

北京

INFORMS  
INTERNATIONAL  
*Beijing* 2012

*In conjunction with*  
The Operations Research Society of China  
and Tsinghua University

China National Convention Center ▪ Beijing, China



*June 24-27, 2012*

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*Copies of papers abstracted in the meeting program are available only from the authors. Requests for papers should be sent to the authors at the addresses shown in the program. Published annually prior to the meeting by the Institute for Operations Research and the Management Sciences. Individual issues of the program are available for \$20US + shipping and handling per copy. Orders must be prepaid and sent to INFORMS, PO Box 632820, Baltimore, MD 21263.*



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## 清华大学

Tsinghua University

欢迎 - Welcome

### 2012 INFORMS Beijing Meeting

On behalf of the Organizing and Program Committees, I warmly welcome you to Beijing and the 2012 INFORMS International Conference. Thanks to your wonderful participation, we are able to put together an impressive program with 1100 plus abstracts in over 280 invited and contributed sessions.

The theme of the conference is OR/MS for a Sustainable World. The role of OR/MS in the delivery of social, environmental and economic benefits is increasing in importance, but there are also unique challenges as well as opportunities. The 2012 INFORMS International Conference will be a showcase of relevant research that addresses these challenges and opportunities in the OR/MS context. In addition to the scientific program, a welcome reception and a banquet will be held on June 24 and 26, respectively. These will provide networking opportunities for all participants; and I wish everyone a fruitful experience.

Beijing has served as the capital of China for long periods of time over the country's 5,000-year history. One can imagine the past glory of imperial China from the numerous historical landmarks such as the Forbidden City, the Summer Palace, the Great Wall, the Temple of Heaven and the Ming Tombs, and many others. Moreover, Beijing has undergone many changes in recent years and is fast becoming a thoroughly modern and cosmopolitan city. I hope while here you will find time to enjoy the city as well as the conference.

The conference has been blessed with the generous support and able assistance from many people and organizations. I would like to express my sincere thanks to all the speakers for their contributions, in particular to the keynote speakers, Dr. Brenda Dietrich, Professor Darrell Duffie, Professor Avishai Mandelbaum and Dr. Yuzhuo Zhang. I would also like to extend my appreciation to all the program committee members and organizing committee members for their tireless effort, particularly Professors David Yao, Jim Dai, Xiuli Chao and Xin Chen for handling the many program details that are essential to putting together a world-class conference. Most specially, I would like to thank INFORMS meetings staff and all the conference secretariat staff for their hard and outstanding work.

Finally, I would like to thank all the sponsoring organizations for their generous financial support; these include the following companies: AIMMS, AMPL, GAMS, IBM, LINDO, Gurobi Optimization and SAS; and the following academic institutions: Business School of Nankai University, Cheung Kong Graduate School of Business, Department of Systems Engineering and Engineering Management of the Chinese University of Hong Kong, School of Economics and Management of Beihang University, School of Economics and Management of Tsinghua University, School of Management of Xiamen University, School of Management and Economics of Beijing Institute of Technology, School of Management and Economics of University of Electronic Science and Technology of China, School of Management and Engineering of Nanjing University, Singapore University of Technology and Design, Research Center for Contemporary Management-Key Research Institute of Humanities and Social Sciences at Universities; and National Natural Science Foundation of China.

Once again, welcome to the 2012 INFORMS International Conference. I wish you all a wonderful time in Beijing!

A handwritten signature in black ink, appearing to read 'Jian Chen'.

Jian Chen  
General Chair

All technical sessions are held at the China National Convention Center. Please refer to the maps on pages 14-15 for the location of the session tracks.

## Thank You

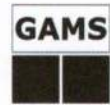
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### BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS International Beijing Meeting 2012 badges must be worn to all sessions. Badges will be checked at the entrance to technical session areas. Attendees without badges will be directed to the registration desk to register and pick up their badges. All attendees, including speakers and session chairs, must register and pay the registration fee.

### SATURDAY, JUNE 23

4:00pm-7:00pm Registration Main Lobby B

### SUNDAY, JUNE 24

7:00am-6:00pm Registration Main Lobby B  
 9:00am-4:00pm Exhibits Main Lobby C  
 9:00am-10:30am Technical Sessions (SA) Convention Center, Level 2  
 10:30am-11:00am Coffee Break Main Lobby C  
 11:00am-12:30pm Technical Sessions (SB) Convention Center, Level 2  
 12:30pm-2:00pm Lunch Break (on your own) Convention Center, Level 2  
 2:00pm-3:30pm Technical Sessions (SC) Main Lobby C  
 3:30pm-4:00pm Coffee Break Convention Center, Level 2  
 4:00pm-5:30pm Technical Sessions (SD) Ballroom A  
 6:00pm-7:30pm Welcome Reception

