL 61801, shj@uiuc.edu, *Edward C. Sewell*

A crowded childhood immunization schedule has led to the development of combination vaccines that combine several antigens into a single injection. We use an integer programming model to reverse engineer the price of 4 combinations vaccines such that this price positions each vaccine as a good economic value.

MD19 Networks & Graphs

Contributed Session

Chair: Luis Gouveia, Universidade de Lisboa, DEIO-CIO, Bloco C2, Campo Grande, Lisboa, 1700, Portugal, lgouveia@fc.ul.pt

1) **On Minimizing Grid Models**, *Marcia H. C. Fampa*, Federal University of Rio de Janeiro, Computing Dept., Rio de Janeiro, 21945-970, Brazil, fampa@cos.ufrj.br, *S. Klein, F. Protti, D. C. A. Rego*

A grid intersection graph is the intersection graph of straight line segments on the plane where the segments lie in at most two directions, e.g., horizontal and vertical, etc., and parallel segments are pairwise disjoint. A representation of a grid intersection graph G by segments on the plane is called a grid model for G. Grid intersection graphs have applications in circuit design.

2) **withdrawn - author request of 5/10**, *Johannes R. van den Brink*, Tilburg University, Dept. of Econometrics & OR, PO Box

90153, Tilburg, 5000 LE, The Netherlands, jbrink@kub.nl

3) **withdrawn - author request of 5/10, Fernando A. Marins**, FEG-UNESP, Av. Ariberto Pereira da Cunha, 333, Guaratingueta, SP, 12516-410, Brazil, fmarins@feg.unesp.br, www.feg.unesp.br, *Clovis Perin, Margarida Mello*

4) **Generalizing Cut Inequalities for Hop-Constrained Network Design Problems, Luis Gouveia**, Universidade de Lisboa, DEIO-CIO, Bloco C2, Campo Grande, Lisboa, 1700, Portugal, lgouveia@fc.ul.pt, *Geir Dahl*

We use a minmax result due to Robacker for deriving cut-like inequalities which characterize sets of arcs containing paths with at most H hops between a given source node and a given target node. We give complete cut linear characterizations of the hop-constrained path problem when $H = 2$ and 3 . A set of facet defining inequalities when $H = 4$ is also given.

MD20 Mathematical Programming & Electricity Markets

Sponsor: ENRE

Sponsored Session

Chair: Antonio Conejo, Universidad de Castilla La Mancha, ETSI Industriales, Campus Universitario s/n, Ciudad Real, 13071, Spain, aconejo@ind-cr.uclm.es

1) **Mathematical Programming Problems in Electricity Markets, Antonio Conejo**, Universidad de Castilla La Mancha, ETSI Industriales, Campus Universitario s/n, Ciudad Real, 13071, Spain, aconejo@ind-cr.uclm.es, *Francisco J. Prieto*

The electric power industry all over the world is undertaking major regulatory and operational changes. The underlying rationale behind all these changes is to move from a centralized operation approach to a competitive one. This new framework requires new tools and procedures, and some procedures drastically differ from traditional ones. Therefore, new challenging mathematical programming and operations research problems naturally arise...

2) **Optimum Uplifts in Electricity Markets, Alexis L. Motto**, McGill University, Montreal, Quebec, Canada, alexis@ece.mcgill.ca, *Francisco D. Galiana*

Uplifts as applied in centralized electricity markets are monetary incentives offered to some key participants to induce them to generate or consume at power levels that would otherwise result in a financial loss. Such situations arise when the marginal nodal prices alone do not provide a sufficient monetary incentive to the market participants to operate...

3) **A Schur Complement Update to Decompose Large-Scale Nonlinear Programs, F. Javier Nogales**, Universidad de Castilla La Mancha, Ciudad Real, 13071, Spain, fnogales@ind-cr.uclm.es, *Antonio Conejo, Francisco J. Prieto*

We present a decomposition technique to solve large-scale nonlinear optimization problems with special structure, such as those arising in many applications in electricity markets: energy production planning or electric power network analysis, among others. The procedure is based on nonlinear interior point techniques and approximates a Schur complement using a quasi-Newton update, with significantly computational gains.

4) **Optimal Response of an Oligopolistic Generating Company to a Competitive Electricity Market, Sebastian de la Torre**, Universidad de Castilla La Mancha, Ciudad Real, 13071, Spain, storre@ind-cr.uclm.es, *Javier Contreras, Jose M. Arroyo, Antonio Conejo*

The target of an oligopolistic generating company in an electric power market is to maximize its profits using 2 related instruments at hand: its ability to modify the market-clearing price and its capability to alter its own production level. Power balance is not an issue for the generating company; the independent system operator ensures power balance considering generator and demand bids through any market-clearing procedure...

MD21 Transportation Scheduling

Contributed Session

Chair: Yusin Lee, National Cheng Kung University, PO Box 7-206, Tainan, 701, Taiwan, yusin@mail.ncku.edu.tw, www.civil.ncku.edu.tw

1) **Cyclic Railway Timetabling & Cycles in Graphs, Leon Peeters**, Rotterdam School of Management, PO Box 1738, Rotterdam, 3000 DR, The Netherlands, lpeeters@fbk.eur.nl, *Leo Kroon, Christian Liebchen*

Many European railway companies operate cyclic timetables, with train connections operated every hour at the same minute. The cyclic railway timetabling problem is modeled as an MIP, the constraints of which are

represented by a graph. Our research investigates cycles and cycle bases in that graph to solve the problem.

2) **The Development of a Column Generation-Based Algorithm for Drivers Scheduling Problems of the Taipei MRT Company, Jin-Yuan Wang**, National Chiao Tung University, Dept. of Transportation, 1001 University Rd., Hsinchu, 30050, Taiwan, jinyuan@cc.nctu.edu.tw, *Chung-Cheng Lu*

We proposed an algorithm for solving the drivers scheduling problem of the Taipei MRT Company. Column generation technique was used to generate promising tasks. A B&B method was then applied to yield integer solutions. Finally, a heuristic method was used to obtain the final solutions. The testing results showed that this algorithm could get better and feasible solutions.

3) **An Optimization Model for the Train Dispatching Problem, Yusin Lee**, National Cheng Kung University, PO Box 7-206, Tainan, 701, Taiwan, yusin@mail.ncku.edu.tw, www.civil.ncku.edu.tw, *Li-Wen Chen*

We decompose the train dispatching problem into the train ordering problem and the train timing problem and develop a mathematical model for each. The first model is an MIP with special structure and the second is an LP. Both models can be solved efficiently with the simplex method.

MD22 Management of Technology

Contributed Session

Chair: Bas J. Oosterman, University of Groningen, Fac. of Mgmt. & Organization, Landleven 5, PO Box 800, Groningen, 9700 AV, The Netherlands, basoosterman@hotmail.com

1) **Predicting the Survival of High-Tech Initial Public Offering Firms, Anthony D. Wilbon**, Morgan State University, 1700 East Cold Spring Ln, 507C Mcmechan Bldg., Baltimore, MD 21251, awilbon@jewel.morgan.edu

This study analyzes the influence of technology management on the survival of 95 high-tech initial public offering firms. Logistic regression analysis shows that firms who survive 5 years after an IPO have more intellectual property rights, more experienced senior executives and spend less on R&D than their cohorts.

2) **Representing Product Architecture: Understanding the Coordination Requirements during the Design Process, Bas J. Oosterman**, University of Groningen, Fac. of Mgmt. & Organization, Landleven 5, PO Box 800, Groningen, 9700 AV, The Netherlands, basoosterman@hotmail.com, *Gerard Gaalman, Frans P. J. Kuijpers*

We analyze the organization of design processes from the perspective of product architecture. A structured method to represent particular product architectures is proposed. The method explains required coordination during the design process and provides options for improvement. We apply the method for the design process of an electric shaver.

3) **Optimal Learning & Process Change Policies in Yield-Driven Manufacturing Ramp-Up, Yi Xu**, University of Pennsylvania, 3260 Locust Walk, 1300 SH-DH, Philadelphia, PA 19104, xuyi@wharton.upenn.edu, *Christian Terwiesch*

We study a manufacturing process for a new product during the production ramp-up stage. Management needs to balance two conflicting objectives: learning about the current process and further improving the current process. These trade-offs are explored using a continuous time profit maximization model. The optimal policies and properties are derived for learning and process change on a finite time horizon.

4) **Creating an Innovative Environment for Senior Scientists & Engineers, George F. Farris**, Rutgers University Business School, 111 Washington St., 302 MEC, Newark, NJ 07102-3027, gfarris@andromeda.rutgers.edu

Relationships between age and innovation were studied for 3,163 industrial scientists and engineers. Innovation peaked in the early 30s and then declined gradually throughout one's career. The decline was associated with personal traits related to age, characteristics of the scientists' working environments and possible biases of managers judging performance.

5) **A Process-Oriented Simulation Model of Organizational New Product Development under Social Network Context, Beiqing Yao**, University of Pittsburgh, Katz Grad. Sch. of Bus., 249 Mervis Hall, Pittsburgh, PA 15260, bqyao@katz.pitt.edu, *John Prescott*

We set up an open-system simulation model of organizational new product development under social network context to study organizational productivity and competitiveness. We discuss relevant literature on process-oriented product development, incorporate the influences of knowledge transfer in inter-organizational network and then develop a preliminary simulation model to study the dynamic process of organizational product development in the context

of inter-organizational knowledge transfer.

Monday 17:45-19:15

ME01 Supply Chain Optimization in Practice II

Cluster: End-to-End Supply Chain Management

Invited Session

Chair: Susan E. Rothberg, IBM, 3039 Cornwallis Rd., RTP, NC 27709, seroth@us.ibm.com

Co-Chair: Mamnoon Jamil, IBM Integrated

Supply Chain, 1000 Atrium Way, Atrium 1, Mt. Laurel, NJ 08054, mamnoon@us.ibm.com

1) Integration? A Key Component in a Successful Supply Chain Implementation, *Krystal Reynolds*, IBM Global Services, 2455 South Rd., Poughkeepsie, NY 12601, kkreyn@us.ibm.com

World-class DSSs create solutions using sophisticated algorithms, taking into consideration competing objectives. But is the data availability, structure and veracity along with the full integration with legacy and/or ERP systems that are key to the level of success and customer satisfaction of the final supply chain implementation.

2) Investigating Market Requirements & the Supply Chain Design, *John Konopka*, IBM Integrated Supply Chain, 2929 North Central Ave., Phoenix, AZ 85012, konopka@us.ibm.com, *Mamnoon Jamil*

We investigate several high technology products and analyze their supply chain design. We focus on supply chain designs that were designed to minimize costs across the supply chain. We also focus on the impact to these supply chain designs when the marketing and/or sales objectives, i.e., increased product availability and "more customer choice," etc., were matched against them.

3) Optimizing the Value Chain: The Next Step in Supply Chain Optimization, *Gerhard Plenert*, AMS, 8545 Sunset Ave., Fair Oaks, CA 95628, gerhard_plenert@amsinc.com

Supply chain management is the efficient optimization of the vendor's vendor to the customer's customer network through the efficient flow of information. Value chain management takes the supply chain and identifies all the resources involved in the transfer of goods, i.e., labor resources, materials resources, financial resources, logistics resources, facilities, etc...

4) Analyzing Service Level Inhibitors in a High Technology Environment, *Susan E. Rothberg*, IBM, 3039 Cornwallis Rd., RTP, NC 27709, seroth@us.ibm.com

We investigate the efficiency of various manufacturing strategies in a high technology, high volume environment. Specifically, we focus on the effects of throughput yield, line interrupts and queuing on serviceability performance. In addition, we evaluate the serviceability inhibitors resulting from line operation strategy selection and accompanying execution.

ME02 Lead-Time Management

Cluster: Supply Chain Management

Invited Session

Chair: Alan Scheller-Wolf, Carnegie Mellon University, GSIA 319, Pittsburgh, PA 15213, awolf@andrew.cmu.edu

1) Inventory Models with Fixed Costs, Multiple Delivery Modes & Forecast Updates, *Houmin Yan*, Chinese University of Hong Kong, Dept. of SE/EM, Hong Kong, Shatin NT, PR China

This paper concerns the optimality of (s,S)-type policies in periodic review inventory systems with fast and slow delivery modes, fixed ordering cost, and regular demand forecast updates. We show that optimal Markov policies of (s,S)-type exist. We also show monotonicity properties of the policy parameters with respect to the updates.

2) Optimal Base-Stock Policies with Convertible Lead-Times, *Guillermo Gallego*, Columbia University, IEOR Dept., 324 SW Mudd Bldg., 500 West 120th St., Rm. 331, New York, NY 10027, ggallego@ieor.columbia.edu

A retailer facing Poisson demand can choose between two linear ordering cost modes: regular and emergency. Additionally, over some time interval a regular order can be converted into an emergency order. We find the policy that minimizes the long-run average ordering, converting, holding and stockout cost: base-stock with conversion thresholds.

3) Inventory Models with Regular & Expedited Ordering, *Alan Scheller-Wolf*, Carnegie Mellon University, GSIA 319, Pittsburgh,

PA 15213, awolf@andrew.cmu.edu

We consider periodic-review inventory models with two delivery modes, regular and expedited (shorter lead time, higher unit cost). If the delivery lead times differ by more than one unit, optimal policy structure is complex. We define 2 classes of heuristic policies, discuss determination of their parameters and compare relative performance.

4) The Serial Supply Chain Conventionally Decentralized, *Kaj A. Rosling*, Vaxjo University, Dept. of IE, Vaxjo, SE-351-95, Sweden, kaj.rosling@ie.lth.se

The independent retailer selects an order-level that minimizes its own costs, the warehouse minimizes supply chain costs. If the warehouse sells at its own marginal replenishment cost, the game equilibrium coincides with the optimal centralized policy. A higher price causes small additional chain costs if the final service-level is high.

ME03 Supply Management in the Manufacturing Industry

Cluster: Supply & Demand Mgmt. in the Mfg. & Service Industries

Invited Session

Chair: Ebru Bish, Virginia Tech. University, ISE Dept., 250 NEB, Blacksburg, VA 24061, ebru@vt.edu

1) Using Product-Mix Flexibility to Implement a Make-to-Order Assembly Line, *James R. Bradley*, Cornell University, Johnson Grad. Sch. of Mgmt., 321 Sage Hall, Ithaca, NY 14853-6201, jrb28@cornell.edu

The assembly line, which is traditionally managed with the goal of maximizing labor efficiency, is inflexible to product variety. We propose efficient tactics that enable the production of a dynamically varying mix of products, thus enabling support of a make-to-order strategy.

2) Bucket Brigades with Varying Worker Speeds, *Dieter Armbruster*, Arizona State University, Goldwater Ctr. 520, Dept. of IE, Tempe, AZ 85287, *Esma S. Gel*

We study the effect of worker speed on the dynamics of bucket brigades. We consider two workers with different productivities for different tasks. We augment the bucket brigade rules such that they balance to either a stable fixed point or a period two orbit, regardless of initial positions and for all worker speeds.

3) Sequential Capacity Procurement in a Stochastic Capacitated Supply, *Feryal Erhun*, Carnegie Mellon University, GSIA, Pittsburgh, PA 15213, *Sridhar Tayur*, *Pinar Keskinocak*

We study a 2-stage supply chain, where the manufacturer who faces a stochastic downward sloping demand function procures capacity from a capacitated supplier. As time progresses, the demand reveals itself. We characterize the unique equilibrium and provide several insights regarding the supply chain.

4) Flexible Capacity Management in Manufacturing, *Ebru Bish*, Virginia Tech. University, ISE Dept., 250 NEB, Blacksburg, VA 24061, ebru@vt.edu, *Ana Muriel*, *Stephan R. Biller*

We analyze the impact that introducing flexible manufacturing plants has on supply chain performance in a make-to-order environment. We find that suppliers observe more variability and the manufacturer holds more component inventory in a flexible system. We also quantify the reduction in outbound distribution cost in a flexible system.

ME04 Models of Product Variety

Sponsor: MSOM

Sponsored Session

Chair: Charles J. Corbett, UCLA, Anderson Sch. of Mgmt., 110 Westwood Plaza, B501, Los Angeles, CA 90095, charles.corbett@anderson.ucla.edu

1) Lot-Sizing for Perishable Products under Postponement & Downward Substitution, *Jayashankar Swaminathan*, University of North Carolina, Kenan-Flagler Bus. Sch., Chapel Hill, NC 27599-3490, msj@unc.edu

We analyze a model where downward substitution and postponement are utilized under deterministic demand for perishable products. Under a constant deterministic demand, we find the optimal lot size and conversion amounts. We find conditions under which it might be optimal not to perform any substitutions. We study the influence of the number of conversions allowed on the total...

2) A Unified Newsvendor Framework for Multi-Product Operations, *Jan Van Mieghem*, Northwestern University, vanmieghem@nwu.edu, *Nils Rudi*

We present a unified formulation of the multi-dimensional newsvendor model to study problems of stochastic capacity investment and inventory procurement.

The distinguishing features of this model is that those decisions are locked in before uncertainty is realized while some managerial discretion remains ex-post during the input-output transformation. The formulation allows a unified approach to analyze commonality, flexibility, substitution and transportation.

3) Theoretical & Practical Results on the Value of Aggregation of Uncertainty under Non-Normal Dependent Demand, Charles J. Corbett, UCLA, Anderson Sch. of Mgmt., 110 Westwood Plaza, B501, Los Angeles, CA 90095, charles.corbett@anderson.ucla.edu, Jose Alfaro, Kumar Rajaram

We use multivariate stochastic orders to show how Eppen's (1979) result on the value of demand pooling can be generalized to arbitrary multivariate distributions with arbitrary dependence. The framework allows us to study multivariate dependence without having to assume normality, as is commonly done.

ME05 Tutorial: Collaborative Planning & Scheduling in Supply Chains in the Digital Economy

Invited Session

Chair: Michael L. Pinedo, NYU, Stern Sch. of Bus., 40 West 4th St., New York, NY 10012, mpinedo@stern.nyu.edu

1) Tutorial: Collaborative Planning & Scheduling in Supply Chains in the Digital Economy, Michael L. Pinedo, NYU, Stern Sch. of Bus., 40 West 4th St., New York, NY 10012, mpinedo@stern.nyu.edu

Internet technology has had a fundamental impact on the way operations are conducted in supply chains. The optimization of operations in supply chains is now done on a more global scale. We discuss the problems that arise in the collaborative planning and scheduling of successive stages in supply chains.

ME06 Scheduling I

Contributed Session

Chair: Tom Schmitt, University of Washington, Box 353200, Seattle, WA 98195, glenssch@u.washington.edu

1) Release Windows: A Means to Improve the Performance of Production Systems using MRP, Henny P. G. van Ooijen, Eindhoven University of Technology, Dept. of Tech. Mgmt., Eindhoven, The Netherlands, h.p.g.v.ooijen@tm.tue.nl

In production systems controlled with an MRP system, orders for the components and their release times are determined from the so-called MPS items using netting and offsetting. With offsetting, using fixed lead times, release times are determined without taking into account the available capacity. This, in general, leads to fluctuating throughput times and is one of the reasons for the poor performance of MRP systems...

2) Solving Project Scheduling Problems by Minimum Cut Computations, Frederik Stork, TU Berlin, MA 6-1, Str. des 17 Juni 136, Berlin, 10623, Germany, stork@math.tu-berlin.de, www.math.tu-berlin.de/~stork/

We report on a Lagrangian-based approach to compute lower bounds and feasible solutions for precedence- and resource-constrained scheduling problems. The core of this approach is the insight that the Lagrangian relaxation is a precedence-constrained scheduling problem with start-time dependent costs, which can be solved efficiently by a minimum cut computation in a digraph. (Joint work with R. H. Mochring, A. S. Schulz & M. Uetz)

3) Hierarchical Production Planning under the Influence of Stochastic Demand, Ricardo N. Casal, Universidad Nacional del Sur, Av. Alem 1253, Bahia Blanca, BA, 8000, Argentina, riccasal@criba.edu.ar, Rafael E. Corral, Nancy B. Lopez, Adrian A. Toncovich

We assess the performance of a hierarchical production planning model under stochastic demand fluctuations. The HPP model takes into account the main elements associated with the considered manufacturing environment. Numerous simulation runs are used to test the behavior of the system under different randomly generated demand conditions.

4) Heuristic Algorithms for Minimizing the Maximum Completion Time in Open Shop Scheduling Problems, Jayakumar Sundaramoorthy, Anna University, Dept. of MS, Chennai, Tamilnadu, 600 025, India, jayakumar@annauniv.edu

We address the issue of minimizing the maximum completion time for the OSSP. We developed and investigated the OSSP with 4 different heuristic algorithms. We also identify which one is the best among them.

ME07 Scheduling & Incentives in Lead Time Quotation

Cluster: Competition & Incentives in Operations Management

Invited Session

Chair: Izak Duenyas, University of Michigan Business School, 701 Tappan, Ann Arbor, MI 48109, duenyas@umich.edu

1) Pricing, Lead-Time Quotation & Scheduling in a Queue with Heterogeneous Customers, Erica Plambeck, Stanford University, Grad. Sch. of Bus., 518 Memorial Way, Stanford, CA 94305, elp@stanford.edu

Consider a single-server queue with two classes of customers that differ in price- and delay-sensitivity. A system manager must set a static price for each class, dynamically quote lead-times to potential customers and decide the order in which customers are processed. The arrival rate for each class decreases with price and quoted lead-time...

2) Optimal Scheduling of a Flexible Server, Hyun-Soo Ahn, University of California, Dept. of IE/OR, Berkeley, CA 94720, Izak Duenyas, Rachel Q. Zhang

We consider dynamic scheduling of a multiclass queuing system with two servers, one dedicated and one flexible and static jobs. Server 1 is only responsible for completion of type-1 jobs while server 2 is primarily responsible for completion of type-2 jobs but can also aid server 1 with its work. The objective is to minimize the total holding costs incurred until all jobs in the system are processed and leave the system...

3) Incentive Mechanisms for Supplier-Manufacturer Coordination, Diwakar Gupta, University of Minnesota, IE Division/ Dept. of ME, 111 Church St. SE, Minneapolis, MN 55455, guptad@me.umn.edu, Waressara Weerawat

We study coordination between a supplier and a manufacturer when sales revenues depend on delivery delay through realized, average or quoted lead-time. Alternatively, sales may be lost if components are not in stock. Two-part revenue sharing schemes are shown to achieve coordination. The impact of capacity and production costs is investigated.

ME08 Stochastic Methods in Global Optimization

Cluster: Global Optimization

Invited Session

Chair: H. Edwin Romeijn, University of Florida, ISE Dept., 303 Weil Hall, Gainesville, FL 32611, romeijn@ise.ufl.edu

1) Approximation of the Distribution to Convergence for Stochastic Global Optimization, Graham Wood, Massey University, Inst. Info Sciences & Tech., Private Bag 11 222, Palmerston North, New Zealand, g.r.wood@massey.ac.nz

How long should we run a stochastic global optimisation algorithm? We initiate a study of this question through approximation of a generic stochastic global optimization algorithm with a backtracking adaptive search algorithm. Our understanding of backtracking adaptive search can thus be used to study the original algorithm.

2) Quadratic Transition Kernels in Genetic Algorithms, David Bulger, Massey University at Wellington, Coll. of Sciences, Private Box 756, Wellington, New Zealand, d.bulger@massey.ac.nz

Consider the populations produced by a GA as samples of underlying distributions. Each member of the next generation comes from two members of the current generation; each distribution depends quadratically on the last. This gives rise to a quadratic version of the standard Markov transition equation.

3) Pure Random Search for Noisy Objective Functions, Stephen Baumert, University of Michigan, Dept. of ISE, Ann Arbor, MI 48109, sbaumert@umich.edu, Robert L. Smith

Pure random search is an abstract model of the simplest stochastic algorithm for global optimization. Although computationally infeasible, it provides important insights into the challenges of global optimization. We extend pure random search to the case of noisy (i.e. stochastic) objective functions and assess the implications to stochastic global optimization.

ME09 Methods for Large-Scale Optimization Problems

Cluster: Nonlinear Optimization

Invited Session

Chair: Jason J. Z. Zhang, City University of Hong Kong, Dept. of Math., Tat Chee Ave., Hong Kong, Hong Kong, mazhang@cityu.edu.hk

1) A New Class of Parallel Algorithms for Large-Scale Nonlinear Optimization, P. K. H. Phua, Dept. of IS, Sch. of Computing, Lower Kent Rd., Singapore, 119260, Singapore, aul.

phua@anderson.ucla.edu, *H. Dan, Masao Fukushima*

A new class of self-scaling parallel algorithms for large-scale nonlinear problems is presented. These algorithms are based on multi-step, multi-directional conjugate-gradient methods with parallel line search strategies. Numerical experiments on a large set of test problems show that the proposed algorithms are effective and robust.

2) On the Smoothness of the Moreau-Yoshida Regularization of the Lagrangian-Dual Functions for Large-Scale Problems, G. Y. Zhao, National University of Singapore, Dept. of Math., 10 Kent Ridge Crescent, Singapore, 119260, Singapore, *H. Dan, Masao Fukushima*

We consider the Lagrangian dual of a class of large optimization problems. We discuss the piecewise smoothness of the Lagrangian dual function, and use this to investigate the second-order properties of the Moreau-Yoshida regularization of the Lagrangian dual function. We show that the gradient of regularized functions is semismooth for certain problems.

3) Minimization of Convex Functions via VU-Space Decomposition, Robert B. Mifflin, Washington State University, Dept. of Math, Pullman, WA, mifflin@math.wsu.edu, *Claudia Sagastizabal*

We describe a recently developed VU-space decomposition theory for minimizing very general convex functions. These functions are nonsmooth on the V-space and have an associated C2 Lagrangian on the U-space. Based on this, we are developing an algorithm that alternates between approximate V-bundle steps and U-Newton steps.

ME10 Polyhedral Approaches in Integer Programming

Cluster: Computational Mixed Integer Programming

Invited Session

Chair: Eva K. Lee, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, eva.lee@isye.gatech.edu, www.isye.gatech.edu/~evakylee

1) Combinatorial & Integer Programming Techniques for DNA Sequencing Problems, Eva K. Lee, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, eva.lee@isye.gatech.edu, www.isye.gatech.edu/~evakylee, *Todd Easton*

We construct graphs related to certain DNA sequencing problems and prove that feasible solutions are characterized by the solution of a node-packing problem in a complete graph. Computational results of a B&C approach will be discussed.

2) Facets for Cyclic Group & Knapsack Polyhedra, Ellis L. Johnson, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, *Lisa Evans*

The main reason for interest in cyclic group problems is that any pure integer program can be relaxed to a cyclic group problem. We will discuss several classes of facets for the cyclic group problem. The connection to the master knapsack partitioning problem will be explained and we will give several classes of facets for this problem. Some facets for the master knapsack covering problem will be described as well as their relationship to the previous problems. problem will be described as well as their relationship to the previous problems.

3) Innovative Branching Strategies with Applications to Computational Biology, Robert Carr, Sandia National Labs, bobcarr@cs.sandia.gov, *G. Lancia, A. Johnston, S. Istrail, B. Walenz*

When a protein is folded, amino acids not contiguous on its backbone can become close together, resulting in a contact map graph. We assess the similarity in the folding patterns of two proteins using integer programming. The resulting integer programs get very large. We use innovative branching strategies to reduce their sizes and tighten them simultaneously.

ME11 Stochastic Programming Applications

Cluster: Stochastic Programming

Sponsor: Optimization

Sponsored Session

Chair: Kevin R. Wood, Naval Postgraduate School, OR Dept., Monterey, CA 93943, kwood@nps.navy.mil

1) Open-Source Input Routine for SMPS Data, Andrew Felt, University of Wisconsin, Dept. of Math & Computing, Stevens Point, WI 54881, afelt@uwsp.edu, www.uwsp.edu/math/afelt/per_home.html, *K. A. Ariyawansa, Jason J. Sarich*

We present a modern test set for stochastic programming, an open-source multi-stage stochastic linear data structure for algorithm developers and

open-source routines for converting SMPS data to this structure.

2) A Graphical User Interface for Multiperiod Stochastic Programming: The Case of MiSOFT, Chanaka Edirisinghe, University of Tennessee, MS Program, 610 SMC, Knoxville, TN 37996, chanaka@utk.edu

We discuss an implementation of multi-period stochastic programming-based techniques for financial portfolio optimization involving multiple stages of trading. A GUI, MiSOFT, allows for model building and solution using a variety of efficient solution techniques. Future uncertainty is modeled with discrete scenarios. Various quantitative and qualitative aspects of the portfolio problem will be discussed and the software will be demonstrated.

3) Solving Stochastic Network Interdiction Problems with Generalized Benders Decomposition, Kevin R. Wood, Naval Postgraduate School, OR Dept., Monterey, CA 93943, kwood@nps.navy.mil

We must optimally degrade a network's expected functionality by attacking its components with limited, discrete resources; data and attack successes are uncertain. We solve these problems using GBD with sampled function estimates and bounded cut coefficients. "Super-valid inequalities" speed convergence. Computational examples are provided.

ME12 Online Consumer Behavior

Sponsor: E-Commerce

Sponsored Session

Chair: Manfred Krafft, WHU, Betriebswirtschaftslehre, Otto-Beisheim-Hochschule, Vallendar, D-56179, Germany, krafft@whu.edu

1) Behavioral Differences between Consumers Attracted to Shopping Online vs. Traditional Supermarkets: Implications for Enterprise Design &, Rick L. Andrews, University of California, Grad. Sch. of Mgmt., Irvine, CA 92697-3125, *Imran S. Currim*

Through multinomial logit models calibrated using scanner data from traditional and online supermarkets, we explore how consumers shopping online behave relative to consumers shopping in traditional stores. Behavioral differences are prevalent among the majority of online consumers rather than a minority. Implications for online enterprise design, marketing and evolution are outlined.

2) Are Prices Really Lower on the Internet? An Analysis of the Vitamin Industry, S. Erevelles, University of California, Anderson Grad. Sch. of Mgmt., Riverside, CA 92521, sunil.erevelles@ucr.edu, *E. Rolland, S. Srinivasan*

We explore the pricing behavior of Internet vs. traditional firms for the vitamin industry. Five retail formats are examined: the Internet, drug stores, discount retailers, supermarkets and warehouse retailers. Pricing behavior was examined across 4 multivitamin market segments: children, adults, women and seniors. Results show that contrary to popular belief, the average price/unit of vitamins is significantly higher for Internet retailers than for traditional retailers...

3) Understanding Customers' Repatronage Intentions with Technology-Based Service Encounters, Manfred Krafft, WHU, Betriebswirtschaftslehre, Otto-Beisheim-Hochschule, Vallendar, D-56179, Germany, krafft@whu.edu, *Roberta Nacif*

The use of self-service technologies as a service delivery channel is changing the way customers interact with service providers. Researchers have acknowledged the need to understand the dynamics of technology-infused service encounters, given that most of the service literature focuses on the interpersonal dynamics of service encounters. This highlights the need to understand the determinants and the consequences of customer satisfaction...

ME13 Manufacturing & Service Quality Models

Cluster: Issues in Manufacturing & Service Quality Management

Invited Session

Chair: Linda V. Green, Columbia Business School, 423 Uris Hall, New York, NY 10027, lvg1@columbia.edu

1) Optimizing Quality, Reliability & Warranty Policies, Ashok Kumar, Grand Valley State University, 454C DeVos Hall, 401 West Fulton, Grand Rapids, MI 49546, kumara@gvsu.edu

Quality, reliability, and warranty policies play a strategic role in determination of order winners for customized markets and are substantially interdependent. Yet, there is scant literature that looks at these policies in an integrated fashion. We present a mathematical model that determines an optimal QRW policy for certain special cases.

2) Developing & Testing a Third Party Benchmarking Model for the Construction Industry, Bhimaraya A. Metri, Indian Institute of Technology of Bombay, Reliability Engineering Group, Powai,

Mumbai, Maharashtra, 400 076, India, metriba@ee.iitb.ernet.in, A. Srividya

A third party benchmarking model for construction industry is developed from the literature study and by interviewing 70 industry experts in India. The model is further validated by the data collected from 8 managers. This model helps an accelerated learning of best practices and improves performance of the industry.

3) The Impact of Hospital Bed Flexibility on Patient Service, Linda V. Green, Columbia Business School, 423 Uris Hall, New York, NY 10027, lvgl@columbia.edu

The costs and benefits of flexibility in bed use has been the subject of debate in many hospitals struggling with competing demands of physicians, managed care organizations and patients. Based on the experience of a major teaching hospital, we analyze the impact of flexibility on various service dimensions, including emergency room delays and ambulance diversions.

ME14 Decision Analysis Arcade

Sponsor: Decision Analysis
Sponsored Session

Chair: Robert T. Clemen, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, clemen@mail.duke.edu

1) Javelin Diagrams, James C. Felli, Naval Postgraduate School, DRMI (64FL), 1522 Cunningham Rd., Monterey, CA 93943-5201, jcfelli@nps.navy.mil

We present a new graphical sensitivity analysis tool that we call a javelin diagram. A javelin diagram is an extension of a tornado diagram that simultaneously provides the decision maker with payoff-, probability- and information value-based measures of the preferred alternative's sensitivity to parametric variation.

2) Teaching Decision Analysis with the Internet, Terry Reilly, Babson College, Div. of Math & Sciences, Babson Park, MA 02157-0310

I will share my experiences in teaching a distance-learning class at Babson College. The class is a required foundation class for MBA students and covers decision analysis, simulation and LP. I will demonstrate on-line tutorials and discuss the differences between face-to-face and distance teaching.

3) Eliciting Probabilities with Groups of Experts, Detlof von Winterfeldt, University of Southern California, Sch. of Policy/Planning/Dev., RGL-214 University Park, Los Angeles, CA 90089, detlof@aol.com

We examine alternative behavioral and mathematical approaches to elicit and combine probability distributions from experts. We will present experimental results and some insights from analyzing real world expert elicitations.

4) A Bayesian Model for Calibrating & Combining Expert Probabilities, Robert T. Clemen, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, clemen@mail.duke.edu

This presentation describes a new Bayesian model for calibrating and combining expert probability distributions. The model can be implemented numerically using standard MCMC methods.

ME15 Applications of Probability in Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Mohan L. Chaudhry, Royal Military College of Canada, Dept. of Math & Comp. Sci., Kingston, Ontario, K7K 7B4, Canada, chaudhry-ml@rmc.ca, www.rmc.ca/academic/math_cs/chaudhry/

1) On the Queue-Length Distributions of the Geom/D/1 & the Geom/D/b Queues, Nam K. Kim, KAIST, Dept. of IE, 373-1 Kusongdong, Daejeon, 305-701, Korea, s_freedom@kaist.ac.kr, Mohan L. Chaudhry, Kyung C. Chae

Knowing the equivalence of the models Geom/D(b)/1 and Geom/D/b, we present a simple analytic and computational solution for the queue Geom/D(b)/1 and Geom/D/b in steady state in terms of roots of the so-called characteristic equation.

2) Analysis of the MAP/G(a,b)/1/N Queue, U. C. Gupta, Indian Institute of Technology, Dept. of Math, Kharagpur, 731302, India, umesh@maths.iitkgp.ernet.in, P. Vijaya Laxmi

We consider a single server finite capacity queue with general bulk service rule in which arrivals are governed by MAP and service times are arbitrarily distributed. The distributions of the number of customers in the queue at

different epochs have been obtained.

3) Operational Behavior of the BMAP/G/1 Queue with Mixed Controls, Ho W. Lee, Sung Kyun Kwan University, Sch. of Systems. Mgmt. Eng., Suwon, Kyungki, 440-746, Korea, hwlee@yurim.skku.ac.kr, iesys.skku.ac.kr/~or/english/prof_e.htm, No I. Park

We analyze the operational behavior of the BMAP/G/1 queue with vacations and dual N-policy. We derive the vector PGF of the queue length in a factorized form and interpret the factorization. Some special cases will be discussed.

4) Computing Waiting-Time Distributions in a Discrete-Time Queue with Bulk-Arrivals & Arbitrary Inter-Arrival & Service-Time Distributions, Mohan L. Chaudhry, Royal Military College of Canada, Dept. of Math & Comp. Sci., Kingston, Ontario, K7K 7B4, Canada, chaudhry-ml@rmc.ca, www.rmc.ca/academic/math_cs/chaudhry/, U. C. Gupta

We consider the discrete-time bulk-arrival GI(X)/G/1 queue and propose a simple procedure for computing waiting-time distributions of the first and the random customers. As can be seen from our analysis that even analytic procedure is simpler than the one discussed by Murata and Miyahara.

ME16 Modeling Issues in DEA

Cluster: Data Envelopment Analysis
Invited Session

Chair: Greg O'Brien, La Trobe University, Fac. of Law & Mgmt., Bundoora, 3083, Australia, obrien@latrobe.edu.au

1) Selection of Alternatives for a Hydropower Development Project by Value-Focused DEA, Ming Li, Norwegian School of Management, Dept. of Strategy, Elias Smith vei 15, Box 580, Sandvika, N-1301, Norway, ming.li@bi.no

We present an application case in which value-focused DEA is applied to MCDA for the Sauda hydropower project in Norway. The application shows that combining decision-maker's value preferences with DEA is an effective way to solve complex MCDA problems.

2) Inefficiency in Statistical Quality Control, Hiroshi Morita, Kobe University, Grad. Sch. of Sci. & Tech., Nada, Kobe, 657-8501, Japan, morita@cs.kobe-u.ac.jp, Bellamine Ilyes

The conventional statistical approaches used in quality control such as analysis of variance and regression analysis do not take inefficiency into account. However, there is a certain inefficiency in the experimental data, where the error distribution should be insymmetric. We discuss the possibility to estimate the inefficiency by using DEA concept for identification of optimal condition.

3) Some Advances in the DEA Model Development, W. Liu, University of Kent, Canterbury Bus. Sch., UK, w.b.liu@ukc.ac.uk, N. Wassan

A group of new DEA models are developed and classified. These are useful in dealing with applications where some undesirable inputs and/or outputs are involved in evaluating performance of decision making units. An output example is the pollution level of a factory. In some applications, outputs have a targeting type in that the performance of the DMUs will be judged by the closeness of the outputs to a pre-set level...

4) Alternative Transformations & Duality of Linear Fractional Programming, Greg O'Brien, La Trobe University, Fac. of Law & Mgmt., Bundoora, 3083, Australia, obrien@latrobe.edu.au, Lifan Wu

We discuss alternative solutions and dual formulations of linear fractional programming. These solutions lie between the 2 usual solutions from denominator or numerator normalization. DEA is presented as an example of homogeneous linear fractional programming. Results provide alternative solutions between those from input- and output-oriented models for constant returns to scale DEA models...

ME17 Design of WDM-Based Optical Networks

Sponsor: Telecommunications
Sponsored Session

Chair: Tom Chen, SMU, Dept. of Elect. Eng., PO Box 750338, Dallas, TX 75275, tchen@seas.smu.edu

1) Routing & Wavelength Assignment in WDM-Based Optical Networks, Eli V. Olinick, SMU, Dept. of Comp. Sci. & Eng., Box 750122, Dallas, TX 75275-0122, olinick@enr.smu.edu, www.enr.smu.edu/~olinick, Jeffery L. Kennington

We present a MIP formulation and a heuristic procedure for the routing and wavelength assignment problem in WDM-based optical networks. Our empirical analysis indicates that the heuristic can find high-quality solutions to

realistically-sized test cases in a fraction of the time required by CPLEX to solve the MIP formulation.

2) Grooming Primitive Rings in SONET Networks, Charles J. Colbourn, University of Vermont, Comp. Sci. Dept., Burlington, VT 05405, charles.colbourn@uvm.edu, Alan C. H. Ling

When point-to-point communication is to be established using SONET rings and each source-destination pair uses a fixed fraction of the wavelength, one method of assigning source-destination pairs to wavelengths is to "groom" primitive rings, i.e. to form unions of primitive rings that can share wavelengths. We describe a method for grooming that employs combinatorial results on graph decompositions and obtains near-optimal results.

3) Routing & Wavelength Assignment in OP-Over-Optical Networks, Tom Chen, SMU, Dept. of Elect. Eng., PO Box 750338, Dallas, TX 75275, tchen@seas.smu.edu

We present the optimization issues involved in routing IP packet flows through an optical WDM backbone network. The packet flows should use the capacity and wavelengths of the optical network efficiently, while constrained by quality of service requirements.

4) An Empirical Study of the Benefits of Wavelength Translation in WDM-Based Optical Networks, Jeffery L. Kennington, SMU, Dept. of Comp. Sci. & Eng., PO Box 150122, Dallas, TX 75275-0122, jlk@seas.smu.edu, Eli V. Olinick

We present integer programming models and empirical results for the WDM wavelength routing and assignment problem with and without wavelength translation. A benefit analysis is presented using models that permit translation at every node as well as models that permit translation at only a subset of the nodes.

ME18 Health Applications

Contributed Session

Chair: Lily M. Adu, AT&T, 124-4A Bluebird Dr., Hillsborough, NJ 08844, ladu@att.com

1) Clinical Case Procurement from XML-Based Electronic Patient Records for a Web-Based Case-Based Reasoning System, Selvakumar Manickam, USM, Health Informatics Research, Sch. of Comp. Sci., Penang, Penang, 11800, Malaysia, selva@cs.usm.my, http://hirg.cs.usm.my

The system entails the procurement of clinical cases from various XML-based EPR repositories available online. The transformation from an EPR to a standardized case requires the use of a unified medical language system (UMLS) on vocabulary and conceptual level. The transformed case is then used by a CBR system that is accessed via the WWW.

2) The Internet-Based Organ Transplantation Program in Turkey, Emin Gundogar, Sakarya University, IE Dept., Bolu, Esentepe Kampus, Adapazari, Sakarya, 54040, Turkey, gun@sakarya.edu.tr, Hayrettin Evirgen, Ismail Cali

Organ transplantation is the most effective treatment for the patients with end-stage organ failure. However, the number of patients needing transplantation increases with time; therefore, not all are provided the needed organs in the current medical system. With studies directed to effective use of organ resources, the problem can be solved. These studies should be carried out in the light of recorded information and statistical data...

3) The Development of an Information & Reporting System for Palliative Care, Kevin J. Leonard, University of Toronto, 12 Queens Park Crescent West, 2nd Floor, McMurrich, Toronto, Ontario, M5S 1A8, Canada, k.leonard@utoronto.ca

We present the design and development work associated with the creation of an information and reporting system for palliative care. In brief, we describe the assessment of data needs, information requirements and the functionality necessary to generate multidimensional decision support. We conclude with an evaluation of the benefits from this IT investment.

4) A DEA-Based Framework for Strategic Group Analysis: An Empirical Investigation in the Hospital Industry, Lily M. Adu, AT&T, 124-4A Bluebird Dr., Hillsborough, NJ 08844, ladu@att.com, Dennis L. Bricker, Thomas S. Gruca

We present an innovative modus operandi for strategic group analysis - a modified DEA formulation. It demonstrates that DEA offers an alternative to factor analysis to operationalize strategic grouping. DEA is modified to adapt it for this purpose by virtue of a tie-breaking strategy for selecting a unique optimal solution.

ME19 Networks

Contributed Session

Chair: Blaise G. Morton, Dresdner Kleinwort Benson, 75 Wall St., New York, NY 10005, blaisemorton@msn.com

1) Solving the Traveling Salesman Problem using a Multi-Commodity Formulation, Trilochan Sastry, KHUST, Dept. of ISM, Clear Water Bay, Kowloon, Hong Kong, China, sastry@ust.hk, sastry@iimahd.ernet.in, Ishwar K. Murthy

We describe a multi commodity formulation for the TSP in $O(mn)$ variables and constraints. We show that this formulation implicitly includes all the sub tour and comb inequalities that successfully solved large instances of the TSP. We present computational results for the formulation using standard problem instances.

2) A Framework for Analysis & Control of Communication Networks, Blaise G. Morton, Dresdner Kleinwort Benson, 75 Wall St., New York, NY 10005, blaisemorton@msn.com, Yi-Ju Chao

Our approach is based on graph theory, model predictive control and dynamic inversion. Predictive control provides dynamic routing in which queue lengths are regulated according to dynamic inversion using feedback. The approach is illustrated in two examples: a shared communication channel and a WAN.

3) Airline Network Analysis Models, Dimitry Keselman, Atraxis North America, Inc., 1899 Powers Ferry Rd., Atlanta, GA 30039, dkeselman@atraxis.com, www.atraxis.com, Roy E. Marsten

Given a combined network of the airlines scheduled flights, a technique of evaluating the passenger and revenue shares of a specific airline is discussed. The method may be represented by 3 major phases: path generation, path scoring and spill and recapture. We consider various approaches, graph and linear programming models of each of these parts of the problem.

4) Implementations of the Pseudoflow Algorithm for the Maximum Flow Problem, Charles L. Anderson, University of California, IEOR Dept., 1425 Spruce St., Berkeley, CA 94709, cander@icor.berkeley.edu, www.icor.berkeley.edu/~cander, Dorit S. Hochbaum

The pseudoflow algorithm is a new algorithm for max-flow and min-cut. We compare the performance of pseudoflow to that of push-relabel and show it matches or exceeds push-relabel. We also present novel parametric implementations of pseudoflow and push-relabel. A new warm-start technique that is a unique capability of pseudoflow is included.

ME20 Energy I

Contributed Session

Chair: Lidija Zadnik-Stirn, University of Ljubljana, Biotechnical Faculty, Vecna Pot 83, Ljubljana, 1000, Slovenia, lidija.zadnik@uni-lj.si, http://rcul.uni-lj.si/bfzadnik/

1) Diagnosing & Optimal Management in a Multiple-Use Natural Environment, Lidija Zadnik-Stirn, University of Ljubljana, Biotechnical Faculty, Vecna Pot 83, Ljubljana, 1000, Slovenia, lidija.zadnik@uni-lj.si, http://rcul.uni-lj.si/bfzadnik/

Our concern is the management of the environment according to economic, ecological and social goals. Dealing with descriptive variables, long-term and a multiple-criteria problem, a decision support model evaluating (diagnosing) the current state of the environment and determining the optimal sequence of decisions will be presented using fuzzy logic, multi-criteria and multivariate methods.

2) A Decision Theoretic Approach to Measuring the Cost of Environmental Quality, Hokey Min, University of Louisville, Logistics/Distribution Inst., Lutz Hall, Ste. 437, Louisville, KY 40292, h0min001@gwise.louisville.edu

Growing concerns about eroding ecosystem quality have led to renewed interest in environmentalism. Nevertheless, the traditional environmental management program has often undermined the importance of environmental quality to the firm's long-term profitability. To transform environmental quality problems into dollar-saving opportunities, we develop a cost of quality framework designed to classify key elements of environmental costs and propose a decision theoretic approach.

3) Maximizing Remanufacturing Profit using Product Acquisition Management, Ruud H. Teunter, Erasmus University Rotterdam, PO Box 1738, Rotterdam, 3000 DR, The Netherlands, teunter@yahoo.com, Daniel R. Guide, Luk N. Van Wassenhove

The profitability of remanufacturing depends on the quantity and quality of product returns and on the demand for remanufactured products. We develop a framework for maximizing the profit by varying quality dependent acquisition prices and the selling price. This is illustrated using real-life data from a cellular phone remanufacturer.

4) A Conceptual Design of a Computer-Aided Compliance Auditing of Environmental Impact Assessment Projects in

Malaysia, Nazar M. Zaki, Multimedia University, Fac. of IS & Technology, Ayer Keroh, Melaka, 75450, Malaysia, nmustafa.zaki@mmu.edu.my

Presently, in Malaysia, 19 different category projects require EIA reports duly approved by the DoE before their implementation. Predictions on environmental impacts made during EIA for major development projects are hypotheses about such responses, which can be tested with data collected from environmental monitoring programs. The systematic comparison of predicted and actual impact has been termed as compliance audit...

ME21 Vehicle Routing

Contributed Session

Chair: Chee Chung Tong, Tamkang University, 151 Ying Chung Rd., Tamsui, Taipei Hsien, 251, Taiwan, cctong@mail.tku.edu.tw

1) **A Study of Dynamic Travel Choice Behavior with a Fuzzy Utility Model**, *Chee Chung Tong*, Tamkang University, 151 Ying Chung Rd., Tamsui, Taipei Hsien, 251, Taiwan, cctong@mail.tku.edu.tw, *Yuan-Ling Liao*

Fuzzy utility models are proposed to study the dynamic travel behavior of urban commuters. The study is performed by integrating the concepts of "utility" in decision theory or probabilistic behavior models and fuzzy reasoning with neuro-networks. A controlled experiment was implemented to observe the experiment subjects' day-to-day departure time and route choices.

2) **The Integrated Inventory & Period Vehicle Routing Problem: A Heuristic Approach**, *Ahmad Rusdiansyah*, Tokyo Institute of Technology, Dept. of IE & Mgmt., 2-12-1 Okayama, Meguro-ku, Tokyo, 152-8550, Japan, arusdian@ie.me.titech.ac.jp, *De-bi Tsao*

We consider a one-warehouse N-retailer distribution system. Based on the optimal frequency of inventory replenishment in a 6-day week for each retailer, we heuristically build itineraries of capacitated vehicles that minimize the transportation costs. The allowable combinations of delivery days are interchanged to improve the solution using a tabu search algorithm.

3) **On the Inventory Routing Problem**, *Kubo Mikio*, Tokyo University of Mercantile Marine, 2-1-6 Etsujima, Koutou-ku, Tokyo, 135-8533, Japan, kubo@ipc.tosho-u.ac.jp, www.tosho-u.ac.jp/~kubo/, *Miyamoto Yuichiro*

We present an integrated vendor managed inventory system being developed for large soft drink firms in Japan. The heart of our system is a heuristic algorithm for the inventory VRP concerned with the supply of a set of products from a single depot to a set of over a given planning horizon. The objective is to minimize the sum of distribution, inventory and shortage costs during the planning periods...

ME22 Education

Contributed Session

Chair: Eunsang Yoon, University of Massachusetts, 1 University Ave., Lowell, MA 01854, eunsang_yoon@uml.edu

1) **Association of Membership Diversity & Project Performance: A Case Study of Marketing Planning**, *Eunsang Yoon*, University of Massachusetts, 1 University Ave., Lowell, MA 01854, eunsang_yoon@uml.edu

We investigate how the diversity of students' background, job experience and career plan affect their interactive learning and group project performance in conducting a marketing planning project. We report empirical findings and implications of statistical analyses on a 5-year long experimental data base.

2) **Enhancing Students' Learning in an Introductory OR/MS Course: An Experiment with Technology**, *Kala C. Seal*, Loyola Marymount University, 7900 Loyola Blvd., Los Angeles, CA 90045-8385, kseal@lmu.edu, *Zbigniew H. Przasnyski*

We share our experience in developing and using various instructional technologies for supporting teaching in a graduate introductory OR/MS course. We developed animations, computer based tutorials, web based learning, and digital video instruction. The experience has provided us with insights into the pros and cons of different approaches and the associated learning curves.

3) **Development of Multimedia Contents in Cyber Distance Learning**, *Hoe K. Shin*, Kumoh National University, Dept. of Industrial Mgmt., Kumi, 730-731, Korea, hkshin@kumoh.ac.kr, *Chang W. Lee*, *Dae R. Kim*, *Byung Gon Kim*

We present a system development of multimedia contents for distance learning in a higher education. The project initiative is producing multimedia computer-based teaching modules in MIS course. System modules are developed, each covering topics in web-based cyber distance learning education

program. Integrated multimedia contents will be easily applicable to online class and offline class in any education system.

4) **Teaching Performance Measurement: An Exercise in New Product Development**, *Lindsley G. Boiney*, Pepperdine University, 24255 Pacific Coast Hwy, Malibu, CA 90263-4100, lboiney@pepperdine.edu

We teach MS/OR techniques for analyzing business data, but neglect to teach managers to gather the appropriate measurements. Given today's rapid product development times and constant pressure to innovate, measuring key business processes and outcomes is vital. A hands-on, new product development exercise immerses student teams in performance measurement issues.

Tuesday 08:00-09:30

TA01 Supply Chain Management in Business-to-Business Exchanges

Cluster: End-to-End Supply Chain Management
Invited Session

Chair: Mani Agrawal, McKinsey & Co., Inc., 21 South Clark St., Ste. 2900, Chicago, IL 60603, mani_agrawal@mckinsey.com

1) **Supply Chain Efficiencies: Successful Web-Based Supply Chain Integration**, *Siegfried Voessner*, McKinsey & Co./Technical University Graz, Wittegasse 10/16, Vienna, A-1130, Austria, siegfried_voessner@mckinsey.com

We will show a new conceptual approach for a successful web-based supply chain integration based on strong organizational foundations, well-defined processes and clear business objectives and discuss some real world applications and their benefits. Contrary to full-fledged "software-package-approaches," lean IT solutions support SCM functionalities and connectivity between existing solutions.

2) **Collaborative Supply Chain Planning using Electronic Marketplaces**, *Martin Rudberg*, Linkoping Institute of Technology, Intl. Grad. Sch. of MIE, Dept. of Production Econ., Linkoping, 58183, Sweden, martin.rudberg@ipe.liu.se, www.ipe.liu.se/mr/index.htm

We show how the functionality of an electronic marketplace can facilitate collaborative supply chain planning. Furthermore, three collaborative supply chain scenarios are defined, illustrating the parties involved, their respective task and roles and the information flows between them.

3) **Supply Chain Management Opportunities in Business-to-Business Exchange**, *Minsok Pak*, McKinsey & Co., Inc., 2200 Ross Ave., Ste. 5200, Dallas, TX 75201, minsok_pak@mckinsey.com

While B2B exchanges differ in their focus, most share one common goal: they proclaim dramatic SCM benefits for their participants. Unfortunately, what many participants will find is that although some purchasing and transaction processing benefits may be real in the near-term, broader SCM improvements will not be as easily achieved.

4) **Supply Chain Management: A Perspective on Information Flow & Forecasting in Trading Exchanges**, *Mani Agrawal*, McKinsey & Co., Inc., 21 South Clark St., Ste. 2900, Chicago, IL 60603, mani_agrawal@mckinsey.com

The impacts of the trading exchanges on a supply chain can best be understood by the changes in the structure of the information flow. This new emerging structure of the flow of information lays the foundation of new decision-making process for supply chains of the future.

TA02 Supply Chain Management & the Market

Cluster: Supply Chain Management
Invited Session

Chair: Seungjin Whang, Stanford University, Grad. Sch. of Bus., Stanford, CA 94305, whang_jin@gsb.stanford.edu

1) **Price & Delivery Frequency Competition in a Supply Chain**, *Lode Li*, Yale University, Sch. of Mgmt., New Haven, CT 06520-8200, lode.li@yale.edu, *Albert Y. Ha*, *Shu-Ming Ng*

We consider a system in which two suppliers compete for supply to a manufacturer and analyze horizontal and vertical competition under different assumptions on how pricing and delivery frequency decisions are made. Our analysis sheds light on the strategic role of delivery frequency and the practice of JIT delivery.

2) **Channel Coordination under Price Protection, Mid-Life Returns & End-of-Life Returns in Dynamic Markets**, *Terry A.*

Taylor, Stanford University, Grad. Sch. of Bus., Stanford, CA 94305, terry.taylor@stanford.edu

Price protection and returns are common in declining price industries. When retail prices are declining, returns alone fails to achieve channel coordination in a win-win fashion. However, price protection and returns succeeds in doing so. If the retail price is static, then returns is sufficient to guarantee coordination and win-win.

3) Business-to-Business Markets & Contracting, *Haim Mendelson*, Stanford University, Grad. Sch. of Bus., Stanford, CA 94305, *Tunay Tunca*

We examine the implications of introducing a B2B marketplace in an environment where manufacturers, who produce a good for the consumer market, previously used long-term contracts for purchasing their supply materials. We find sufficient conditions for the existence of an equilibrium and compare alternative market mechanisms to find conditions and entry rules under which each mechanism would prevail.

4) The Impact of the Secondary Market on the Supply Chain, *Seungjin Whang*, Stanford University, Grad. Sch. of Bus., Stanford, CA 94305, whang_jin@gsb.stanford.edu, *Hau Lee*

We investigate the impacts of the secondary market where resellers trade excess inventories. We develop a 2-period model with one manufacturer and many resellers. First, resellers buy from the manufacturer. Then, they trade inventories in the secondary market. We characterize the equilibrium and study the implications to the supply chain.

TA03 Supply & Demand Management in the Airlines

Cluster: Supply & Demand Mgmt. in Mfg. & Service Industries
Invited Session

Chair: Ebru Bish, Virginia Tech. University, ISE Dept., 250 NEB, Blacksburg, VA 24061, ebru@vt.edu

Co-Chair: Connie Chen, United Airlines, Whqkb, 1200 East Algonquin Rd., Elk Grove Village, IL 60007, connie.chen@ual.com

1) An Overview of Network-Based Revenue Management at United Airlines, *Douglas R. Bish*, United Airlines, WHQKB, 1200 East Algonquin Rd., Elk Grove Village, IL 60007, douglas.r.bish@ual.com, *Ken Straus*

We give an overview of revenue management and discuss the state-of-the-art at United Airlines. Specifically, we present United Airline's network based revenue management solutions and discuss the benefits.

2) Demand-Driven Dispatch: A Successful Combination of Network Optimization & Risk Analysis, *Steven P. Coy*, Continental Airlines, 1600 Smith St., HQSRT 9th Floor, Houston, TX 77002, scoy@coair.com, *Judy A. Pastor*

DDD seeks to maximize revenue by exchanging aircraft in markets that have excess capacity with markets that have excess demand. We will examine how the combination of network optimization and a simulation-based risk analysis has contributed to the success of Continental Airlines' DDD program.

3) Demand-Driven Dispatch, *Connie Chen*, United Airlines, WHQKB, 1200 East Algonquin Rd., Elk Grove Village, IL 60007, connie.chen@ual.com, *Raj A. Sivakumar*

DDD is an optimization model to revise the initial fleet assignment by using more accurate and detailed revenue management demand forecasts, so as to maximize revenue and minimize interruptions to the operations. We formulate this problem into a string-based refloating model. In order to maintain operation feasibility, the maintenance and crew constraints are incorporated.

TA04 Analytic Models for Supply Chain Management

Sponsor: MSOM

Sponsored Session

Chair: Michael Fry, University of Michigan, 2811 IOE Bldg., 1205 Beal Ave., Ann Arbor, MI 48109, mjfry@umich.edu

Co-Chair: Tava Lennon Olsen, Washington University, Olin Sch. of Bus., St. Louis, MO 63130, olsen@olin.wustl.edu

1) Managing a Non-Cooperative Supply Chain with Limited Capacity, *Rodney P. Parker*, University of Michigan Business School, 2259 Davidson Hall, 701 Tappan St., Ann Arbor, MI 48109-

1234, rpparker@umich.edu, *Roman Kapuscinski*

We consider a serial supply chain with capacity limits at each stage under decentralized ownership. We show the existence and properties of the Markov equilibrium and compare it to the optimal policy of the centralized-ownership version of the model.

2) Supply Chain Management with Overtime & Premium Freight, *Eric Huggins*, University of Michigan, IOE Dept., 1205 Beal Ave., Ann Arbor, MI 48109-2117, erichuggins@netscape.net, *Tava Lennon Olsen*

We consider a 2-stage supply chain where stochastic demand must be filled at one or both of the stages. When shortages occur, the unmet demand may be filled with overtime production and/or by premium freight shipments. We derive optimal production policies for both stages and discuss the tradeoffs involved.

3) Adjusting Demand Forecasts with Multiple Retailers under Vendor Managed Inventory, *Michael Fry*, University of Michigan, 2811 IOE Bldg., 1205 Beal Ave., Ann Arbor, MI 48109, mjfry@umich.edu, *Roman Kapuscinski*, *Tava Lennon Olsen*

Cooperative agreements in the supply chain such as vendor managed inventory offer unique opportunities for sharing demand information, and using this shared information to update demand forecasts. Our work examines how such demand updating may take place under VMI-type agreements and what advantages this offers the supply chain.

TA05 Tutorial: Dynamic Pricing Strategies to Improve Supply Chain Performance

Invited Session

Chair: David Simchi-Levi, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1171, Cambridge, MA 02139-4307, dslevi@mit.edu

1) Tutorial: Dynamic Pricing Strategies to Improve Supply Chain Performance, *David Simchi-Levi*, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1171, Cambridge, MA 02139-4307, dslevi@mit.edu

Dynamic pricing techniques such as yield management have been successfully applied to a variety of industries, e.g., airlines or rental car agencies, with a focus on those that have perishable inventory. In this tutorial, we extend dynamic pricing techniques to a more general supply chain setting with nonperishable inventory. The focus is on coordinating pricing, production and distribution decisions in a multi-period environment.

TA06 Scheduling II

Contributed Session

Chair: Shrikant S. Panwalkar, Purdue University, Krannert Sch. of Mgmt., 1310 Krannert Bldg., West Lafayette, IN 47906

1) A Single Machine Scheduling Problem for Common & Unique Components, *Sang Hum Yoon*, Jeonju University, 3-1200 Hyoja-Dong, Wansan-gu, Jeonju, Jeonbuk, 560-759, Korea, hjk@etri.re.kr, *Hyoun Jong Kim*

We consider a single machine scheduling problem concerned with the manufacture of components for subsequent assembly into end-products. Each end-product is composed of common and unique components and a setup is required for a batch of common components. Under the so-called

2) Single Machine Scheduling to Minimize the Number of Early Jobs, *Surya D. Liman*, Texas Technical University, Dept. of IE, Lubbock, TX 79424, surya.liman@coe.ttu.edu, *Shrikant S. Panwalkar*

We present an optimal algorithm to solve a scheduling problem where the early completion of jobs requires additional costs that are considered a waste of resources. Particularly, a scheduling algorithm to minimize number of early jobs is proposed. This algorithm modifies one of the more well-known algorithms originally proposed by Moore-Hodgson in 1968 to minimize number of tardy jobs. A numerical example is also given to illustrate the algorithm.

3) Minimizing the Total Weighted Tardiness in a Single Machine, *Hyungwoo Park*, POSTECH, Hyoja San 31, Pohang, Kyungbook, 790-784, Korea, phw@postech.ac.kr, *Yushin Hong*

Minimizing the total weighted tardiness in a single machine is known to be NP-hard in the strong sense, while the total tardiness minimization problem is NP-hard in the ordinary sense. For exact methods, a pseudo-polynomial time algorithm based on dynamic programming exists for the latter, and some B&B procedures have been addressed for the former. Some heuristic algorithms have also been proposed in both problems...

4) Scheduling Parallel Machines with a Single Server: Equal

Processing & Equal Setup Time Cases, *Andrew Wirth*, University of Melbourne, Dept. of Mech. & Mfg. Eng., Parkville Vic, 3052, Australia, wirth@mame.mu.oz.au, *Amir H. Abdekhodae*

The problem of scheduling 2-operation jobs on two identical machines, with a single server available to carry out the setups and processing done in parallel, is unary NP-hard. The equal processing and equal setup times cases are shown to be binary NP-hard and effective heuristics are reported.

TA07 Marketing Applications

Contributed Session

Chair: Stefan Stremersch, Tilburg University, Warandelaan 2, PO Box 90153, Tilburg, 5000, The Netherlands, s.stremersch@kub.nl

1) **A Knowledge-Driven EC/eCR System for One-to-One Marketing**, *Inshik Hwang*, Korea University, Dept. of IE, 1 5-Ka Anam-dong Sungbuk-ku, Seoul, 136-710, Korea, sesamest@chollian.net, *HongChul Lee*

We aim to develop a knowledge-driven EC/eCRM system, which can support 1-to-1 marketing on the Web. The system can catch propensities to consume of specific customer in real-time by knowledge driven negotiation not by click streams or web log off-line analysis but by knowledge.

2) **Opportunities of the 3G Mobile telecommunications Market in Korea**, *Eok-Soo Han*, ETRI, 161 Kajong-Dong, Yusong-Gu, Taejon, 305-350, Korea, eshan@ietri.re.kr, *Dong-Heon Jeong*, *Hyun-Moon Shin*

Compared with the commercialized 2.5G service, generating new needs with developing new services, contents, market penetration and maintenance by evolving 2.5G service to 3G service is in the spotlight due to the initial IMT-2000 service is lack of capability regarding data transmission speed and processing capacity. We present directions employing marketing strategy and pay more attention to market opportunities can launch IMT-2000 service...

3) **Time-Varying Regime-Switching Models: An Application to New Product Takeoff**, *Stefan Stremersch*, Tilburg University, Warandelaan 2, PO Box 90153, Tilburg, 5000, The Netherlands, s.stremersch@kub.nl, *Gerard J. Tellis*, *Philip Hans Franses*

Time varying regime-switching models are nonlinear time series models, which allow regime-dependent behavior. They are fairly unknown in MS. Our model estimates the time and determinants of takeoff of new durables. We model two regimes in the product life cycle, introduction and growth, takeoff being the point of transition.

4) **Technological Marketing & Management of Transportation & Communications Network Operators**, *Sefkija Cekic*, Faculty of Transport & Communications, Zmaja od Bosne 7, Sarajevo, Bosnia, Hercegovina, kljakt@fpz.hr, www.fpz.hr, *Samir Causevic*, *Ivan Bosnjak*

Efficient and effective management of transportation and communication network operators in new competitive environment requires new capabilities of managerial and non-managerial personnel and functions. We consider why and how the concept of technological (high-tech) marketing and technological management can improve the business performance of network operators.

TA08 Frontiers in Global Optimization

Cluster: Global Optimization

Invited Session

Chair: Jacob Barhen, Oak Ridge National Laboratory, CESAR, Comp. Sci. & Math Division, Oak Ridge, TN 37831-6355, barhenj@ornl.gov

1) **Information vs. Complexity in Global Optimization**, *V. Protopenescu*, Oak Ridge National Laboratory, CESAR, Comp. Sci. & Math Division, Oak Ridge, TN 37831-6355, vvp@ornl.gov, *Jacob Barhen*

We analyze the interplay of information and complexity for the GOP. Knowledge of the value of the global minimum and Lipschitz constants reduces the GOP to pure descent. This information is reasonable in identification problems, where the objective functional attains its global minimum at zero.

2) **The Theory & Algorithms of Lagrange Multipliers in Discrete Space for Nonlinear Constrained Optimization**, *Benjamin W. Wah*, University of Illinois, Dept. of EEC, Coordinated Sci. Lab., Urbana, IL 61801, b-wah@uiuc.edu

We present derivative-free search algorithms to solve constrained NLPs with discrete, continuous, or mixed-integer variables by transformation into unconstrained problems. We completely characterize constrained local minima in the original NLP by conditions on the unconstrained penalty function and we

present benchmark results.

3) **A Quantum Evolutional Algorithm for Global Optimization**, *Masayuki Hirafuji*, Computational Modeling Laboratory, NARC, Tukuba, 305-8666, Japan, *Scott Hagan*

While in principle, tunneling allows escape from local minima, in biological problems, the surface energy cannot be designed in advance. We propose to dynamically reshape the potential by quantum stochastic resonance. Dynamics of the two layer systems, which consist of quantum systems (DNA) and macroscopic systems (ecosystems) will be used.

4) **Stochastic Pijavskij Tunneling: An Improved Tunneling Method for Large Global Optimization Problems**, *David B. Reiser*, Oak Ridge National Laboratory, CESAR, Oak Ridge, TN 37831-6355

We present the SPT algorithm for global optimization problems. Tunneling is implemented by varying one parameter at a time, for each of the N parameters. In addition, SPT uses Pijavskij cones to efficiently identify regions where a local minimum cannot be located.

TA09 Advances in Optimization Theory & Practice

Cluster: Nonlinear Optimization

Invited Session

Chair: Todd S. Munson, Argonne National Laboratories, Math & Comp. Sci. Division, 9700 South Cass Ave. Bldg. 221, Argonne, IL 60439, tmunson@mcs.anl.gov

1) **A Subspace Method based on a Differential Equation to Solve Optimization Problems**, *Walter Murray*, Stanford University, Dept. of MSE, Stanford, CA 94305-4026, walter@stanford.edu, www.stanford.edu/~walter, *Antonino Del Gatto*

Two strategies, line search and trust-region, are the basis of current optimization algorithms. A third approach based on solving ordinary differential equations (ODEs) has not found favor due to the difficulties inherent in solving ODEs. We propose a method similar in spirit that requires the equations be solved only on a subspace.

2) **What's the Best Way to Piece-Wise Linearize (and Why Bother?)**, *Rick Rosenthal*, Hewlett Packard Labs. & Naval Postgraduate School, M3 1U-2, 1501 Page Mill Rd., Palo Alto, CA 94304, rick_rosenthal@hp.com, *David P. Morton*, *Alex Zhang*

NLP solvers can handle nonlinear separable functions very nicely without using piece-wise linearization (PWL), but because of interest in nonlinear integer programs, we are exploring this old ground. We will discuss a number of formulations and approaches for the determination of PWL break-points to achieve the minimum approximation error.

3) **A Semismooth Method for Large Complementarity Problems**, *Todd S. Munson*, Argonne National Laboratories, Math & Comp. Sci. Division, 9700 South Cass Ave. Bldg. 221, Argonne, IL 60439, tmunson@mcs.anl.gov

We present recent work on a semismooth method for large complementarity problems with emphasis on preconditioned iterative methods for solving the (nonsymmetric) linear systems of equations arising in the direction generation subproblems. Computational results for several large complementarity problems are presented.

TA10 Branch Decomposition & Tree Decomposition Applications

Cluster: Computational Mixed Integer Programming

Invited Session

Chair: Illya V. Hicks, Texas A&M University, Dept. of IE, 237K Zachry Engineering Ctr., College Station, TX 77843-3131, ivhicks@ie.tamu.edu

1) **Upper Bounds for Treewidth, Lower Bounds for Frequency Assignment**, *Arie M. C. A. Koster*, Konrad-Zuse-Zentrum für Informationstechnik ZIB, Takustrasse 7, Berlin-Dahlem, D-14195, Germany, koster@zib.de

We discuss how a tree decomposition of the constraint graph can help to find lower bounds for the minimum interference frequency assignment problem. A tree decomposition with small width is needed. The treewidth of a graph is given by the minimum width over all tree decompositions. Many combinatorial optimization problems can be solved in polynomial time whenever the treewidth of the associated graph is bounded by a constant...

2) **withdrawn - author request of 5/9**, *William A. Christian, Jr.*, James Madison University, CIS/Op. Mgmt. Program, MSC 0202, Harrisonburg, VA 22807, christwa@jmu.edu

3) **Maximum Weight Planar Subgraphs via Branch Decomposition**, *Illya V. Hicks*, Texas A&M University, Dept. of IE, 237K Zachry Engineering Ctr., College Station, TX 77843-3131, ivhicks@ie.tamu.edu

Branch decompositions were introduced by Robertson & Seymour. A practical implementation of a branch decomposition-based algorithm for finding the maximum weight planar subgraph is offered. This problem is of importance in facility layout design.

TA11 Stochastic Programming Models & Methods

Cluster: Stochastic Programming

Sponsor: Optimization

Sponsored Session

Chair: David P. Morton, University of Texas, Grad. Program in OR, Mech. Eng., Austin, TX 78712, morton@mail.utexas.edu

1) **On Robust Optimization of Two-Stage Systems**, *Shabbir Ahmed*, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332, sahmed@isye.gatech.edu, *Samer Takriti*

Robust optimization extends stochastic programming by incorporating measures of variability. We argue that using an arbitrary variability measure can lead to sub-optimal solutions. We propose a sufficient condition on the variability measure to preserve optimality and a modified L-shaped decomposition algorithm to solve the resulting robust model.

2) **Stochastic Programs with Recourse having Quantile Objectives**, *Ruediger Schultz*, Gerhard-Mercator University, Dept. of Mathematics, Duisburg, Germany, schultz@math.uni-duisburg.de

We study linear 2-stage stochastic programs possibly involving integer requirements. Whereas in traditional models the objective of such problems is based on optimizing an expectation, we place accent on optimizing probabilities of relevant events not to exceed given threshold values. Some first results on the structure and the algorithmics of these models will be presented.

3) **A Sampling-Based Cutting-Plane Method for Stochastic Programs**, *David P. Morton*, University of Texas, Grad. Program in OR, Mech. Eng., Austin, TX 78712, morton@mail.utexas.edu, *Javier Salmeron*, *Kevin R. Wood*

We develop a sampling-based cutting-plane method for stochastic programming. The algorithm uses a mixed-integer master program that yields a probabilistic lower bound by dropping an appropriate subset of the estimated cuts. Rules for selecting sample sizes to ensure valid confidence interval construction are discussed.

TA12 Panel: E-Business Models & Strategy - Theory in Action

Sponsor: E-Commerce

Sponsored Session

Chair: Michael J. Savoie, University of Dallas, 1845 East Northgate Dr., Irving, TX 75062-4736, msavoie@gsm.udallas.edu

1) **Panel: E-Business Models & Strategy - Theory in Action**, *Mahesh Raisinghani*, University of Dallas, Grad. Sch. of Mgmt., 1845 East Northgate Dr., Irving, TX 75062-4736, mraising@gsm.udallas.edu

We focus on assessing and evaluating innovative e-business models, e-business strategy in the digital/knowledge economy and best practices in implementation tactics. The scope ranges from managing the procurement and production links of the supply chain to providing a broad view of an entire supply chain to reveal full product and component life cycle in a collaborative environment with personalizable monitoring of metrics.

TA13 E-Services Design

Cluster: Service Strategy & Design

Invited Session

Chair: Rohit Verma, DePaul University, Dept. of Mgmt., 1 East Jackson Blvd., Chicago, IL 60604, rverma@condor.depaul.edu

1) **The Role of Value-Added Features in the Design of E-Services**, *Zafar Iqbal*, DePaul University, Dept. of Mgmt., 1 East Jackson Blvd., Chicago, IL 60604, ziqbal@wppost.depaul.edu, *Rohit Verma*

Do customers choose on-line services based only on price or do they also consider value-added features? In the aftermath of the dot.com collapse, many have argued that the lack of value-added services led to failure of several

e-businesses. Based on the results of an online discrete choice study, we will demonstrate how the utility of value-added services is perceived to be non-uniform across multiple segments of e-customers.

2) **Benefitting from Resource Pooling: Applications in Purchase Management**, *Gilles Reinhardt*, DePaul University, Dept. of Mgmt., 1 East Jackson Blvd., Chicago, IL 60604, greinhar@condor.depaul.edu

We posit an aggregator, i.e., mobshop.com, that seeks out customers to increase their buying power over their common supplier, who offers volume discounts. The aggregator disentangles the savings from the supplier discount among its customers through a pricing scheme. It must be incentive compatible, efficient, rational and fair. We design fast and exact algorithms to compute the Shapley value and the nucleolus...

3) **E-Service Process Configurations**, *Rohit Verma*, DePaul University, Dept. of Mgmt., 1 East Jackson Blvd., Chicago, IL 60604, rverma@condor.depaul.edu, *Aleda V. Roth*, *Larry Menor*

We present an approach for configuring e-service processes based on customer needs and preferences. Using discrete choice analysis, we estimate the utilities of various attributes of e-businesses including web-interface and other service features. The results are compared to theoretical typologies of e-service processes.

4) **Services & the Wireless Web: M-Services**, *Peter Tarasewich*, University of Massachusetts, MSIS Dept., 100 Morrissey Blvd., Boston, MA 02125, tarase@umb.edu

With wireless devices, people and organizations can communicate without the boundaries of space or time. Although the Web and e-commerce are still relatively new, there is already a shift to the wireless Web and m-commerce. We look at the factors necessary to create a successful service experience in this pervasive information environment.

TA14 Medical Decisions, or MAU in Maui

Sponsor: Decision Analysis

Sponsored Session

Chair: Ward Edwards, Wise Decisions, Inc., 11466 Laurelcrest Rd., Studio City, CA 91604, wedwards@mizar.usc.edu

1) **Summary Measures & Health Policy**, *Edward J. Sondik*, National Center for Health Statistics, Disease Control & Prevention, 6525 Belcrest Rd., Hyattsville, MD 20782, esondik@cdc.gov

Recently, there has been a marked increase in research and application of utility-related summary health measures. We will review some of the recent applications of these measures to assess health system efficiency and related issues of how to structure these measures to inform US health policy and research.

2) **Multiattribute Utility Theory & Medical Decision Making**, *Francois Sainfort*, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, sainfort@isye.gatech.edu

We review how the field of medical decision making has contributed to the development and application of multiattribute utility theory. In particular, we discuss current challenges faced by theorists as well as practitioners in developing, using and applying multiattribute utility evaluation models.

3) **Bayesian Network to Aid the Diagnosis & Treatment of Obstructive Sleep Apnea**, *Alan J. Brothers*, Battelle PNNL, Environ. Policy & Risk Mgmt., Richland, WA, alan.brothers@pnl.gov, *Ward Edwards*, *Glen Mesaros*

The model helps surgeons and their patients to decide whether to have surgery and where to operate. The diagnoses are made via a Bayesian net that combines expert judgments of priors and likelihoods with clinical observations. Preference for the reduction in anatomical severity is traded off with risk, pain and recovery time.

4) **Discussion**, *Ward Edwards*, Wise Decisions, Inc., 11466 Laurelcrest Rd., Studio City, CA 91604, wedwards@mizar.usc.edu

We will discuss the presentations in this session with an emphasis on the progress of using multiattribute utility analysis methods in medical decision making.

TA15 Reliability & Maintainability Models

Cluster: Applications of Applied Probability & Applied Statistics

Invited Session

Chair: Lisa M. Maillart, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, maillart@umich.edu

1) **Preventive Maintenance Models based on Continuous Time MDPs**, *Eugene A. Feinberg*, SUNY, Dept. of Applied. Math & Stats,

Stony Brook, NY 11794-3600, efeinberg@notes.cc.sunysb.edu

We consider continuous-time Markov decision models for preventive maintenance. The performance of a preventive maintenance policy is evaluated by a vector which elements characterize cost and reliability characteristics. In the case of 2 characteristics, we optimize one under the inequality constraint on another. Though failure distributions in all states are exponential, we show that optimal preventive maintenance policies are age-dependent.

2) Scheduling Maintenance Activities for Deteriorating Systems with Imperfect Observations, Lisa M. Maillart, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, maillart@umich.edu, Stephen M. Pollock

The discussion will focus on the development and evaluation of adaptive policies that dictate preventive maintenance and observation schedules while achieving, to some degree, the objective of minimizing long run expected cost per unit time.

3) Compressed Annealing within the Context of a Maintenance Scheduling Problem, Jeffrey W. Ohlmann, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48105-2117, johlmann@umich.edu, James C. Bean, Shane Henderson

We discuss compressed annealing, a variant of simulated annealing. Introducing the concept of pressure (analogous to penalty multipliers) to complement temperature, compressed annealing addresses optimization problems with relaxed constraints. This search heuristic explores a dynamic solution topography that shifts due to changes in pressure. Results on an equipment replacement/ maintenance problem exhibiting computational effectiveness are reported.

4) An Analysis of Integrating Production Scheduling & Preventive Maintenance Planning Decisions, Erhan Kutanoglu, University of Arkansas, 4207 Bell Eng. Ctr., Fayetteville, AR 72701, erhank@engr.uark.edu, C. Richard Cassady, Scott J. Mason

Two research areas that have received tremendous attention in the manufacturing systems and OR literature are PS and PM planning. Although these areas are interrelated in practice, they have not been addressed together. We integrate PM planning and PS decisions and show the benefits of the proposed integration on the overall system performance. We present our initial findings using single-machine integrated PM/PS models.

TA16 Data Envelopment Analysis I

Contributed Session

Chair: Hiroaki Ishii, Osaka University, 2-1 Yamadaoka, Suita Osaka, Japan, burberry@manekineko.ne.jp

1) Triple Bottom Line Benchmarking for Socially Responsible Investments, Necmi K. Avkiran, University of Queensland, 11 Salisbury Rd., Ipswich, Queensland, 4305, Australia, n. avkiran@mailbox.uq.edu.au, www.uq.edu.au/financesite/

Investments are examined through DEA for output-oriented technical and scale efficiencies. The productivity model developed constitutes an innovative approach to the measurement of relative performance in the financial services sector. Triple bottom line benchmarking rates investment performance on key financial, environmental and ethical variables through a multi-stakeholder perspective.

2) An Empirical Study of Stochastic DEA & Financial Performance: The Case of the Turkish Commercial Banking Industry, Thomas G. Weyman-Jones, Loughborough University, Dept. of Economics, Leicestershire, LE11 3TU, UK, t.g. weyman-jones@lboro.ac.uk, Meryem D. Fethi, Peter M. Jackson

The study breaks important new ground in the analysis of financial institutions. It is one of the first empirical uses of stochastic DEA in the efficiency literature. The pattern of efficiency is examined over the period 1992-1999. The purpose of stochastic setting of DEA is to accommodate both the inefficiency and the presence of measurement errors and to convert the resulting stochastic LPs for DEA into deterministic non-linear DEA programs.

3) Evaluating Transportation Quality of Steel Products using Data Envelopment Analysis, Sungik Pieh, RIST, San 32 Hyojadong Namku, Pohang, Kyungbuk, 790-330, Korea, sipieh@rist.re.kr, www.rist.re.kr

An important problem that many steel companies face is to provide satisfactory transportation quality for products they offer. We suggest the method for evaluating transportation quality of steel products based on DEA. Results from an empirical study to demonstrate the applicability of the method are also presented.

4) A Method to Discriminate DEA Efficient Candidates for Ranked Voting Data, Obata Tsuneshi, Oita University, 700 Dan-noharu, Oita, 870-1192, Japan, obata@csis.oita-u.ac.jp, Ishii Hiroaki

Ranked voting data arise when voters select more than one candidate. Cook & Kress introduced DEA to analyze such data. By using DEA, more than one candidate may be regarded as efficient equally. We propose a new method to discriminate efficient candidates without using information about inefficient candidates.

TA17 Telecommunications Networks Designs

Sponsor: Telecommunications

Sponsored Session

Chair: Abdel Lisser, France Telecom R&D, 38-40 rue du General Leclerc, Issy Les Moulineaux, 92794, France, abdel.lisser@francetelecom.com

1) Multicriteria Evaluation & Cellular Network Planning, Alexandre Caminada, France Telecom R&D, 6 Ave. des Usines, Belfort, 90000, France, alexandre.caminada@rd.francetelecom.fr

Cellular network evolution requires high financial investment while ensuring network quality and capacity. To assess the network design process, we use multicriteria evaluation and try to compare the solutions on the basis of experts analysis. Some results on solutions clustering regarding economical and technical criteria will be proposed.

2) Linearization Techniques for Unconstrained 0-1 Quadratic Programming, Philippe Michelon, Universite d'Avignon et des Pays de Vaucluse, Lab. d'Informatique D'Avignon, BP 1228, Avignon Cedex, 84911, France

Unconstrained 0-1 quadratic are still among the most challenging problems. Until now, exact methods are only able to tackle problems with a fairly small number of variables, i.e., 100 for full density problems. Moreover, such formulation may be applied to telecommunication design problems. We focus on linearization techniques which an integer linear formulation to 0-1 QP by adding variables and constraints...

3) Stochastic Network Design Problems, Nelson F. Maculan

New services and the recent open telecommunication environment in Europe change the classic deterministic network design problems. Indeed, network design should be performed using probabilistic materials to handle this new dimension. We propose an approach based on lift-and-project for solving stochastic mixed integer multi-commodity flow problems. Numerical results on real France Telecom Networks data are given.

TA18 Tutorial: The Logical Analysis of Data

Invited Session

Chair: Peter L. Hammer, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854, hammer@rutcor.rutgers.edu

1) Tutorial: The Logical Analysis of Data, Peter L. Hammer, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854, hammer@rutcor.rutgers.edu

LAD is a new combinatorial optimization and Boolean function theory-based methodology for data analysis. We shall present its theoretical foundations, describe an implementation and various applications, including a recent joint study with cardiologists from the Cleveland Clinic on mortality risk prediction for cardiac patients.

TA19 Logistics I

Contributed Session

Chair: Cheng-Chang Lin, National Cheng Kung University, Aeronautical/Astro. Eng., 1 University Rd., Tainan, 701, Taiwan, cclin@mail.ncku.edu.tw

1) Mew Measure of Freight Statistics: Distribution Levels, Kyungwoo Kang, Hanyang University, 1271 Sa-1-Dong, Ansan, Kyunggi-Do, 425-791, South Korea, kyungwoo@email.hanyang.ac.kr

Generally, the tons lifted and ton-kilometers are widely used to analyze the road freight transport. However, these two indicators are simply to show the road freight transport statistics rather than to explain the road freight transportation systems. The variables such as the number of distribution channel levels, the integral distance, tons in transport and the average transport distance are defined...

2) The Dynamic Load Planning Problem of Time-Definite Freight Delivery Common Carriers, Cheng-Chang Lin, National Cheng Kung University, Aeronautical/Astro. Eng., 1 University Rd., Tainan, 701, Taiwan, cclin@mail.ncku.edu.tw, Yiing-Yuh Lin

The dynamic load planning problem of time-definite freight delivery industry is to determine when and how small shipments should be consolidated to minimize the sum of fleet fixed and operating costs while satisfying the level of service

and operational restrictions. A dual method and computational results will also be presented.

3) A New Highest-Ascent-Mildest-Descent Approach using an Intelligent Reduced Neighborhood to Solve the Quadratic Assignment Problem, Stefan Bock, University of Paderborn, Production Mgmt. Dept., Warburger Str. 100, Paderborn NRW, 33098, Germany, stbo@uni-paderborn.de, http://econweb.uni-paderborn.de/prowi, Kai Hoberg, Otto Rosenberg

A new highest-ascent-mildest-descent-procedure for solving very complex instances (with up to 200 machines) of the well-known QAP is described and compared with known efficient heuristics. Thus, the superiority of the new algorithm concerning the solution quality can be stated.