### MONDAY, JUNE 25

7:00am-6:00pm Registration Main Lobby B  
 8:00am-9:30am Technical Sessions (MA) Convention Center, Level 2  
 9:00am-4:30pm Exhibits Main Lobby C  
 9:30am-9:50am Coffee Break Main Lobby C  
 9:50am-10:50am Omega Rho Distinguished Lecture: Darrell Duffie Function Hall AB  
 11:00am-12:30pm Technical Sessions (MB) Convention Center, Level 2  
 12:30pm-1:30pm Lunch Break (on your own) Convention Center, Level 2  
 1:30pm-3:00pm Technical Sessions (MC) Convention Center, Level 2  
 3:00pm-3:50pm Plenary: Avishai Mandelbaum Function Hall AB  
 3:50pm-4:30pm Coffee Break Main Lobby C  
 4:30pm-6:00pm Technical Sessions (MD) Convention Center, Level 2  
 6:00pm-7:30pm ISMS Reception for John Little Room 308

### TUESDAY, JUNE 26

7:00am-6:00pm Registration Main Lobby B  
 8:00am-9:30am Technical Sessions (TA) Convention Center, Level 2  
 9:00am-4:30pm Exhibits Main Lobby C  
 9:30am-9:50am Coffee Break Main Lobby C  
 9:50am-10:50am IFORS Distinguished Lecture: Brenda Dietrich Function Hall AB  
 11:00am-12:30pm Technical Sessions (TB) Convention Center, Level 2  
 12:30pm-1:30pm Lunch Break (on your own) Convention Center, Level 2  
 1:30pm-3:00pm Technical Sessions (TC) Convention Center, Level 2  
 3:00pm-3:50pm Plenary: Yuzhuo Zhang Function Hall AB  
 3:50pm-4:30pm Coffee Break Main Lobby C  
 4:30pm-6:00pm Technical Sessions (TD) Convention Center, Level 2  
 7:00pm-10:00pm Traditional Chinese Banquet Hot Spring Leisure City

*Buses will depart from the Convention Center (Tianchen East Road side) at 6:15pm. After dinner, the first returning bus will leave the restaurant at 9:00pm; the last bus will leave at 9:30pm..*

### WEDNESDAY, JUNE 27

7:00am-1:00pm Registration Main Lobby B  
 8:00am-9:30am Technical Sessions (WA) Convention Center, Level 2  
 9:00am-12:00pm Exhibits Main Lobby C  
 9:30am-10:00am Coffee Break Main Lobby C  
 10:00am-11:30am Technical Sessions (WB) Convention Center, Level 2  
 11:45am-1:15pm Technical Sessions (WC) Convention Center, Level 2

## REGISTRATION & GENERAL INFORMATION

### Badges Required for Technical Sessions

INFORMS International Beijing badges must be worn to all sessions and to the Welcome Reception. Badges will be checked at the entrance to technical session areas. *All attendees, including speakers and session chairs, must register and pay the registration fee.*

Your registration fee includes admittance to the complete technical program. Also included are the Sunday evening Welcome Reception, Tuesday General Reception, and morning and afternoon coffee breaks. No other meals are included.

### Messages

The best way for people to reach you is to contact you directly at your hotel. Please leave your hotel phone number with your colleagues and family members. Messages can be posted on a message board located near registration; you can contact colleagues attending the meeting using this message board. Please check the board periodically to see if you have received a message.

### Internet

You can purchase a wireless Internet card from the Business Centre located on the third floor of the convention center. The fees are (approx. in U.S.\$) \$13 for one day, \$18 for two days or \$21 for three days.

### Lunch/Food

These restaurants are located in the CNCC Grand Hotel:

#### Café Restaurant

Located on the second floor, the café offers an all-you-can-eat style buffet for breakfast, lunch and dinner. Hours: 6:30am-11:00pm.

#### Chinese Tea Bar

Enjoy a pleasant moment participating in a traditional Chinese tea ceremony. The Tea Bar is located on the second floor. Hours: 9:00am-11:00pm.

#### Delicatessen Shop

Located next to the lobby bar on the first floor, and featuring freshly made sandwiches, breads and cookies. Hours: 9:00am-9:00pm.

## SPEAKER GUIDELINES

### Audio-Visual Services

All session rooms will be equipped with LCD (computer) projectors, but please note that you need to bring your own computer or pre-arrange to share with others in your session. Please note that overhead projectors will NOT be available. Please follow these guidelines to ensure a successful presentation.