4) An AGV Routing Procedure based on a Stochastic Time Model, Jungdae Suh, Kyungwon University, San 65, Pokjung-dong, Sujung-gu, Sungnam, Kyunggi, 461-701, Korea, jdsuh@mail.kyungwon.ac.kr, ie.kyungwon.ac.kr, Jaemin Jang, Pyung-Hoi Koo

We present a procedure for AGV and part routing using information on the current and future status of a clean bay for semiconductor and LCD production. The procedure determines the AGV and part routing using blocking and starving times of the source and destination machines. These times are obtained by using the available current and future status information of the systems...

TA20 Energy II

Contributed Session

Chair: Shishir K. Mukherjee, City of Palo Alto Utilities, 1174 Scotland Dr., Cupertino, CA 95014-5026, shishir_mukherjee@msn.com, city.palo-alto.ca.us

1) Nonlinear Programming Models for Hazardous Waste Remediation by Plasma Arc Systems, Joao-Lauro D. Faco, Federal University of Rio de Janeiro, Rua Lasar Segall, 100/105A Joa, Rio de Janeiro, 22611-100, Brazil, jldfaco@acd.ufrj.br

Plasma arc technology systems to destroy Class I hazardous wastes are the best remediation solution from the environmental point of view. To achieve a competitive commercial price, as these systems are intensive energy consuming, complex models are needed to schedule the system operation. Coupled sets of discrete-time difference equations can describe the interaction dynamics of wastes from different origins...

2) A Model for Assessing Aviation Emissions & Potential Reduction from CNS/ATM Initiatives, Nastaran Coleman, FAA, 800 Independence Ave. SW, ASD-430 Portals, Washington, DC 20591, nastaran.coleman@faa.gov, Fran Melone, Marc D. Rose

A parametric model is introduced that is capable of estimating global emissions and fuel consumption and evaluating the impact of various enhancements in the Communication Navigation Surveillance/Air Traffic Management systems for Europe and the US. Variables that influence emissions are identified and calibrated for different regions. Outputs of previous simulation studies are utilized.

3) Lessons Learned from Electricity Industry Restructuring in California, Shishir K. Mukherjee, City of Palo Alto Utilities, 1174 Scotland Dr., Cupertino, CA 95014-5026, shishir_mukherjee@msn.com, city.palo-alto.ca.us

The restructuring of the electricity industry in California was expected to reduce electricity rates for all consumers due to competition. Within two years, it has resulted in an energy crisis for consumers and a financial crisis for two major utilities and the State. Major lessons from the experience will be discussed.

TA21 Dynamics of Organizational Design

Sponsor: Organization Science

Sponsored Session

Chair: Richard M. Burton, Duke University, Fuqua Sch. of Bus., Durham, NC 27708-0120, rmb2@mail.duke.edu

1) Managing Strategic & Organizational Misfits, Richard M. Burton, Duke University, Fuqua Sch. of Bus., Durham, NC 27708-0120, rmb2@mail.duke.edu, Borge Obel

Strategic and organizational misfits are misalignments among the firm's environment, strategy, leadership style, climate and technology, and its organizational structure. We show that misfits lead to decreased financial performance, the order of fixing is important and creating misfits is central to strategy.

2) Organization Design: An Action-Theoretic Approach, Alex V. Werder, Technical University of Berlin, Organisation/Unternehmensfuh., Uhlandstrade 4-5, Berlin, D-10623, Germany, a.werder@berlin.de, Jens Grundel

We address the way human behavior in organizations is dealt with when organization design prescriptions are derived. In our action-theoretic OD-approach, we propose to use both behavioral assumptions (configuration dimension) and insights from organizational behavior research (motivation dimension) when evaluating the efficiency of structural alternatives. The systematic integration of the 2 dimensions is the focal point of our approach.

3) Designing Organizations for Projects & Programs, Raymond E. Levitt, Stanford University, Ctr. for Integrated Fac. Eng., Stanford, CA 94305, rel@cive.stanford.edu

Organizations translate strategies into operations through projects. Time pressures force managers to fast-track projects, resulting in frequent organizational overloads, missed deadlines and quality failures. Instead of adapting project/program organizations by trial and error, it is now possible to model and simulate organizations executing multiple fast-track projects to design them proactively.

4) On Understanding Military Organizations: The Exercise of Authority & Direction, Erik Jansen, Naval Postgraduate School, Monterey, CA, Carl R. Jones

Military organizations are modeled using the enfolded layer framework composed of the layers: deciding and leading action-network, command and control coordination action-network, sensing to shooting task architecture and technical systems architecture. This framework is used as the foundation for a proposed organizing heuristic for mission focused military organizations.

TA22 Workshop on Modeling: How to Teach & Open Research Questions

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) Workshop on Modeling: How to Teach & Open Research Questions, Thomas A. Grossman, University of Calgary, Fac. of Mgmt., 2500 University Dr. NW, Calgary, Alberta, T2N 1N4, Canada, grossman@ucalgary.ca

Modeling, the process of creating, exploring and learning from models, is the foundation of MS/OR. Remarkably little is known about modeling. Modeling ability is rare among business students. We provide a step-by-step roadmap to the modeling process, explain how to teach modeling to business students and discuss important open research questions.

Tuesday 09:45-10:45

TP04 Omega Rho Distinguished Lecture: Parallel Computing & Integer Programming

Invited Session

Chair: Kathryn E. Stecke, University of Michigan Business School, 701 Tappan St., Ann Arbor, MI 48109-1234, kstecke@umich.edu

1) Omega Rho Distinguished Lecture: Parallel Computing & Integer Programming, William R. Pulleyblank, IBM TJ Watson Research Center, PO Box 218, Yorktown Heights, NY 10598, wrp@watson.ibm.com

The size of integer programming problems solvable on computers continues to increase, due to improvements in machine speed and size and also due to significant algorithmic improvements. Efficiently exploiting parallelism provides significant challenges, both for small-scale parallelism (tens of processors) and large-scale parallelism (up to one million processors). We discuss this with reference to several ongoing research activities, including the massive one petaflop Blue Gene computer, designed for completion in 2004.

Tuesday 11:00-12:30

TC01 Operations Research Applications on Supply Chain Management

Cluster: End-to-End Supply Chain Management

Invited Session

Chair: Robert Stawicki, Aspen Technology, 200 South St., New Providence, NJ 07974, robert.stawicki@aspentech.com

1) Printing Press Schedule Optimization using Aspen Technology's MIMI Factory Scheduler: A Case Study, Robert Stawicki, Aspen Technology, 200 South St., New Providence, NJ 07974, robert.stawicki@aspentech.com

Scheduling the printing operation in consumer packaging production is extremely difficult because there are numerous competing goals and a seemingly infinite number of sequences. A methodology for modeling this operation and comparing the results obtained using exchange algorithms, simulated annealing and GAs is presented using Aspen Technology's MIMI Factory Scheduler.

2) **Semiconductor Planning using Aspen Technology's MIMI Global Planner**, *Danielle A. Cohen*, Aspen Technology, 1293 Eldridge Parkway, Houston, TX 77077, danielle.cohen@aspentech.com

About 7 years ago, AspenTech's Chesapeake Supply Chain Division began the process of understanding the production planning and ATP requirements of firms in the semiconductor industry and incrementally enhanced their software where appropriate to meet these needs. We will describe the core decision technology deployed by AspenTech to meet the needs of its customers and the evolution of this software.

3) **Aspen Technology's MIMI Application to the Power Industry**, *Bety Peng*, Aspen Technology, Waterway House, The Ham, Brentford, TW8 8HQ, UK, bety.peng@aspentech.com

The UK New Electricity Trading Arrangement requires competitive planning and scheduling systems for power industries. MIMI is used to develop a short-term plan of decisions for power station start-ups/shutdowns and power levels, together with trading decisions via buying and selling, so that demand levels can be met at minimum cost.

4) **withdrawn - author request of 5/9**, *Brian T. Downs*, Aspen Technology, Inc., 1293 Eldridge Parkway, Houston, TX 77077, brian.downs@aspentech.com, *John H. Semple*

TC02 Supply Chain Pricing & Coordination

Cluster: Supply Chain Management

Invited Session

Chair: Yu-Sheng Zheng, University of Pennsylvania, The Wharton School, 1300 SH-DH, Philadelphia, PA 19104, zheng@wharton.upenn.edu

1) **Supply Chain Information Sharing with Horizontal Competition**, *Lode Li*, Yale University, Sch. of Mgmt., New Haven, CT 06520-8200, lode.li@yale.edu

We examine the incentives for firms to share information vertically in supply chains with one upstream firm and many competing downstream firms. We show 3 effects of information sharing: the information rent sought by the informed upstream firm, strategic reaction of the competitors and reduction in inventory related costs. We show how prices are determined when information is traded.

2) **The Analysis of Bidding Strategies for Suppliers of Spot Markets**, *Houmin Yan*, Chinese University of Hong Kong, Dept. of SE/EM, Hong Kong, Shatin NT, PR China, *Hanqin Zhang*

We consider a spot market consisting of two suppliers and one consumer. The consumer's purchase policy uses the news vendor solution and suppliers compete on their marginal supply of price. We establish a unique Nash equilibrium. Potential applications include bidding strategies for power plants in the deregulated California energy market.

3) **On the Inventory Allocation Rules in Assemble-to-Order Systems**, *Yalcin Akcay*, Pennsylvania State University, Dept. of MS & IS, Coll. of Bus. Admin., University Park, PA 16802, yxa105@psu.edu, *Susan H. Xu*

We propose an order-based inventory allocation rule to maximize the order fill rate in ATO systems. We show the rule is nearly optimal under mild conditions. We also propose an item-based allocation rule that combines the fixed priority and fare shares rules proposed by others. Our computations indicate both rules significantly outperform existing methods.

4) **Reducing the Adverse Effects of Overreaction to Demand Changes in a Supply Chain**, *Noel Watson*, University of Pennsylvania, The Wharton School, 1300 SH-DH, Philadelphia, PA 19104, nhwatson@wharton.upenn.edu, *Yu-Sheng Zheng*

Inventory managers often overreact to demand changes. A supplier responding to orders from over-reacting managers may compound supply-chain inefficiency. We consider various ways the supplier may respond. We show gain can be achieved if the supplier manages his echelon inventory to meet the end customer demand instead of the orders.

TC03 Issues in New Product Introduction

Sponsor: MSOM

Sponsored Session

Chair: Glen Schmidt, Georgetown University, McDonough Sch. of Bus., Washington, DC 20057, schmidtg@msb.edu

1) **Fringe Benefits: Neo-Rawlsian Strategies for New Entrants**, *Avi Giloni*, Yeshiva University, Syms Sch. of Bus., 500 185th St., BH-428, New York, NY 10033, agiloni@ymail.yu.edu, *Sridhar Seshadri*, *Christopher Tucci*

We study whether a new entrant into a market can successfully compete by designing a product that only appeals to a disgruntled minority or "fringe" of the market. We model this product design problem as an optimization problem and describe the performance of the fringe strategy for different scenarios.

2) **Balancing Structure & Flexibility in New Product Innovation**, *Vish Krishnan*, University of Texas, CBA 4.202, Austin, TX 78712, krishnan@mail.utexas.edu

We examine the tension between structure and flexibility in new product development. We examine how this trade-off differs in various product markets, and propose a conceptual framework.

3) **What Impacts Industry Clockspeed?**, *Glen Schmidt*, Georgetown University, McDonough Sch. of Bus., Washington, DC 20057, schmidtg@msb.edu

Our model suggests that when customers closely agree on the superiority of a new product generation relative to the old, we expect shorter product lifetimes and narrower product lines (faster clockspeeds). It also suggests a slower clockspeed in a duopoly than in a monopoly or a fully competitive market.

TC04 Multi-Echelon Inventory & Supply Chain Management

Sponsor: MSOM

Sponsored Session

Chair: Edward G. Anderson, Jr., University of Texas, McCombs Sch. of Bus., Mgmt. Dept., CBA 4.202, Austin, TX 78712, edward.anderson@bus.utexas.edu

1) **Bounds & Heuristics for Optimal Policies in a Serial Supply Chain**, *Kevin Shang*, University of California, Grad. Sch. of Mgmt., Irvine, CA 92697, hshang@gsm.uci.edu, *Jing-Sheng Song*

We study the classic N-stage serial inventory system with linear ordering costs and Poisson demand process. We develop an easy-to-compute heuristic for the optimal echelon base-stock levels by solving 2N single-stage problems. The heuristic is the average of an upper and a lower bound.

2) **Replenishment Strategies with Advance Demand Information for One-Warehouse Multi-Retailer Distribution Systems**, *Ozalp Ozer*, Stanford University, Dept. of MSE, 336 Terman, Stanford, CA 94305-4026, ozalp.ozel@stanford.edu

We propose an efficient replenishment policy for a distribution system. Retailers obtain advance demand information by convincing customers to place early orders. We show how to use this information and reduce inventory costs and levels. We also illustrate how to enhance the outcome of a postponement strategy.

3) **Capacity & Backlog Management in Service-Oriented Supply Chains**, *Edward G. Anderson, Jr.*, University of Texas, McCombs Sch. of Bus., Mgmt. Dept., CBA 4.202, Austin, TX 78712, edward.anderson@bus.utexas.edu, *Douglas J. Morrice*

We investigate service-oriented supply chains in which each stage holds no finished goods inventory, rather only backlogs that can be managed solely by adjusting capacity. Using control theory, we study the impact of different management strategies. One non-intuitive result is that lead-time reduction can exacerbate the bullwhip effect.

TC05 Tutorial: Inside Discrete-Event Simulation Software - How it Works & Why it Matters

Invited Session

Chair: Thomas J. Schriber, University of Michigan, Sch. of Bus., Ann Arbor, MI 48109-1234, schriber@umich.edu

1) **Tutorial: Inside Discrete-Event Simulation Software - How it Works & Why it Matters**, *Thomas J. Schriber*, University of Michigan, Sch. of Bus., Ann Arbor, MI 48109-1234, schriber@umich.edu

This tutorial describes how discrete-event simulation software works. Topics include discrete-event systems; entities, resources, control elements and operations; and entity management. The implementation of a generic model in several commercial languages is discussed. Examples are given of "why it matters" for modelers to know how their models work "deep down."

TC06 Intelligent Manufacturing**Contributed Session**

Chair: Nikolay V. Zakharov, Sumy State Agrarian University, Kirova St. 160, Sumy UA, 40021, Ukraine, mech@sau.sumy.ua, www.sau.sumy.ua

1) The Rational Synthesis of Technological Processes, Nikolay V. Zakharov, Sumy State Agrarian University, Kirova St. 160, Sumy UA, 40021, Ukraine, mech@sau.sumy.ua, www.sau.sumy.ua, Evgeniy V. Konoplyanenko, Oleg V. Radchuk

The novelty of the approach to the analysis and maintenance of the reliability of technological process consists in "weighing" refusals according to the expenditure of time. It allows to open and use for maintenance of normal functioning of systems internal reserves (time in particular), incorporated in systems themselves, deeper penetration into the essence of the researched processes...

2) Representation & Situation-Based Evaluation of Alternative Process Plans, Junho Shin, POSTECH, Dept. of IE, San 31 Hyoja, Pohang, Kyungbuk, 790-784, Korea, jangpy@postech.ac.kr, Sungsik Park, Buhwan Jung

The consensus shared by a distributed shop floor control system is that each controller should be able to resolve the global decision-making problems through negotiation. This research covers various negotiation-based decision-making functions that are required to resolve the and/or graph-based process plans in a distributed manner.

3) Validation of Non-Linear Process Plans for Shop Floor Control, Pyoung Yol Jang, POSTECH, Dept. of IE, San 31 Hyoja, Pohang, Kyungbuk, 790-784, Korea, jangpy@postech.ac.kr, Dowan Kim, Hyunbo Cho

Although feature-based process planning is popular in industry due to its ability to rigorously integrate design and manufacturing, there have been few efforts in validating the hard-constructed non-linear process plan. We present the elaboration and validation methodologies of the and/or graph-based non-linear process plans for effective shop floor control.

TC07 Customer Relations**Contributed Session**

Chair: Werner Reinartz, INSEAD, Blvd. de Constance, Fontainebleau, 77305, France, werner.reinartz@insead.fr

1) Modeling Customer Retention on the Internet: Empirical Findings, Jasmin Bergeron, Concordia University, 2919 Bellechasse #37, Montreal, Quebec, H1Y 1K1, Canada, bergeron.jasmin@uqam.ca

E-commerce executives mistakenly concentrate all their attention on attracting customers, rather than retaining them. We propose a model to explain the causes and consequences of customer retention. Empirical results show that enormous advantages can be obtained by retaining online customers. Managerial implications and opportunities for future research are discussed.

2) Managing Customer Value: Customer Acquisition, Retention & Cross-Selling, Werner Reinartz, INSEAD, Blvd. de Constance, Fontainebleau, 77305, France, werner.reinartz@insead.fr, Jacquelyn S. Thomas

We propose a model to measure the value of a customer to firm. It integrates acquisition, retention and up-selling strategies into a single framework and seeks to understand the impact that each strategy has on individual customer value. Furthermore, we want to develop a decision aid for optimally allocating resources across customer acquisition, retention and cross-selling.

3) Customer Knowledge in the Adult Incontinence Market, Kaoru Yuasa, Kansai University, Faculty of Commerce, 3-3-35 Yamate-cho, Suita, Osaka, 564-8680, Japan, k-yuasa@mvd.biglobe.ne.jp, Hiroshi Iida, Katsutoshi Yada

Our purpose is to discover useful knowledge that helps us understand the consumer behavior in the adult incontinence market (paper diapers for adults) by applying data mining tools to sales data of drugstores. We present a method for quantitatively measuring store loyalty and discovering sequential patterns in associative purchasing among different product categories. We hope this knowledge contributes to the business world for customer relationship management.

4) Customer Behavior in an Internet Shop, Takashi Namatame, Science University of Tokyo, Dept. of IME, Fac. of Eng., 1-3 Kagurazaka, Shinjuku-ku, Tokyo, 162-8601, Japan, namatame@ms.kagu.sut.ac.jp, Tomoaki Tabata, Takahiro Ohno

In recent years, many kinds of service on the Internet are increasing. To keep an Internet shop, we must grasp the customer's behavior or preferences. We consider the customer's behavior at an Internet shop by using cookies and

buying data.

TC08 New Methods in Global Optimization**Cluster: Global Optimization****Invited Session**

Chair: N. V. Thoai, University of Trier, thoai@orsun6.uni-trier.de

Co-Chair: Y. Yamamoto, No Address, no email

1) A Successive Approximation Algorithm for Reverse Convex Programming, Syuuji Yamada, Toyama College, Dept. of Mgmt. & Info., 444 Mizuguchi, Gankaiji, Toyama, 930-0193, Japan, yamada@toyama-c.ac.jp, Tetsuzo Tanino, Masahiro Inuiguchi

We propose a successive approximation algorithm for a reverse convex programming problem. At every iterative provisional solution of a relaxed problem of the problem is obtained. We then show that every accumulation point of the sequence of the provisional solutions solves the problem.

2) A Branch Bound & Cut Algorithm for Solving Nonconvex Quadratic Programs, Ivo Nowak, Humboldt University of Berlin, Institute of Math, Rudower Chaussee 25, Berlin, D-10099, Germany, ivo@mathematik.hu-berlin.de

We present a BB&C algorithm for solving a class of nonconvex quadratically constrained quadratic programs. Lower bounds are computed by (approximately) solving a dual problem using a proximal bundle algorithm. To reduce the number of subproblems generated by the branching procedure, a new technique for computing optimality cuts is used.

3) A Prioritization Model for Decision Making Units in DEA from Uncertain Cross-Evaluation Values by the Eigenvalue Method, Kazuyuki Sekitani, University of Shizuoka, Dept. of Systems Eng., 3-5-1 Johuku, Hamamatsu, 432-8561, Japan, sekitani@sys.eng.shizuoka.ac.jp

DEA has been used widely to evaluate the efficiency of DMUs; however, it does not perform full ranking of DMUs. We analyze cross evaluation information of DMUs by the eigenvalue method and present a new ranking method.

4) An Algorithm for Solving a Mean-Variance-Skewness Portfolio Optimization with Transaction Costs, Shouyang Wang, Chinese Academy of Sciences, Inst. of Systems Sci., Beijing, 100080, China, sywang@iss02.iss.ac.cn

Portfolio selection problems can be modeled by the mean-variance-skewness methodology. But if transaction costs are taken into consideration, the optimization model is in general non-differentiable. We present an algorithm to solve mean-variance-skewness portfolio optimization problems with transaction costs. We prove some theoretical results and present numerical results.

TC09 Topics in Nonlinear Optimization**Cluster: Nonlinear Optimization****Invited Session**

Chair: Walter Murray, Stanford University, Dept. of MSE, Stanford, CA 94305-4026, walter@stanford.edu, www.stanford.edu/~walter

1) Two Decomposition Algorithms for the Nonconvex Optimization Problem with Global Variables, Angel-Victor DeMiguel, Stanford University, Dept. of MSE, Stanford, CA 94305-4026, avmiguel@stanford.edu, www.stanford.edu/~avmiguel, Walter Murray

Generalized Benders decomposition is an efficient decomposition algorithm for convex optimization problems with global variables (OPGVs). We propose 2 novel locally-convergent decomposition algorithms for the nonconvex OPGV. We create a new test-problem set and show that both algorithms solve the test set for a wide variety of circumstances.

2) A Homotopy Algorithm for Global Optimization & Nonlinear Discrete Problems, Kien-Ming Ng, Stanford University, Dept. of MSE, Stanford, CA 94305-4602, kienming@stanford.edu, www.stanford.edu/~kienming, Walter Murray

One of the most challenging optimization problems is determining the minimizer of a nonlinear nonconvex problem in which there are some discrete variables. Such problems may be transformed to that of finding a global optimum. We describe a method to solve such problems using a homotopy approach.

3) Algorithms for Mathematical Programs with Equilibrium Constraints with Applications to Deregulated Electricity Markets,

Heiko Pieper, Stanford University, Dept. of MSD, Stanford, CA 94305-4026, www.stanford.edu/~pieper, **Hung-Po Chao**, **Walter Murray**

A new sequential quadratic programming algorithm for mathematical programs with equilibrium constraints is described. Results on a comprehensive set of test problems are reported. The algorithm has been applied to a new model of deregulated electricity markets. A fundamental relationship between transmission capacity and forward markets was revealed and its relevance will be discussed.

TC10 Research Related to COIN OR: The Common Optimization Interface for Operations Research

Cluster: Computational Mixed Integer Programming
Invited Session

Chair: Laszlo Ladanyi, IBM TJ Watson Research Center, Research Division, PO Box 218, Yorktown Heights, NY 10598, ladanyi@us.ibm.com

1) **Branch & Cut for Routing & Packing Problems**, **Ted Ralphs**, Lehigh University, Dept. of ISE, 200 West Packer Ave., Bethlehem, PA 18015, tkralphs@lehigh.edu

We discuss the application of SYMPHONY and COIN/BCP, two generic, parallel frameworks for branch, cut and price to the solution of a class of routing and packing problems that includes the vehicle routing, bin packing and capacitated spanning tree problems. We discuss implementational issues and present computational results.

2) **Volume Algorithm-Based Branch & Cut**, **Laszlo Ladanyi**, IBM TJ Watson Research Center, Research Division, PO Box 218, Yorktown Heights, NY 10598, ladanyi@us.ibm.com, **Francisco Barahona**

We present a B&C algorithm based on COIN/BCP where the volume algorithm is applied to the linear programming relaxations instead of the traditionally used dual simplex method. Computational results presented for the max-cut and Steiner tree problems show the superiority of the volume algorithm-based approach.

3) **Derivative Free Optimization Open Source Software**, **Katya Scheinberg**, IBM TJ Watson Research Center, PO Box 218, Yorktown Heights, NY 10598, katyas@us.ibm.com

DFO is a Fortran package aimed at solving small-scaled general non-linear optimization problems whose objective function is expensive to compute and whose gradient (and Hessian) are not available. We will discuss the performance of the software, the underlying method, extensions to constrained cases and possible extensions to medium-scale problems.

TC11 Tutorial: Constraint Programming for Math Programmers

Invited Session

Chair: Robert Fourer, Northwestern University, Dept. of IE/MS, Evanston, IL 60208-3119, 4er@iems.nwu.edu

1) **Tutorial: Constraint Programming for Math Programmers**, **Robert Fourer**, Northwestern University, Dept. of IE/MS, Evanston, IL 60208-3119, 4er@iems.nwu.edu

The commercial development of constraint logic programming (CLP) methods is changing the way that people approach optimization modeling, especially for highly combinatorial problems. This survey addresses the implications of CLP from the standpoint of potential users whose backgrounds are in OR and whose experience is with conventional mathematical programming systems.

TC12 Marketing Issues on the Internet

Sponsor: E-Commerce

Sponsored Session

Chair: S. Erevelles, University of California, Anderson Grad. Sch. of Mgmt., Riverside, CA 92521, sunil.erevelles@ucr.edu

1) **Effective Websites: The Importance of Site Design**, **Suresh Sundaram**, University of Houston, Mktg. & Entrepreneurship, Bauer Coll. of Bus., Houston, TX 77204, ssuresh@uh.edu, **Betsy D. Gelb**

We examine the effects of website design factors on the perceived effectiveness of websites. Specifically, we assess the effects of the level of simplicity of the website, degree of user selection of a site navigation process and the number of levels required to maneuver to obtain the desired information, using user perceptions of website effectiveness as dependent variables...

2) **Pattern Identification & Segmentation of Online Search Behavior**, **Anuradha Sivaraman**, University of Houston, Mktg. &

Entrepreneurship, Bauer Coll. of Bus., Houston, TX 77204, anu@bayou.uh.edu, **R. Sukumar**

Despite the explosive growth of e-commerce and the rapidly increasing number of consumers using the web for prepurchase information search and online shopping, very little is known about how the pattern of their search effects their purchase decision. We apply the hierarchical Bayesian technique to study the page visit pattern of consumers and segment them into different groups: searcher, browser and directed buyer...

3) **Technological Barriers to the Business-to-Business Segment of E-Business**, **M. B. Khan**, California State University, Coll. of Bus. Admin., Long Beach, CA, mkhan@csulb.edu, **Merle P. Martin**

We focus on a host of technological barriers that affect the B2C segment of e-business. These barriers encompass both computer hardware and software, including system security and reliability, user interface design, processor speed, bandwidth, sound and picture quality and virtual reality. We correlate technological barriers with the various types of business activities.

TC13 Service Strategies in the Financial Sector

Cluster: Service Strategy & Design

Invited Session

Chair: Nikos Tsikriktsis, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, UK, nikos@london.edu

1) **E-Business Strategies in the UK Financial Services Sector**, **Mark Frohlich**, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, UK, mfrohlich@london.edu, **Nikos Tsikriktsis**

We address the current status of e-business developments and the anticipated pace of change in the next 2 - 3 years in the UK financial services sector. It investigates the relationships between the drivers for and barriers to implementation, the key enabling processes and the principal benefits and strategic implications of e-business.

2) **Exploring the Direct & Indirect Effects of Market Orientation, Relationship Depth & Customer Satisfaction on Customer Behavioral**, **Antreas D. Athanassopoulos**, ALBA & London Business School, Athinas Av. & Areos Str. 2A, 166 71, Greece, athan@bpm.gr

We propose a theoretical framework that demonstrates the potential links between the behavioral aspects of customers, the perceived market orientation of service providers with the satisfaction levels of customers and their behavioral intentions. We seek to investigate the direct and indirect effects of factors such as the way customers conduct their business with the service provider, the depth of service, etc...

3) **The Relationship between Culture & Web Site Quality Perceptions**, **Nikos Tsikriktsis**, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, UK, nikos@london.edu

We investigate the link between culture and evaluation of web site quality. Specifically, we investigate how the relative importance of each dimension of web site quality varies across different cultural groups. Web site quality is measured through a recently developed instrument (WEBQUAL), while culture is measured through Hofstede's cultural dimensions.

TC14 Decision Analysis is Not Value Free: Issues & Challenges from Decision Conferencing

Sponsor: Decision Analysis

Sponsored Session

Chair: Lawrence D. Phillips, London School of Economics & Political Science, Flat A, Upfleet Vale of Health, London, NW3 1AN, UK, larry_phillips@classic.msn.com

1) **Multi-Criteria Qualitative Decision Conferencing: Some Practical Issues**, **Carlos Bana e Costa**, London School of Economics & Political Science, Dept. of OR, Houghton St., London, WC2A 2AE, UK, carlosbana@hotmail.com

We discuss issues arising when facilitating committees that evaluate bids in public calls for tenders. These include explaining the choice of the winning contractor, accommodating criteria and their weights when they must be included in the call for tenders, demonstrating that the best option is also a "good" one and using qualitative approaches to scoring and weighting.

2) **Issues of Quality Assurance in Decision Conferencing**, **John D. De Reuck**, Murdoch University, Sch. of Bus., Perth, WA 6156, Australia, j.dereuck@murdoch.edu.au

We address an under-theorized issue in decision conferencing facilitation procedures, that of the possibility of inauthentic commitment avowals. Under a

disequilibrium conception of rationality, it is argued that subject to certain pragmatic constraints, facilitation processes can be modified to guarantee the epistemic quality assurance of decision outcomes.

3) Implicit Values in Applying Decision Analysis: Lessons from Decision Conferencing, Lawrence D. Phillips, London School of Economics & Political Science, Flat A, Upfleet Vale of Health, London, NW3 1AN, UK, larry_phillips@classic.msn.com

How we apply decision analysis is profoundly affected by the values we bring to the enterprise. We draw on experience with decision conferencing and contrast it to conventional decision analytic practice, highlighting major value differences in these approaches. This presentation is intended to stimulate debate about our values.

TC15 Inventory Control with Unknown Stochastic Demand
Cluster: Applications of Applied Probability & Applied Statistics
Invited Session

Chair: David W. Glenn, University of British Columbia, Fac. of Commerce, 1053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, david_glenn@commerce.ubc.ca

1) Joint Forecasting & Replenishment Processes in Supply Chains & the Value of Information Sharing, Yossi Aviv, Washington University, Olin Sch. of Bus., One Brookings Dr., CB 1133, St. Louis, MO 63141, aviv@olin.wustl.edu

A stylized, linear state space model for collaborative forecasting and information sharing in supply chains will be discussed. Several illustrations will be presented as a motivation for this work.

2) Multi-Product Replenishment Strategies under a Joint Capacity Constraint, Stefan Minner, University of Calgary, Fac. of Mgmt., 2500 University Dr. NW, Calgary, Alberta, T2N 1N4, Canada, sminner@mgmt.ucalgary.ca, **Edward A. Silver**

We analyze a multi-product inventory replenishment problem with Poisson demands where the inventory levels at any time are restricted by a common budget or space limitation. We present a semi-Markov decision problem formulation, several heuristics for finding the replenishment quantities, given the current inventories of all products, and a comparison from a cost performance perspective.

3) Adaptive Inventory Control in a Two-Echelon System, David W. Glenn, University of British Columbia, Fac. of Commerce, 1053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, david_glenn@commerce.ubc.ca, **Martin L. Puterman, Arnab Bisi**

We model a 2-echelon inventory system composed of a single supplier and several retailers, where demand is stochastic and the underlying probability distribution is unknown. In each period, the supplier observes retailer sales data and seeks to estimate a common demand distribution parameter using aggregate sales data. We analyze the supplier's optimal ordering and allocation policy under two performance measures, supplier profit and system profit...

TC16 Data Envelopment Analysis II
Contributed Session

Chair: Phillip F. Fanchon, California Polytechnic State University, Dept. of Economics, San Luis Obispo, CA 93407, pfanchon@calpoly.edu

1) The Influence of Lags on Dynamic Efficiency Measures, Phillip F. Fanchon, California Polytechnic State University, Dept. of Economics, San Luis Obispo, CA 93407, pfanchon@calpoly.edu, **Jati Kumar Sengupta**

We investigate how the choice of lagged variables influences long run measure of growth efficiency in a hyper competitive market, where the rapid change in economic environment invalidates the static assumptions of window analysis. We use the computer industry as an example to compare the static and dynamic measures of efficiency.

2) The Diffusion of Research on Productive Efficiency, Nikias Sarafoglou, Mid-Sweden University, Dept. of Economics, Sundsvall, 85732, Sweden, nikias_sa@yahoo.se, **Finn R. Forsund**

Recent availability of electronically accessible databases of journal articles makes studies of the diffusion of papers through citations possible.

3) DEA in View of Production & Decision Theory, Andreas Kleine, University of Saarland, Rechts und Wirtschaftswissens., Fakultät, Saarbrücken, D-66041, Germany, ak@wiwi.uni-sb.de, <http://www.ufo.uni-sb.de/main.html>

DEA models are based on efficiency-test programs known from MCDM. The set of reference units in DEA is generated on the assumption of a production technology. On these grounds it is possible to formulate a general DEA model.

This formulation is the basis for well known and new DEA approaches.

4) An Interactive Approach to Deal with Negative Outputs DMU, Danilo A. Gonvalves, Sociedade Brasileira de Pesquisa Operacional, Rua Bambina, 60/803 Botafogo, Rio de Janeiro, 22251-050, Brazil, daniloag@uol.com.br, **Joao Carlos C. Mello, Marcos E. Lins**

We present an algorithm development using artificial DMU to deal with negative outputs DMU that cannot be considered efficient. We provide a didactic example, bi-dimensional and an application in finances for expansion of the negative Sharpe index with mutual funds investments.

TC17 Tutorial: Storage Area Network Design
Invited Session

Chair: Julie A. Ward, Hewlett-Packard Labs., 1501 Page Mill Rd., MS 1U-2, Palo Alto, CA 94304, jward@hp.com

1) Tutorial: A Storage Area Network Design, Julie A. Ward, Hewlett-Packard Labs., 1501 Page Mill Rd., MS 1U-2, Palo Alto, CA 94304, jward@hp.com, **Mike O'Sullivan, Troy Shahoumian, John Wilkes**

The SAN fabric design problem is to find a network of links, hubs and switches connecting hosts to storage devices to support data flow requirements between host-device pairs. This is a network design problem confounded by degree constraints and other technological issues. We describe several approaches to this problem.

TC18 Boolean & Pseudo-Boolean Functions

Cluster: Boolean Functions, Data Analysis & Optimization
Invited Session

Chair: Michel Minoux, University of P. et M. Curie, Lab. d'Informatique de Paris, 4 place Jussieu, Paris Cedex, F-75252, France, michel.minoux@lip6.fr

1) Boolean Functions & Submodular Separators, Endre Boros, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854, boros@rutcor.rutgers.edu, **K. Elbassioni, V. Gurvich, L. Khachiyan**

True and false points of a monotone Boolean function are separable by a submodular function and the size of the dual is shown to be limited in terms of the number of minterms and range of separator. Thus, efficient incremental identification is possible whenever a submodular separator oracle is used.

2) A Non-Linear SAT Solver, John Franco, University of Cincinnati, Dept. of Computer Sci., Cincinnati, OH 45221, franco@gauss.eecs.uc.edu

We describe a hybrid SAT solver which takes, as input, a collection of Boolean functions in standard forms such as BDD, CNF, etc., and determines an interpretation satisfying all functions or verifies that none exists. The solver uses a BDD front end that includes all the usual BDD-based tools to pre-process the given collection.

3) A Continuous Method for the Minimization of a Quadratic Pseudoboollean Function F, Ivo G. Rosenberg, University of Montreal, Dept. of Mathematics, Montreal, Quebec, H3C 3J7, Canada, rosenb@dms.umontreal.ca

The points of minima of f are also those of f on the whole hypercube H . We combine the steepest descent with a subdivision of H based on the eigenvalues of the quadratic part of f .

4) Restricted Consensus Algorithms & Transitive Closures, Bruno Simeone, University of Rome, Dept. of Stats. & Probability, Rome, Italy, bsimeone@katamail.com, **Endre Boros, Stephan Foldes, Peter L. Hammer**

We study a restricted consensus algorithm where, at each iteration, an initial term is selected and all the possible consensus of that term and the other existing terms are generated; then the term is never used again in subsequent consensus. When the input DNF is quadratic and submodular, a fast and simple $O(nm)$ transitive closure algorithm is obtained.

TC19 Logistics II
Contributed Session

Chair: Miyamoto Yuichiro, Tokyo University of Mercantile Marine, 2-1-6 Etsujima, Koutou-ku, Tokyo, 135-8533, Japan, yuichiro@ipc.tosho-u.ac.jp

1) On a Products Assignment Problem of Vending Machines, Miyamoto Yuichiro, Tokyo University of Mercantile Marine, 2-1-6 Etsujima, Koutou-ku, Tokyo, 135-8533, Japan, yuichiro@ipc.tosho-u.

ac.jp, *Kubo Mikio*

We deal with a problem that aims to determine an optimal combination of products assigned to columns of vending machines. The problem gets a lot of attention at large soft drink firms in Japan. We present an ILP formulation with column generation techniques and also present a heuristic with tabu search.

2) **Design of a Carousel System based on a Recursive Optimization/Simulation Procedure**, *Dae-Won Choi*, KAIST, Dept. of IE, 373-1 Kusong-dong, Yusong-gu, Taejon, 305-701, South Korea, ourroom@ie1.kaist.ac.kr, *Hark Hwang*

We develop a design model for a carousel system based on a recursive optimization/simulation procedure. With the optimization model, we seek design parameters that minimize the total cost of the carousel system while complying with the desired level of performances obtained by the simulation model.

3) **A Static Model for Purchasing, Remanufacturing & Waste Disposal**, *Yonghui Oh*, KAIST, Dept. of IE, 373-1 Kusong-dong, Yusong-gu, Taejon, 305-701, Korea, yhoh@ie1.kaist.ac.kr, *Kwonik Shon*, *Hark Hwang*

A model is studied in which the stationary demand can be satisfied by both newly made products and remanufactured used products. It is assumed that the used products are collected and repaired at some rate and the leftovers might be disposed of according to some waste disposal rate.

TC20 Tutorial: Dynamic Programming - A Multi-Faceted View

Invited Session

Chair: Augustine O. Esogbue, Georgia Institute of Technology, Sch. of ISyE, Intell. Systems & Controls Lab, Atlanta, GA 30332-0205, augustine.esogbue@isye.gatech.edu

1) **Tutorial: Dynamic Programming - A Multi-Faceted View**, *Augustine O. Esogbue*, Georgia Institute of Technology, Sch. of ISyE, Intell. Systems & Controls Lab, Atlanta, GA 30332-0205, augustine.esogbue@isye.gatech.edu

We present dynamic programming from its multifarious aspects, starting with its inception to its modern day developments. We utilize a state space approach in unfolding both the fundamentals and computational aspects. We include dynamic programming models of the novel type such as non-serial, fuzzy and neuro-dynamic programming. Some fascinating applications are also briefly reviewed.

TC21 Organization Theory I

Contributed Session

Chair: John P. Keenan, John Keenan & Associates, Intl., 2 Hillsboro Dr., Orchard Park, NY 14127, jkeenan945@aol.com

1) **Determinants of Firm Performance: Coupling Strategic Group & Resource-Based Views**, *Jeremy C. Short*, Portland State University, Sch. of Business Admin., Portland, OR 97207-0751, jeremys@sba.pdx.edu, www.sba.pdx.edu/faculty/jeremys/js.html, *Timothy B. Palmer*, *David J. Ketchen*

The resource-based view of the firm argues that competitive advantage is best attained when firms have unique resources, while strategic groups research argues that several firms within the same industry may be able to achieve sustained profitability. We develop propositions concerning when each factor, or both, improves firm performance.

2) **What is Organizational Knowledge?**, *Haridimos Tsoukas*, University of ALBA & Strathclyde, 2A Athinas Ave. & Areos St., Vouliagmeni, 16671, Greece, htsoukas@alba.edu.gr, *Efi Vladimirov*

We conceptually and empirically explore the nature of organizational knowledge. Drawing on the work of Bell, Polanyi & Wittgenstein, our claim is that organizational knowledge is the capability members of an organization have developed to draw distinctions in the process of carrying out their work, in particular contexts, by enacting sets of generalizations whose application depends on historically evolved collective understandings...

3) **The Role of the PMO in Supporting Inductive Models of Custom Software Firms**, *Scott T. Serich*, George Washington University, 1603 Kirby Rd., McLean, VA 22101-3207, serich@acm.org, *Christine X. Dai*

We introduce a framework for evaluating the inductive features of decision models in organizations that conduct custom software development. It highlights the role a project management office can play in such organizations to diversify the risk of sub-optimal decisions on individual projects.

4) **Modeling & Assessing Internet-Information Ethics: An Exploratory Study**, *John P. Keenan*, John Keenan & Associates,

Intl., 2 Hillsboro Dr., Orchard Park, NY 14127, jkeenan945@aol.com, *Yumiko Nara*

New internet-information technologies continue to have major expected and unexpected impacts on almost all facets of organizational life today. Yet the study of internet-information ethics is a relatively unexplored area of research. Using the findings of an earlier empirical study, a new model and assessment tool are presented and evaluated.

5) **Socio-Economic Characteristics of Speed Choice**, *Woongyi Kim*, Hanyang University, 1271 Sa-1-Dong, Ansan, Kyunggi-Do, 425-791, South Korea, logo1004@hotmail.com, *Kyungwoo Kang*

Many studies on drivers' speed choice behavior have been reported in the last decade. Most previous studies, however, concentrated on the relationship between drivers' speed selection and road/vehicle characteristics without considering other important factors, i.e., personal characteristics and drivers' perception of the speed limit. We analyze Korean drivers' speed selection behavior by taking into account trip characteristics and personal, vehicular and attitudinal factors, etc...

TC22 From Decision Models to Decision Support: Case Study of Electrical Power Districting Problem in the Republic of Ghana

Sponsor: INFORM-ED

Sponsored Session

Chair: Paul K. Bergey, North Carolina State University, Coll. of Mgmt., CB 7229, Raleigh, NC 27695-7229, paul_bergey@ncsu.edu

1) **From Decision Models to Decision Support: Case Study of the Electrical Power Districting Problems in the Republic of Ghana**, *Paul K. Bergey*, North Carolina State University, Coll. of Mgmt., CB 7229, Raleigh, NC 27695-7229, paul_bergey@ncsu.edu

VBA can be used to leverage the power of Microsoft Excel's intrinsic objects to integrate, automate and extend its built in functionality with customized objects. This workshop will demonstrate how to create and utilize custom Excel objects to enhance an OR/MS educator's toolkit.

Tuesday 16:00-17:30

TD01 Aspentech/UCC Alliance MIMI Integrated Demand Management, Planning & Scheduling Supply Chain Optimization Solutions

Cluster: End-to-End Supply Chain Management

Invited Session

Chair: Ann Bixby, Aspen Technology, 1293 Eldridge Parkway, Houston, TX 77077, ann.bixby@aspentech.com

1) **Aspentech MIMI Supply Chain Optimization Data Interface**, *Gary Provance*, Aspen Technology, 1293 Eldridge Parkway, Houston, TX 77077, gary.provance@aspentech.com, *James Steiner*, *Robert Ellis*

The supply chain optimization solution requires a robust and flexible interface with SAP R/3 to support forecasting, planning, and scheduling. It is fully automated and runs in batch mode on daily, weekly and monthly cycles. The design is also scalable to easily accommodate the addition of future business units.

2) **Aspentech MIMI Demand Management Model for the Polymers Industry**, *Nives Stanfelj*, Aspen Technology, 1293 Eldridge Parkway, Houston, TX 77077, nives.stanfelj@aspentech.com, *Kevin J. Zyskowski*, *Robert Ellis*

We will present the demand management model, which interacts with the ERP system to forecast demand. The model also interacts with planning and scheduling models to determine feasible and economically desirable forecasts. The model provides numerous forecasting algorithms together with functionality to incorporate sales collaboration and track forecast accuracy.

3) **Aspentech MIMI Scheduling Model for the Polymers Industry**, *Laura Pacher*, Aspen Technology, 1293 Eldridge Parkway, Houston, TX 77077, laura.pacher@aspentech.com, *Sukran Kadipasaoglu*, *Robert Ellis*

The scheduling model we will present applies heuristic techniques to schedule production and distribution with respect to customer orders, demand forecast, material availability and production throughput. The model includes functionality to perform what-if analysis and scenario comparisons to determine cost impacts of various production schedule options.

4) **Aspentech MIMI Planning Model for the Polymers Industry**,

Ann Bixby, Aspen Technology, 1293 Eldridge Parkway, Houston, TX 77077, ann.bixby@aspentech.com, **Mark Rockey**, **Danielle A. Cohen**, **Robert Ellis**

We will present the MIP planning model, which interacts with demand management and scheduling models to provide long-term planning for production, material purchases and distribution. The model includes functionality for users to modify/view data, optimize, view solution reports and perform what-if analysis.

TD02 Supply Chain Optimization I

Cluster: Supply Chain Optimization
Invited Session

Chair: Dolores Romero Morales, Maastricht University, Dept. of Quant. Economics, PO Box 616, Maastricht, 6200MD, The Netherlands, d.romero@ke.unimaas.nl

1) **A Combined Model for Production Capacity Planning & Inventory Scheduling under Uncertainty**, **Gautam Mitra**, Brunel University, Dept. of Math Sci., Uxbridge, Middlesex, UB8 3PH, UK, mastggm@brunel.ac.uk, **Cormac A. Lucas**, **Chandra A. Poojari**, **Belen Dominguez-Ballesteros**

In supply chain planning and management there is an emerging trend to combine the and the tactical aspects of the decision problem. We present a stochastic programming model encompassing these aspects of the problem. The solution algorithms, relevance and interpretation of the model results are presented.

2) **A Decentralized Dual-Based Algorithm for Computing Optimal Flows in a General Supply Chain**, **Vladimir Brayman**, University of Washington, Dept. of Elect. Eng., Box 352500, Seattle, WA 98195, vbrayman@ee.washington.edu, **Zelda B. Zabinsky**, **Wolf Cohn**

We formulate an optimization problem for computing the optimal flows of goods or services in a general supply chain. Then a decentralized algorithm based on the duality and decomposition of the optimization problem is constructed. The computed flows satisfy a proportional fairness criterion.

3) **New Capacitated Lot-Sizing Problems arising when Coordinating Transportation & Inventory Decisions in a Supply Chain**, **Dolores Romero Morales**, Maastricht University, Dept. of Quant. Economics, PO Box 616, Maastricht, 6200MD, The Netherlands, d.romero@ke.unimaas.nl, **Stan van Hoesel**, **H. Edwin Romeijn**, **Albert P. M. Wagelmans**

Efficient performance of supply chains calls for the coordination of the location/allocation of production, inventory and demand. This coordination is of special interest when demand patterns show a strong seasonal component. We propose some extensions of the well-known capacitated lot-sizing problem which adequately model this situation and present solution methods.

TD03 Supply Chain Inventory

Contributed Session

Chair: Yavuz Gunalay, Bilkent University, Fac. of Bus. Admin., Ankara, 06533, Turkey, gunalay@bilkent.edu.tr, www.bilkent.edu.tr/~gunalay/

1) **Managing a Supply Chain Consisting of an Assembler & a Supplier**, **Dongsoo Jeon**, POSTECH, San 31, Hyo-ja, Nam-Gu, Pohang, Kyungbuk, 790-784, Korea, millenia@unitel.co.kr, **Yushin Hong**

We deal with a supply chain in which an assembler orders parts from a supplier. The assembler tries to optimize an order size and a lead time while the supplier wants longer lead time and less investment in production capacity. We construct the coordinated supply chain model and show how to determine the order size, the lead time and the production capacity which minimize the total cost for both parties.

2) **Optimal Inventory & Pricing Policies for Manufacturers & Retailers with Game-Theoretic Considerations**, **Cheng-Kang Chen**, Tamkang University, Dept. of Bus. Admin., 151 Ying-Chuang Rd., Tamsuei, Taipai, 251, Taiwan, ROC, ckchen@mail.tku.edu.tw

Optimal inventory and pricing policies are determined for manufacturers and retailers. A closed-form Stackelburg equilibrium is obtained for the case that the manufacturer is leader and the retailer is follower. Analyses for cooperative and non-cooperative cases are also included.

3) **Supplier Contract Management in the Multi-Item Manufacturing Environment**, **Yavuz Gunalay**, Bilkent University, Fac. of Bus. Admin., Ankara, 06533, Turkey, gunalay@bilkent.edu.tr, www.bilkent.edu.tr/~gunalay/, **Diwakar Gupta**

Consider a component supplier (CS) that produces multiple items using make-to-stock policy. This company offers components to several assembly manufacturers (AM). Each CS-AM contract sets the component price and late delivery penalties with respect to the delivery performance. Efficient contract strategies are discussed.

TD04 Inventory Management

Sponsor: MSOM

Sponsored Session

Chair: Lawrence W. Robinson, Cornell University, Johnson Grad. Sch. of Mgmt., Ithaca, NY 14853-6201, lwr2@cornell.edu

1) **Inventory Management with Asset-Based Financing**, **Rachel Q. Zhang**, Cornell University, Johnson Grad. Sch. of Mgmt., 364 Sage Hall, Ithaca, NY 14853, rqz2@cornell.edu, **John A. Buzacott**

Most of the traditional models in production and inventory control ignore the financial state of an organization and can lead to infeasible practices in real systems. We investigate how a firm's production decisions should be adjusted if it needs an asset-based loan from a bank to finance its operations.

2) **Inventory Allocation & Replenishment Strategies for Non-Identical Retail Stores**, **Naren Agrawal**, Santa Clara University, 323 Kenna Bldg., 500 El Camino Real, Santa Clara, CA 95053-0382, nagrawal@scu.edu, **Stephen Smith**

The stores within a retail chain often differ significantly in the mean and variance of their sales rates or a given class of merchandise. We develop methods that incorporate these differences in the initial allocation of merchandise to the stores, as well as in subsequent replenishment decisions.

3) **Consequences of Order Crossover in Inventory Replenishment Systems**, **Lawrence W. Robinson**, Cornell University, Johnson Grad. Sch. of Mgmt., Ithaca, NY 14853-6201, lwr2@cornell.edu, **James R. Bradley**, **L. Joseph Thomas**

"Order crossover" occurs whenever replenishment orders do not arrive in the sequence in which they were placed. Costs can be significantly reduced by basing the inventory control policy on the distribution of the inventory shortfall (outstanding orders at the start of a period), rather than on the common lead-time demand.

TD05 Simulation Methodology

Contributed Session

Chair: Bjorn J. I. Johansson, Chalmers Universitu of Technology, Dept. of Production Eng., Horsalsvagen 7, Gothenburg, 412 96, Sweden, job@pe.chalmers.se

1) **A New-Finite Memory Algorithm for Estimating the Variance of the Sample Mean**, **Wheyming T. Song**, National Tsing Hua University, Dept. of IEEM, Hsinghu, Taiwan, ROC, wheyming@ie.nthu.edu.tw

Estimating the variance of the sample mean is a classical problem of stochastic simulation. Traditional batch means estimators require that the storage space is proportional to the sample size. We propose dynamic partial batch means (DPBM) estimators requiring a constant storage space. We show that DPBM works better than DBM, which to our knowledge is the only existing finite-memory estimator of the variance of the sample mean.

2) **Estimation of Means & Covariances of Inverse-Gaussian Order Statistics**, **Huifen Chen**, Chung Yuan Christian University, Dept. of IE, 22 Pu Jen, Pu-Chung Li, Chung Li, 320, Taiwan, huifen@cycu.edu.tw, **Liuying Cheng**

We propose simulation algorithms to estimate means and covariances for a set of order statistics from inverse-Gaussian distributions. The algorithm estimates all means and covariances simultaneously using the same samples. Two control variates, one internal and one external, are considered and their variance-reduction effects are discussed based on simulation results.

3) **An Enhanced Methodology for Reducing Time Consumption in Discrete Event Simulation Projects**, **Bjorn J. I. Johansson**, Chalmers Universitu of Technology, Dept. of Production Eng., Horsalsvagen 7, Gothenburg, 412 96, Sweden, job@pe.chalmers.se, **Thomas B. Jorgensen**

Our main purpose is to show how time savings can be obtained in simulation projects. The result includes an improved methodology that builds on traditional simulation procedures. The approach ensures continuous comparison of the projects present state and its objectives. This assures the shortest possible time spent within the simulation project.

TD06 Capacity Management & Allocation**Contributed Session**

Chair: Aditya P. Rastogi, Arizona State University, 920 South Terrace Rd., #210, Tempe, AZ 85281, rastogi@asu.edu, www.public.asu.edu/~rastogi

1) Capacity Management in Decentralized Networks, Yasushi Masuda, Keio University, Faculty of Science & Tech., Hiyoshi, Kohoku, Yokohama, 223-8522, Japan, masuda@ae.keio.ac.jp, **Seungjin Whang**

Under a decentralized network where individual users are allowed to select their own routes, straightforward application of bottleneck analysis does not necessarily yield an optimal performance. We show that the externality pricing solves the joint problem of demand/routing control and study the capacity problem for decentralized systems.

2) On Control Strategies in a Generally Configured Production System, Zhao Xiaobo, Tsinghua University, Sch. of Economics & Mgmt., Beijing, 100084, China, zhaoxb@em.tsinghua.edu.cn, **Gong Qiguo, Wang Jiancai**

A generally configured production system comprises a set of workstations, each of which consists of a limited input buffer, a single machine, a limited output buffer, a fixed number of kanbans and a single vehicle. The WIP in a workstation can be controlled by any one of buffer mechanism or kanban mechanism. The vehicle at a workstation moves a processed part to another workstation according to any one of push policy or pull policy...

3) The Search Allocation Game & Flaming Datum Search, Ryusuke Hohzaki, National Defense Academy, Dept. of Computer Sci., 1-10-20 Hashirimizu, Yokosuka, Kanagawa, 239-8686, Japan, hozaki@cc.nda.ac.jp, **Alan Washburn**

We present a 2-person 0-sum game, known as the search allocation game. A searcher allocates his searching effort on a search space in order to detect an evader. The evader chooses his path across the space to avoid the searcher. We prove the existence of equilibrium points for the continuous and discrete search allocation games and use the so-called flaming datum search as an example.

4) Supply Network Optimization in Semiconductor Manufacturing under Uncertainty with Strategic Outsourcing, Aditya P. Rastogi, Arizona State University, 920 South Ter Rd., #210, Tempe, AZ 85281, rastogi@asu.edu, www.public.asu.edu/~rastogi

A supply network in the semiconductor industry involves many expensive steps, thus it is necessary to incorporate optimization methodologies for long-term planning. A model capable of making dynamic decisions is built using a 2-stage stochastic programming model with recourse and describes the strategies of production, inventory, transportation, distribution and subcontracting.

TD07 Marketing**Contributed Session**

Chair: Aharon Hibshoosh, San Jose State University, Dept. of Mktg. & DS, Coll. of Bus, 1 Washington Sq., San Jose, CA 95192, hibsho_a@cob.sjsu.edu

1) A System of Control Models for Simulating the Promotion of Exported Branded Agricultural Seasonal Products, Aharon Hibshoosh, San Jose State University, Dept. of Mktg. & DS, Coll. of Bus, 1 Washington Sq., San Jose, CA 95192, hibsho_a@cob.sjsu.edu, **Amir Heiman, David Zilberman**

Exported fruit has a U shaped seasonal demand. We developed a system to simulate its optimal or referential control. Consumer attitude is the state variable, price premiums are the observed variables, samples are the promotional control. The family of optimal promotional controls has a distinctive, flexible, not necessarily monotonic pattern.

2) Market Segmentation & a Competitive Market Structure Model using Switching Data of Consumer Durables, Geonha Kim, Waseda University, Ohno Lab., Dept. Sci. & Eng., 4-3-1 Okubo Shinjuku, Tokyo, 169-8555, Japan, 699b5031@mn.waseda.ac.jp, **Takahiro Ohno**

We can estimate loyal cluster and switching one of a brand, and divide a switching cluster into detail clusters by switching patterns; the change of attributes between current brands and previous ones. Competitive market structure can be analyzed by loyal cluster ratio and switching pattern ratio among brands.

3) Evaluation of Sales Promotion with a Real Option Approach, Tomoaki Tabata, Waseda University, Okubo 3-4-1, Shinjuku-ku, Tokyo, 169-8555, Japan, tabata@mgmt.waseda.ac.jp, **Takashi Namatame, Takahiro Ohno**

Concerning a promotion at a retail store, there is much research about the effect of a promotion, but there is little research about the optimal level or timing of a promotion. We estimate the optimal cost and timing for the promotion by using a real-option approach.

4) Housing Markets Segmentation & Financing Modeling, J. C. R. Vieira, University of West Santa Catarina, Technological Ctr., Joacaba SC, Brazil, jairo@unoesjca.br, **O. Possamai, L. F. A. M. Gomes**

We present conceptual models for segmentation and financial analysis of housing markets. The variables are sale prices, housing areas and enterprising lengths (segmentation) and profitability, risk, demand, employment generation and financial accessibility - financing. We also show a segmentation and financing case study in a Brazilian local housing market.

TD08 GRASP**Cluster: Global Optimization****Invited Session**

Chair: Mauricio G. C. Resende, AT&T Labs Research, 180 Park Ave., Bldg. 103, Rm. C241, Florham Park, NJ 07932, mgcr@research.att.com

1) Parallel GRASP with Path Relinking, Renata M. Aiex, Catholic University of Rio de Janeiro, Dept. of Comp. Sci., R. Marques de Sao Vicente 225, Rio de Janeiro, RJ 22453, Brazil, rma@inf.puc-rio.br

We describe parallelization strategies for GRASP with path relinking. Each processor maintains its elite set for path relinking. The sets exchange information to update themselves when new elite set members are found by the processors. Experimental results with GRASPs for job shop scheduling, MAX-CUT and 3-index assignment problem are described.

2) GRASP for Routing Private Virtual Circuits, Celso Ribeiro, Catholic University of Rio de Janeiro, Dept. of Computer Sci., Rio de Janeiro, 22453-900, Brazil, celso@research.att.com

We consider a GRASP for a multi-commodity flow problem where flows between demand pairs are required to follow a single path. The objective function is the sum of piecewise linear functions of arc flow. This model has many applications in telecommunication, including routing frame relay private virtual circuits.

3) Probability Distribution of Solution Time in GRASP: An Experimental Investigation, Mauricio G. C. Resende, AT&T Labs Research, 180 Park Ave., Bldg. 103, Rm. C241, Florham Park, NJ 07932, mgcr@research.att.com

We study the probability distribution of solution time to a sub-optimal target in GRASP. Graphical statistical analysis is used to compare empirical and theoretical distributions and estimate the parameters of the distributions. Solution time fits a two-parameter exponential distribution. Hence linear speed-up can be approximately achieved in a parallel implementation.

TD09 Nonlinear Programming I**Contributed Session**

Chair: Mike Mayergoiz, 258 Congressional Lane, #512, Rockville, MD 20852

1) Geometric Programming Applied to Coding Theory, John K. Karlof, University of North Carolina, Math. & Stats. Dept., Wilmington, NC 28403, karlof@uncwil.edu

Consider a communications model in which messages are represented by real vectors and transmitted over a noisy channel. The set of messages is called a code. The problem of finding optimal codes can be written as a nonlinear programming problem. We develop a geometric programming algorithm to solve this problem.

2) Curvilinear Ordering & Global Optimization, Yefim Y. Vladimirovsky, Booz-Allen & Hamilton, 216 Congressional Ln, #203, Rockville, MD 20852, yefim@gwu.edu, vladimirsky_yefim@bah.com

We will give an extension of monotonicity, positiveness, heterogeneity, etc. The application of this extension to multi-extremal and multi-variant mathematical programming, non-convex/non-concave games, chaotic and ergodic dynamic systems, problems of fixed point sets with arbitrary cardinality will be shown.

3) Almost-Everywhere Smooth Analysis as the Most Possible Extension of the Non-Smooth Analysis, Mike Mayergoiz, 258 Congressional Ln, #512, Rockville, MD 20852

Almost everywhere locally Lipschitz analysis will be presented as the extension of locally Lipschitz analysis. We will show the theoretical properties of almost-everywhere locally Lipschitz analysis. The applications of using ergodic

theory instead of the theory of the semi-martingals will be shown. On this basis, effective iterative processes will be proposed for solving general optimization problem in general spaces.

TD10 Applications in Integer Programming

Cluster: Integer Programming

Invited Session

Chair: Natasha Boland, University of Melbourne, Dept. of Math & Stats., Parkville VIC, 3052, Australia, natashia@unimelb.edu.au

1) **Optimization Methods for the Construction of Data Cycle Maps**, *David Panton*, University of South Australia, Industrial & Applicable Math, Mawson Lakes SA, 5095, Australia, david.panton@unisa.edu.au, *M. John, Andrew J. Mason*

Flight testing of aircraft involves collecting a large number of parameters with varying sample rates and word sizes. Data must be multiplexed and placed in an array (data cycle map) before being sent to a ground receiving station. Optimization models for the efficient construction of DCMs will be discussed.

2) **Bicriteria Robustness vs. Cost Optimization in Airline Pairings**, *M. Erghott*, University of Auckland, Dept. of Eng. Science, Private Bag 92019, Auckland, New Zealand, m.ergott@auckland.ac.nz, *D. Ryan*

Besides constructing pairings with minimal cost, airlines should also construct pairings that are robust in that schedule disruptions are less likely to propagate into the future. The two objectives of cost and robustness are treated in a bicriteria optimization to generate "efficient" pairings that do not allow a simultaneous improvement in cost and robustness.

3) **The Multi-Leaf Collimator Problem in Cancer Radiation Therapy: Network & Integer Programming Models**, *Natasha Boland*, University of Melbourne, Dept. of Math & Stats., Parkville VIC, 3052, Australia, natashia@unimelb.edu.au, *H. Hamacher, F. Lenzen*

A multi-leaf collimator is a machine for irradiating tumour sites, in the treatment of cancer. Radiation is delivered via patterns created by leaves which block radiation. A combination of patterns and irradiation times delivering the required dose while minimizing delivery time is sought. We present integer programming and network solutions.

4) **Solution Methods for Cyclic Personnel Roster Construction**, *Andrew J. Mason*, University of Auckland, Dept. of Eng. Science, Private Bag 92019, Auckland, New Zealand, a.mason@auckland.ac.nz, *David Panton*

We consider the problem of building staff rosters (personnel schedules) that repeat in a cyclic fashion. Traditionally, cyclic rosters have been built manually or using heuristics. We present a number of new integer programming models and associated solution techniques (including cuts) and compare these with earlier approaches.

TD11 New Directions in Modeling Tools for Optimization

Cluster: Modeling Tools for Optimization

Invited Session

Chair: Robert Fourer, Northwestern University, Dept. of IE/MS, Evanston, IL 60208-3119, 4er@iems.nwu.edu

1) **Bridging the Gap between Spreadsheets & Modeling Languages**, *Sam L. Savage*, Stanford University, 417 Terman Engineering, Stanford, CA 94305-4026, www.stanford.edu/~savage/

Spreadsheets are ubiquitous and interactive, but small, and in the words of Art Geoffrion, "dimensionally arthritic." Modeling languages are big and powerful, but understood by very few. Some approaches toward bridging this gap will be discussed.

2) **Remote Access to Optimization Software from Local Modeling Environments**, *Todd S. Munson*, Argonne National Laboratories, Math & Comp. Sci. Division, 9700 South Cass Ave. Bldg. 221, Argonne, IL 60439, tmunson@mcs.anl.gov, *Elizabeth Dolan*

We present the design and implementation of Kestrels, a framework that enables locally installed software packages to access remotely available optimization software via CORBA and pre-existing NEOS Server technology. As examples, we describe Kestrels clients that give existing AMPL and GAMS users easy access to a variety of remote solvers.

3) **New Modeling Language Features for Non-Traditional Optimization Methods**, *Robert Fourer*, Northwestern University, Dept. of IE/MS, Evanston, IL 60208-3119, 4er@iems.nwu.edu,

David M. Gay

To keep up with developments in solvers for global nonlinear programming and for combinatorial optimization via constraint programming, optimization modeling languages are being forced to become more expressive and to provide a broader variety of information to solvers. We present a range of examples, using the AMPL language for illustration.

TD12 E-Commerce I

Contributed Session

Chair: Jong C. Kim, Kumoh National University, Dept. of Industrial Mgmt., Kumi, 730-731, Korea, kimjc@kumoh.ac.kr

1) **Successful Strategies of Business-to-Business Customer Relationship Management**, *Won-Soon Hong*, ETRI, 161 Kajong-dong, Yusong-Gu, Taejeon, 305-350, Korea, kmg1211@freechal.com, *Moon-Koo Kim*

The purpose of this study is to increase the odds of success as well as to better understand CRM through the empirical analysis of B2B CRM dimensions that drive profitable expectations and outcomes in Korea now. Understanding customers and how to add customer value is critical for successful B2B CRM.

2) **An Adaptive Approach to Customer-Centered Online Category Management**, *Chiang-Luan Liu*, National Sun Yat-Sen University, 70 Lien-Hi Rd., Kaohsiung, Taiwan, chiangluan@yahoo.com, *Te-Min Chang*

Traditional retailers are making efforts to organize their catalogs for online sales with the growth of electronic commerce. We propose an adaptive 2-stage approach to constructing customer-centered category management that aids online catalog organization. It helps web browsers for efficient navigation with catalog organization adapted to browsers changing behavior over time.

3) **Advanced Technologies to Support Internet-Based Scalable E-Business Enterprises**, *Stanley Su*, University of Florida, Ctr. for Electronic Commerce, Supply Chain Mgmt., Gainesville, FL 32611, *Herman Lam, Max Shen, Sherman Bai*

We extend the current basic information infrastructure by developing a number of advanced technologies to enable ISEEs. The list of technologies being investigated includes active object modeling, event management, business rule management, dynamic workflow and constraint-based multi-agent technologies. The emphasis is on their integration to form an enhanced infrastructure, i.e., ISEE infrastructure...

4) **Web-Based Multimedia Contents Development in the E-Learning Business**, *Hoe K. Shin*, Kumoh National University, Dept. of Industrial Mgmt., Kumi, 730-731, Korea, hkshin@kumoh.ac.kr, *Chang W. Lee, Dae R. Kim*

We present the development of a web-based multimedia contents model as an e-learning tool for the Internet education business in the digital age. The development process is focused on system analysis and design aspects. New web technologies provide unprecedented opportunities to reengineering strategic multimedia contents in terms of structure, process and outcome in the e-learning business.

TD13 Service Performance

Cluster: Service Strategy & Design

Invited Session

Chair: Andreas C. Soteriou, University of Cyprus, PO Box 20537, Nicosia, Cyprus, basotir@ucy.ac.cy

1) **Stakeholders, Operational Practices, Resources & Service Firm Performance**, *George Kassinis*, University of Cyprus, PO Box 20537, Nicosia, Cyprus, kassinis@ucy.ac.cy, *Andreas C. Soteriou*

We develop a service performance framework that considers the internal and external environment of the firm. Empirical results from the European hotel industry suggest a positive relationship between stakeholder management and the implementation of quality and human resource management practices and firm performance. Firm resources and capabilities moderate the relationship between practices and performance. Future research avenues are discussed.

2) **Modeling Customer Satisfaction in Telecommunications: Contribution of Multiple Contact Points to Overall Satisfaction Function of Corporate**, *Antreas D. Athanassopoulos*, ALBA & London Business School, Athinas Av. & Areos Str. 2A, 166 71, Greece, athan@bpm.gr, *A. Iliakopoulos*

We provide theoretical and empirical evidence concerning the assessment of customer satisfaction of corporate customers in telecommunications. We propose a hierarchical 3-stage structural equation model where each contact point leads to a partial satisfaction function that then leads to the overall satisfaction function of individual customers. An empirical illustration of the

theoretical framework proposed is provided...

3) Investigating the Value of Quality of Financial Institutions, Andreas C. Soteriou, University of Cyprus, PO Box 20537, Nicosia, Cyprus, basotir@ucy.ac.cy, **Stavros A. Zenios**

We provide further evidence as to whether quality pays in the financial services industry. Stock performance information is used to further explore the relationship between quality and performance in the financial services industry. Weaknesses inherent in existing stock-performance studies on the impact of quality are identified and future research directions are discussed.

TD14 Multicriteria Decision Making I

Contributed Session

Chair: V. Berkin Toktas, University of Washington, Dept. of IE, Box 352650, Seattle, WA 98195-2650, berkin@u.washington.edu

1) ELEQUAL: A Multi-Criteria Approach for Classification Problems, Helder Gomes Costa, Universidade Estadual do Norte Fluminense, Av. Alberto Lamego 2000, Campos RJ, 28015-620, Brasil, hgc@uenf.br, **Andre L. P. Freitas**

We describe a multi-criteria approach for sorting problems. More precisely, the multi-criteria sorting problem is a decision problem which, besides evaluating a finite set of alternatives concerning a set of criteria, also requires to assign these alternatives to one of the predefined categories. Specifically, the ELEQUAL approach is structured to permit the application of the ELECTRE III method traditionally used in ranking problems...

2) A Multi-Criteria Filtering Method for Classification Problems, Andre L. P. Freitas, Universidade Estadual do Norte Fluminense, CEFET Campos, Av. Alberto Lamego 2000, Campos RJ, 28015-620, Brasil, policiani@uenf.br, **Helder Gomes Costa**

The multi-criteria sorting problem is a decision problem which evaluates a finite set of alternatives concerning a set of criteria and requires assigning these alternatives to one of the predefined categories. Considering the concordance/discordance concepts and the concordance and non-discordance principle, we propose a method based on the construction of fuzzy strict preference relations that must be aggregated into an overall relation...

3) Machine Supplier Selection based on the Multicriteria ELECTRE Method, Lara Calado, UFPE, CP 7462, Recife, 50722-590, Brazil, gpsid@npd.ufpe.br, **Adiel T. Almeida**

We present an analysis of a machine supplier selection problem in an automotive industry. The selection is based on the ELECTRE method. Alternatives are pointed out regarding the supplier of solder ultrasonic machine. The main criteria analyzed are price and quality. The case study is presented, taking into account decision maker preference modeling.

4) A Multicriteria Decision Aid for the Selection of an Electrical Energy Supplier based on the ELECTRE Method, Eduardo H. D. Fittipaldi, Companhia Hidro Eletrica do Sao Francisco, CP 7462, Recife PE, 50722-970, Brazil, gpsid@npd.ufpe.br, **Luciano M. B. Sampaio**, **Adiel T. Almeida**

We present a multicriteria decision aid model based on the ELECTRE method for the selection of an electrical energy supplier. Several energy purchasing options opened to the purchasing company are analysed based on criteria related to the objectives of the clients. Criteria such as price and energy availability have been taken into account.

TD15 Fluid Models

Cluster: Applications of Applied Probability & Applied Statistics
Invited Session

Chair: Stefanos Zenios, Stanford University, Grad. Sch. of Business, Stanford, CA 94305, stefzen@leland.stanford.edu

1) Optimal Pricing of a Product which Diffuses in Rich & Poor Subpopulations, Richard F. Haril, Vienna, Austria, **Andras Novak**, **Ambar G. Rao**, **Suresh P. Sethi**

We consider a luxury product market consisting of rich and poor subpopulations. We obtain optimal pricing policies over time under different model parameters. We examine cases giving rise to different scenarios and the order in which they may occur over time.

2) A Numerical Method for Solving Singular Brownian Control Problems, Sunil P. Kumar, Stanford University, Grad. School of Business, 518 Memorial Way, Stanford, CA 94305-5015, kumar_sunil@gsb.stanford.edu, **Muthukumar Muthuraman**

We present a method for numerically solving such singular stochastic control problems. We adapt finite element methods to iteratively solve the

Hamilton-Jacobi-Bellman equation associated with singular Brownian control problems. The solution to the Hamilton-Jacobi-Bellman equation is then used to construct an optimal control for the stochastic system.

3) Towards the Optimal Initiation of Dialysis Therapy, Stefanos Zenios, Stanford University, Grad. Sch. of Business, Stanford, CA 94305, stefzen@leland.stanford.edu, **Tao Yao**

Clinical evidence suggest that incremental dialysis protocols, in which the dialysis dose is adjusted according to disease severity, are far superior than existing practices. We derive an optimal incremental dialysis protocol by formulating and solving an optimal control problem for a non-linear first-order parabolic differential equation.

TD16 Finance: Risk Management

Contributed Session

Chair: Silvio R. B. de Gouvea, Billiton Metais SA, Praia de Botafogo 228, 4th Fl., Rio de Janeiro, 22359-900, Brazil, silvio@billiton.com.br

1) Early Signs to Identify Troubled Financial Institutions using Statistical Models, Silvio R. B. de Gouvea, Billiton Metais SA, Praia de Botafogo 228, 4th Fl., Rio de Janeiro, 22359-900, Brazil, silvio@billiton.com.br, **David Benaroch**

We show how statistical models, logistics regression and PROBITO, can help to identify financial institutions that may face financial difficulties in the near future. The study is based in 3 attributes: liquidity, net worth and profitability.

2) Kiting Detection in Banking, Moez Hababou, York University, Schulich Sch. of Bus., 4700 Keele St., Toronto, Ontario, M3J 1P3, Canada, mhababou@ssb.yorku.ca, **Wade D. Cook**, **Kamel Bala**

Kiting is fraudulent behavior in which account holders lure the bank by making artificial deposits, which will be subsequently withdrawn illegally, resulting in a straight loss for the bank. Using a logit model, we propose a 2-stage logistic regression-based methodology to detect kiting patterns among business and customer banking accounts. We explore how to potentially improve the predictive power of the model...

3) A Diffusion Model for Optimal Dividend Distribution for a Company with Constraints on Risk Control, Xun Yu Zhou, Chinese University of Hong Kong, Dept. of SEEM, Shatin NT, Hong Kong, xyzhou@se.cuhk.edu.hk, **Tahir Choulli**, **Michael I. Taksar**

We investigate a model of a corporation that faces constant liability payments. The objective is to maximize the expected present value of the total dividend distributions. Our main purpose is to deal with the impact of constraints on business activities. By delicate analysis on the corresponding Hamilton-Jacobi-Bellman equation, we explicitly compute the optimal return function and determine the optimal policy.

4) The Importance of Risk Management for the Companies' Survival, Sergio Ricardo Souza, Universidade Federal Fluminense, Rua Barao de Icarai, 21/606 Flamengo, Rio de Janeiro, 22250-110, Brazil, sricardosouza@uol.com.br, **Jose R. Farias Filho**

We will be discussing risks, loss prevention and a plan for business survival. We will try to answer the following questions: what perspectives should be linked to risk analysis and companies' survival? What kind of losses could be really insured by the companies in relation to their own negligence regarding risks treatment or transference? What is the social responsibility?

5) The Corporate Failure Prediction Model for Korean Industrial Firms, Dong-Ryung Shin, Dankook University, Dept. of Bus. Admin., Anseodong 29, Cheonan, Chungnam, 330-714, Korea, drshin@anseodankook.ac.kr

We develop a corporate failure prediction model. The sample consists of 45 failed Korean industrial firms during 1995-1997 and 45 healthy firms selected by matching year, industry and firm size. By logit regression analysis, we construct 3 versions of bankruptcy prediction models: step-wise regression model (model S), Altman's 5 variables model (model A) and 3 variables model (model K)...

TD17 Korean Telecommunications Industry

Contributed Session

Chair: MoonSoo Kim, ETRI, 161 Kajong-dong, Yusong-Gu, Taejon, 305-350, Korea, mskim@etri.re.kr, www.etri.re.kr

1) Quality & Prices: Empirical Evidence from the Korean Cellular Market, Hyoun Jong Kim, ETRI, Internet Econ. Res. Team, 161 Kajong-dong, Yusong-gu, Taejon, 305-350, Korea, hjk@etri.re.kr

High-quality producers can reap superior profits by charging higher prices, selling greater quantities or both. If qualities are known by consumers and production costs are constant, then having a higher quality secures the producer both higher price and higher quantity. We will test this hypothesis with respect to the Korean cellular market.

2) **A Comparative Analysis of Major Korean Operators' Global Roaming Service Strategies based on Different Technology Standards**, *Ilsue Roh*, ETRI, Techno Policy Research Team, 161 Kajong-Dong, Yusong-Gu, Taejon, 305-600, Korea, isroh@etri.re.kr, *Myung-Hwan Rim*

IMT-2000 services will be commercialized in year 2002 and this will result in drastic changes in global telecommunication markets. We present the role of the global roaming services of the major operator's business strategies in the 3G services market based on different technology standards. We also analyze the major Korean operator's global roaming strategies along with the migration pass from initial 2.5G services market to fully mature 3G services market...

3) **Digital Divide in Korea: Analysis & Policy Implication**, *Sang-Baek Kang*, ETRI, 161 Yusung ku Kajeongdong, Taejon, 305-350, South Korea, sbkang@ietri.re.kr, *Youngjoon Park, Sung-Soo Han*

The main objective of our research is to analyze the digital divide in Korea and to find information and telecommunication policy implications. Analyzing the gap between individuals, households, businesses and geographic areas at different social-economic level with indicators will be major topics for the research.

4) **A Study on Call Quality in the Korean Mobile Communication Industry**, *Kim Mincheol*, Cheju University, Aradong, Jeju City, 690-756, South Korea, mck1292@orgio.net, *Kim Dookyung*

We utilized actual transaction prices of mobile communication service to determine whether or not the market functions in pricing call quality. This study finds that as call quality increase, the payment of consumer increases, all else held constant. The findings show that the market does work in pricing these characteristics.

5) **Diffusion Patterns of the Korean Telephone & Internet Service: Some Differences & the Diffusion Factors**, *MoonSoo Kim*, ETRI, 161 Kajong-dong, Yusong-Gu, Taejon, 305-350, Korea, mskim@etri.re.kr, www.etri.re.kr

There are differences between the demand diffusion pattern of the telephone service and that of the Internet service, although they are utilized for communication. We use 2 perspectives to examine those differences. We first analyze the difference of diffusion pattern on the demand attributes between the Internet and telephone service. The demand attributes comprise business-use and household-use...

TD18 Boolean Functions, Learning, Inference & Knowledge Representation

Cluster: Boolean Functions, Data Analysis & Optimization
Invited Session

Chair: Endre Boros, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854, boros@rutcor.rutgers.edu

1) **Rough Sets, Logical Analysis of Data & Monotone Discrete Functions**, *Jan C. Bioch*, Erasmus University Rotterdam, Dept. of Comp. Sci., Rotterdam, The Netherlands, bioch@few.eur.nl

It appears that the theories of rough sets and LAD are quite similar with respect to some important topics. We will discuss the relationship between the two theories. Furthermore, we show how these theories can be analyzed using monotone discrete functions for ordinal datasets.

2) **Evaluation of Strong Patterns in the Logical Analysis of Data**, *Alex Kogan*, Rutgers University, Acctg. & Info Systems, RUTCOR, kogan@rutcor.rutgers.edu, *Peter L. Hammer, Bruno Simeone, Sandor Szedmak*

We model several suitability criteria for patterns in the logical analysis of data as partial preorders and characterize patterns which are Pareto-optimal. We empirically evaluate the relative merits of the studied types of Pareto-optimality by comparing classification accuracy. This evaluation indicates the advantages of "strong patterns," which are Pareto-optimal with respect to the "evidential preference" introduced.

3) **Theory Revision with Queries**, *Robert Sloan*, University of Illinois, Math, Stats. & CS Dept., Chicago, IL, sloan@cecs.uic.edu

Given a propositional Boolean formula that is not quite right, how does one fix it? That is, if a given formula differs from an unknown target formula, what is the complexity of revising it? We give algorithms using a polynomially bounded

number of queries to membership and equivalence oracles.

4) **Reasoning through Semi-Definite Programming**, *Hans van Maaren*, Delft University of Technology, Fac. of Information, Delft, The Netherlands, h.vanmaaren@its.tudelft.nl

We use semi-definite programming relaxations to detect unsatisfiability of a variety of CNF formulas. We show that these relaxations are capable of solving the notorious pigeonhole and similar problems in a truly automated way. The theory is accompanied by numerical experiments on the so called 2+p-SAT formulas.

TD19 Revenue Management Applications

Sponsor: Revenue Management

Sponsored Session

Chair: Montgomery Blair, 5330 East 31st St., Tulsa, OK 74153, mblair@dollar.com

1) **Practical Issues in Revenue Management: Proving Out a Forecaster in the Multi-Family Housing Industry**, *Donald M. Davidoff*, Manugistics PRO, Overlook II, 2839 Paces Ferry Rd. SE, Atlanta, GA 30339, ddavidoff@manu.com, *Ahmet Kuyumcu, Marianne Grieco*

Applying revenue management to a new industry by building a new model is always exciting. But after all the algorithms are written and applications coded, there's always the challenging issue of whether the application really works. We present an approach and some results from demonstrating to a real-world customer that a new forecaster and optimizer works for their business needs.

2) **Forecasting Problems in the Natural Gas Pipeline Industry**, *Doug Harvey*, PROS Revenue Management, 3223 Smith St., Ste. 100, Houston, TX 77006, dharvey@prosr.com

Many different aspects of the natural gas pipeline industry present opportunities to employ forecasting techniques on a daily basis. We focus on how forecasting can be applied to several different problems faced in daily pipeline operations. We also discuss the use of forecasting in a natural gas pipeline revenue management framework.

3) **The Price Elasticity of Demand-Modeling Framework, Techniques, Classification & Quantification**, *Montgomery Blair*, 5330 East 31st St., Tulsa, OK 74153, mblair@dollar.com

A key element to most revenue management systems is the assumption made about the price elasticity of demand. Many people understand the theory but struggle with attempts at quantification. We will illustrate some elasticity work performed in the rental car industry.

TD20 Option Values in Dynamic Optimization

Cluster: Dynamic Optimization

Invited Session

Chair: Sarah M. Ryan, Iowa State University, 2019 Black Engineering, Ames, IA 50011-2164, smryan@iastate.edu

1) **Optimal Control under uncertainty: Real Option Theory from Finance to Batch Distillation**, *Vicente Rico-Ramirez, Urmila Diwekar, Benoit Morel*

The mathematical and numerical complexities of the optimal control problem get worse when uncertainties are present. By applying the optimality conditions from the real option theory based on the Ito's Lemma, we have developed mathematical tools needed to solve optimal control problems in pharmaceutical and specialty chemical industries where uncertainties are unavoidable.

2) **An Option-Based Approach to Real Asset Valuation through Simulation**, *Shi-Jie Deng*, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, deng@isye.gatech.edu

We investigate a simulation approach for valuing a real asset that derives its value from its embedded operational options. We incorporate into the valuation operating characteristics of the real asset such as set-up cost and lead-time. The optimal operating policy is derived and is obtained through simulation.

3) **Options & Forecast Horizons**, *Sarah M. Ryan*, Iowa State University, 2019 Black Engineering, Ames, IA 50011-2164, smryan@iastate.edu

An optimal initial decision for a long-term dynamic optimization problem can frequently be identified by solving a sufficiently long finite horizon problem. We formulate a model of capacity expansion with uncertain demand to explore whether the finite horizon length can be shortened if option valuation replaces traditional discounted cash flow analysis.

TD21 Organization Theory II

Contributed Session

Chair: Daniel Solow, Case Western Reserve University, Dept. of Operations, Cleveland, OH 44106, dxs8@po.cwru.edu, http://weatherhead.cwru.edu/solow/

1) Cases in Intrafirm Knowledge Transfers: Fit, Leadership & Context Similarity, Adva Dinur, Tulane University, Freeman Sch. of Bus., New Orleans, LA 70118, adinurl@tulane.edu

We examine factors that influence intrafirm, cross border knowledge transfers. What role does critical context similarity between the knowledge source and recipient play in explaining transfer difficulty? The analysis provides new insights into the important role of leadership and of fit between knowledge mechanisms used and knowledge type.

2) A Mathematical Model for Studying the Team-Replacement Process, Daniel Solow, Case Western Reserve University, Dept. of Operations, Cleveland, OH 44106, dxs8@po.cwru.edu, http://weatherhead.cwru.edu/solow/, **George L. Vairaktarakis, Sandy K. Piderit**

A model is proposed for the team-replacement problem. The "interaction catastrophe" of decreasing performance associated with increased interaction among members is explained, as are ways to attenuate it. A new strategy for replacing members is shown to reduce the number of interviews and replacements to obtain a good team.

3) Strategic International Human Resource Management, Won P. Shim, Andong National University, 388 Song-Chun Dong, Andong, South Korea, wpshim@andong.ac.kr

We offer a definition of the field of SIHRM and present an integrative framework for this field of practice. We research which identifies key factors and characteristics and their inter-relationships. We also present testable propositions suggested by the framework and suggest implications of this framework for academics and practitioners in the field of SIHRM.

4) CEO Succession: Empirical Relationships between CEO Propensity for Change, Firm Strategic Persistence & Performance, Nandini Rajagopalan, University of Southern California, Marshall Sch. of Bus., Bridge Hall 303-A, Los Angeles, CA 91011, nrajagop@marshall.usc.edu, **Deepak Datta, Anthea Zhang**

We examine the empirical relationships between CEO propensity for change, post-succession strategic persistence and firm performance among 132 non-diversified US manufacturing firms. CEO propensity for change is negatively associated with post-succession strategic persistence. Also, the fit between CEO attributes and firm strategy results in better performance in the post-succession period.

5) Empirical Study of End-User Computing Acceptance Factors in Small & Medium Enterprises in Taiwan: Analyzed by Structural Equation Modelin, Fen-Hui Lin, Yat-sen University, Dept. of Info. Mgmt., National Sun, Hsi-Tze Wan, kaohsiung, 804, Taiwan, fhlin@mis.nsysu.edu.tw, **Jen-Hur Wu**

We investigate the EUCA as well as its influent factors. A survey was performed in Taiwan among small and median enterprises. The results show high computer usage, but mostly for routine work. In addition, management support is the most influent and the only leading factor of end-user computing perception.

TD22 Location Theory Research in Japan

Sponsor: Location

Sponsored Session

Chair: Atsuo Suzuki, Nanzan University, Dept. of Math. Sci., 27 Seirei-cho, Seto-shi, Aichi, 489-0863, Japan, atsuo@ms.nanzan-u.ac.jp

1) On the Multi-Allocation Hub & Spoke Model with Capacity Constraints, Mihiro Sasaki, Nanzan University, Dept. of Math. Sci., 27 Seirei-cho, Seto-shi, 489-0863, Japan, mihiro@ms.nanzan-u.ac.jp, **Masao Fukushima**

We present a new formulation of the one-stop capacitated hub & spoke model as a natural extension of the uncapacitated 1-stop model. The model involves arc capacity constraints as well as hub capacity constraints, which enable us to incorporate some practical factors into the model. We also present a solution method and report some results of numerical experiments using real aviation data.

2) Computation of Various Types of Voronoi Diagrams using Graphics Hardware, Osami Yamamoto, Aomori University, Dept. of ISE, Sch. of Eng., 2-3-1 Sachihata, Aomori, 030-0943, Japan, osami@aomori-u.ac.jp, **Kokichi Sugihara**

Recently, 3-dimensional graphics hardware has become popular in personal computers, particularly, game computers. Using the hidden-surface removal

function of this type of hardware, we present new algorithms for generating various types of generalized Voronoi diagrams in the plane and on the sphere. The algorithm is very fast; hence, we can generate an animation of the dynamic Voronoi diagram in real time...

3) Tour-Distance Voronoi Diagram & Agglomeration in Spatial Competition, Tsutomu Suzuki, University of Tsukuba, Inst. of Policy/Planning Sci., 1-1-1 Tennodai, Tsukuba, Ibaraki, 305-8573, Japan, tsutomu@sk.tsukuba.ac.jp, **Takashi Ohyama**

Although the Voronoi diagram is a popular tool for solving continuous location problems, the effect of relaxing the nearest facility assumption for purchasing behavior remains unexplored. We present a tour-distance Voronoi diagram, which assumes that users make tours to visit more than one facility all at once in a trip. The diagram is a variant of the additively weighted higher order Voronoi diagram...

4) Voronoi Heuristics for Packing Problems, Atsuo Suzuki, Nanzan University, Dept. of Math. Sci., 27 Seirei-cho, Seto-shi, Aichi, 489-0863, Japan, atsuo@ms.nanzan-u.ac.jp

We solve the packing problems using a Voronoi diagram-based algorithm. The packing problems are pack circles with a certain diameter into a unit square and pack sphere circles with a certain diameter into a sphere. We use the Voronoi diagram algorithm and the sphere Voronoi diagram algorithm respectively to construct heuristics for these problems.

Tuesday 17:45-19:15

TE01 Industrial Research in Supply Chain Management

Cluster: End-to-End Supply Chain Management

Invited Session

Chair: Jose Beltran, United Airlines R&D, 1200 East Algonquin Rd., WHQKB, Elk Grove Village, IL 60007, jose.l.beltran@ual.com

Co-Chair: Dirk M. Beyer, Hewlett-Packard

Labs., 1501 Page Mill Rd., MS 1U-2, Palo Alto, CA 94304,

beyer@hpl.ph.com

1) Dynamic Allocation of Inventory of Spares in a Network, Jose Beltran, United Airlines R&D, 1200 East Algonquin Rd., WHQKB, Elk Grove Village, IL 60007, jose.l.beltran@ual.com

We show some inventory optimization models for the supply chain of aircraft components demanded across a worldwide network of stations. The models are applied to the airline maintenance operations considering a complex schedule of a large fleet. Similar problems arise in other service industries, such as service of computer networks with limited stocking locations of a large variety, very low use and very expensive spares...

2) Modeling a Price-Demand Relationship for Consumer Products using Auction Bid Data, Alex Zhang, Hewlett Packard Labs., MS 1U-2, HP Labs., 1501 Page Mill Rd., Palo Alto, CA 94304, azhang@hpl.hp.com, **Dirk M. Beyer, Julie A. Ward, Tongwei Liu, Kemal Guler, Alan Karp**

We present 2 models that extract price-demand relationships for consumer products using publicly available online auction bid data. The auctions that we consider follow popular online auction format the partially censored data include bidder identity, bid amount, and time of bid. Our models explicitly consider the effect of the random arrival streams of bidders on the auction outcome...

3) An Integrated Test Marketing & On-Line Campaign Management Solution, Dirk M. Beyer, Hewlett-Packard Labs., 1501 Page Mill Rd., MS 1U-2, Palo Alto, CA 94304, beyer@hpl.ph.com, **Jerry Shan, Pano Santos**

Traditional campaign management solutions depend heavily on the availability of relevant historical data. We introduce a solution for managing on-line marketing campaigns in a rapidly changing product and customer environment that integrates test marketing and optimization into one decision automation system. We will discuss the underlying statistical and optimization models and give an overview of the current implementation.

TE02 Supply Chain Optimization II

Cluster: Supply Chain Optimization

Invited Session

Chair: Erwin van der Laan, Erasmus University Rotterdam, Fac. of Bus. Admin., Rotterdam, 3000 DR, The Netherlands, elaan@fbk.eur.nl

1) withdrawn - chair request of 5/10, Fausto Freire, University

of Coimbra, Mech. Eng. Dept., Coimbra, Portugal

2) **Decision Processes in Reverse Logistics, Marisa de Brito**, Erasmus University Rotterdam, Fac. of Economics, Rotterdam, The Netherlands, debrito@few.eur.nl

There is established research scanning problems in reverse logistics. However, more details are needed to tackle the real issues and problems. Besides, the potential application of the literature on OR techniques cannot be fairly acknowledged. I will discuss how to narrow the gap between the general and technical literature.

3) **Application of an Insertion Heuristic for the VRP with Simultaneous Delivery & Pick-Up to the VRP with Backhauls, Jan Dethloff**, University of Hamburg, Dept. of Logistics/Transport., Hamburg, Germany

Many papers on VRP with backhauling have been published. Two such problems, VRP with backhauls and "mixed deliveries" (VRPBM) and VRP with simultaneous delivery and pick-up (VRPSDP), are closely related. The solution of the VRPBM by applying an algorithm designed for the VRPSDP is investigated.

4) **Inventory Control for Remanufacturing: Some Recent Contributions, Erwin van der Laan**, Erasmus University Rotterdam, Fac. of Bus. Admin., Rotterdam, 3000 DR, The Netherlands, elaan@fbk.eur.nl

An overview is given of new developments in the area of inventory control for remanufacturing. On the basis of 10 research questions that are all relevant for practice, we list the recent contributions of quantitative research. Moreover, we indicate where additional research is still needed.

TE03 Inventory Issues in Supply Chains

Contributed Session

Chair: Rodney P. Parker, University of Michigan Business School, 2259 Davidson Hall, 701 Tappan St., Ann Arbor, MI 48109-1234, rpparker@umich.edu

1) **X-Y Band & Modified (s,S) Policy: An Infinite Horizon Case, Shaoliang Chen**, Nanyang Technological University, B2A-30 Nanyang Bus. School, Singapore, 639798, Singapore, aschen@ntu.edu.sg

We study the long-run limiting behavior of the one-product, periodic review inventory systems that assume a finite production capacity with a fixed production cost component. It shows that the limiting cost function exists and there exist stationary policies that are optimal in the long run. The optimal policy is not of the modified-(s,S) type in general, but exhibits an X-Y band structure...

2) **A Two-Echelon Perishable Inventory System, Emre Berk**, Bilkent University, Faculty of Bus. Admin., Ankara, 06533, Turkey, eberk@bilkent.edu.tr, www.man.bilkent.edu.tr/~emberk

We consider a 2-echelon perishable inventory system operating under (S-1,S) policies. We present operating characteristics and some numerical results on sensitivity of policies to shelf-life distributions.

3) **An Age-Based Control Policy for Perishables with Fixed Lifetimes, Ulku Gurler**, Bilkent University, Dept. of IE, Ankara, 06533, Turkey, ulku@bilkent.edu.tr, **Nursen Tore**

We consider a perishable inventory system with fixed shelf lives and constant resupply times. We propose a novel age-based ordering policy class and model the system with at most one outstanding order. We present comparisons with classic (Q,r) policies and sensitivity results.

TE04 Dynamic Pricing & Supply Contracts

Sponsor: MSOM

Sponsored Session

Chair: David Simchi-Levi, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1171, Cambridge, MA 02139-4307, dslevi@mit.edu

Co-Chair: Julie L. Swann, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, j-swann@northwestern.edu

1) **Pricing of Bandwidth Derivatives under Network Arbitrage Conditions, Jussi S. Keppo**, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, keppo@umich.edu

The underlying assets of the bandwidth derivatives are different bandwidth capacity prices. Because of the network arbitrage conditions, the capacity prices depend on each other nonlinearly, a forward contract on a single point-to-point

capacity can be seen as an option; therefore, a bandwidth option is a compound option.

2) **Supply Contracts for High-Tech Capacity Reservation, S. David Wu**, Lehigh University, Dept. of IMSE, 200 West Packer Ave., Bethlehem, PA 18015-1582, david.wu@lehigh.edu, **Murat Erkoç**

We propose supply contracts for the coordination of capacity reservation, pricing, and expansion between a buyer and supplier in the high-tech industry. We consider a Stackelberg game where the supplier offers capacity pricing while the buyer decides on reservation quantity. Our analysis evaluates key properties of the reservation contract.

3) **Pricing & Production Planning for Make-to-Order Products with Lead-Time-Sensitive Random Demands, Candace A. Yano**, University of California, IE/OR Dept., 4135 Etcheverry Hall, Berkeley, CA 94720-1777, yano@ieor.berkeley.ca, **Panupol Lersrisuriya**

We address the problem of pricing make-to-order products and planning their production on a shared facility when demands are random and sensitive to price and lead times. We characterize the production and pricing policy that maximizes expected profit and present insights regarding the effects of demand uncertainty and product diversity.

4) **Dynamic Pricing Strategies with Stochastic Demand, Lap Mui Ann Chan**, University of Toronto, Sch. of Mgmt., 105 Saint George St., Toronto, Ontario, M5S3E6, Canada, achan@rotman.utoronto.ca, **David Simchi-Levi, Julie L. Swann**

We examine the problem of coordinating pricing strategies with production planning decisions where demand is assumed to be a general stochastic function. We develop several heuristics and characterize the worst-case performance of these heuristics, which are based on solving a deterministic approximation of the stochastic model. Computational results are also reported.

TE05 Simulation Applications

Contributed Session

Chair: Ihsan Sabuncuoglu, Bilkent University, IE Dept., Bilkent, Ankara, 06533, Turkey, sabun@bilkent.edu.tr

1) **A Simulation Modeling Approach for Organizational Goal Alignment, J. D. Selby-Lucas**, Old Dominion University, 102 Kaufman Hall, Norfolk, VA 23259, jselbylu@odu.edu, **William W. Swart**

Kaufman's organizational elements model (OEM) serves as a planning framework whose elements are inputs, processes, products, outputs and outcomes. We suggest utilizing the OEM for aligning an organization's training and performance objectives by exploring simulation, as a means of quantifying and aligning the results chain and its linked components.

2) **Justification of a Material Handling System using Simulation, Umesh Saxena**, University of Wisconsin, Dept. of IME, PO Box 784, Milwaukee, WI 53201, uksaxena@uwm.edu

We describe an application of simulation in justification of a part retrieval system for small manufacturing companies. The simulation model is used for estimating labor savings by using an automated part retrieval system.

3) **Analysis of the Task Assignment Problem in a Flexible Manufacturing System, Ihsan Sabuncuoglu**, Bilkent University, IE Dept., Bilkent, Ankara, 06533, Turkey, sabun@bilkent.edu.tr, **Maher Lahmar**

We study the task-assignment problem in an FMS. Specifically, we compare aggregation and disaggregation approaches, in a random FMS and to analyze its interaction with other factors such as routing-flexibility, sequencing-flexibility, machine-load, buffer capacity and alternative processing-time ratio. The analysis of simulation results highlights the important factors and their levels that could yield near-optimal shop performance.

4) **A Simulation Model to Evaluate Options for Operational Excellence: The Case of a Publishing Unit, N. Ravichandran**, Indian Institute of Management, Wing 3 Ahmedabad, Vastrapur, Gujarat, 380015, India, nravi@iimahd.ernet.in

We evaluate the improvements in operating parameters such as effectiveness and efficiency between two different types of work organizations in a publishing unit by a simulation model. The impact of such a change in the overall business of the publishing unit is discussed.

TE06 Facilities Planning & Design

Contributed Session

Chair: Masashi Umezawa, Keio University, Dept. of Admin. Eng., 3-14-1 Hiyoshi, Kohoku-Ku, Yokohama, Kanagawa, 223-8522, Japan, ume@ae.keio.ac.jp

1) The Competitive Facility Location Problem Depending on Facility Size, Tatsuo Matsumoto, Kinki University, 5-1-3 Hirokoshinkai, Kure, Hiroshima, 737-0112, Japan, matutomi@hiro.kindai.ac.jp, **Hiroaki Ishii, Takeshi Uno**

We consider the following competitive problem under the rectilinear distance: there are 2 competitive companies. Each makes efforts to capture demands distributed on the plane. Distance attracting demands depends on the size as monotonical decreasing function. Centroid and medianoid problems are considered with establishing costs.

2) An Evaluation of Some Layout Algorithms under Extreme Conditions, Richard M. Schilhavy, Marywood University, 2300 Adams Ave., Scranton, PA, daganoth@epix.net, **Richard A. Schilhavy**

We evaluate improvement algorithms for extreme travel charts across the full range of flow dominance. Results for each algorithm will be compared to a database of enumerated solutions.

3) The Multi-Facility Location Problem with Nonincreasing Piecewise Linear Demand on a Tree, Masashi Umezawa, Keio University, Dept. of Admin. Eng., 3-14-1 Hiyoshi, Kohoku-Ku, Yokohama, Kanagawa, 223-8522, Japan, ume@ae.keio.ac.jp, **Hisakazu Nishino**

This paper deals with a multi-facility location problem with demand function on a tree, which is a generalization of the problem proposed by Megiddo-Zemel-Hakimi (1983) and the p-median problem. We propose an algorithm that yields the exact optimum within a polynomial time.

TE07 Business Applications

Contributed Session

Chair: Stephane L. Cheung, University of Southern California, 18722 Stratton Lane, Huntington Beach, CA 92648, cheungs@usc.edu, www-rcf.usc.edu/~cheungs

1) Customer Attrition Analysis using the History of Purchase Patterns, Stephane L. Cheung, University of Southern California, 18722 Stratton Ln, Huntington Beach, CA 92648, cheungs@usc.edu, www-rcf.usc.edu/~cheungs, **Yukinobu Hamuro, Naoki Katoh, Edward H. Ip, Yada Katsutoshi**

Customer attrition adversely affects profitability. We present an analysis of customer attrition data. We examine the history of purchasing patterns for customers who stop buying from a retail chain store. By applying several data mining tools, we are able to extract important marketing decision rules about predicting customer attrition.

2) On a Joint Economic Lot-Size Model with Deteriorating Inventory, Gary C. Lin, Bradley University, 1501 West Bradley Ave., Peoria, IL 61625, clin@hilltop.bradley.edu, **Evgenya Kukoleva**

We consider a joint economic lot size model for an inventory system with deteriorating items. Transportation costs are included in a study where items are subject to a constant rate of deterioration. Mathematical expressions for optimal production run time, cycle time, shipment size and annual total costs have been obtained.

3) Redesigning a Core Business Process in Postal Enterprises, Ivan Bosnjak, University of Zagreb, Fac. of Traffic Sciences, Vukeliceva 4, Zagreb, 10000, Croatia, bosnjaki@fpz.hr, www.fpz.hr

To survive in a new environment, postal administrations or state-owned postal enterprises need adapted business process improving/reengineering (BPI/R) programs focused on core postal business processes. Efficient postal operations and effectively managed postal business require several new solutions on technological and beyond-technological levels. We discuss basic approach and content of BPI/R programs adapted to postal organizations.

4) A Strategic Knowledge Management Model for Competitive Edge, Jae H. Min, Sogang University, Sch. of Bus., CPO Box 1142, Seoul, 121-742, Korea, jaemin@ccs.sogang.ac.kr

Through extensive surveys, we identified an overall perception of Korean firms on KM and their current practices and analyzed difference in KM practices among industries. Combining recent KM frameworks and best practices, we derived a KM model, which could provide Korean firms with strategic directions for continuous value creation.

TE08 Optimization in Networks & Graphs

Cluster: Global Optimization
Invited Session

Chair: Xiaotie Deng, City University of Hong Kong, Dept. of Comp. Sci., Tat Chee Ave., Kowloon, Hong Kong, deng@cs.cityu.edu.hk

1) Optimal Intersection Problems of Two Networks, CaoAn Wang, Memorial University of Newfoundland, Canada, wang@cs.mun.ca, **Francis Chin**

We consider the intersection of weighted straight-line planar graphs to minimize the number of intersecting edges, the weight of intersection and the weight of portion of one covered by the other. We present polynomial time algorithms to solve the above problems and extend to 3-D cases.

2) The Optimal Bottleneck Steiner Tree Problem, Lusheng Wang, City University of Hong Kong, Dept. of Comp. Sci., Kowloon, Hong Kong, lwang@cs.cityu.edu.hk, **DingZhu Du**

Given a set of points and a positive integer k, we are interested in finding a tree with at most k Steiner points such that the length of the longest edges in the tree is minimized. We present a 1.732-approximation algorithm (the previous best bound was 2).

3) Packing Cycles in Graphs Optimally, Wenan Zang, City University of Hong Kong, Dept. of Comp. Sci., Tat Chee Ave., Kowloon, Hong Kong, wzang@maths.hku.hk, **Guoli Ding**

A graph is called "cycle Mengerian" if for any nonnegative integral weight-function defined on its vertex set, the maximum size of a cycle packing is equal to the minimum total weight of a feedback vertex set. Our goal is to characterize all cycle Mengerian graphs in terms of forbidden structures.

TE09 Nonlinear Programming II

Contributed Session

Chair: Bala Shetty, Texas A&M University, INFO Dept., 322 Wehner, College Station, TX 77843, b-shetty@tamu.edu

1) Specially Structured Nonlinear Integer Programs, Bala Shetty, Texas A&M University, INFO Dept., 322 Wehner, College Station, TX 77843, b-shetty@tamu.edu, **Kurt M. Brethauer, Siddhartha Syam**

We present algorithms for solving a class of nonlinear integer programs with specially structured constraints. Both continuous and integer versions of the problem are considered. Applications in health care, production planning and portfolio optimization are discussed.

2) Optimal Solution Existence & Approximation for Infinite Positive Semi-Definite Linear Quadratic Programming, Sze-kai Tsui, Oakland University, Dept. of Math. & Stats., Rochester, MI 48309-4485, tsui@oakland.edu, **Robert L. Smith, Irwin E. Schochetman**

First, we give sufficient conditions for general infinite semi-definite quadratic programming problems to have optimal solutions. Further, we show when these solutions can be approximated by a sequence of optimal solutions of truncated finite dimensional quadratic programming problems. Finally, we apply our results to an infinite horizon LQ regulator problem.

3) A New Class of Proximal Interior-Point Methods, Paulo R. Oliveira, Federal University of Rio de Janeiro, CP 68511, PESC/COPPE-CT, Rio de Janeiro, 21945-970, poliveir@cos.ufrj.br, **Gilvan L. Oliveira**

In order to solve convex smooth programs on the positive orthant, we propose a new class of interior-point algorithms, through the using of some diagonal metrics. Such metrics are natural extensions of the metrics that underly interior-point methods. Under usual hypothesis, some convergence results are established. Computational results are also presented.

4) A Modified Nelder-Mead Simplex Procedure for Optimizing a Stochastic Simulation Model, Shu-Kai S. Fan, Yuan Ze University, Dept. of IE & Mgmt., 135 Yuan-Tung Rd., Chung-Li, Taoyuan County, 320, Taiwan, ROC, simonfan@saturn.yzu.edu.tw, **Erwie Zahara**

Stochastic simulation models are increasingly important for rapidly developing low-cost, effective real systems. These models employ optimization algorithms as tools for the effective use of stochastic simulation. The original Nelder-Mead simplex method is designed to be a simple, robust direct-search procedure to find the minimum of a function. When the Nelder-Mead method is used to optimize a function with large random errors, it can lead to inappropriate termination...

TE10 Network Design I

Cluster: Integer Programming
Invited Session

Chair: Alper Atamturk, University of California, Dept. of IE/OR, 4135 Etcheverry Hall, Berkeley, CA 94720-1777, atamturk@ieor.berkeley.edu

1) Strength of the Cut-Set Relaxation for Network Design Problems, Oktay Gunluk, IBM Research, oktay@watson.ibm.com

We present a new min-cut max-flow ratio for multi-commodity flow problems. Our results provide tight bounds on the "quality" of the cut-set relaxation of the capacitated network design problem. The relaxation is obtained by replacing flow balance and capacity constraints by cut-set inequalities.

2) An Exact Formulation & Algorithm for Two-Commodity Capacitated Network Design, Trilochan Sastry, KHUST, Dept. of ISM, Clear Water Bay, Kowloon, Hong Kong, China, sastry@ust.hk, sastry@iimahd.ernet.in

We study capacitated 2-commodity network design and show that either $d(k)$ or $(d(k)/C - 1)C$ units of each commodity are sent on a shortest path. We solve the problem in polynomial time and describe an LP formulation using $O(m)$ variables and $O(n)$ constraints that guarantee integer optimal solutions.

3) The Capacitated Network Design Cut-Set Polyhedra, Alper Atamturk, University of California, Dept. of IE/OR, 4135 Etcheverry Hall, Berkeley, CA 94720-1777, atamturk@ieor.berkeley.edu

We give a complete linear description of the cut-set polyhedron of the single commodity single facility capacitated network design problem and valid inequalities for multi-commodity multi-facility capacitated network design problems with an arbitrary number of facility types and arbitrary capacities. We also present a computational study.

4) Design of Optical Telecommunication Networks, Arie M. C. A. Koster, Konrad-Zuse-Zentrum für Informationstechnik ZIB, Takustrasse 7, Berlin-Dahlem, D-14195, Germany, koster@zib.de, Adrian Zymolka

In the near future, the backbone of telecommunication networks will evolve to an all-optical network. Optical switching technology will replace current electronic devices, enabling full-optical signal processing. We discuss mathematical models for the optimization of optical networks, differences with existing network design problems and polyhedral approaches to solve optical network design problems.

TE11 Modeling Tools for Hybrid Optimization

Cluster: Modeling Tools for Optimization

Invited Session

Chair: Laurent Michel, Brown University, Dept. of Comp. Sci., Providence, RI 02912, ldm@cs.brown.edu

1) Tight Integration of Integer Programming & Constraint Programming based on an Automatic Reformulation of Constraint Programming Models, Philippe Refalo, ILOG SA, 9 rue de Verdun, BP 85, Gentilly, 94253, France, refalo@ilog.fr

We present examples of successful integration of integer programming and constraint programming. The essential aspect is to provide automatically linear formulations of constraint programming models in general and of global constraints in particular. These formulations are automatically updated to take into account new constraints inferred on the constraint programming side.

2) withdrawn - author request of 5/3, Pascal Van Hentenryck, Brown University, Dept. of Comp. Sci., Providence, RI 02912, pvh@cs.brown.edu

3) Localizer++: A Modeling Library for Local Search, Laurent Michel, Brown University, Dept. of Comp. Sci., Providence, RI 02912, ldm@cs.brown.edu

Localizer++, an object-oriented library to support design and implementation of efficient local search methods, provides declarative abstractions to describe neighborhoods and high-level constructs to specify local moves and metaheuristics. Aspects of particular interest include concise, readable statements typical of modeling languages and extensibility to facilitate integration of new, user-defined, abstractions.

TE12 E-Commerce II

Contributed Session

Chair: Willard I. Zangwill, University of Chicago, Grad. Sch. of Bus., Chicago, IL 60637, willard.zangwill@gsb.uchicago.edu

1) The Effect of Internet Dependency on Performance: Business Models Analysis, Aurore J. Kamssu, Tennessee State University, 330 10th Ave. North, Nashville, TN 37203, akamssu@tnstate.edu, Godwin J. Udo

E-commerce has become a key to business success. While traditional firms need the Internet, Internet firms have realized the need for traditional business models. We empirically compare firms based on their level of Internet dependency and conclude that hybrid firms perform better and are more stable than either traditional or Internet firms.

2) Simplification & Stability in a Model for a Firm's Optimal Growth Rate, Willard I. Zangwill, University of Chicago, Grad. Sch. of Bus., Chicago, IL 60637, willard.zangwill@gsb.uchicago.edu, Debashish Sarkar

A rapidly growing firm seeks the growth rate that will optimize its financial value. A quadratic equation provides the solution - a surprisingly simple result, since no computer optimization is needed despite the many factors in the revenue and cost stream. Stability against uncertainty is another feature because the deterministic solution also holds when the customer arrivals are stochastic...

3) The Rise & Fall of dot.coms, Hassan A. Ibrahim, 14412 Rockymount Ct., Centreville, VA 20120, amtibrahim@aol.com

As many businesses have used e-commerce to reduce costs and/or increase revenues, others have suffered serious setbacks. By examining the common characteristics among the successful ones, we can define a set of critical success factors and develop a model that can be used in explaining why others have failed.

TE13 Explorations in Service Design

Cluster: Service Strategy & Design

Invited Session

Chair: Larry Menor, University of Western Ontario, Ivey Sch. of Bus., 1151 Richmond St. North, London, Ontario, N6A 3K7, Canada, lmenor@ivey.uwo.ca

1) Modeling & Managing the Percentage of Satisfied Customers in Hidden & Revealed Waiting Line Systems, Chester G. Chambers, Washington University, Olin Sch. of Bus., CB 1133, 1 Brookings Dr., St. Louis, MO 63130-4899, chambers@olin.wustl.edu

We present models of waiting line systems that explicitly incorporate customers' expectations of the waiting time upon arrival to the queue. We discuss 2 cases of the customers' expectations setting process: "hidden queues" and "revealed queues." We study both cases for different service time distributions and various distributions of customers' expectations of waiting time.

2) New Service Development Competence & Performance, Larry Menor, University of Western Ontario, Ivey Sch. of Bus., 1151 Richmond St. North, London, Ontario, N6A 3K7, Canada, lmenor@ivey.uwo.ca

We assume that NSD success results from building a competence in managing service development resources and routines. We conceptualize NSD competence as a multidimensional second-order latent construct. Using survey data and structural equation modeling, findings show the positive relationship between NSD competence and development-level effectiveness and competitiveness performance.

3) Service Strategy & the Technological Revolution: The Seven Myths of E-Services, Aleda V. Roth, University of North Carolina, CB 390, Chapel Hill, NC 27599-3490, rotha@school.unc.edu

As we move from the post-industrial to the service economy to the experience economy, the technological revolution has promised much. We explore retail service strategies in the context of the Internet and outline 7 myths of e-services. service strategies in the context of the Internet and outline 7 myths of e-services.

TE14 Multicriteria Decision Making II

Contributed Session

Chair: N. K. Kwak, St. Louis University, 3674 Lindell Blvd., St. Louis, MO 63108, kwakn@slu.edu

1) A Decision Support Model for Supply Chain Management using Multi-Criteria Mathematical Programming, Chang W. Lee, Chinju National University, Dept. of Business Admin., Chinju, 660-758, Korea, cwlee@chinju.ac.kr, N. K. Kwak

We present the development of a multicriteria mathematical programming model as a decision aid to the planning process for SCM. Some problems encountered in SCM planning are identified and discussed in terms of managerial concerns. A real-world application of the model adds a managerial insight to the SCM planning function and other operations system.

2) The Incorporation of Decisional Wealth into a Multiple Criteria Decision Making Model, Esra K. Karasakal, University of Ottawa, Fac. of Admin., 1000 Castle Hill Ct., Ottawa, Ontario, K2C

3L7, Canada, esra@admin.uottawa.ca, *Wojtek Michalowski*

We describe how the multiple criteria decision making modeling framework can be extended to account for one of the behavioral issues of a decision making activity, namely decisional wealth. We foresee that the risk attitude of a decision maker and the importance of criteria vary over time depending upon the decisional wealth.

3) **A Maintenance Policy Decision based on an Additive Utility Function**, *Cristiano A. V. Cavalcante*, UFPE, CP 7462, Recife, 50722-590, Brazil, gpsid@npd.ufpe.br, *Caroline M. G. Miranda*, *Adiel T. Almeida*

Several proposals for maintenance policy have been found in the literature. However, there are a few works dealing with multiple objectives. We present a multicriteria decision model based on multi-attribute utility theory, which deals with the attributes cost and availability of the system. An additive utility function is taken into account with appropriate independence.

4) **Solutions to a Multi-Objective Mathematical Program by Polynomial Interpolation**, *Ricardo Enrico Namay*, University of the Philippines, Math Dept., UP Diliman, Quezon City M Manila, Philippines, namay@math01.cs.upd.edu.ph

An MOMP model is transformed to a single-objective mathematical program (SOMP) by means of a scalarizing function involving the Utopia vector. Traces of the efficient surface are generated using such previously obtained solutions as polynomial interpolating points. First order conditions are imposed as constraints in the SOMP to ensure non-domination of solutions. The mathematical programs are solved using GAMS/MINOS...

5) **A Multicriteria Screening Model for Assessing Nutrition Status in Pregnancy**, *Jung-A Park*, Keimyung University, Korea, myjapark@hotmail.com, *Jin S. Yoon*, *Chang W. Lee*

We present the development of a multicriteria screening model to assess the nutritional status of pregnant women. A survey was conducted to develop a nutritional screening model to separate the high-risk subjects. Study results indicated that significant factors contribute to the Fe deficiency anemia during pregnancy. The proposed screening model will provide health-care managers with a managerial insight to the assessment of nutritional status in pregnancy.

TE15 Analysis of Queuing Systems

Cluster: Applications of Applied Probability & Applied Statistics
Invited Session

Chair: *Sudha Jain*, University of Toronto, Dept. of Stats., 100 Saint George St., Toronto, Ontario, M5S 3G3, Canada, jainsu@utstat.utoronto.ca

1) **Analysis of a State-Dependent Queuing Network via Cumulant Functions**, *Timothy Matis*, Texas A&M University, Zachary Engineering Ctr., College Station, TX 77843-3131, t-matis@tamu.edu

We present a technique for approximating key characteristics of a queuing network with state dependent arrival and service rates. A finite number of differential cumulant equations are generated and solved numerically. The technique is illustrated for a forking queuing network describing a helicopter repair facility.

2) **A Stochastic Model with Two Types of Customers & Flexible Servers**, *Srinivas R. Chakravarthy*, Kettering University, Dept. of IME & Bus., 1700 West 3rd Ave., Flint, MI 48504-4898, schakrav@kettering.edu, *Sal Agnihotri*

We study a queuing model with two types of Poisson customers and a finite number of servers. Some of these servers are dedicated solely to serve only their particular type of customers and some are flexible who can serve both types of customers. Under specific set of assumptions, this model is discussed in detail.

3) **Analysis of a Finite-Capacity Double-Ended Queuing System with Batch Service Time**, *Sudha Jain*, University of Toronto, Dept. of Stats., 100 Saint George St., Toronto, Ontario, M5S 3G3, Canada, jainsu@utstat.utoronto.ca, *T. S. S. Rao*

The supplementary variable technique is used to develop a recursive method to compute the steady-state probabilities of the number of units in the system at arbitrary and arrival instants. The performance measures and the probabilities of blocking of customers and servers are illustrated by numerical results.

TE16 Finance: Theory & Empirics Contributed Session

Chair: *Kevin C. Desouza*, Illinois Institute of Technology, Stuart Grad. Sch. of Bus., 565 West Adams St., Chicago, IL 60661, kevind@stuart.iit.edu, www.kevindesouza.homestead.com

1) **Optimal Utility Balancing for Asset Assignment among Heirs**, *Peter M. Ellis*, Utah State University, Dept. of Bus. Admin., Logan, UT 84322-3510, petee@b202.usu.edu

Two mixed integer programming versions are formulated for the problem of assigning assets to heirs. One seeks overall utility maximization, the other seeks to minimize differences in individual assigned utilities among the heirs.

2) **Public Private Partnership in Transportation**, *Michaela M. Schaffhauser-Linzatti*, University of Vienna, Feldergasse 15, Weidling Lower Austr, 3411, Austria, linzatti@finance2.bwl.univie.ac.at

Inefficiency and financial distress of European infrastructure, mainly owned and operated by governmental institutions, force to doubt public structures. As overall privatization has not proved to be successful, public private partnership is seen as future approach. Empirical evidence of PPP models in transportation projects is presented to discuss further developments.

3) **Exchange Rate Forecasting using Artificial Neural Networks**, *Kevin C. Desouza*, Illinois Institute of Technology, Stuart Grad. Sch. of Bus., 565 West Adams St., Chicago, IL 60661, kevind@stuart.iit.edu, www.kevindesouza.homestead.com, *Hector M. Vielma*

We deal with forecasting of exchange rates in the US, UK and Japan in the short run using artificial neural networks. Preliminary results of the network surpass those of prior econometric and statistical methods. The emphasis will be on the presentation of research methodology used.

4) **An Investigation into Movement of the Johannesburg Stock Exchange Overall Index by Fuzzy Analysis**, *Chibelushi M. Musongole*, University of Cape Town, Dept. of Statistical Sci., Cape Town Rondebosch, 7701, South Africa, musongol@maths.uct.ac.za, *R. Guo*

Stock exchange indices are fuzzy in nature though expressed as accurate number. We perform fuzzy analysis on the JSE overall index. We classify the index in 3 fuzzy states. Possibility distributions and necessity measures are computed for each state. A fuzzy Markov transition matrix is computed. A narrow prediction interval is obtained.

5) **No Title Supplied**, *Hua Zhang*, Chinese University of Hong Kong, Dept. of Finance, Hong Kong, China, hzhang@cuhk.edu.hk

We examine the expiration day effect of the Hang Seng Index (HSI) derivative contracts on the underlying cash market in Hong Kong. The HSI derivative markets are unique in computing the settlement price by taking the average of 5-minute quotations on the last trading day, and thus provide an alternative setting for testing the expiration day effect...

TE17 Telecommunications Management & Planning Contributed Session

Chair: *Ramesh Bollapragada*, Bell Labs., Lucent Technologies, 101 Crawfords Corner Rd., Rm. 4G-423A, Holmdel, NJ 07733, rbollapragada@lucent.com

1) **withdrawn - author request of 5/10**, *Guizhen Zong*, Lucent Technologies, 30 Fu Te Dong San Rd., Wai Gao Qiao Free Trade Zone, Shanghai, 200131, China, zg7502@yahoo.com

2) **An Approach to Planning Broadband Wireless Networks**, *Ramesh Bollapragada*, Bell Labs., Lucent Technologies, 101 Crawfords Corner Rd., Rm. 4G-423A, Holmdel, NJ 07733, rbollapragada@lucent.com

We discuss network planning for broadband converged voice, data and video networks for a fast growing Broadband wireless CLIC. The network planning methodology is implemented in 4 phases: cluster analysis to identify pockets of demand, hub configuration planning (RF design), end-to-end economic analysis of networks and network architecture design.

3) **Mobile Business Strategies for Mobile Operators**, *Dong-Heon Jeong*, ETRI, 161 Kajong-Dong, Yusong-Gu, Taejon, 305-350, Korea, dhjeong@etri.re.kr, *Eok-Soo Han*, *Moon-Koo Kim*

We examine the characteristics, present situations and prospects of mobile business focusing on the mobile business strategies of mobile operator. We discuss and analyze the market definition, market development strategies and service provision strategies based on the survey.

TE18 Pseudo-Boolean Functions & Applications to Graphs & Networks

Cluster: Boolean Functions, Data Analysis & Optimization
Invited Session

Chair: Bruno Simeone, University of Rome, Dept. of Stats. & Probability, Rome, Italy, bsimeone@katamail.com

1) Progress in the Solution of Some Hard Discrete Cost Network Optimization Problems, *Michel Minoux*, University of P. et M. Curie, Lab. d'Informatique de Paris, 4 place Jussieu, Paris Cedex, F-75252, France, michel.minoux@lip6.fr

We address minimum cost multi-commodity flow problems in networks with discrete (= discontinuous step-increasing) cost functions on the links. We will review recent work on the development of exact solution algorithms, using a specialization of Benders approach (cutting planes) and polyhedral results. Various possible approximate solution algorithms will also be mentioned.

2) Approximating Arc-Crossing Minimal Embeddings of Level Graphs by Reduction to MAX-SAT, *Ewald Speckenmeyer*, University of Cologne, Germany, esp@informatik.uni-koeln.de

Software engineering projects often require displaying level graph structures with as few intersections of straight lines as possible indicating dependencies between pairs of tasks. This hard problem can be formulated and approximately solved in a Boolean MAXSAT framework. Heuristics such as WalkSat or better tabu search are convenient for solving this problem.

3) Pseudo-Boolean Functions & Graph Stability, *Peter L. Hammer*, Rutgers University, RUTCOR, 640 Bartholomew Rd., Piscataway, NJ 08854, hammer@rutcor.rutgers.edu

After establishing an efficiently implementable transformation between the problem of maximizing a pseudo-Boolean function and that of finding the stability number of a graph, this transformation is used for carrying out substantial simplifications in both problems, and for developing heuristic and exact methods for their solution.

TE19 Statistics/Quality Control Contributed Session

Chair: Duncan K. Fong, Pennsylvania State University, 340 Beam BAB, University Park, PA 16802, i2v@psu.edu

1) Statistical Measures of Brilliance & Scintillation in a Highly Refractive Object, *Lalit K. Aggarwal*, Drexel University, 5869 Overbrook Ave., Philadelphia, PA 19131, aggarwal@drexel.edu

We describe statistical methods and the results used in the measurement of brilliance and scintillation of highly refractive objects fashioned to enhance reflectivity and dispersive qualities of an object. This research has been successfully commercialized.

2) A Two-Stage Bayesian Model Selection Strategy for Supersaturated Designs, *Duncan K. Fong*, Pennsylvania State University, 340 Beam BAB, University Park, PA 16802, i2v@psu.edu, *Scott D. Beattie, Dennis Lin*

In early stages of experimentation, one often has many candidate factors of which only few have significant influence on the response. Supersaturated designs can offer important advantages. However, standard regression techniques fail to analyze data properly from such designs. A 2-stage Bayesian model selection strategy is proposed. The strategy is demonstrated on a well-known data set and compared to competing methods via simulation.

3) Assessing the Precision of Jackknife Estimators, *Daesu Park*, Korea Telecom, 206 Jungja-Dong Bundang-gu, Sungnam, Kyunggi, 463-711, parkd2@kt.co.kr, *Thomas R. Willemain*

We introduce a new method for assessing the accuracy of a jackknife estimate of standard error: the jackknife-after-jackknife (JAJ). Using Monte Carlo simulation, we assess the performance of the JAJ as a function of the statistic of interest, data distribution, and sample size. We conclude that the JAJ provides a useful supplement to Turkey's jackknife for situations where the computational cost of the bootstrap is prohibitive.

4) A Bayesian Stochastic Method for Obtaining Priorities from Pairwise Judgment Matrices, *Eugene D. Hahn*, George Washington University, 2821 29th Place NW, Washington, DC 20008, genehahn@gwu.edu

In AHP, priorities are derived via a deterministic method. However, judgments may be subject to error. A stochastic characterization of pairwise comparison ratios is provided and statistical models are provided for deriving the underlying priorities. Inference is conducted from the Bayesian viewpoint using Markov chain Monte Carlo methods.

5) Estimating a Third-Order Translog Demand System using Canadian Micro-Data, *Vik Singh*, University of Regina, 303

Centennial St., Regina, SK, S4S 6W3, Canada, eco_analysis@yahoo.com

We present a third-order translog to estimate systems of budget-share equations using Canadian micro-data. We test the statistical significance of the third-order terms and the regularity conditions. The rejection of these conditions can imply that our data does not support the theory of utility maximization or the improper use of a particular functional form. The third-order terms are found statistically, but the regularity conditions are rejected...

TE20 Applications of Dynamic Optimization in Transportation

Cluster: Dynamic Optimization
Invited Session

Chair: Karl Wunderlich, Mitretek Systems, Inc., 600 Maryland Ave. SW, Ste. 755, Washington, DC 20024, kwunderl@mitretek.org

1) Advanced Traveler Information Services: Do Users Actually Save Time in the Long Run?, *Karl Wunderlich*, MITREtek Systems, Inc., 600 Maryland Ave. SW, Ste. 755, Washington, DC 20024, kwunderl@mitretek.org

Survey research indicates that users of ATIS feel they are saving time, but numerous field studies have failed to verify these perceived benefits with empirical in-vehicle travel time reductions. Using an innovative DP technique, we show that ATIS users do realize substantial travel budget reductions from improved on-time travel reliability - but only marginally reduced in-vehicle travel time.

2) Automated Freeway Queue Warning Systems: Optimizing Performance, *Bruce Hellinga*, University of Waterloo, 200 University West, Waterloo, Ontario, N2L 3G1, Canada, bhellinga@waterloo.ca

A disproportionately larger fraction of highway collisions occur within the transition from uncongested to congested traffic. Automated queue warning systems provide drivers with advance warning of downstream traffic queues with the objective of improving safety. We describe a prototype queue tracking system and present a methodology for quantifying and optimizing system performance.

3) Evaluation of a Non-Linear Ramp Metering Control Strategy using a Microscopic Simulator, *Kaan Ozbay*, Rutgers University, 632 Bowser Rd., Piscataway, NJ 08854-8014, kaan@rci.rutgers.edu

We propose a non-linear feedback control law for isolated ramp metering under accident conditions. Accidents can cause major disturbances in traffic conditions that cannot be effectively handled by traditional linear control laws optimized for steady-state conditions. In an evaluation utilizing the Paramics 3.0 traffic microsimulation, we demonstrate that a non-linear feedback control law can perform better...

4) Key Findings from the Minnesota Ramp Metering Experiment, *Douglas Sallman*, Cambridge Systematics, Inc., 1300 Clay St., Ste. 1010, Oakland, CA 94612, dds@camsys.com

In the months of October and November 2000, the Minnesota Department of Transportation conducted an experiment in which ramp meters throughout the Minneapolis-St. Paul metropolitan area were turned off in order to evaluate their impact on traffic flow and travel times. We describe the before and after data collection efforts, evaluation techniques and key findings from the experiment.

TE21 Economics Contributed Session

Chair: Chuhwan Park, ETRI, 161 Kajong-Dong, Yusong-Gu, Taejeon, 305-350, Korea, parkch@etri.re.kr

1) Traffic Infrastructure as a Function of Economic Development, *Damir Simulcic*, University of Zagreb, Faculty of Traffic Sci., Vukeliceva 4, Zagreb, Hrvatska, 10000, Croatia, simulcic@fpz.hr, www.fpz.hr, *Tomislav Kljak*

Traffic infrastructure is an integral part of the traffic economic system of every country. The creators of investment policies for traffic infrastructure projects are faced with the task of basing policies on scientific facts and the synchronization of activity on all segments of economic activities.

2) A Simulation Model for Export Market Promotion Programs, *Conrado Gempesaw*, University of Delaware, 234 Hullahen Hall, Newark, DE 19716, gempesaw@udel.edu, www.udel.edu/provost/acadprog.html, *Adbus Shahid*

We examine the effectiveness of price versus non-price promotion programs for US poultry exports using an econometric based recursive simulation model. The model parameters are estimated using system and time-varying parameter regression techniques. Results indicate that price subsidy is more effective in

raising demand for poultry exports.

3) Research on the Effectiveness of IT Capital & R&D Stock's Variation on the Growth of Korea's Industrial Sector with Time Series Analysis, Chuhwan Park, ETRI, 161 Kajong-Dong, Yusong-Gu, Taejeon, 305-350, Korea, parkch@etri.re.kr, Dong-Heon Jeong

We examine the effects of IT capital and R&D stock's variation on the growth of Korea's industries with time series approaches. We analyze in detail the Granger causality and impulse response analysis among Korea's industrial growth, IT capital and R&D stocks. In addition, in order to analyze the long-term relation among the variables, the Johansen co-integration test is specified...

4) Economically Optimum Processing & Storage of Sugar Cane Juice, Mohammad A. Quasem, Howard University, Dept. of IS & Analysis, Sch. of Bus., Washington, DC 20059, mquasem@howard.edu, Mohammad S. Hoque

A method to prepare an acceptable ready to serve bottled sugarcane juice was developed. Shelf life of sugarcane stored at room temperature 28, 5 and -18 degrees Centigrade, respectively. Results indicated that samples stored at 5 and -18 degrees retained acceptable color, flavor and taste for 10-12 days.

TE22 Hub Location

Sponsor: Location

Sponsored Session

Chair: Mohan Krishnamoorthy, CSIRO, Private Bag 10, Clayton South VIC, 3169, Australia, mohan.krishnamoorthy@cmis.csiro.au

Co-Chair: Andreas Ernst, CSIRO, Private Bag 10, Clayton South, Vic, 3169, Australia, andreas.ernst@cmis.csiro.au

1) The Hub Covering Problem: Models & their Computational Performances, Bahar Y. Kara, Bilkent University, Dept. of IE, Bilkent, Ankara, 06533, Turkey, bkara@bilkent.edu.tr, Barbaros C. Tansel

The single-assignment hub covering problem is analyzed on the basis of a basic model and a new model. The new model's performance is substantially better in CPU time than different linearizations of the basic model.

2) The Latest Arrival Hub Location Problem for the Multi-Assignment Case, Barbaros C. Tansel, Bilkent University, Dept. of IE, Bilkent, Ankara, 06533, Turkey, Bahar Y. Kara

The latest arrival hub location problem is a new minimax model that takes into account the journey times as well as the transient times at hubs. We focus on the multi-assignment model which presents structural difficulties not present in the single assignment case.

3) Hub Arc Location Problems, James F. Campbell, University of Missouri, Coll. of Bus. Admin., 8001 Natural Bridge Rd., St. Louis, MO 63121-4499, campbell@sierra.umsi.edu, Andreas Ernst, Mohan Krishnamoorthy

Hub arc location problems involve designing hub networks by locating arcs with reduced unit flow costs. We provide motivation for several new models and relate them to existing hub location models. We present optimal solutions for 4 hub arc models and identify interesting spatial patterns and promising locations for hubs.

4) Solving Hub Arc Location Problems, Andreas Ernst, CSIRO, Private Bag 10, Clayton South, VIC, 3169, Australia, andreas.ernst@cmis.csiro.au, Mohan Krishnamoorthy, James F. Campbell

We present integer programming formulations and optimal solution algorithms for several new hub arc location models. We describe techniques to tighten the IP formulations and present results using CPLEX. We also present an enumeration-based optimal algorithm and discuss how to sequence the data to improve performance.

Wednesday 08:30-10:00

WA01 Manufacturing

Contributed Session

Chair: Sheo G. Misra, Misra Associates, 5 Catalpa St., Morgantown, WV 26505-3677

1) Managing Flexible Manufacturing Systems, M. Goh, National University of Singapore, Business Sch., 15 Law Link, Singapore, 117591, Singapore, fbago@nus.edu.sg, Moosa Sharafali, Henry

C. Co

A job shop is an eclectic collection of machines of different process capabilities. In contrast, most FMSs consist of only 1 or 2 types of programmable machines. We contend that FMS machines are analogous to the multi-skilled workers in lean production. In lean production, each team works on one job at a time, from start to finish...

2) Material Handling Activities in Integrated Manufacturing Systems, Sheo G. Misra, Misra Associates, 5 Catalpa St., Morgantown, WV 26505-3677, Sita Misra

A systems view of manufacturing is presented from a MH perspective. The role of MH in manufacturing and the need for integrated systems are discussed. Various aspects of designing, selling, specifying and implementing integrated systems are treated. Finally, the status of the analytic techniques and the development needs for MH are assessed.

3) A Production Competence Measurement Model based on an Implementation Gap, Suk-Hee Won, Hanyang University, Dept. of Bus. Admin., Ansan, KyungKi, Korea, shwon@email.hanyang.ac.kr, Yung-Mok Yu

The use of invalid measures or lack of applying rigorous validation process made the previously proposed production competence models show only limited relationship with business performances. We propose a new model based on the implementation gap of a firm. Compared with other models, this model showed higher predictability for discriminating leading business performance companies from lagging ones.

WA02 Supply Chain Optimization III

Cluster: Supply Chain Optimization

Invited Session

Chair: Shabbir Ahmed, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332, sahmed@isye.gatech.edu

1) An Optimization Problem for Delayed Product Differentiation, Earl R. Barnes, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332, ebarnes@isye.gatech.edu, Shi-Jie Deng

Several manufacturers have adopted a delayed product differentiation strategy enabling delivery of a wide variety of products to customers in a timely fashion. This sometimes involves the use of subassemblies (vanilla boxes). We describe a model to determine an optimal set of vanilla boxes for manufacturing a specified product set.

2) Design of Strategic Production-Distribution Networks under Uncertainty, Marc Goetschalckx, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, Alex Shapiro, Shabbir Ahmed, Tjendera Santoso

During the design of a strategic production-distribution network, many tactical parameters and cost are not known with certainty. We present a 2-stage design methodology based on random sampling. Computational results for small test cases will be discussed.

3) Tool Capacity Planning for Semiconductor Fabs, Gyana Parija, IBM TJ Watson Research Center, Yorktown Heights, NY 10598, Alan J. King

Semiconductor fabrication facilities spend millions of dollars on tool purchases every year. Some of the key issues in this context are uncertainty in demand, technological obsolescence and high set-up costs. We will discuss tool capacity planning models and algorithms that address the above issues.

WA03 Global Supply Chains

Contributed Session

Chair: Oleg Gusikhin, Ford, MD 2122, 2101 Village Rd., Dearborn, MI 48124, ogusikhi@ford.com

1) Adoption/Diffusion of E-Markets, Paul D. Brown, Georgia State University, 3415 Framingham Dr., Lithonia, GA 30038, brownpries@aol.com

Adoption and diffusion of e-markets is a recent phenomena that is attracting the interest of both researchers and practitioners. Although many exchanges have emerged recently, the adoption of e-procurement exchanges has been slow. We examine factors that impact this process.

2) A Framework for Assessing Global Supply Chain Agility, Soumen Ghosh, Georgia Institute of Technology, Dupree Coll. of Mgmt., Atlanta, GA 30332-0520, soumen.ghosh@mgt.gatech.edu, Patty Swafford, Nagesh N. Murthy

Competitive survival mandates that an organization must possess the ability to adapt to the changing global marketplace rapidly. Global supply chain agility

measures this ability, and is determined by the synergies among the individual flexibilities of the major supply chain components. We present a framework for empirically determining global supply chain agility.

3) Real Option Analysis of Production Process Design in Global Manufacturing, Martin West, Linkoping Institute of Technology, Dept. of Production Economics, Linkoping, 581 83, Sweden, martin.west@ipe.liu.se, *Jens Bengtsson*

We extend the work of Kogut & Kulatilaka (1994) by allowing plants to use different production technologies that better match the comparative advantages of the countries in which the respective plants are located. We also analyze the problem of deciding upon production technology when the firm applies a copy exactly approach.

4) Theoretical & Practical Challenges of Implementing an Inventory Planning System as a Distribution Intensive Environment in a, Deb Bhattacharjee, Cap Gemini Ernst & Young, 444 Saratoga Ave., 11-J, Santa Clara, CA 95050, deb.bhattacharjee@us.cgeyc.com, *Sven Dharmani*

Appropriate inventory planning is the cornerstone of profitability in any distribution intensive environment. We will first address the theoretical aspects and associated practical challenges in implementing any inventory planning system with detailed discussions on possible alternatives. Extensive sensitivity analyses on the impact of demand, supply and target customer service level on inventory carrying cost will also be reported...

WA04 Pricing & Contracts

Sponsor: MSOM

Sponsored Session

Chair: Stephen M. Gilbert, University of Texas, Dept. of Mgmt., Austin, TX 78739, steve.gilbert@bus.utexas.edu

1) Market Structure & Pricing in Interconnected Congestible Communication Networks, Philipp Afeche, Northwestern University, MEDS Dept., Kellogg Grad. Sch. of Mgmt., Evanston, IL 60208-2001, p-afeche@kellogg.nwu.edu

How should Internet Service Providers (ISPs) structure interconnection contracts? We study this question in settings where complementary ISPs serve delay-sensitive customers in multiple markets. We characterize equilibria under common contract structures and compare them to the coordinated solution. We derive necessary conditions for coordinating contracts and evaluate admissible contract structures.

2) Analysis of Order Periodicity in Supply Contracts under Uncertainty, Jens Bengtsson, Linkoping Institute of Technology, Dept. of Production Economics, Linkoping, 581 83, Sweden, jens.bengtsson@ipe.liu.se, *Martin West*

We use option pricing theory to study the value of supply contracts under price and exchange rate uncertainty. Earlier analyses of Li & Kouvelis (1999) are extended by analyzing the impact of various order periodicity with respect to more than one supplier, capacity constraints, inventory and supply contract commitments.

3) Non-Linear Pricing in Single Period Supply Contracts with Asymmetric Demand Information, Stephen M. Gilbert, University of Texas, Dept. of Mgmt., Austin, TX 78739, steve.gilbert@bus.utexas.edu, *Apostolos N. Burnetas, Craig E. Smith*

We investigate how a manufacturer can use a non-linear price schedule to influence retail stocking decisions in a newsvendor environment. We assume that the retailer has more accurate demand information than the manufacturer and that the manufacturer and retailer interact with one another only once.

WA05 Tutorial: Simulation

Sponsor: College on Simulation

Sponsored Session

Chair: Paul Sanchez, Naval Postgraduate School, OR Dept., 1411 Cunningham Rd., Monterey, CA 93943-5219

1) Tutorial: Tips for Successful Practice of Simulation, Deb Sadowski, Rockwell Software, 504 Beaver St., Sewickley, PA 15143, dasadowski@software.rockwell.com

Succeeding with a technology as powerful as simulation involves much more than the technical aspects of a study. The parts of a simulation study that are outside the realm of modeling and analysis are critical as well and are the focus of this presentation.

WA06 Analytic Hierarchy Process I

Contributed Session

Chair: Germaine H. Saad, Widener University, 1 University Place, Chester, PA 19013, germaine.h.saad@widener.edu

1) Modified AHP Methodology & its Application to Select the Strategic Technologies for Standardization, Jongbong Park, ETRI/PEC, 161 Kajong-dong, Yusong-gu, Daejeon, 305-350, Korea, jbpark@etri.re.kr, http://ernie.com.ne.kr, *Yong-Tae Kim, Kishik Park*

Within the framework of the AHP, a multiplicity of pairwise comparison has to be handled when a problem has abundant alternatives. Administering alternatives into subsets can decrease the number of pairwise comparison remarkably. This modification is to be applied in choosing the strategic technologies for standardization.

2) withdrawn - author request of 5/7, Ami Arbel, Tel Aviv University, Dept. of IE, Tel Aviv, 69978, Israel, ami@eng.tau.ac.il, *Luis G. Vargas*

3) Representing the Strength & Direction of Pairwise Comparisons, David B. Hartvigsen, University of Notre Dame, 354 Mendoza Coll. of Bus., Notre Dame, IN 46556-5646, hartvigsen.1@nd.edu, www.nd.edu/~dhartvig

We consider the problem of finding a set of weights that well represents a set of pairwise multiplicative comparisons, e.g., AHP. Our (axiomatically based) method for computing these weights takes into consideration not only the strength of the pairwise comparisons, but also their direction.

4) Improving Strategic Performance Evaluation: An AHP Approach, Germaine H. Saad, Widener University, 1 University Place, Chester, PA 19013, germaine.h.saad@widener.edu

We focus on advancing strategic performance evaluation systems. The contribution sought is 2-fold: first, basic deficiencies and limitations in current performance evaluation systems are discussed. Secondly, an AHP model that helps overcome these limitations is introduced. The proposed model incorporates 'inter' and 'intra' functional interfaces, intangible drivers of business success in addition to financial indicators...

WA07 Cost/Performance Analysis

Contributed Session

Chair: Hong Bae Jun, KAIST, Concurrent Eng. Lab., Dept. IE, 373-1 Kusong-dong, Yusong-ku, Taejeon, 305-701, Korea, s_phobator@cais.kaist.ac.kr

1) Cost Driver Selection & Aggregation for Activity-Based Costing, Kyung Keun Lee, Pusan National University, Dept. of IE, 30 Jangjeon-dong, Kumjeong-Gu, Pusan, 609-735, South Korea, kkleee@hyowon.pusan.ac.kr, *Han Lee*

Activity-based costing (ABC) is an accounting cost system that distributes overhead cost to each cost object more accurately. The ABC system achieves improved accuracy in estimating the cost of cost object by using multiple cost drivers to trace the cost of activities to the cost objects associated with the resources consumed by those activities...

2) A Penalty Method for a Natural Gas Cash-Out Problem, Vyacheslav V. Kalashnikov, Universidad Autonoma de Nuevo Leon, AP 111-F, Cd. Universitaria, San Nicolas de Garza, 66450, Mexico, kalash@yalma.fime.uanl.mx, *Roger Z. Rios-Mercado*

We address a bilevel programming problem, which consists of minimizing cash-out penalties of a natural gas shipper (the leader) subject to the lower level problem reflecting the aims of a pipeline (the follower). An efficient penalty method is presented along with a computational evaluation that shows its effectiveness.

3) An Analytical Approach for Performance Evaluation of Relation Types in the Design Process, Hong Bae Jun, KAIST, Concurrent Eng. Lab., Dept. IE, 373-1 Kusong-dong, Yusong-ku, Taejeon, 305-701, Korea, s_phobator@cais.kaist.ac.kr, *Hyo Won Suh*

The design process is quite complex because of its inherent characteristics such as uncertainty, inaccuracy, iteration, collaboration, dynamics, etc. These factors occur the complex relations among design processes. Many problems can arise from missed or misunderstood these relations and the nature of the design processes. These make it difficult to manage and analyze the design process effectively...

WA08 Global Optimization - Topics

Cluster: Global Optimization

Invited Session

Chair: Jacek Klinowski, University of Cambridge, Dept. of Chemistry, Lensfield Rd., Cambridge, CB2 1EW, UK, jk18@cam.ac.uk

1) Prediction of Inorganic Crystal Structures using a Genetic Algorithm & Energy Minimization, S. M. Woodley, Royal Institution of Great Britain, Davy-Faraday Research Lab., 21 Albemarle St., London, W1X 4BS, UK, smw@ri.ac.uk, C. R. A. Catlow, P. D. Battle, J. D. Gale

The details of a GA will be given together with its application to the prediction of inorganic crystal structures. Success in the "prediction" of known binary and ternary oxides will be reviewed before discussing recent developments, including the use of polyatomic units, symmetry information and exclusion zones.

2) Deformation Methods in Global Optimization, Jucjan Piela, University of Warsaw, Quantum Chem. Lab., Chem Dept., Pasteura 1, Warszawa, 02-093, Poland, piela@chem.uw.edu.pl, piela@tiger.chem.uw.edu.pl

Optimization methods based on deformation of the target function are related to various physical laws: Newton, Schrödinger, Smoluchowski, Fokker-Planck dynamics and Bloch & Gibbs equations. We show that all corresponding global optimization procedures use the same strategy: go downward of the deformed potential, melt barriers and hunt for distant minima.

3) Energy Landscapes & Global Optimization, David Wales, University of Cambridge, Dept. of Chemistry, Lensfield Rd., Cambridge, CB2 1EW, UK, wales@clust.ch.cam.ac.uk

It is now possible to produce large databases of minima, transition states and rearrangement pathways for complex multidimensional potential energy surfaces. The characterization of these energy landscapes provides new insight into global optimisation, the phenomenology of glasses and relaxation processes in biomolecules, such as protein folding.

4) Smoothing & Global Optimization: A General Approach, Henri Verschelde, Ghent University, Math Physics & Astronomy, Krijgslaan 281 S9, Ghent, B-9000, Belgium, henri.verschelde@rug.ac.be

We present a general variational principle for a distribution function which when convoluted with the energy yields an effective potential which is completely smooth and has one minimum. Popular smoothing techniques are an approximation to this potential. We speculate on an algorithm for global optimization using quantum computation.

WA10 Network Design II

Cluster: Integer Programming Invited Session

Chair: Alper Atamturk, University of California, Dept. of IE/OR, 4135 Etcheverry Hall, Berkeley, CA 94720-1777, atamturk@ieor.berkeley.edu

1) Locating Electronic Message Service Facilities, Dorit S. Hochbaum, University of California, Dept. of IEOR, Haas Sch., Etchverry Hall, Berkeley, CA 94720-1777, dorit@hochbaum.berkeley.edu, www.ieor.berkeley.edu/~hochbaum

Electronic message services exhibit increased benefit with larger number of facilities. This problem is formalized as finding a clique of highest ratio of revenue to cost. Earlier work identified solutions on the efficient frontier. These solutions are shown to be generated within the run time required to find the minimum cut on a certain network.

2) Solving Steiner Tree Problems in Graphs with Lagrangian Relaxation, Francisco Barahona, IBM Watson Research Center, PO Box 218, Yorktown Heights, NY 10598, barahon@us.ibm.com, **Laura Bahiense, Oscar Porto**

We present an algorithm to obtain near optimal solutions for the Steiner tree problem in graphs. It is based on a Lagrangian relaxation of a multi-commodity flow formulation of the problem. An extension of the subgradient algorithm, the volume algorithm, has been used to obtain lower bounds and to estimate primal solutions.

3) An Exact Solution Method for the Local Access Network Design Problem, F. S. Salman, Purdue University, Krannert Sch. of Mgmt., West Lafayette, IN 47907, salmanf@mgmt.purdue.edu, **J. N. Hooker, R. Ravi**

We consider the minimum cost capacity installation and single-sink routing problem in a network. We give a B&B algorithm that obtains relaxations by approximating the cost function, which is a step function, by its convex envelope. Our computational experiments indicate that the method is effective.

WA11 Heuristic Programming

Contributed Session

Chair: Guoqing Zhang, Chinese University of Hong Kong, Dept. of SE/EM, Shatin NT, Hong Kong, China, gqzhang@se.cuhk.edu.hk

1) A Simultaneous Approach to Search for the Optimal Number of Clusters & Selection of Useful Features using Genetic Algorithms, Young-Hyun Ko, POSTECH, San 31 Hyoja-dong, Nam-gu, Pohang, Kyungbuk, 790-784, South Korea, notime@postech.ac.kr, **Chi-Hyuck Jun**

In clustering, the search for the optimal number of clusters and the selection of features are not independent problems, so these problems must be dealt simultaneously not individually. We propose a modified genetic K-means algorithm to solve these problems simultaneously. Several experiments on synthetic and real data are performed.

2) The Yield Enhancement Technique of Layouts based on Simulated Annealing, Seung Hwan Lee, Yonsei University, Dept. of Comp. Sci. & ISE, 134 Shinchon-dong Sudaemoon-ku, Seoul, South Korea, g-ray@hanmail.net, **So Young Sohn**

The semiconductor industry has continuously been looking for ways to improve yield and reduce manufacturing costs. The layout modification approach, a yield enhancement technique, is applicable to all design styles, but it does not require any additional resources in terms of silicon area. The layout modification method for yield enhancement consists of making local variations in the layout of some layers...

3) A Multiple-Start Simulated Annealing Approach for a Warehouse Layout Problem, Guoqing Zhang, Chinese University of Hong Kong, Dept. of SE/EM, Shatin NT, Hong Kong, China, gqzhang@se.cuhk.edu.hk

We investigate a new warehouse layout problem, a multiple-level warehouse layout problem with adjacent constraint constraints. An IP model is proposed to formulate the problem. A multiple-start simulated annealing approach is developed to solve the problem. The experiment and results are reported.

4) Ball-Screw Selection for Intelligent Design using Genetic Algorithms, Young-Tae Sohn, KIST, CAD/CAM Research Ctr., Cheong-Ryang, PO Box 131, Seoul, Korea, ytsohn@kist.re.kr, **Myon-Wong Park, HongChul Lee**

In the design of a feed drive for machine tools, a designer selects a ball-screw from a catalogue with heuristic knowledge and various equations provided by ball-screw makers. This selection method is time-consuming process, however. We demonstrate the application of GAs for a quick selection of optimal or near optimal ball-screw. A novel initialization scheme for representing the genetic code and a new crossover operator are designed.

5) Optimal Design of an Inflatable Knee Bolster using Combinatorial Optimization Techniques, Yan Fu, Ford Motor Co., Ford Research Lab., MD 2115, 2101 Village Rd., Dearborn, MI 48124, yfu4@ford.com, **Isheng Yeh, R. J. Yang**

An inflatable knee bolster (IKB) is an inflatable airbag cushion deployed in the knee area in conjunction with frontal airbags to reduce the potential occupant injuries. Optimal design of an IKB is a difficult large-scale, discrete, combinatorial optimization problem. An efficient GA method is applied for solving this problem based on a CAE model...

WA12 E-Commerce III

Contributed Session

Chair: Vincent S. Lai, Chinese University of Hong Kong, Faculty of Bus. Admin., Shatin, Hong Kong, China, vslai@cuhk.edu.hk

1) An Architecture of the Web Application for One-to-One Personalization, Hyeonjae Cheon, Korea University, IE Dept., 1 5-Ka Anam-dong, Sungbuk-Ku, Seoul, 136-701, Korea, slash@korea.ac.kr, **HongChul Lee**

As the number of websites grows and the size of the average website becomes larger, they need the interoperability and reusability of the Web services. We propose an architecture of the Web application using XML and SOAP.

2) Influential Factors on Investing Internet Business Ventures, Kyoung A. Lee, Hankuk University of Foreign Studies, Dept. of Mgmt., Imun Dong 270, Dongdaemun Gu, Seoul, 130-791, Korea, kalee@maincc.hufs.ac.kr, http://bk21.hufs.ac.kr, **John H. Lee**

We identify factors affecting investment decisions, venture performance indices and their relationships. Moderating factors are growth stages and investment timing. The results indicate that the moderating factors make significant differences. The perceived performance is found to have high correlation with the influential factors during the venture's initiation and maturation stages.

3) Beyond the Horizon of the Internet: Real-Time Financial

Disclosure using IT & the Internet, In-Hyoung Cho, ETRI, 161 Kojong Dong, Yusong Gu, Taejon, 305-350, Korea, jih62766@etri.re.kr

We focus on enlarging range of economic activity using the Internet. While decisions using relevant information are important in capital market, there are delays in disclosure, to secure the reliability of financial information, required by regulator. We explore the way that reinforces the relevance of information without deteriorating the reliability.

4) Financial Performance Analysis of Electric Commerce & Non-Electronic Commerce Companies, Minmei Lai, City University of Hong Kong, Tat Chee Ave., Kowloon Tong, Hong Kong, China, aclai@cityu.edu.hk, **Vincent S. Lai**

This study assessed the performance of e-commerce and non-e-commerce companies in Hong Kong. A total of 47 companies listed in the GEM Market of the Hong Kong Stock Exchange were analyzed. The findings indicated that non-e-commerce companies were performing better than electric commerce companies whereas B2B companies were financially healthier than their B2C counterparts.

WA13 Panel: Conducting Multi-Country Research - Lessons from the International Service Study

Cluster: Service Strategy & Design
Invited Session

Chair: Aleda V. Roth, University of North Carolina, CB 390, Chapel Hill, NC 27599-3490, rotha@bschool.unc.edu

1) Panel: Conducting Multi-Country Research - Lessons from the International Service Study, Richard B. Chase, University of Southern California, Marshall Sch. of Bus., Los Angeles, CA 90089, dchase@bus.usc.edu, **Norma J. Harrison**, Macquarie University, Grad. Sch. of Mgmt., New South Wales, 2109, Australia, norma.harrison@mq.edu.au, **Larry Menor**, University of Western Ontario, Ivey Sch. of Bus., 1151 Richmond St. North, London, Ontario, N6A 3K7, Canada, lmenor@ivey.uwo.ca, **Andreas C. Soteriou**, University of Cyprus, PO Box 20537, Nicosia, Cyprus, basotir@ucy.ac.cy

Over the last decade, globalization has revolutionized service operations. With the Internet, any company in the world can now become a service business. But globalization raises many issues for conducting multi-country research in service management. This panel session discusses critical issues in conducting reliable and valid cross-country research. We provide lessons learned from the ISS.

WA14 Multicriteria Decision Making III

Contributed Session

Chair: Olena Sinkevich, University of Michigan, GG Brown Bldg., 2350 Hayward, Rm. 2250, Ann Arbor, 48109, olenas@umich.edu

1) Coordination of Product Design Decisions, Olena Sinkevich, University of Michigan, GG Brown Bldg., 2350 Hayward, Rm. 2250, Ann Arbor, 48109, olenas@umich.edu, **Richard Gonzalez**, **Panos Papalambros**

We study the coordination problem of dealing with multiple objectives from multiple constituents in the context of a product design decision making. We propose several new approaches to the formulation and solution of the problem based on multi-attribute utility analysis and multi-objective optimization and discuss preliminary results.

2) A Multicriteria Decision Aid Applied to the Building Fire Safety Engineering Method, Thiago T. Pires, PLANTEC/UFPE, Rua Sao Bento, 52. Varadouro, Olinda PE, 53020-080, Brasil, pirstt@hotmail.com, **Dayse C. Duarte**, **Adiel T. Almeida**

We present a multi-criteria decision model based on ELECTRE, built in order to support the building fire safety engineering method (BFSEM), for the fire risk management program in the Data Processing Nucleus of the Federal University of Pernambuco, Brazil. The BFSEM was developed by Dr. Fitzgerald at WPI, USA.

3) withdrawn - author request of 5/10, Arvinder S. Loomba, San Jose State University, Dept. of Org. & Mgmt., Coll. of Bus., BT650, San Jose, CA 95192-0070, loomba_a@cob.sjsu.edu, **Taeho Park**

4) Using Multi-Criteria Evaluation to Profile the Quality of the use in Four Web Sites, Javier Pereira, Universidad de Talca, Avenida Lircay s/n, Talca 7, Chile, jpereira@utalca.cl, **Pedro Charnay**, **Tamara Marquez**

The development of web sites is a multi disciplinary activity relating design, information retrieval, journalism, usability engineering, marketing and computer

science perspectives, each of them appealing for their own specific systems of values, goals and informational networks. Thus, these perspectives represent the multicriteria requirements and the quality in use properties of web sites.

WA15 Probability Applications

Cluster: Applications of Applied Probability & Applied Statistics
Invited Session

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

1) Statistical Analysis of the Limiting Distribution in the Output Process, Katsumi Ujii, Tokai University, Dept. of Math., Sch. of Sci., 1117 Kitakaname, Hiratsuka Kanagawa, 259-1292, Japan, ujii@keyaki.cc.u-tokai.ac.jp

We show the statistical analysis of correlation structures resulting from seeking the limiting distribution of the joint distribution in the output process. In the analysis of the output process, most researchers begin by assuming the steady state, but we tried to calculate the joint distribution in the output process without assuming steady state at the beginning...

2) Stream of Variance Modeling & Analysis for the Multi-Stage Manufacturing Process, Jianjun Shi, University of Michigan, Dept. of IOE, Ann Arbor, MI 48109-2117, shihang@umich.edu

A multistage manufacturing process (MMP) is referred as that multiple operations are used in producing a product, which can be found in many processes such as assembly, machining, semiconductor manufacturing, etc. We present the research accomplishments in the SOV research for MMPs and discuss future research directions in the area.

WA16 Strategic Planning

Contributed Session

Chair: Fouad El Ouardighi, ESSEC Business School, Ave. Bernard Hirsch, BP 105, Cergy Pontoise, 95021, France, elouardighi@essec.fr

1) The Dynamics of Optimal Cooperation, Fouad El Ouardighi, ESSEC Business School, Ave. Bernard Hirsch, BP 105, Cergy Pontoise, 95021, France, elouardighi@essec.fr, **Frederic Gannon**

We consider the problem of optimal cooperation in a centralized dynamic framework. The proposed model inter-relates the dynamics of a joint production activity and the dynamics of a common monitoring activity involving 2 partners delegating authority to an independent entity intended to solicit their optimal contributions. The specification of an objective function for the independent entity leads to the search for the dynamic optimal contribution policy...

2) Knowledge-Based Diversification, Dong-Hyun Lee, 43-1 Yokkok 2-Dong, Wonmi-Gu, Puchon, Kyonggi-Do, 420-743, Korea, dhlee@www.cuk.ac.kr

Applying the knowledge-based view to diversification strategies, we demonstrate that the transferability of the knowledge in the existing business to a new business is the key criterion of the relatedness between the existing and new businesses. In terms of knowledge perspective, entry and exit are understood as the process of transferring the organization's knowledge.

3) A Late-Comer's Catch-Up Strategy in the Game Industry, Yunchool Lee, Hankuk Aviation University, 200-1 Hwajeong-dong, Duckyang-ku, Koyang, Kyungkee, 412-791, Korea, lyc@mail.hangkong.ac.kr, **Hoeil Kang**, **Changho Lim**

The emergence of a PC that is utilized as a gaming platform made change in an electronic gaming marketplace growing rapidly. We identify various types of electronic games and emphasize 4 strategic groups. A couple of strategies for a firm, especially in the view of late-comers, are analyzed.

4) Technical Innovation & the Catch-Up Process, Bongwoo Lee, Hankuk Aviation University, Grad. Sch. of Bus. Admin., 200-1 Hwajon-dong, Deokyang-gu, Koyang, Kyonggi-do, 412-791, Korea, bongwoo.lee@saetong.com, **Yunchool Lee**

We attempt to examine the relationship between technical innovation and the catch-up pattern of firms in the broadcasting industry. The major findings define the distinguished patterns of dynamic catch-up processes through historical case studies based on broadcasting industry in the US, Japan and Korea.

WA17 Telecommunications Traffic

Contributed Session

Chair: Young-Soo Myung, Dankook University, Dept. of Bus. Admin., Anseodong 29, Cheonan, Chungnam, 330-714, Korea, myung@dankook.ac.kr

1) Analogy & Homomorphy of Traffic Processes in Transportation & Telecommunication Network Facilities, Jurij

Kolenc, Faculty of Maritime Studies & Transport, Pot Pomorscakov, Portoroz, Slovenia, 6320, Slovenia, *Franc Jakos, Ivan Bosnjak*

There are some basic (generalized) traits of traffic phenomenon that can be recognized in transportation and telecommunication systems. The traffic process is strongly related to physical and/or virtual mobility of traffic entities on fixed network facilities. We present a conceptualization of analogy and homomorphy between traffic processes in different networks.

2) **withdrawn - author request of 5/3, Larry E. Stanfel**, Defense Information Systems Agency D85, 10701 Parkridge Dr., Reston, VA 20191, stanfell@ncr.disa.mil

3) **Modeling & Analysis of UMTS Downlink Multi-Class Traffic, Yi-Ju Chao**, InterDigital Communications Corp., 2 Huntington Quadrangle, 3rd Floor, South Wing, Melville, NY 11747

We developed an end-to-end UMTS downlink analytical model for multi-class traffic. The goal is to dimension the interfaces, lu-cs, lu-ps, lur and lub to achieve bandwidth efficiency while maintaining QoS requirements including the queuing delay and the delay jitter of each class of traffic.

4) **A Faster Algorithm for the Relaxed Ring Loading Problem, Young-Soo Myung**, Dankook University, Dept. of Bus. Admin., Anseodong 29, Cheonan, Chungnam, 330-714, Korea, myung@dankook.ac.kr, *Hu-Gon Kim*

We develop an algorithm for the ring loading problem with demand splitting that runs in $O(\min\{n^2, nK\})$ time where n is the number of nodes and K is the index set of the OD pairs of nodes having flow traffic demands.

WA18 Military Applications I

Contributed Session

Chair: Albert A. Stahel, Swiss Military College, Steinacherstr. 101b, Au/ZH, 8804, Switzerland, stahel@msf.ethz.ch

1) **The Strategy of Asymmetric Warfare: A Systems Analysis, Albert A. Stahel**, Swiss Military College, Steinacherstr. 101b, Au/ZH, 8804, Switzerland, stahel@msf.ethz.ch

The NATO-led operation "Allied Force" is considered to be the first conflict in history in which air warfare brought about the decision and in which for the first time, almost 50% of the weapons used were precision-guided weapons. Nevertheless, at the end of the war it was established that the Yugoslav armed forces withdrew from Kosovo almost intact and that less than 40% of the weapons used were precision-guided weapons...

2) **Optimizing the Production Schedule of the DoD's Largest Equipment Purchases, Charles A. Weber**, Institute for Defense Analyses, 1801 North Beauregard St., Alexandria, VA 22311, cweber@ida.org, *Stephen J. Balut, David E. Hunter*

An MILP optimization model is presented that optimizes the production schedule of the DoD large equipment purchases. The model is intended for long-term strategic planning decisions. The model finds the minimum-cost schedules over an 18-year period that meets user-defined capability requirements (i.e., demand for systems), annual budgets and production capacity restrictions.

3) **Measuring Information Quality Impact on Mission Effectiveness, Rene Proulx**, NEURING Inc., 7 rue de Laval, Quebec, Quebec, G1R 3T8, Canada, rproulx@drev.dnd.ca, www.drev.dnd.ca, *Paul Labbe*

We report on ongoing research for model-based measures designed to assess information quality impact on mission effectiveness for over-the-horizon targeting operations. The value of tactical picture information is used to estimate the outcome of potential target engagements thus providing a valuable decision support tool for commanders.

WA19 Quality Management

Contributed Session

Chair: Tarik A. Sulimani, Advanced Electronics Co., 40 Ave. at the Common, Ste. 201, Shrewsbury, NJ 07702, tsulimani@yahoo.com, tsulimani@aecl.com

1) **Quality: A Dilemma, a Challenge, an Opportunity in Developing Nations, Tarik A. Sulimani**, Advanced Electronics Co., 40 Ave. at the Common, Ste. 201, Shrewsbury, NJ 07702, tsulimani@yahoo.com, tsulimani@aecl.com

Developing nations are caught up in the tidal waves of quality management and ISO 9000 standards. However, there are still many obstacles facing organizations in these countries to implement the latest quality practices or ISO standards. There is confusion on which approach may suite their needs. Using Saudi Arabia as a case study, we highlight obstacles facing developing nations to implement quality measures...

2) **Cost of an Ownership Model for the Inspection Equipment of Multiple Characteristics Attributes, So Young Sohn**, Yonsei University, Dept. of ISE, Sudaemoon-gu Shinchon-dong 134, Seoul, 120-749, South Korea, sohns@yonsei.ac.kr, *Hyoung-Wuk Moon, Cheol-Kee Hong*

Procurement decisions for inspection equipment are often made based heavily on the initial purchase price instead of the effects of inspection cost, equipment calibration and utilization over the lifetime. To take into account all of these factors over the lifetime, cost of ownership models have been developed focusing on a single quality characteristic...

3) **The ISO 9000 Certification Process: The Case of the Brazilian Enterprises, Denise D. de Medeiros**, UFPE/CTG/DEP/PPGEP, Av. Academico Helio Ramos s/n, Recife, PE, 50740-530, Brazil, ddm@npd.ufpe.br, *Manuela F. Silvestre*

We present a goal to identify the processes adopted by enterprises on Pernambuco (Brazil). For the collection of data, we applied a questionnaire in all certified companies. The obtained results permitted to characterize them in relation with the adopted project and the benefits of ISO 9000 certification.

4) **The Operational Strategic Planning for Construction, Vania S. Santos**, Fluminense Federal University, Rua Carlos Oswald, 230-BL, 02-301, Rio de Janeiro, 22793-120, Brazil, vania@engenharia.org.br, *Luiz Antonio P. Campagnac*

The implantation of an operational strategic planning will reduce the impacts caused in the urban space during the execution of a construction. We examine what activities are included in the planning process and the various aspects of the plan itself. Finally, we suggest a model to be applied.

WA20 Dynamic Transportation

Cluster: Dynamic Optimization

Invited Session

Chair: Chelsea C. White, University of Michigan, 1205 Beal Ave., IOE Bldg., Ann Arbor, MI 48109-2117, ccwiii@umich.edu

Co-Chair: Ismail Chabini, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1263, Cambridge, MA 02139-4307, chabini@mit.edu

1) **Continuous-Time Dynamic Traffic Assignment Models & Algorithms, Ismail Chabini**, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1263, Cambridge, MA 02139-4307, chabini@mit.edu, *Jennifer Farver*

We present a class of dynamic traffic assignment models and solution algorithms, in which time is represented as a continuous-variable. O-D flow rates are assumed stepwise time-dependent functions and the fundamental diagram of a given road link is assumed piece-wise linear. We state the models and analyze their properties. We develop algorithms that find an exact continuous-time solution without the need to discretize time...

2) **Real-Time Load Plan Selection for Package Delivery, David E. Benson**, University of Michigan, Dept. of IOE, Ann Arbor, MI 48109-2117, *Chelsea C. White*

We consider the problem of determining when, during the delivery vehicle loading process, to change the assignment of delivery regions to delivery vehicles and what this new assignment should be. Using a Markov decision process model, we determine structural value function and optimal policy results that support a computationally useful algorithm.

3) **Fleet Scheduling & Dispatching for Demand-Responsive Passenger Services, Mark E. T. Horn**, CSIRO, Math. & Info. Sciences, GPO Box 664, Canberra ACT, 2601, Australia, mark.horn@emis.csiro.au

Recent research has led to development of new methods for estimating fastest paths in road networks where travel speeds vary over time. We report the application of these methods in a scheduling system directed at the needs of demand-responsive passenger transport fleets, with time-windowed pickups and setdowns. The time-windowing scheme raises important methodological issues...

4) **Algorithms for Solving the Multi-Class Dynamic Traffic Assignment Problem, Michiel Bliemer**, Delft University of Technology, Transport Planning/Traffic Eng, Fac. Civil Eng. & Geosciences, The Netherlands, m.bliemer@ct.tudelft.nl, *Piet Bovy*

We address the problem of solving the analytical DTA problem. To illustrate the model, a small case study is solved using a simple numerical simulation method. Two frameworks for solution approaches to solve the DTA problem on general networks are presented. Some specific solution methods are presented

and discussed. Conclusions are drawn and directions for further research are indicated.

WA21 Forecasting

Contributed Session

Chair: Peter T. Ittig, University of Massachusetts, MS & IS Dept., Boston, MA 02125-3393, peter.ittig@umb.edu

1) **EWMA-Based Fusion for Time Series Forecasting**, *Hyung Won Shin*, Yonsei University, Dept. of ISE, Sudaemoon-gu Shinchon-dong 134, Seoul, 120-749, South Korea, won3@yonsei.ac.kr, *So Young Sohn*

We propose a new data fusion method to improve the performance of individual prediction methods for time series data, i.e., ARIMA and neural networks. Their results are combined based on the weight reflecting the inverse of EWMA of the squared prediction error of each individual prediction method. Experimental design along with Monte Carlo simulation is used to identify the situation where the proposed approach performs better than ARIMA...

2) **Comparison of Seasonal Indexes**, *Peter T. Ittig*, University of Massachusetts, MS & IS Dept., Boston, MA 02125-3393, peter.ittig@umb.edu

We compare several efficient seasonal indexing procedures appropriate for routine applications. It is often possible to achieve an improvement in the precision of the seasonal index by considering alternatives to standard procedures. The opportunities for improvement appear to be greatest when the data contain substantial trend and seasonal aspects.

3) **The Demand for High-Speed Internet Choice & the Analysis of Penetration Forecasting using a Mixed Logit Model**, *Sang-Sup Cho*, ETRI, 161 Kajong-Dong, Yusong-Gu, Taejeon, 305-350, South Korea, choss@etri.re.kr, *Byung-Woon Kim*

The rapid increase in demand for Internet services and the emergence of new and broad bandwidth network capacities like ADSL make it possible to connect high quality and fast access to the Internet. We investigate the demand for alternative digital data communication forecasting new product as ADSL's penetration in digital data communication market using the mixed logit model suggested by Revelt & Train (1997) and Brownstone & Train (1999)...

WA22 Location Models I

Sponsor: Location

Sponsored Session

Chair: Joy Bhadury, California State University, Sch. of Business & Economics, Hayward, CA 94542, jbhadury@csu.hayward.edu

1) **Perspectives on Partial Assignment & Partial Covering P-Median Problems**, *Mark S. Daskin*, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208, *Larry Snyder*

We present formulations of two extensions of the P-median problem in which all demands need not be served: the partial assignment and partial covering P-median problems. Solution approaches are outlined and computational results are provided.

2) **A Lagrangian Approach to an Integrated Inventory-Location Problem**, *Mark S. Daskin*, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208, *Max Shen*

We formulate a non-linear extension of the uncapacitated fixed charge location problem that incorporates cycle and safety stock inventory as well as economics of scale in supplier to DC shipments. A Lagrangian solution approach is outlined and computational results are provided.

3) **Using Facility Location Theory to Measure the Effectiveness of Team-Building Exercises**, *Joy Bhadury*, California State University, Sch. of Business & Economics, Hayward, CA 94542, jbhadury@csu.hayward.edu

We show how the 1-median model can be used to develop a quantitative model that attempts to objectively measure the effectiveness of team-building exercises. Computational results on an actual study are presented.

Wednesday 10:15-11:45

WB01 Industrial Applications I

Contributed Session

Chair: Philip J. Mizzi, Arizona State University West, Sch. of Mgmt. 2451, PO Box 37100, Phoenix, AZ 85069-7100, pjmm@asu.edu, www.west.asu.edu/pjmizzi/

1) **An Efficient Sizing Algorithm for Steel Plates**, *Taebok Kim*, POSTECH, San 31, Hyo-ja, Nam-Gu, Pohang, KyungBuk, 790-784,

Korea, tbkim@postech.ac.kr, *Yushin Hong*

In a steel plate mill, various sizes of orders are grouped to enhance the productivity. The proposed problem is a variation of the 2-dimensional bin-packing problem, where the bin sizes are to be determined. We develop an efficient algorithm based on the approaches for the bin packing and matching problem.

2) **Weekend Scheduling at United Airlines**, *Balaji Ramanathan*, United Airlines, 1200 East Algonquin Rd., Elk Grove Village, IL 60007, balaji.ramanathan@ual.com, *Jon B. Goodstein*, *Amit Mukherjee*

Because of daily variations in passenger demand, it may not be profitable operating a schedule that repeats 7 days a week. At United Airlines, an optimization model is used to make weekend adjustments to schedules. We discuss the model, potential benefits and operational issues associated with operating such schedules.

3) **Supply Chain Management in a Not-for-Profit Setting**, *Philip J. Mizzi*, Arizona State University West, Sch. of Mgmt. 2451, PO Box 37100, Phoenix, AZ 85069-7100, pjmm@asu.edu, www.west.asu.edu/pjmizzi/, *Mohan Gopalakrishnan*, *Stephen J. Zabłski*, *Cari L. Ogden*

A needs analysis, operational analysis and distribution analysis of a not-for-profit organization has enhanced the efficiency and output of a food supply chain for needy individuals in a major metropolitan area. Practical issues related to food reclamation and redistribution are addressed along with theoretical issues related to supply chain management.

WB02 Supply Chain Optimization IV

Cluster: Supply Chain Optimization

Invited Session

Chair: Ana Muriel, University of Massachusetts, Amherst, MA 01089, muriel@ecs.umass.edu

1) **When to Share Demand Information in a Simple Supply Chain?**, *Guillermo Gallego*, Columbia University, IEOR Dept., 324 SW Mudd Bldg., 500 West 120th St., Rm. 331, New York, NY 10027, ggallego@ieor.columbia.edu, *Ying Huang*, *Kaan Katircioglu*, *Yin-Tat Leung*

What should a supplier do with retail demand information? The supplier's optimal policy delays orders until the retailer's inventory position drops to a threshold. Without information, the supplier's optimal policy induces a delay before ordering. The savings/costs to the supplier/retailer determine whether selling/sharing information is beneficial.

2) **Optimal Flexible Supply Policy**, *Ningxiang Xu*, Stanford University, Dept. of MSE, Stanford, CA 94305, nxn1@stanford.edu, *Arthur F. Veinott, Jr.*

A firm facing uncertain demands seeks a flexible multi-period supply policy for placing orders and revising their sizes and lead times between placement and delivery with appropriate charges for so doing. The firm's minimum expected cost and optimal policy are characterized under various assumptions about the costs and allowable revisions.

3) **Capacity & Flexibility Planning in a Make-to-Order Environment**, *Ana Muriel*, University of Massachusetts, Amherst, MA 01089, muriel@ecs.umass.edu

Recent changes in the marketplace are forcing manufacturers to transform their production systems into make-to-order ones. Our main objective is to determine the impact of manufacturing flexibility on supply chain performance in a make-to-order environment when designing multi-plant multi-product manufacturing systems.

WB03 Supply Chain Planning

Contributed Session

Chair: Seung-Lae Kim, Drexel University, Dept. of Dec. Sci., 232 Academic Bldg., 33 & Arch, Philadelphia, PA 19104, kimsl@drexel.edu

1) **An Integrated Process Planning & Scheduling with Outsourcing**, *Chan Seok Jeong*, Hanyang University, Dept. of IE, Ansan, Kyunggi-do, 425-791, South Korea, csjeong@pis.hanyang.ac.kr, *Young Hae Lee*

For years, researchers have mainly investigated the various processes within manufacturing supply chain individually. Recently, however, there has been increasing attention placed on the integrated model of manufacturing supply chain planning. An integrated process planning and scheduling model considering outsourcing in manufacturing supply chain is proposed. The process planning and scheduling considering outsourcing are actually interrelated and

should be solved simultaneously...

2) **withdrawn - author request of 4/30, Pitipong Veerakamolmal**, IBM Corporation, 41 Radnor Rd., Boston, MA 02135, pitipong@usa.net

3) **An Optimal Price & Order Cycle in a Single Warehouse/Retailer Supply Chain, Jeong Eun Lee**, POSTECH, San 31, Hyo-ja, Nam-Gu, Pohang, Kyungbuk, 790-784, Korea, yhong@postech.edu, **Yushin Hong**

We consider the problem of determining the optimal price and order cycle in a single warehouse/retailer supply chain. Hierarchical, integrated and coordinated models are analyzed. In the hierarchical model, the retailer first determines its policy and then the warehouse does using the retailer's policy. In the integrated model, we assume that the warehouse and the retailer belong to the same company...

4) **Selection of a Delivery Policy for a Supplier in a Manufacturing Supply Chain, Seung-Lae Kim**, Drexel University, Dept. of Dec. Sci., 232 Academic Bldg., 33 & Arch, Philadelphia, PA 19104, kims1@drexel.edu, **Daesung Ha**

We examine the benefits of a partnership between a buyer and a supplier. Delivery size and frequency will be optimized, based on the interactions among variables, such as transportation costs, setup costs and holding costs for both parties.

WB04 Distribution Techniques for the New Economy

Sponsor: MSOM

Sponsored Session

Chair: Kevin R. Gue, Naval Postgraduate School, Dept. of Systems Mgmt., Monterey, CA 93943, krgue@nps.navy.mil

1) **Order Picking Path Selection for a Distribution Center, Dale T. Masel**, Ohio University, Dept. of IMSE, OH

In a distribution center, the length of an order picker's path is affected by many variables including number of storage locations, path strategy and aisle width. We examine the impact of these and other factors on path length and identify recommended strategies to minimize path length under different picking conditions.

2) **A Theory of Make & Buy, Wei Shi Lim**, National University of Singapore, 15 Law Link, Singapore, 117591, Singapore, fbalimws@nus.edu.sg, **Khai Sheang Lee**

We examine how outsourcing decision changes over time and identify specific learning and the salvageability of specific learning by suppliers as 2 reasons for firms to make and buy, even if outsourcing completely is less costly initially.

3) **A Model for Single-Stage Staging in a Crossdock, Kevin R. Gue**, Naval Postgraduate School, Dept. of Systems Mgmt., Monterey, CA 93943, krgue@nps.navy.mil

Most retail crossdocks stage orders outside of shipping doors to facilitate value-added processing and efficient loading. We describe a model for this type of queue and compare it with a model for flowrack. We confirm our results with simulation and discuss implications for crossdock design.

WB05 USMC Project Albert

Sponsor: College on Simulation

Sponsored Session

Chair: Gary E. Horne, MITRE Corporation, MCCDC, 3300 Russell Rd., Quantico, VA 22134-5001, hornege@mccdc.usmc.mil

1) **Project Albert Overview, Alfred Brandstein**, MCCDC, 3300 Russell Rd., Quantico, VA 22134-5001

The US Marine Corps is interested in exploring new technologies and methodologies to increase its understanding and effectiveness. MCCDC has been developing Operational Synthesis and Data Farming to reach this understanding in an effort called Project Albert. We provide an overview of Project Albert.

2) **Models to Capture Nonlinearity, Intangibles & Co-Evolution, Gary E. Horne**, MITRE Corporation, MCCDC, 3300 Russell Rd., Quantico, VA 22134-5001, hornege@mccdc.usmc.mil, **Steve Upton**

Project Albert's main research thrusts are the investigation of nonlinearity, intangibles and co-evolution in military applications. These 3 phenomena are being explored using complex adaptive systems models called distillations. This presentation will include demonstrations of the models and how the models capture non-linearity, intangibles and co-evolution to help answer questions.

3) **Adaptive Exploration of Project Albert Distillations, Tom**

Lucas, Naval Postgraduate School, OR Dept., 1411 Cunningham Rd., Monterey, CA 93943-5219, twlucas@nps.navy.mil, **Susan M. Sanchez**

Insights from combat models should be based on distributions of ensembles of results: individual outcomes, average performance or even optima for specific scenarios carry little weight. We examine adaptive, sequential approaches for identifying robust command and control decisions. Examples are drawn from a suite of test problems and agent-based distillations.

WB06 Analytic Hierarchy Process II

Contributed Session

Chair: Yubo Gao, Hebei Institute of Technology, Dept. of Economic Mgmt., Tangshan, Hebei, 063009, PR China, gaoyubo@hotmail.com

1) **Assessment of Information Technology's Commercial Viability using AHP, Jae-hyang Kim**, KAIST, hyang@kgsm.kaist.ac.kr, **Ji Soo Kim, Il-ho Park**

The problem regarding the evaluation of technology's commercial viability occupies an important position in technology assessment. Our research clarifies unsolved problems regarding the evaluation of technology's commercial viability and obtains commercial opportunity assessment results from 50 promising technologies. We break down the commercial potential assessment, from the goal to criteria to sub-criteria down to alternative courses of action...

2) **An Analytic Hierarchical Process-Based Simple Recursive Procedure for Determining Weights, Yubo Gao**, Hebei Institute of Technology, Dept. of Economic Mgmt., Tangshan, Hebei, 063009, PR China, gaoyubo@hotmail.com

In multiple decision making, Saaty has proposed a practical method known as AHP; however, AHP needs cumbersome calculations. Considering this point, we developed a more simple procedure that only needs the upper triangular matrix elements. By using a recursive procedure, we can easily get satisfactory weight coefficients.

3) **A Fuzzy Analytic Hierarchy Process for Evaluating Advanced Manufacturing Technology, Yavuz Burak Canbolat**, Vatan Mah, Demirci Sok No. 11, Bursa, 16260, Turkey, ybcanbolat@yahoo.com, **Ibrahim Cil, Emin Gundogar**

Advanced manufacturing technology (AMT) evaluation plays an important role in today's highly competitive manufacturing environment. In this study, we present a new method to make decision for AMT. The new method, called F-AHP, integrates fuzzy decision making system and AHP to take into account both economic and strategic criterions for selection.

WB07 Auctions/Competitive Bidding

Contributed Session

Chair: Chonawee Supatgiat, Enron Corporation, Research Group, 1400 Smith St., Houston, TX 77002, csupatg@enron.com

1) **A Coordinating Mechanism based on Negotiation Decision Function for Holonic Manufacturing Systems, Kung-Jeng Wang**, Chung-Yuan Christian University, Dept. of IE, 22 Pu-Jen, Pu-chung Li, Chung Li, 320, Taiwan, ROC, kungjeng@mail.ie.cycu.edu.tw, <http://140.135.139.88/>, **Koong-In Wang**

We present a coordination mechanism based on negotiation decision function for holonic manufacturing systems. This mechanism is characterized by multi-parties and multi-issues. We proved the convergence properties of the proposed mechanism. We also applied it to the scheduling in a job-shop-based holonic manufacturing system.

2) **A Model for a Kind Auction on the Internet, Jian Chen**, Tsinghua University, Sch. of Economics & Mgmt., Beijing, 100084, China, jchen@tsinghua.edu.cn, **Xilong Chen**

Auctions on the Internet have recently become quite a hot topic. Consider a seller who wishes to conduct an auction in a setup with many potential buyers on the Internet. We present a model for describing the behaviors of both seller and buyers, which is in terms of their profits.

3) **Optimal Bidding Strategies for Bidders in Online Auctions of Common Products, Chonawee Supatgiat**, Enron Corporation, Research Group, 1400 Smith St., Houston, TX 77002, csupatg@enron.com, **John R. Birge, Rachel Q. Zhang**

We consider non-sealed and sealed online auctions of common products. Both first-price and uniform-price auctions are considered. All bidders have the same valuation for the product but may have different demand quantities. The number of units being auction can be random with common distribution. Nash equilibrium solutions are derived.

4) A Column Generation Algorithm for the Winner Determination Problem in Transportation Tendering, Linda van Norden, Erasmus University, PO Box 1738, Rotterdam, 3000 DR, The Netherlands, lnorden@fbk.eur.nl, **Steeff L. van de Velde, J. van Nunen**

The tendering process for outsourcing transportation of bulk chemicals can be seen as a combinatorial auction. We present an algorithm for the solution of the winners determination problem.

WB10 Integer Programming

Contributed Session

Chair: Knud D. Andersen, Lindo Systems, 817 Columbus Ave., PBO 109, San Francisco, CA 94133, kda@kdaworld.com, www.lindo.com

1) Solving Mixed Integer Quadratic Programming Problems with the LINDO Subroutine Library, Knud D. Andersen, Lindo Systems, 817 Columbus Ave., PBO 109, San Francisco, CA 94133, kda@kdaworld.com, www.lindo.com, **Linus Schrage**

The B&B method in the LINDO Subroutine Library has been extended to handle problems with a quadratic objective. We will discuss some of the issues involved, such as efficient methods for handling QP problems. We present results for cardinality constrained portfolio optimization problems, an important application.

2) Exact & Heuristic Algorithms for the Travelling Salesman Problem: A Comparative Survey, Idalia Flores, UNAM, Plazuela de los Reyes 45-B301, Mexico City, DF, 04330, Mexico, idalia@servidor.unam.mx

The rapid advance of computer technology has allowed us to consider the solution of some special TSP problems that would have been considered computationally intractable a few years ago. Due to this, new exact algorithms have been developed as well as heuristic approaches. Our goal is to clarify and unify these diverse approaches in order to provide insight into their use; when to use each one of them, as well as their advantages.

3) The Shrinking Strategy for Solving Linear Diophantine Systems, Jean-Claude Sogno, INRIA, BP 105, Rocquencourt, 78153, France, jean-claude.sogno@inria.fr

Solving a system of linear diophantine equations and inequalities consists of enumerating its minimal solutions. However, the computational cost greatly increases with the number of variables. Using unimodular changes of variables, we propose substituting an equivalent reduced system of inequalities. Consequently, the domain for finding its solutions is greatly reduced.

WB11 Modeling Systems & Languages

Contributed Session

Chair: Vladimir Sevastyanov, Multistat, Inc., 1 Pazzi, Irvine, CA 92614, vlad@multistat.com, www.multistat.com

1) A Support Model for Municipal Solid Waste Soil Remediation, Boguslaw Bieda, University of Mining & Metallurgy, Mgmt. Dept., ul. Gramatyka 10, Krakow, 30067, Poland, bbieda@wzn4.zarz.agh.edu.pl, **Wieslaw Wajs, Ryszard Tadeusiewicz**

Modeling the biodegradation of contaminants in porous media is a very useful tool for estimating the waste decomposition. We develop a numerical model for 1-D transport (water flow equation) in MSW soil using the 2-step Crank-Nicolson finite-difference approximation. The best in situ soil remediation technique involves a decision process. The present numerical model is a framework for decision-making process for MSW soil remediation.

2) A Study on a Modeling Frame for the Design Process, Hyo Won Suh, KAIST, Concurrent Eng. Lab., Dept. IE, 373-1 Kusong-dong, Yusong-ku, Taejon, 305-701, Korea, hwsuh@sorak.kaist.ac.kr, **Hong Bae Jun**

The design process is a complex and unstructured process that has various objectives, constraints, numerous interaction and information transfers. For managing and controlling the complex design processes effectively, appropriate and logical descriptions of design process to capture their nature should be described. This needs an appropriate modeling frame for design processes. However, previous research lacks these points.

3) Design of a Relational Database Scheme for a Mathematical Programming Model, Youngjoon Park, ETRI, Internet Econ. Research Team, 161 Gajong-dong, Yusong-gu, Taejon, 305-350, South Korea, joony@etri.re.kr, **Jae-Hee Kim, Sheung-Kown Kim**

It is an inevitable requirement to handle numerous data and transform them into the inner data structure on the computer when we apply the large-scale mathematical programming model to the real world problem. The massive data are a burden on input/output process in validating data and model, what-if

simulation and in simply solving a problem. Therefore, we need a scheme to manage data efficiently...

4) A Method of Visualization for Multi-Dimensional Functions, Vladimir Sevastyanov, Multistat, Inc., 1 Pazzi, Irvine, CA 92614, vlad@multistat.com, www.multistat.com

A new visualization method for multi-dimensional functions is provided (dimension < 500). A function is approximated by own values in points of a uniformly distributed sequence, divided on non-intersecting subsets via a split-criterion. Each subset is drawn in distinct color on plurality of 2-dimensional projections. See www.multistat.com.

WB12 E-Commerce IV

Contributed Session

Chair: Angappa Gunasekaran, University of Massachusetts, 285 Old Westport Rd., North Dartmouth, MA 02747-2300, agunasekaran@umassd.edu

1) The Emerging Knowledge Economy: Exchange in Internet Spot Markets for IT Expertise, Eli M. Snir, University of Pennsylvania, The Wharton Sch. 1318 SH-DH, 3620 Locust Walk, Philadelphia, PA 19104, eli@grace.wharton.upenn.edu, http://opimweb.wharton.upenn.edu/eli/, **Lorin Hitt**

We investigate the characteristics of Internet-enabled markets for professional services by examining bidding behavior in the market for IT contractors. Using auction theory, we develop a theoretical model relating market characteristics to bidding and transaction behavior. The model is tested using data from one active online market for IT services.

2) A Study on the Evaluation Factors for Internet Venture Business Investment Decision-Making, Lee Myoung Ho, HanKuk University of Foreign Studies, 270 I-Mun Dong, Dong Dae Mun Gu, Seoul, 130-791, Korea, leemh@maincc.hufs.ac.kr, **Lee Woo Hyoung, Huh Hoon**

This study investigates the differences of various factors that are considered in the course of investment decision making of Internet venture business. These findings will be utilized to present an objective index of investment on the venture business for the professional as well as general investors.

3) Business-to-Business E-Commerce in a Supply Chain Environment, Angappa Gunasekaran, University of Massachusetts, 285 Old Westport Rd., North Dartmouth, MA 02747-2300, agunasekaran@umassd.edu

This paper deals with the application of B2B e-commerce in a supply chain environment. Information technology/information systems such as ERP, SAP, BAAN and Oracle have been implemented for improving the effectiveness of communication; hence, the supplier management system. An overview of the issues involved in the design and implementation of such a system, including the business process design, is discussed.

WB13 Service & Travel

Contributed Session

Chair: Sookon Kim, Hankuk Aviation University, 200-1 Hwajeong-dong, Duckyang-ku, Koyang, Kyungkee, 412-791, Korea, kim.sookon@lycos.com

1) The Impact of Employees with Different Capabilities on Customer Delay, Thomas Y. Lee, University of Illinois, IDS Dept., MC 294, 601 South Morgan St., Chicago, IL 60607, yslee@uic.edu, www.uic.edu/~yslee

The periodic staffing problem is modeled via a multiple server vacation queueing system. Transient and steady state analysis on the queueing model are used to analyze the impact of employees with different capabilities on customer delay. A variant of our model can be used to analyze queues with permanent customers.

2) Analysis of the Contribution of Capital, Labor & Resource to the Production of the Korea Electric Power Corporation, Kyoung Yong Jee, ETRI, 161 Kajong-Dong, Yusong-Gu, Taejon, 305-350, Korea, kyjee@etri.re.kr, **Joong Gul Ko**

Conventional OLS regression analysis overestimates or underestimates elasticity of input factors. The objectives of this paper are to verify OLS and unit root to show that variable is non-stationary. According to the estimation, OLS estimations showed higher contribution of capital and labor and lower contribution of resource use, compared with FM-OLS estimations.

3) Taxonomy of Service & Service Products in Electronic Commerce, Sungeui Cho, Korea University, Grad. Sch. of Bus. Admin., 1, 5 KA Anamdong, Sungbukgu, Seoul, 136-701, South Korea, dcsmk10@hanmail.net, **Kwangtae Park**

Service and service products are assumed to be easily adaptable in EC, due to the characteristics of intangibility, and we need to test the relevance of service and service products in EC. For this purpose we newly classify service and service products based on the degree of low and high interaction, characteristics of delivery, etc.

4) Using Analytic Hierarchy Process for the Service Information Technology Adoption Process, Godwin J. Udo, Tennessee State University, 330 10th Ave. North, Nashville, TN 37203, gudo@tnstate.edu, **Aurora J. Kamssu**

Innovative use of IT has transformed industrial economy into service economy. IT has singularly changed the basis for competition and how services are provided. Unfortunately, not many decision tools are available to guide in IT adoption process. We use AHP to demonstrate how adoption process can be analyzed to ensure success.

WB14 Group Decisions & Negotiation

Contributed Session

Chair: Katsunori Ano, Nanzan University, 18 Yamazato-cho, Showa-ku, Nagoya, Aichi, 466-8673, Japan, ano@math.iq.nanzan-u.ac.jp

1) Clusterability & Information Exchange in Group Decision Making, Takehiro Inohara, Tokyo Institute of Technology, 2-12-1 Okayama, Meguro-ku, Tokyo, 152-8552, Japan, inohara@valdes.titech.ac.jp, www.valdes.titech.ac.jp/~inohara/

We discuss on the relations between clusterability of a group and information exchange in group decision making. Based on the equivalence of clusterability to Newcomb's stability of emotions, we show that interaction consistency of a group is equivalent to the clusterability of the group.

2) Nonsymmetric Indices of Power & their Application to the House of Councilors in Japan, Takashi Suzuki, Nanzan University, 18 Yamazato-cho, Showa-ku, Nagoya, Aichi, 466-8673, Japan, m99b020@iq.nanzan-u.ac.jp, **Susumu Seko, Katsunori Ano**

We deal with the Shapley-Shubik, Banzhaf and nonsymmetric Shapley-Owen indices of power and their application to the House of Councilors in Japan. We investigated the power of each party, taking into consideration the supporting rate for each party among eligible voters as well as the voting percentage.

3) Nonsymmetric Banzhaf Index without a Profile Space & its Application to the House of Councilors in Japan, Riyo Endo, Nanzan University, 18 Yamazato-cho, Showa-ku, Nagoya, Aichi, 466-8673, Japan, m99b020@iq.nanzan-u.ac.jp, **Takashi Suzuki, Katsunori Ano**

The non-symmetric Banzhaf index seems to include some problems on a way of constructing an ideology profile space. We propose the modified Banzhaf index calculating direct from the voting data. We apply this index to the House of Councilors in Japan and compute the power of the parties.

WB15 Applied Probability

Contributed Session

Chair: Yu Song, Fukuoka Institute of Technology, 3-30-1 Wajirohigashi, Higashi-ku, Fukuoka, 811-0295, Japan, song@fit.ac.jp

1) An Analysis on a Multi-Server Queue with Synchronous Single Vacations, Zhe George Zhang, Western Washington University, Finance, Mktg. & Dec. Sci., Bellingham, WA 98225-9077, george.zhang@wwu.edu, www.bus.sfu.ca/homes/zhang/gzhang.htm, **Naisho Tian, Boxiong Lan**

We study a multi-server M/M/c type queue with vacations for partial servers. If at a service completion instant, d ($d \leq c$) servers become idle, these d servers will take one and only one vacation together. During the vacation of d servers, the other $c-d$ servers do not take vacation even they are idle. By changing the parameter d , the queueing manager can better allocate the servers' time to performing the primary jobs (arriving customers) and the secondary jobs (taking vacations)...

2) Restricted Admissibility of Batches into an M/G/1-Type Queue with Bernoulli Schedule Server Vacations, Kailash C. Madan, Yarmouk University, Dept. of Stats., Fac. of Science, Irbid, Irbid, 211277, Jordan, kailashm@yu.edu.jo

We investigate the steady-state behavior of an M/G/1-type queue with Bernoulli schedule server vacations. Batches of variable size arrive at the system according to a compound Poisson process. However, all arriving batches are not allowed into the system at all times. The restriction policy differs when the server is available in the system and when he is on vacation.

3) The Optimal Service Policies in a M/G/1 Queue with

Stochastically Available Vacations, Yu Song, Fukuoka Institute of Technology, 3-30-1 Wajirohigashi, Higashi-ku, Fukuoka, 811-0295, Japan, song@fit.ac.jp, **Zhe G. Zhang, Ernie Love**

We formulate an SMDP structure to represent an M/G/1 queueing system with stochastically available vacations. With this, we are able to construct an algorithm to determine both a service redemption policy for the server as well as the optimal rules regarding choice of vacation types to be utilized.

4) Bounds & Approximations of the M/G/c Queues, Chia-Li Wang, National Dong Hwa University, Shoufeng, Hualien, Taiwan, 974, ROC, cwang@mail.ndhu.edu.tw

We show how to use insensitivity of symmetric M/G/c queues in conducting sample-path comparisons between the M/G/c and M/M/c queues. Results of the comparisons can be translated into new bounds and approximations of the expected waiting times. Numerical comparisons between these and existing approximations will also be presented.

5) Impact of Work-in-Process Inventories on Multi-Product Capacitated Lot-Sizing with Stochastic Arrivals, Sangjin Choi, University of Calgary, Fac. of Mgmt., Dept. of MME, Calgary, Alberta, T2N 1N4, Canada, sjinchoi70@hotmail.com, **S. T. Enns**

The cost model to be minimized consists of setup cost, finished inventory holding cost and WIP carrying cost derived by queueing theory. The inventory control is based on a reorder policy with fixed order quantities. The profit function is also developed when both demand and lot sizes are decision variables.

WB16 Planning

Contributed Session

Chair: Wann-Ming Wey, Chaoyang University of Technology, Architecture & Urban Design, 168 Gifeng E. Rd., Wufeng, Taichung County, 413, Taiwan, ROC, wmwey@mail.cyut.edu.tw

1) Optimal Planning of a Multi-Station System with Sojourn Time Constraints, Marcos J. Singer, Pontificia Universidad Catolica de Chile, Escuela de Admin., Vicuna Mackenna 4860 Macul, Santiago, Chile, singer@facepuc.cl, **Patricio Donoso, Jose L. Noguera**

We study a dynamic production system with multiple products constrained by maximum and minimum sojourn times, flow balance equations and resources availability. We decompose the problem into single product serial systems and propose a dynamic programming algorithm of linear complexity. We show a real world application.

2) A Study of Dynamic Parking Facility Location when Demand is Time Dependent, Wann-Ming Wey, Chaoyang University of Technology, Architecture & Urban Design, 168 Gifeng E. Rd., Wufeng, Taichung County, 413, Taiwan, ROC, wmwey@mail.cyut.edu.tw, **Ching-Teng Liao**

A model of dynamic parking facility location is proposed and a progressive p-median problem of parking facility allocations is considered. The problem is formulated and a standard code AMPL (a modeling language for mathematical programming) is adopted to solve our proposed non-linear mathematical programming model.

3) A Production Planning Model based on an Activity-Based Costing System in an Automobile Parts Manufacturing Shop, Soonil Kwon, POSTECH, San 31, Hyo-ja, Nam-Gu, Pohang, KyungBuk, 790-784, Korea, sihm@chollian.net, **Yushin Hong**

A conventional costing system cannot incorporate setup costs appropriately in a production planning model. To overcome this, a production planning model based on ABC system is introduced and implemented in an automobile part manufacturing shop. We present the method of determining whether the parts should be manufactured in-house or out-sourced.

4) A Multi-Resource Scheduler for Planning & Replanning, Abha Moitra, GE CRD, 2 Metcalf St., Westwood, MA 02090, abha.moitra@crd.ge.com

We present a MIP system for multi-resource scheduling that efficiently finds optimal solutions in tight scenarios. No a priori time granularity is assumed, jobs can require multiple resources, temporal relationships among jobs are permitted and resources have flexible shift structures. The system handles long running situations by allowing partial freezing of solution and replanning.

WB17 Telecommunications Applications

Contributed Session

Chair: Shinichi Ueshima, Kansai University, Dept. of Informatics, 2-1-1 Ryozenji, Takatsuki, Osaka, 569-1095, Japan, ueshima@res.kutc.kansai-u.ac.jp

1) Optimizing Call Center Schedules, Angela O. Barboza, Centro Federal de Educacao Tecnologica, Rua Prof. Duilio Calderari 164, Curitiba, Parana, 80.000-000, Brazil, aobarboza@yahoo.com, **Celso Carnieri, Maria T. Steiner**

We propose a solution for the elaboration and designation of attendants' time at a telephone "customer support center" that operates 24 hours a day. Three phases were considered. In the first, we determined the number of attendants for every half-hour of the day. The second was to find the best time and form to minimize the costs to the company. The last was to set the time for the attendants to maximize their satisfaction related to their schedule...

2) Uniformly Distributed Bindings in Colored Stochastic Petri Nets, Michael Schmeink, Aachen University of Technology, LFG Stochastik, Wuellnerstr 3, Aachen, 52062, Germany, schmeink@stochastik.rwth-aachen.de, **Klaus Junghaertchen**

Combining colored and stochastic Petri nets yields a very powerful modeling tool particularly suitable for the simulation and analysis of manufacturing systems or telecommunication networks. We introduce a fast variable binding algorithm that chooses feasible token combinations uniformly.

3) Wavelength Routing in Optical Networks, Yogesh K. Agarwal, Indian Institute of Management, 516 IIM Campus, Off Sitapur Rd., Lucknow, UP, 243001, India, yka@iiml.ac.in, **Harsha P. Harshavardhana**

The problem of routing wavelength demands in optical networks based on WDM technology is modeled as an IP problem. Given network topology and a set of demands, each demand must be assigned a path and a specific wavelength so that all demands can be routed using the smallest number of wavelengths. The issue of limited range wavelength conversion is also addressed. A heuristic algorithm and computational results are presented.

4) An Experiment on Distance Collaborative Conferencing based on Space Collaboration Systems & ATM Networks, Shinichi Ueshima, Kansai University, Dept. of Informatics, 2-1-1 Ryozenji, Takatsuki, Osaka, 569-1095, Japan, ueshima@res.kutc.kansai-u.ac.jp, **Takashi Kobayashi, Noboru Kataoka**

We report on our experiment on collaborative conferencing among three geographically distant graduate schools. We've enhanced session reliability by multimedia connection, based on space collaboration system and ATM network and ISDN, Cable TV. We've employed DV over ATM, IP and streaming video, IP multi-casted to 250 workstations using high performance.

WB18 Military Applications II

Contributed Session

Chair: Leroy A. Jackson, TRAC-Monterey, US Army, PO Box 8692, Monterey, CA 93943, jacksonl@trac.nps.navy.mil

1) Forecasting Models for Sequential Flight Test Results, Yong Kwan Jo, Yonsei University, Dept. of Comp. Sci. & ISE, Sudaemoon-gu Shinchon-dong 134, Seoul, 120-749, South Korea, jykcss@hanmail.net, **So Young Sohn**

We present selection criteria for ROK Airforce pilot training candidates, using classification models such as decision tree, logistic regression and neural network based on 31 aptitude test results of 288 ROK Air Force applicants (1994-1996). Logistic regression model is evaluated as the best model for the last flight test results. We suggest a pilot selection criterion based on this logistic regression...

2) Improvement of Barrack Life in the Republic of Korea Army, Hyoung Ki So, Yonsei University, 134 Shinchon-dong, Sudaemoon-ku, Seoul, 120-749, Korea, rokaso@yonsei.ac.kr, **So Young Sohn**

The Republic of Korea Army (ROKA) has been making every effort to improve the quality of barrack life environment. Recently, ROKA introduced a new scheme that allows soldiers to spend their free time on learning foreign language, enhancing their computer skills and enjoying more leisure time. We use SERVQUAL in order to analyze the effect of the new scheme...

3) Sim Clinic, Leroy A. Jackson, TRAC-Monterey, US Army, PO Box 8692, Monterey, CA 93943, jacksonl@trac.nps.navy.mil, **John Hiles**

SimClinic is an agent-based simulation training tool to assist the DoD medical community in training clinic staffs. This project will accomplish the initial research and preliminary design of an interactive training simulator for use by mid-level leaders as they prepare to manage a DoD medical clinic. Training will focus on the decisions and actions of 4 leadership roles: medical director, nurse executive, group practice manager (business manager) and NCOIC.

WB19 Reliability

Contributed Session

Chair: Chin-Chia Jane, Ling Tung College, Dept. of Bus. Admin., 1 Ling Tund Rd., Taichung, Taiwan, 40816, ROC, mrjane@mail.ltc.edu.tw

1) Bounding the Reliability of Flow Networks, Chin-Chia Jane, Ling Tung College, Dept. of Bus. Admin., 1 Ling Tund Rd., Taichung, Taiwan, 40816, ROC, mrjane@mail.ltc.edu.tw

We present lower and upper bounds for approximating the reliability of a flow network by utilizing a sum of disjoint products algorithm. The reliability is the probability that source node can supply sink node the asked demand. Computational experiments are conducted to discover the properties of the proposed algorithm.

2) Performance of a Real-Time System with Limited Maintenance Facilities, Joseph Kreimer, Ben-Gurion University of the Negev, Dept. of IE & Mgmt., PO Box 653, Beer-Sheva, 84105, Israel, kremer@bgumail.bgu.ac.il

A real-time multi-server and multi-channel system with a limited number of maintenance teams is considered. Tasks are executed immediately upon arrival. That part of the task that is not served immediately is lost. Queuing of tasks is impossible. Analytical and numerical results such as equilibrium probabilities and performance indices are provided.

3) Maintenance Priorities by using Reliability Importance Factors, Hoon Y. Koo, Seoul National University, Dept. of IE, Seoul, 151-742, Korea, eloh@rellab.snu.ac.kr, **Jung S. Hong, Chang H. Lie**

In large complex systems, maintenance priorities for the failed components are important to maintain system reliability at required levels. Commonly used methods of determining maintenance priorities are based on ranking the failed components using reliability importance factors, i.e., Birnbaum reliability importance, risk achievement worth, etc. In preceding works, maintenance priorities for the failed components are identified by the descending order of Birnbaum reliability importance...

4) Moments of Time to Failure of a Non-Repairable System Subject to Heterogeneous Random Shocks, Kunmin Yeo, POSTECH, Dept. of IE, San 31 Hyoja-dong, Pohang, Kyungbuk, 790-78, Korea, kunmin@postech.ac.kr, **Chi-Hyuck Jun**

We consider a non-repairable system subject to heterogeneous random shocks that arrive according to a renewal process causing the system to fail independently with a certain probability. Based on the characterization of inherent life as a hyper-Erlang distribution, the moments of time to failure are derived with a computational algorithm.

WB20 Dynamic Optimization

Contributed Session

Chair: Irwin E. Schochetman, Oakland University, Dept. of Math. & Stats., Rochester, MI 48309-4485, schochet@oakland.edu

1) A Multi-Period Optimization Model for Dynamic Strategic Asset Allocation under Taxation, Dong X. Shaw, Zurich Scudder Investments/Columbia University, 101 California St., San Francisco, CA 94111, dong@ieor.columbia.edu

We study a strategic asset allocation model under taxation. The traditional mean-variance analysis was static. Under taxation, an optimal strategy might be a dynamic one. Hence, we formulate the problem into a multi-period stochastic dynamic programming. A heuristic procedure is developed based on solving a sequential quadratic programming problems.

2) Existence of Efficient Average Optimal Solutions in Deterministic Infinite Horizon Optimization, Irwin E. Schochetman, Oakland University, Dept. of Math. & Stats., Rochester, MI 48309-4485, schochet@oakland.edu, **Robert L. Smith**

Consider the problem of making a sequence of decisions over an infinite horizon, each decision chosen from a finite action set, so as to minimize the associated long-term average cost. We give sufficient conditions for such an optimal decision sequence to exist, which is also efficient, i.e., finite optimal.

3) A New Approach to Distribution Fitting: Decision on Beliefs, Ali Eshragh Jahromi, Sharif University of Technology, No. 9, 1st Block, 3rd Phase, 6th St., Karaj, Rajae Shahr, Tehran, Iran, a_eshragh@kimianet.com, **Mohammad Modarres**

We introduce a new approach to distribution fitting known as DOB. We assume the observations come from an unknown distribution and by using the sequential Bayesian belief revision process, the belief on distributions is updated and by stochastic dynamic programming, an algorithm is derived which maximizes the probability of correct selection. Finally, the efficiency of this method is

compared with the goodness-of-fit common methods by simulation.

WB22 Location Models II

Sponsor: Location

Sponsored Session

Chair: Dmitry Krass, University of Toronto, Rotman Sch. of Mgmt., 105 Saint George St., Toronto, Ontario, M5S 3E6, Canada, krass@rotman.utoronto.ca

1) **A Distribution Map for the Weber Location Problem on a Network**, *Zvi Drezner*, California State University, Dept. of MS, Fullerton, CA 92834-9480, *Shogo Shiode*

Consider the Weber location problem on a network with weights (demands at the nodes) which are stochastic rather than deterministic. By the Hakimi (1964) property the solution to the Weber problem is at a node of the network. We find the probability that the optimal location is on a given node. The compilation of these probabilities are formed by the distribution map.

2) **Exploiting Self-Cancelling Demand Point Aggregation Errors for Some Planar Median Problems**, *Richard L. Francis*, University of Florida, Dept. of ISE, 303 Weil Hall, Gainesville, FL 32611-6595, *Timothy J. Lowe*, *Brenda Rayco*

We develop theory and algorithms for certain types of centroid aggregations for rectilinear n -median location problems. We test the theory computationally and find that every error measure we consider can be well approximated by some decreasing power function in the number of aggregate demand points.

3) **Facility Location Problems with Stochastic Demand & Congestion**, *Dmitry Krass*, University of Toronto, Rotman Sch. of Mgmt., 105 Saint George St., Toronto, Ontario, M5S 3E6, Canada, krass@rotman.utoronto.ca, *Oded Berman*

Problems in this class frequently arise in the context of location of emergency service facilities. Other applications include retail and general service facilities. We survey the work in this area, provide a classification of various formulations and discuss strengths and weaknesses of various approaches.

Wednesday 12:00-13:30

WC01 Industrial Applications II

Contributed Session

Chair: Kwang-Su Park, POSTECH, Dept. of IE, San 31 Hyoja-dong, Nam-gu, Pohang, Kyungbuk, 790 784, South Korea, kspark@postech.ac.kr

1) **A Multi-Objective Product Design Decision System in the Handloom Industry**, *Bijaya K. Mangaraj*, Utkal University, Dept. of Bus. Admin., Bhubaneswar, Orissa, 751004, India, mangaraj@yahoo.com, *Upali Aparajita*, *Ashis Mishra*

A product design decision system is a systematic approach to consider the target market's expected benefit from the product that is based on the optimal design of product's attribute-mix so as to satisfy the consumers. A handloom sector in Indian context has been taken into account and fuzzy goal programming approach has been utilized for the illustration.

2) **A New Calibration Method based on the Recursive Multiple Linear Regression Coefficients with Variable Selection/Feature Construction**, *Kwang-Su Park*, POSTECH, Dept. of IE, San 31 Hyoja-dong, Nam-gu, Pohang, Kyungbuk, 790 784, South Korea, kspark@postech.ac.kr, *Chi-Hyuck Jun*

We propose a calibration method that uses the linearization method for spectral responses and the repetitive adoptions of the linearization weight matrices to construct a feature. We compare the new method with PLS after applying to three data sets. It gives stable result and better performance than the PLS.

WC02 Supply Chain Optimization V

Cluster: Supply Chain Optimization

Invited Session

Chair: Yehuda Bassok, University of Southern California, IOM Dept., Marshall Sch. of Bus., Los Angeles, CA 90089-1421, bassok@marshall.usc.edu

1) **Demand Postponement in Contingency Management**, *Ananth V. Iyer*, Purdue University, Krannert Sch. of Mgmt., West Lafayette, IN 47907, aiyer@mgmt.purdue.edu, *Vinayak V. Deshpande*, *Zhengping Wu*

We model demand postponement as an approach to deal with demand surges. Our model uses the range family of distributions to characterize signals indicating demand surges. We develop optimal initial capacity, optimal amount of demand to postpone and several comparative static results. Analysis of the

model provides interesting managerial implications.

2) **Order Acceptance in a Make-to-Order Business**, *Sriram Dasu*, University of Southern California, Marshall Sch. of Bus., Los Angeles, CA 90089-1421, sriram.dasu@marshall.usc.edu, *Ravi Kumar*

Motivated by problems faced by a manufacturer of credit cards, we develop and analyze a model that provides criteria for accepting orders. Customers differ in terms of the order size and lead-time. We seek rules for accepting or rejecting incoming orders. Since the problem is NP-hard, we explore heuristics.

3) **Coordination Buyback & Negotiation**, *Mahesh Nagarajan*, University of Southern California, IOM Dept., Marshall Sch. of Bus., Los Angeles, CA 90089-1421, mahesh.nagarajan@marshall.usc.edu, *Yehuda Bassok*

We study "buyback" policies as a tool for channel coordinating. We show that in a system with one manufacturer and one retailer, using the Nash-bargaining concept, buybacks are likely when the retailer is "weak." In a system with 2 competing manufacturers under intense competition, at equilibrium buybacks are not likely.

4) **Make-to-Order or Make-to-Stock: Model & Application**, *Sampath Rajagopalan*, University of Southern California, IOM Dept., Marshall Sch. of Bus., Los Angeles, CA 90089, raj@marshall.usc.edu

We present a model and solution approach to decide which items to make to stock and which ones to make to order under an environment characterized by multiple items, setup times, limited capacity and congestion effects. We present insights into the problem, an efficient heuristic and discuss the application of the model.

WC03 Supply Chain Management

Contributed Session

Chair: Maureen P. Lojo, California State University, 6000 J St., Sacramento, CA 95819-6088, lojom@csus.edu

1) **withdrawn - author request of 5/4**, *Gabriella Muratore*, Saltare.com, 2755 Campus Dr., Ste. 255, San Mateo, CA 94403, gmuratore@saltare.com, *Javad Seyed*

2) **Supplier Management in the Semiconductor Industry**, *Maureen P. Lojo*, California State University, 6000 J St., Sacramento, CA 95819-6088, lojom@csus.edu

We report the results of a benchmarking study of supplier management practices in the semiconductor industry. Relationships between semiconductor manufacturers and their processing equipment suppliers are compared on outsourcing strategies employed, the degree of control exercised by customers and various measures of supplier performance and customer satisfaction.

3) **Vendor-Manufacturer Partnerships in the Supply Chain in Process Industries**, *Jay Sankaran*, University of Auckland, MSIS Dept., Private Bag 92019, Auckland, New Zealand, j.sankaran@auckland.ac.nz, *Terence H. Wilson*

We report findings from a 2-phased investigation into a vendor-manufacturer partnership located in the forestry sector in New Zealand. The first, field-based, inductive phase of the research reveals insights into partnership dynamics in process industries and the second, deductive phase formalizes these insights with recourse to mathematical models.

WC04 Algorithmic Techniques in Manufacturing

Sponsor: MSOM

Sponsored Session

Chair: Ronald G. Askin, University of Arizona, Dept. of SIE, Tucson, AZ 85721-0020, ron@sie.arizona.edu

1) **Two Genetic Algorithms for Flexible Flow Line Scheduling**, *Mary E. Kurz*, University of Arizona, Dept. of SIE, PO Box 210020, Tucson, AZ 85721-0020, maryk@sie.arizona.edu, *Ronald G. Askin*

Design plays an important role in genetic algorithm effectiveness. Two GAs (implemented for a flexible flowline scheduling problem to minimize makespan) are compared empirically. One design uses a simplistic chromosome representation. The other uses random keys. Comparisons are made in terms of solution quality and running time.

2) **Analysis of the Performance of an ACO Algorithm for a Multi-Objective Industrial Problem**, *Wilson L. Price*, Universite Laval, FSA/OSD (43-07), Quebec, Quebec, G1K 7P4, Canada, wilson.price@fsa.ulaval.ca, *Caroline Gagne*, *Marc Gravel*

We schedule a single machine having sequence-dependent setup times and present new elements introduced to an ant-colony optimization algorithm to treat

the multi-objective nature of the industrial scheduling problem. We show the impact of each element on the quality of the solutions and on the computation times.

3) A Due-Date Quotation Method for a Make-to-Order Manufacturing Company, Geun-Cheol Lee, KAIST, Dept. of IE, 373-1 Kusong-Dong, Yusong-Gu, Daejeon, 305-701, South Korea, lgc@kaist.ac.kr, Yong-Chan Choi, Yeong-Dae Kim

We suggest a method of quoting due dates of orders in a complex manufacturing system. In the method, due dates are determined by planning release dates and estimating lead times of the orders, which is done iteratively using information on future workloads of workstations in the system.

WC11 Information Systems

Contributed Session

Chair: Yong Shi, University of Nebraska, 60 & Dodge St., Omaha, NE 68182-0392, yshi@unomaha.edu

1) International Journal of Information Technology & Decision Making, Yong Shi, University of Nebraska, 60 & Dodge St., Omaha, NE 68182-0392, yshi@unomaha.edu

We introduce a new journal, "International Journal of Information Technology and Decision Making," (World Scientific Publishing Co.) to disseminate the research findings and applications on the interface of information technology and decision making techniques. This will include its objective and scope as well as the members of the advisory board and editorial board.

2) A Web-Based Approach to Knowledge Management, Ranjit Bose, University of New Mexico, Anderson Sch. of Mgmt., Albuquerque, NM 87131, rbose@unm.edu

Knowledge management is a systematic and integrative process through which firms create and use their institutional and collective knowledge for achieving their organizational goals. This research provides a web-based approach to building knowledge management systems in organizations.

3) Investments in Information Technology & Organizational Improvements: Qualitative & Quantitative Analysis from Portuguese Banking Sector, Manuel J. Pereira, Universidade Catolica Portuguesa, Palma de Cima, Lisboa, 1600, Portugal, mjp@dislogo.ucp.pt, www.dislogo.ucp.pt, Luis V. Tavares

The productivity paradox in IT investments has been discussed during the last years without clear conclusions. The methodology used in this research project combines the quantitative and qualitative approaches, correlating IT investments with organizational variables and perceptions of clients and employees.

4) Classification for Credit Card Portfolio Management via a Multiple Criteria Approach, Yi Peng, University of Nebraska, 60 & Dodge St., Omaha, NE 68182, ypeng@unomaha.edu, Yong Shi

We use a multiple criteria LP approach to predict the cardholders future behavior in credit card portfolio management, which is an alternative technique of data mining in the credit card business. We will examine the development of a series of the real-life credit data for its applicability.

WC13 Service Applications

Contributed Session

Chair: Yunchool Lee, Hankuk Aviation University, 200-1 Hwajeong-dong, Duckyang-ku, Koyang, Kyungkee, 412-791, Korea, lyc@mail.hangkong.ac.kr

1) No Title Supplied, Taihoe Koo, Hankuk Aviation University, 170 Choji-dong, Ansan City, Kyunggi, 425-792, South Korea, ts9812085@hanmail.net, Yunchool Lee

IT has provided opportunities and challenges to the tourism industry. With the ambiguity in developing ITs, the actors in the industry, including airlines, hotels and travel companies, have taken adventurous steps for their activities by adopting ITs. The factors in the industrial networks on the basis of GDS and ADS will be identified in the tourism industry and strategic implications will be discussed.

2) Strategic Alliance in the Airline Industry, Myung Sun Suh, Hankuk Aviation University, Grad. Sc. of Bus. Admin., 200 Hwajeong-dong, Koyang-shi, Kyungkee, 412-791, Korea, airqueen@cheju.tamna.ac.kr, Yunchool Lee

We examine the confrontation strategy of the global alliance for national carriers by analyzing the purpose, type and present condition of a strategic alliance between international airlines based on frequent flyer programs.

3) Networks Structure & Competition: A Case Study of an Airline Industry, Yong Jae Yoo, Tong Won University, San 1-1, Shinchon-ri, Shilchon-myun, Kwangjoo-si, Kyonggi, Korea,

yooyj@tongwon.ac.kr, Yunchool Lee, Heeyong Hurr

Firms are competing against each other in a world of various networks in which they are embedded. Thus, we contend that the conduct and performance of firms can be more fully understood by examining the network of relationships in which they are embedded. Armed with this knowledge, we will examine the features of network and the total network structure in an airline industry.

4) Network & Performance: Between an Airport Operator & Concessionaires, Sookon Kim, Hankuk Aviation University, 200-1 Hwajeong-dong, Duckyang-ku, Koyang, Kyungkee, 412-791, Korea, kim.sookon@lycos.com, Yunchool Lee, Heeyong Hurr

An airport operator needs to manage the network with concessionaires to secure high levels of service and turnover. Using transaction cost analysis, we attempt to find out how the relationship, which is characterized by control of opportunism and cooperation, influences the level of service and turnover of the airport.

WC14 Decision Support Systems

Contributed Session

Chair: Jinwoo Park, Seoul National University, Dept. of IE, Shinlim-Dong, Kwanak-Gu, Seoul, 151742, Korea, autofact@snu.ac.kr

1) An Efficient Method for Interactive Multi-Attribute Decision-Aiding, Hillary A. Holloway, University of Michigan, 1205 Beal Ave., IOE Bldg., Ann Arbor, MI 48109-2117, hhollowa@umich.edu, Chelsea C. White

We consider an alternative selection problem with preferentially independent attributes and precise value scores. The trade-off weight vector is described by a finite set of linear inequalities. Questions and responses add linear inequalities. We model this question-response process as a dynamic program to determine what question to ask next.

2) A Case-Based Reasoning Approach for the Quotation of Rolling Facilities, Jonghan Kim, RIST, San 32 Hyojadong Namku, Pohang, Kyungbuk, 790-330, Korea, kjh@rist.re.kr, Jinwoo Park, Hyungon Whi

In a plant engineering company, one of the most important problems is to accurately estimate the cost of a new project. We suggest a DSS for the quotation of rolling facilities using case-based reasoning. The effectiveness of the proposed approach is demonstrated by some experimental results.

3) Internet-Based Technologies for Flexible Production Networks, J. Hammer, University of Florida, Ctr. for Electronic Commerce, Supply Chain Mgmt., Gainesville, FL 32611, W. O'Brien, R. Issa, J. Geunes, D. Conway, Sherman Bai

A FPN is an association of firms that work together to fabricate products to order with short lead times and variable demand. This association can be short-lived or long-standing as dictated by market requirements. We develop a flexibly configurable information hub that can link to a firm's internal system and provide a shared infrastructure to support FPN operations...

4) Entropy Methods in Decision Analysis Practice, Ali Abbas, Stanford University, MS & Engineering, Stanford, CA 94305, aliabbas@leland.stanford.edu

In many decision analysis applications, a decision-maker is interested in a quantity theta. He consults an expert who provides 5 fractiles or a full probability distribution. Using entropy methods, we construct a distribution very similar to the original distribution and also filter off "bad" points acquired during the assessment. I also show entropy applications to the aggregation of expert opinion.

WC18 Advances in Medical Treatment & Diagnosis

Cluster: Health & Medical Applications

Invited Session

Chair: Ariela Sofer, George Mason University, SEOR Dept., MS 4A6, Fairfax, VA 22030, asofer@gmu.edu, www.gmu.edu/departments/ore/sofer.html

1) Optimal Radiation Therapy Planning: A Mixed Integer Approach, Felisa Preciado, Purdue University, Sch. of IE, West Lafayette, IN 47907, preciado@ecn.purdue.edu, Ronald L. Rardin, Mark Langer

In IMRT radiation cancer treatment, beams are partitioned into a grid of separately controlled beamlets. The objective is to maximize tumor dose subject to radiation surrounding normal tissues tolerances. We investigate the use of a MILP and column generation to compute a solution within a known tolerance of the optimum.

2) Optimization of Biopsy Schemes for Detection of Prostate

Monday 08:00-09:30

- MA01 Optimizing Configure-to-Order Supply Chains
 MA02 Models Arising from Manufacturing & Retailing Operations
 MA03 FMS & Supply Chain Flexibility
 MA04 Auctions in Scheduling
 MA05 Factory Operations Research Center Program
 MA06 Scheduling Problems
 MA07 Tutorial: The Principal-Agent Paradigm & its Applications in Operations Management
 MA08 Enhancing Global Optimization Models & Algorithms
 MA09 Advances in Nonlinear Optimization
 MA10 Data Analysis in Reliability
 MA11 Tutorial: Stochastic Integer Programming: Applications & Methods
 MA12 Virtual Collaborative Design, Manufacturing, Engineering Management & Education
 MA13 Quality Issues in Manufacturing
 MA14 Information Technology & Decision Analysis
 MA15 Markov Modeling
 MA16 New Models in DEA
 MA17 Network Routing Algorithms
 MA18 Diagnosis & Disease Control
 MA19 Tutorial: So You Want to be an OR Consultant?
 MA20 Modeling Distributed Generation in Large-Scale Energy Systems Modwls
 MA21 Tutorial: Fixing an Ailing Air Traffic Control System
 MA22 New Product Development

Monday 09:45-10:45

- MP04 Plenary: Engineering at the National Science Foundation

Monday 11:00-12:30

- MC01 Dynamic Pricing
 MC02 E-Commerce & Supply Chain Strategy: Research Opportunities
 MC03 Panel: Flexibility in Non-Traditional FMSs
 MC04 Health Care Operations
 MC05 Scheduling & Dispatching in Semiconductor Manufacturing
 MC06 Flow-Shop Scheduling
 MC07 Competition & Incentives in Supply Chains
 MC08 Nonconvex Optimization Problems
 MC09 Large-Scale Constrained Optimization Algorithms
 MC10 Optimization Models for the Reserve Site Selection Problem
 MC11 Applications of Stochastic Programming
 MC12 Tutorial: Extended Enterprise Integration
 MC13 The Role of E-Commerce in Manufacturing & Service Quality
 MC14 Advances in Decision Analysis
 MC15 Some Recent Single Server Queueing Models
 MC16 New DEA Applications
 MC17 Design of Survivable Networks
 MC18 Scheduling in Health Care
 MC19 IFORS Tutorial: OR/MS Tutorials on the WWW: An Overview of the IFORS TutORial Project
 MC20 Optimization & Equilibrium Modeling in Energy
 MC21 Transportation in the Airline Industry
 MC22 Project Management

Monday 16:00-17:30

- MD01 Supply Chain Optimization in Practice I
 MD02 Supply Contracts: Issues & Models
 MD03 FMS Planning & Scheduling Models
 MD04 OR Methods in Logistics Planning
 MD05 Modeling & Analysis of Semiconductor Manufacturing
 MD06 Production & Scheduling Applications

- MD07 Contracting, Coordination, Information Sharing & Optimization in Supply Chains
 MD08 Topics in Global Optimization
 MD09 Computational Methods for Some Nonlinear Problems
 MD10 Advances in Discrete Optimization Methods
 MD11 Applied Stochastic Programming
 MD12 Financial & Economic Analysis of Online Businesses
 MD13 International Quality Issues
 MD14 Behavioral Issues in Decision Theory
 MD15 Control of Queues
 MD16 Regulatory DEA Models
 MD17 Network Topology & Dimensioning
 MD18 Integer Programming Techniques to Medical Applications
 MD19 Networks & Graphs
 MD20 Mathematical Programming & Electricity Markets
 MD21 Transportation Scheduling
 MD22 Management of Technology

Monday 17:45-19:15

- ME01 Supply Chain Optimization in Practice II
 ME02 Lead-Time Management
 ME03 Supply Management in the Manufacturing Industry
 ME04 Models of Product Variety
 ME05 Tutorial: Collaborative Planning & Scheduling in Supply Chains in the Digital Economy
 ME06 Scheduling I
 ME07 Scheduling & Incentives in Lead Time Quotation
 ME08 Stochastic Methods in Global Optimization
 ME09 Methods for Large-Scale Optimization Problems
 ME10 Polyhedral Approaches in Integer Programming
 ME11 Stochastic Programming Applications
 ME12 Online Consumer Behavior
 ME13 Manufacturing & Service Quality Models
 ME14 Decision Analysis Arcade
 ME15 Applications of Probability in Queues
 ME16 Modeling Issues in DEA
 ME17 Design of WDM-Based Optical Networks
 ME18 Health Applications
 ME19 Networks
 ME20 Energy I
 ME21 Vehicle Routing
 ME22 Education

Tuesday 08:00-09:30

- TA01 Supply Chain Management in Business-to-Business Exchanges
 TA02 Supply Chain Management & the Market
 TA03 Supply & Demand Management in the Airlines
 TA04 Analytic Models for Supply Chain Management
 TA05 Tutorial: Dynamic Pricing Strategies to Improve Supply Chain Performance
 TA06 Scheduling II
 TA07 Marketing Applications
 TA08 Frontiers in Global Optimization
 TA09 Advances in Optimization Theory & Practice
 TA10 Branch Decomposition & Tree Decomposition Applications
 TA11 Stochastic Programming Models & Methods
 TA12 Panel: E-Business Models & Strategy - Theory in Action
 TA13 E-Services Design
 TA14 Medical Decisions, or MAU in Maui
 TA15 Reliability & Maintainability Models
 TA16 Data Envelopment Analysis I
 TA17 Telecommunications Networks Designs
 TA18 Tutorial: The Logical Analysis of Data
 TA19 Logistics I
 TA20 Energy II
 TA21 Dynamics of Organizational Design

TA22 Workshop on Modeling: How to Teach & Open Research Questions

Tuesday 09:45-10:45

TP04 Omega Rho Distinguished Lecture: Parallel Computing & Integer Programming

Tuesday 11:00-12:30

TC01 Operations Research Applications on Supply Chain Management
 TC02 Supply Chain Pricing & Coordination
 TC03 Issues in New Product Introduction
 TC04 Multi-Echelon Inventory & Supply Chain Management
 TC05 Tutorial: Inside Discrete-Event Simulation Software - How it Works & Why it Matters
 TC06 Intelligent Manufacturing
 TC07 Customer Relations
 TC08 New Methods in Global Optimization
 TC09 Topics in Nonlinear Optimization
 TC10 Research Related to COIN OR: The Common Optimization Interface for Operations Research
 TC11 Tutorial: Constraint Programming for Math Programmers
 TC12 Marketing Issues on the Internet
 TC13 Service Strategies in the Financial Sector
 TC14 Decision Analysis is Not Value Free: Issues & Challenges from Decision Conferencing
 TC15 Inventory Control with Unknown Stochastic Demand
 TC16 Data Envelopment Analysis II
 TC17 Tutorial: Storage Area Network Design
 TC18 Boolean & Pseudo-Boolean Functions
 TC19 Logistics II
 TC20 Tutorial: Dynamic Programming - A Multi-Faceted View
 TC21 Organization Theory I
 TC22 From Decision Models to Decision Support: Case Study of Electrical Power Districting Problem in the Republic of Ghana

Tuesday 16:00-17:30

TD01 Aspentech/UCC Alliance MIMI Integrated Demand Management, Planning & Scheduling Supply Chain Optimization Solutions
 TD02 Supply Chain Optimization I
 TD03 Supply Chain Inventory
 TD04 Inventory Management
 TD05 Simulation Methodology
 TD06 Capacity Management & Allocation
 TD07 Marketing
 TD08 GRASP
 TD09 Nonlinear Programming I
 TD10 Applications in Integer Programming
 TD11 New Directions in Modeling Tools for Optimization
 TD12 E-Commerce I
 TD13 Service Performance
 TD14 Multicriteria Decision Making I
 TD15 Fluid Models
 TD16 Finance: Risk Management
 TD17 Korean Telecommunications Industry
 TD18 Boolean Functions, Learning, Inference & Knowledge Representation
 TD19 Revenue Management Applications
 TD20 Option Values in Dynamic Optimization
 TD21 Organization Theory II
 TD22 Location Theory Research in Japan

Tuesday 17:45-19:15

TE01 Industrial Research in Supply Chain Management
 TE02 Supply Chain Optimization II
 TE03 Inventory Issues in Supply Chains

TE04 Dynamic Pricing & Supply Contracts
 TE05 Simulation Applications
 TE06 Facilities Planning & Design
 TE07 Business Applications
 TE08 Optimization in Networks & Graphs
 TE09 Nonlinear Programming II
 TE10 Network Design I
 TE11 Modeling Tools for Hybrid Optimization
 TE12 E-Commerce II
 TE13 Explorations in Service Design
 TE14 Multicriteria Decision Making II
 TE15 Analysis of Queuing Systems
 TE16 Finance: Theory & Empirics
 TE17 Telecommunications Management & Planning
 TE18 Pseudo-Boolean Functions & Applications to Graphs & Networks
 TE19 Statistics/Quality Control
 TE20 Applications of Dynamic Optimization in Transportation
 TE21 Economics
 TE22 Hub Location

Wednesday 08:30-10:00

WA01 Manufacturing
 WA02 Supply Chain Optimization III
 WA03 Global Supply Chains
 WA04 Pricing & Contracts
 WA05 Tutorial: Simulation
 WA06 Analytic Hierarchy Process I
 WA07 Cost/Performance Analysis
 WA08 Global Optimization - Topics
 WA10 Network Design II
 WA11 Heuristic Programming
 WA12 E-Commerce III
 WA13 Panel: Conducting Multi-Country Research - Lessons from the International Service Study
 WA14 Multicriteria Decision Making III
 WA15 Probability Applications
 WA16 Strategic Planning
 WA17 Telecommunications Traffic
 WA18 Military Applications I
 WA19 Quality Management
 WA20 Dynamic Transportation
 WA21 Forecasting
 WA22 Location Models I

Wednesday 10:15-11:45

WB01 Industrial Applications I
 WB02 Supply Chain Optimization IV
 WB03 Supply Chain Planning
 WB04 Distribution Techniques for the New Economy
 WB05 USMC Project Albert
 WB06 Analytic Hierarchy Process II
 WB07 Auctions/Competitive Bidding
 WB10 Integer Programming
 WB11 Modeling Systems & Languages
 WB12 E-Commerce IV
 WB13 Service & Travel
 WB14 Group Decisions & Negotiation
 WB15 Applied Probability
 WB16 Planning
 WB17 Telecommunications Applications
 WB18 Military Applications II
 WB19 Reliability
 WB20 Dynamic Optimization
 WB22 Location Models II

Wednesday 12:00-13:30

WC01 Industrial Applications II
 WC02 Supply Chain Optimization V

- WC03 Supply Chain Management
- WC04 Algorithmic Techniques in Manufacturing
- WC11 Information Systems
- WC13 Service Applications
- WC14 Decision Support Systems
- WC18 Advances in Medical Treatment & Diagnosis

- Abbas, Ali WC14
 Abdekhodaee, Amir H. TA06
 Abdel-Malek, Layek MA03, MC03, MD04
 Adu, Lily M. ME18
 Afeche, Philipp WA04
 Agarwal, Yogesh K. WB17
 Aggarwal, Lalit K. TE19
 Agnihothri, Sal TE15
 Agrawal, Mani TA01
 Agrawal, Naren MC02, TD04
 Agrawal, Vipul MC02
 Agrell, Per J. MD16
 Ahmed, Shabbir MA08, TA11, WA02
 Ahn, Hyun-Soo ME07
 Aiex, Renata M. TD08
 Akcay, Yalcin TC02
 Alfa, Attahiru S. MC15
 Alfaro, Jose ME04
 Al-Khayyal, Faiz A. MA08
 Almeida, Adiel T. MC22, TD14, TE14, WA14
 Alptekinoglu, Aydin MA02
 Anand, Krishnan S. MC02
 Andersen, Knud D. WB10
 Anderson, Charles L. ME19
 Anderson, Jr., Edward G. TC04
 Andrews, Rick L. ME12
 Ano, Katsunori WB14
 Antunes, Carlos H. MA16
 Aparajita, Upali WC01
 Arbel, Ami WA06
 Ariyawansa, K. A. ME11
 Armbruster, Dieter ME03
 Aron, Ravi MC02
 Arroyo, Jose M. MD20
 Arthur, Jeffrey L. MC10
 Askin, Ronald G. WC04
 Atamturk, Alper TE10, WA10
 Athanassopoulos, Antreas D. MC16, TC13, TD13
 Aviv, Yossi TC15
 Avkiran, Necmi K. TA16
 Awdeh, Ra'ed MC17
 Aykin, Turgut MA01
 Azarmi, Ted MD12
 Azizoglu, Meral MC06
 Badillo, Dominique MC16
 Badillo, Patrick-Yves MC16
 Bahiense, Laura WA10
 Bai, Sherman TD12, WC14
 Bain, Daniel J. MC10
 Bala, Kamel TD16
 Balakrishnan, S. MC20
 Balut, Stephen J. WA18
 Barahona, Francisco TC10, WA10
 Barboza, Angela O. WB17
 Barhen, Jacob TA08
 Barnes, Earl R. WA02
 Bassok, Yehuda WC02
 Bastos, Roselita C. MD13
 Batta, Rajan MD01
 Battle, P. D. WA08
 Baucells, Manel MC14
 Baumert, Stephen ME08
 Beamon, Alan MA20
 Bean, James C. TA15
 Beattie, Scott D. TE19
- Beltran, Jose TE01
 Benaroch, David TD16
 Bengtsson, Jens WA03, WA04
 Benson, David E. WA20
 Bergeron, Jasmin TC07
 Bergey, Paul K. TC22
 Berk, Emre TE03
 Berman, Oded WB22
 Beyer, Dirk M. TE01
 Bhadury, Joy WA22
 Bhattacharjee, Deb WA03
 Bieda, Boguslaw WB11
 Biller, Stephan R. ME03
 Bioch, Jan C. TD18
 Biosca, Albert Ferrer MD08
 Birge, John R. WB07
 Bish, Douglas R. TA03
 Bish, Ebru ME03, TA03
 Bisi, Arnab TC15
 Bixby, Ann TD01
 Blair, Montgomery TD19
 Bliemer, Michiel WA20
 Bock, Stefan TA19
 Bogetoft, Peter MD16
 Boiney, Lindsley G. ME22
 Boland, John J. MC10
 Boland, Natasha TD10
 Bollapragada, Ramesh TE17
 Bomze, Immanuel M. MD08
 Boros, Endre TC18, TD18
 Bose, Ranjit WC11
 Bosnjak, Ivan TA07, TE07, WA17
 Bovy, Piet WA20
 Bradley, James R. ME03, TD04
 Brandstein, Alfred WB05
 Brayman, Vladimir TD02
 Breithauer, Kurt M. TE09
 Bricker, Dennis L. ME18
 Brill, Percy H. MC15
 Brom, James MD01
 Brothers, Alan J. TA14
 Brown, Alexander O. MA02
 Brown, Paul D. WA03
 Bulger, David ME08
 Burke, James V. MA09
 Burnetas, Apostolos N. WA04
 Burton, Richard M. TA21
 Buzacott, John A. MD07, TD04
 Byrd, Richard MC09
 Cabral, Edgar MA15
 Cai, Xiaoliang MA06
 Cakanyildirim, Metin MA06
 Calado, Lara TD14
 Calli, Ismail ME18
 Caminada, Alexandre TA17
 Camm, Jeffrey D. MC10
 Campagnac, Luiz Antonio P. WA19
 Campbell, James F. TE22
 Canbolat, Yavuz Burak WB06
 Carlyle, Matt MA05, MC05, MD05, MD06
 Carnieri, Celso WB17
 Carr, Robert ME10
 Carr, Scott MC07
 Casal, Ricardo N. ME06
 Cassady, C. Richard TA15
 Castano-Pardo, Alberto MD01
 Catlow, C. R. A. WA08
- Causevic, Samir TA07
 Cavalcante, Cristiano A. V. TE14
 Cekic, Sefkija TA07
 Chabini, Ismail WA20
 Chae, Kyung C. ME15
 Chakravarthy, Srinivas R. TE15
 Chakravarty, Amiya K. MA03, MC03
 Chambers, Chester G. TE13
 Chan, Lap Mui Ann TE04
 Chandra, Pankaj MD07
 Chang, Te-Min TD12
 Chao, Hung-Po TC09
 Chao, Yi-Ju ME19, WA17
 Charlton, Bill MC11
 Charnay, Pedro WA14
 Chase, Richard B. WA13
 Chaudhry, Mohan L. ME15
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 Chen, Chia-Yu MC21
 Chen, Connie MC21, TA03
 Chen, Huifen TD05
 Chen, Jian WB07
 Chen, Li-Wen MD21
 Chen, Rachel MC04
 Chen, Shaoxiang TE03
 Chen, Tom ME17
 Chen, Xilong WB07
 Chen, Yao MA16
 Cheng, Feng MA01, MD02
 Cheng, Liuying TD05
 Cheon, Hyeonjae WA12
 Cheung, Stephane L. TE07
 Chien, Steven MD04
 Chin, Francis TE08
 Cho, Hyunbo TC06
 Cho, In-Hyung WA12
 Cho, Sang-Sup WA21
 Cho, Sungeui WB13
 Choi, Dae-Won TC19
 Choi, Sangjin MA06, WB15
 Choi, Yong-Chan WC04
 Chong, Juin Kuan MA02
 Choulli, Tahir TD16
 Christian, Jr., William A. TA10
 Chung, William S. W. MC20
 Cil, Ibrahim WB06
 Clemen, Robert T. MD14, ME14
 Co, Henry C. WA01
 Cohen, Danielle A. TC01, TD01
 Cohen, Morris A. MC02
 Cohn, Wolf TD02
 Colbourn, Charles J. ME17
 Coleman, Nastaran TA20
 Conejo, Antonio MD20
 Contreras, Javier MD20
 Conway, D. WC14
 Cook, Wade D. MA16, TD16
 Corbett, Charles J. MA02, ME04
 Corral, Rafael E. ME06
 Costa, Carlos Bana e TC14
 Costa, Helder Gomes MD13, TD14
 Coullard, Collette R. WA22
 Coy, Steven P. TA03
 Crowder, Harlan MA19
 Cupers, Sascha MC18
- Currim, Imran S. ME12
 Dahl, Geir MD19
 Dai, Christine X. TC21
 Dan, H. MD09, ME09
 Dang, C. Y. MD09
 Daniels, Richard MC01
 Daniilidis, A. MD08
 Daskin, Mark S. WA22
 Dasu, Sriram WC02
 Datta, Deepak TD21
 Davenport, Andrew J. MC01
 Davidoff, Donald M. TD19
 Dawande, Milind W. MA06
 de Brito, Marisa TE02
 de Gouvea, Silvio R. B. TD16
 de Klerk, Etienne MD08
 de la Torre, Sebastian MD20
 de Matta, Renato E. MC18
 de Medeiros, Denise D. MD13, WA19
 de Oliveira, Giovanilza M. P. MD13
 De Reuck, John D. TC14
 de Sousa, Amaro F. MD17
 DeMiguel, Angel-Victor TC09
 Deng, Shi-Jie TD20, WA02
 Deng, Xiaotie TE08
 Deshpande, Vinayak V. WC02
 Desiraju, Ramakrishna MD01
 Desouza, Kevin C. TE16
 Dethloff, Jan TE02
 Devpura, Amit MC05
 Dharmani, Sven WA03
 Dheeriyaa, Prakash L. MD12
 Dillon, Robin MA14
 Ding, Guoli TE08
 Dinur, Adva TD21
 Diwekar, Urmila MD11, TD20
 Docef, Alen MA18
 Dolan, Elizabeth TD11
 Dominguez-Ballesteros, Belen TD02
 Donoso, Patricio WB16
 Dookyung, Kim TD17
 Doverspike, Robert D. MC17
 Downs, Brian T. TC01
 Drezner, Zvi WB22
 Dryer, David A. MA12
 Du, DingZhu TE08
 Duarte, Dayse C. WA14
 Duenyas, Izak ME07
 Duer, Mirjam MD08
 Dyer, James S. MA14
 Easton, Todd ME10
 Edirisinghe, Chanaka ME11
 Edwards, Ward TA14
 Einolf, Karl MC16
 Elbassioni, K. TC18
 Ellis, Peter M. TE16
 Ellis, Robert TD01
 Elmaghraby, Wedad MA04
 Elshafei, Moustafa MD10
 Elwalid, Anwar MA17
 Endo, Riyo WB14
 Enns, S. T. WB15
 Erevelles, S. ME12, TC12
 Erghott, M. TD10
 Erhun, Feryal ME03
 Ericsson, Marten MA17
 Erkoc, Murat TE04

- Ernst, Andreas TE22
 Ervolina, Thomas R. MA01
 Eso, Marta MA04
 Esogbue, Augustine O. TC20
 Ettl, Markus MA01, MA02, MC01
 Evans, Lisa ME10
 Evirgen, Hayrettin ME18
 Eynon, Robert T. MA20
 Faco, Joao-Lauro D. TA20
 Fampa, Marcia H. C. MD19
 Fan, Jin-Yan MA09
 Fan, Miao MC22
 Fan, Shu-Kai S. TE09
 Fanchon, Phillip F. TC16
 Farris, George F. MD22
 Farver, Jennifer WA20
 Feinberg, Eugene A. TA15
 Felli, James C. MC14, ME14
 Felt, Andrew ME11
 Fernandez, Emmanuel MA05
 Fethi, Meryem D. TA16
 Filho, Jose R. Farias TD16
 Fisher, Ron MA18
 Fittipaldi, Eduardo H. D. TD14
 Flores, Idalia WB10
 Floudas, C. A. MA08
 Foldes, Stephan TC18
 Fong, Duncan K. TE19
 Forsund, Finn R. TC16
 Fourer, Robert TC11, TD11
 Fowler, John W. MA05, MC05, MD05, MD06
 Fox, Craig R. MD14
 Francis, Richard L. WB22
 Franco, John TC18
 Franses, Philip Hans TA07
 Fraticelli, Barbara M. P. MA08
 Freire, Fausto TE02
 Freitas, Andre L. P. MD13, TD14
 Frohlich, Mark TC13
 Fry, Michael TA04
 Fu, Michael C. MA05
 Fu, Yan WA11
 Fujisaki, Norman T. MA21
 Fukushima, Masao MD09, ME09, TD22
 Gaalman, Gerard MD22
 Gabriel, Steven A. MC20
 Gagne, Caroline WC04
 Gale, J. D. WA08
 Galiana, Francisco D. MD20
 Gallego, Guillermo ME02, WB02
 Gannon, Frederic WA16
 Gao, Yubo WB06
 Garland, Buddy MA20
 Gatto, Antonino Del TA09
 Gaver, Donald P. MD15
 Gay, David M. TD11
 Gel, Esma S. MC05, MD05, ME03
 Gelb, Betsy D. TC12
 Gempesaw, Conrado TE21
 Geunes, J. WC14
 Ghosh, Diptesh MD10
 Ghosh, Soumen WA03
 Gilbert, Stephen M. WA04
 Giloni, Avi TC03
 Giokas, Dimitris MC16
 Glazebrook, Kevin D. MD15
 Glenn, David W. TC15
 Goetschalckx, Marc MA08, WA02
 Goh, M. WA01
 Golany, Boaz MD04
 Goldschmidt, Olivier MD10
 Gomes, L. F. A. M. TD07
 Gonvalves, Danilo A. TC16
 Gonzalez, Richard WA14
 Goodstein, Jon B. WB01
 Goossens, Joel MD05
 Gopalakrishnan, Mohan WB01
 Gouveia, Luis MD17, MD19
 Grahovac, Jovan MC07
 Grassmann, Winfried K. MA15
 Gravel, Marc WC04
 Green, Linda V. ME13
 Grey, William MC01
 Grieco, Marianne TD19
 Grossman, Thomas A. TA22
 Gruca, Thomas S. ME18
 Grundei, Jens TA21
 Guan, Sichong MC22
 Gue, Kevin R. WB04
 Guide, Daniel R. ME20
 Guler, Kemal TE01
 Gullede, Thomas R. MC12
 Gumus, Z. MA08
 Gunalay, Yavuz TD03
 Gunasekaran, Angappa WB12
 Gundogar, Emin ME18, WB06
 Gung, Roger R. MA01
 Gunluk, Oktay TE10
 Guo, R. TE16
 Guo, Xin MC01
 Gupta, Diwakar ME07, TD03
 Gupta, Sudheer MC07
 Gupta, U. C. ME15
 Gurler, Ulku TE03
 Gurvich, V. TC18
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 van Norden, Linda WB07
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 Vladimirov, Efi TC21
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 White, Chelsea C. WA20, WC14
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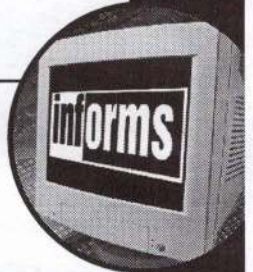
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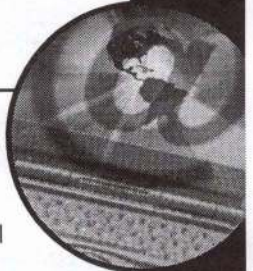
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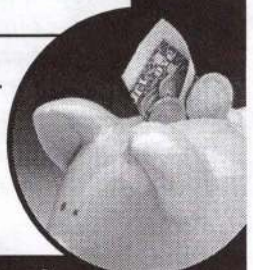
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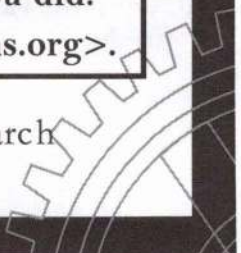
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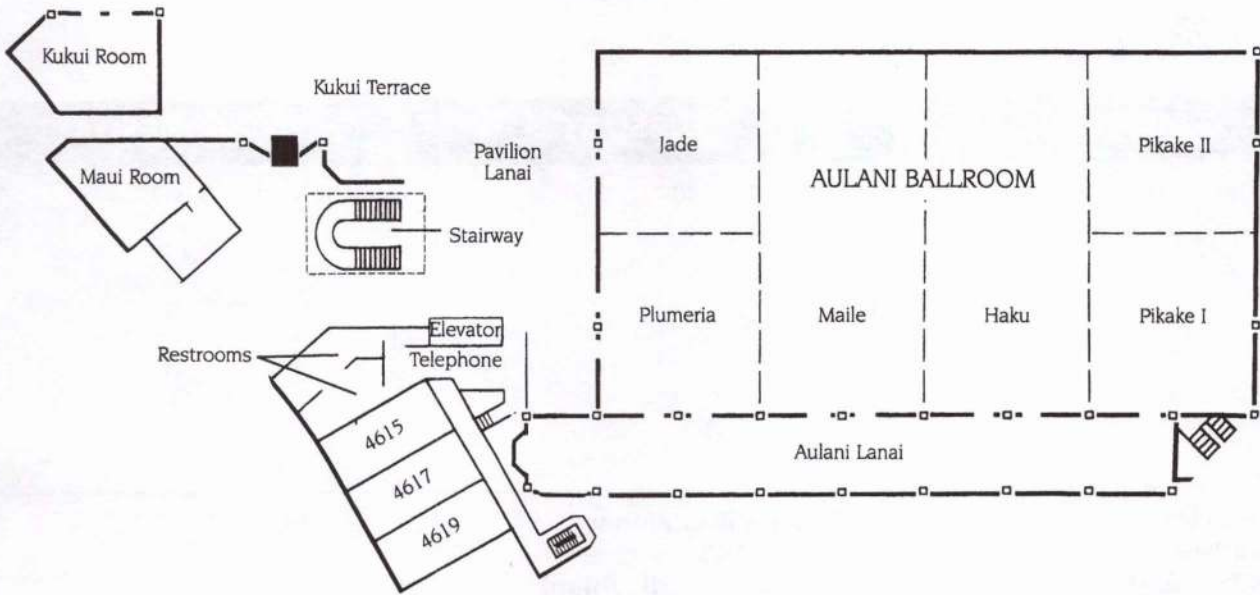
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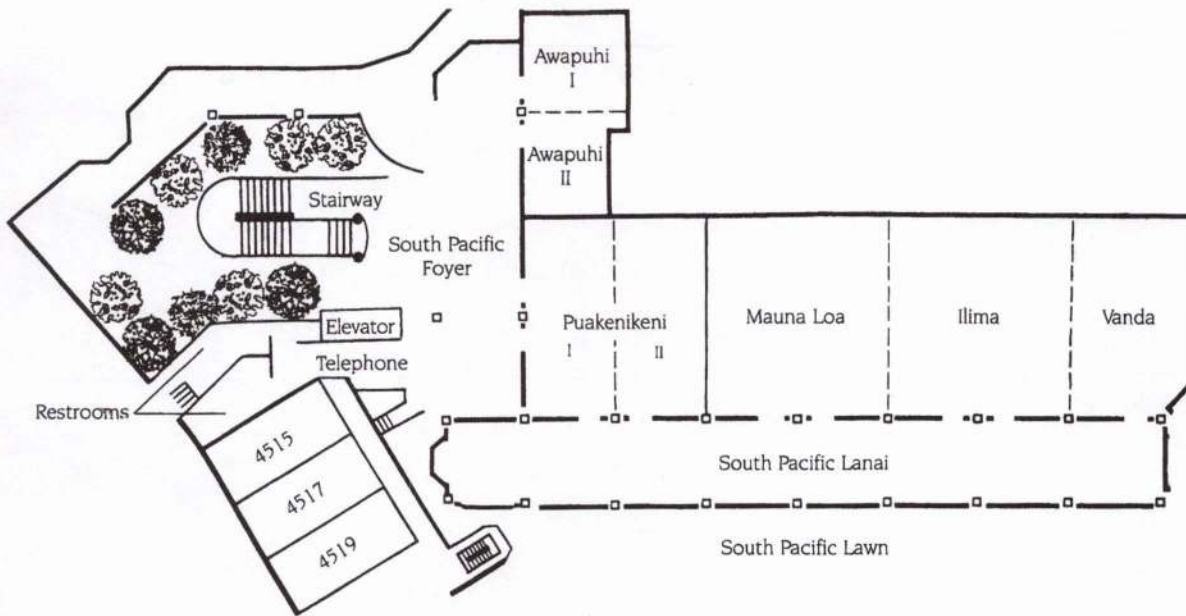
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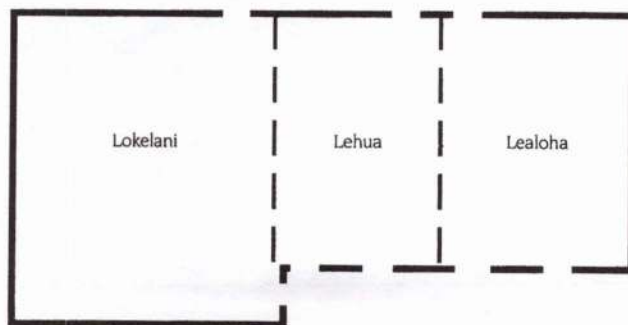
Aulani Ballroom – Lobby Level South Conference Pavilion



South Pacific Ballroom – Conference Level South Conference Pavilion



Lokelani Ballroom – Lobby Level





Daily Planner

MONDAY	TUESDAY	WEDNESDAY
MA 8:00 - 9:30	TA 8:00 - 9:30	WA 8:30 - 10:00
Invited Plenary 9:45 - 10:45 Louis Martin-Vega	Omega Rho Plenary 9:45 - 10:45 William R. Pulleyblank	WB 10:15 - 11:45
MC 11:00 - 12:30	TC 11:00 - 12:30	WC 12:00 - 1:30
MD 4:00 - 5:30	TD 4:00 - 5:30	
ME 5:45 - 7:15	TE 5:45 - 7:15	

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		MONDAY, JUNE 18TH				TUESDAY, JUNE 19TH				WEDNESDAY, JUNE 20TH		
		MA	MC	MD	ME	TA	TC	TD	TE	WA	WB	WC
ROOM	TRACK	8:00-9:30	11:00-12:30	4:00-5:30	5:45-7:15	8:00-9:30	11:00-12:30	4:00-5:30	5:45-7:15	8:30-10:00	10:15-11:45	12:00-1:30
Pikaki 1	1	End-to-End Supply Chain Management							Manufacturing	Industrial Applications		
Pikaki 2	2	Supply Chain Management					Supply Chain Optimization					
Awapuhi 1	3	Flexible Manufacturing			Supply & Demand Mgmt.		MSOM	Supply Chain				
Male-Haku Aulani Ballroom	4	MSOM										
Awapuhi 2	5	Semiconductor Manufacturing			Mike Pinedo		David Simchi-Levi	Tom Schriber	Simulation	Simulation		
Conference 4515	6	Production Scheduling		Production Scheduling			Intelligent Manufacturing	Capacity Mgmt. & Allocation	Facility Planning & Design	AHP		
Conference 4517	7	Competition & Incentives				Marketing			Business Applications	Cost Performance	Auctions	
Lokelani 3	8	Global Optimization										
Plumeria	9	Nonlinear Optimization					Nonlinear Programming					
Lobby 4615	10	QSR	Environmental Optimization Models	Computational Mixed Integer Programming			Integer Programming					
Mauna Loa	11	Suvrajeet Sen	Stochastic Programming			Robert Fourer	Optimization Modeling Languages		Heuristic Programming	Modeling Systems & Languages	Information Systems	
Lokelani 2	12	Virtual Collaboration	Tom Gullledge	E-Commerce		E-Commerce			E-Commerce			
Ilima	13	Issues in Service & Manufacturing Quality				Service Strategy & Design				Service		
Jade	14	Decision Analysis					MCDM			Group Decision Making	Decision Support	
Lokelani	15	Applied Probability				Applications of Applied Probability					Applied Probability	
Lobby 4617	16	Data Envelopment Analysis				Data Envelopment Analysis		Finance		Strategic Planning	Planning	
Vanda	17	Telecommunications					Julie Ward et al.	Telecommunications				
Lobby 4619	18	Medical & Health Applications			Health Applications	Peter Hammer	Boolean Functions			Military Applications		Health Applications
Puakenikeni 2	19	Harlan Crowder	Moshe Sniedovich	Networks		Logistics		Revenue Management	Statistical QC	Quality Mgmt.	Reliability	
Puakenikeni 1	20	Energy					Augustine Esogbue	Dynamic Optimization			Dynamic Programming	
Lobby 4621	21	Norman Fujisaki	Transportation			Organization Science	Organizational Theory		Economics	Forecasting		
Kukui	22	New Product Development	Project Management	Management Of Technology	Education	Education		Location Analysis				