- Bring your laptop to your session. We recommend that you pre-arrange with other speakers in your session to ensure that at least one of you brings a laptop from which you can project your talks.
- Bring your power supply cord with you. We recommend that you do not attempt to run your presentation off the laptop battery.
- You may need an adaptor to connect your computer to the local voltage in Beijing (220).
- If your laptop is a Mac, you will need the appropriate adapter for the external video output.
- Arrive at your session at least 10 minutes before it begins. All presenters in a session should set up and test the connection to the projector before the session begins.
- We encourage speakers to put their presentations on a flash drive as a backup.

## PRESENTATION GUIDELINES

The room and location of your session are listed in the Technical Sessions section and in the Master Track Schedule. Please be on time for your session and check in with the session chair.

- Presentations are expected to be in English.
- Limit the presentation to key issues with a brief summary.
- Time your presentation to fit within your designated time span (determined by the number of speakers presenting in that session), leaving time for audience questions.
- You may bring copies of your paper or other handouts to distribute to the audience.
- No proceedings with complete papers are produced for this meeting. To obtain complete copies of any papers abstracted in the program, please contact the authors directly at the address supplied with each abstract.

### Questions about the Program, Last-Minute Presentation Changes or Cancellations

Come to the INFORMS Beijing Registration Desk if you have general questions about the meeting and/or questions about your own presentation.

### For Assistance during Your Session: Session Monitor Desks

Session Monitor Desks will be located in several areas of the Convention Center, staffed by students from Tsinghua University. If you have a problem in your session room (related to AV needs or any other requests), go to the Session Monitor Desk in the area to ask for assistance.

## SESSION CHAIR GUIDELINES

The role of the Chair is to coordinate the smooth running of the session. The Chair:

- Begins and ends each session on time. Each session lasts 90 minutes, with the time per presentation determined by the number of papers in the session. Equal time should be given to each paper.
- Introduces each presentation (just the title of the paper and the name of the presenting author).
- Ensures that presentations are made **in the order shown in the program**. This allows for "session jumping." If a speaker cancels or does not attend, the original time schedule should be adhered to rather than sliding every talk forward.
- Completes the session attendance form (forms will be in the room).
- We ask Session Chairs to notify us about any last-minute changes or cancellations; these changes will be posted outside the meeting rooms.

**SOCIAL EVENTS**

Admission to these social events is included in your conference registration. If your guest would like to accompany you to these events, you can purchase a guest registration (\$50US) when you arrive at the conference in Beijing.

**WELCOME RECEPTION**

Sunday, June 24

6:00pm-7:30pm (18:00-19:30)

Ballroom A, China National Convention Center

Jian Chen, General Chair of the Conference Committee, and Nicholas Hall, Treasurer of INFORMS, welcome you to Beijing and to the International Conference. We hope you will join us for this evening of friendship and fellowship. Hors d'oeuvres and beverages will be served (wine and cocktails are available for purchase).

Thank You



SINGAPORE UNIVERSITY OF  
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**INFORMS INTERNATIONAL  
ACTIVITIES COMMITTEE (IAC)**

The INFORMS IAC invites you to attend these special sessions during the meeting.

**Panel Discussion – Recent Developments in  
Industrial Engineering in Asia**

Sunday, SA13, 9:00am-10:30am

Room 210A

Moderator: Fugee Tsung, HKUST

Panelists include Paul Hsing Luh, National Chengchi University; Tae-Eog Lee, KAIST; Loon Ching Tang, National University of Singapore; and Li Zheng, Tsinghua University.

**Overview of INFORMS & Analytics Initiatives**

Sunday, SB13, 11:00am-12:30pm

Room 210A

This special session, chaired by Judy Jin, INFORMS Vice President of International Activities, and Nicholas Hall, INFORMS Treasurer, is jointly sponsored by the IAC and INFORMS Board. The presentation considers the history of INFORMS, INFORMS international activities and new initiatives in Analytics.

**CONFERENCE BANQUET & PERFORMANCE**

Tuesday, June 26, 6:15pm-10:00pm

Buses will depart from the Convention Center (Tianchen East Road side) at 6:15pm. After dinner, the first returning bus will leave the restaurant at 9:00pm; the last bus will leave at 9:30pm.

**Traditional Chinese Banquet and Special Performance**

The Golden Hall, Huwan Hotel (East), Hot Spring Leisure City

The Beijing Committee is pleased to invite you to attend this special banquet and performance. The event will be held at Hot Spring Leisure City, located in the northwest suburb, about a 40-minute bus ride from the Convention Center. Bus transportation will be provided both ways. This is an opportunity to enjoy a delicious banquet and also be entertained by a wonderful performance of Chinese culture and art.

Admission to the banquet is included in your registration fee. Your registration badge will serve as your ticket to the banquet. If your guest would like to join you for this event, you can purchase a guest registration (\$50US) at the INFORMS registration desk. The guest registration allows admission for your guest to the Welcome Reception and the Banquet.

**IF YOU ARE DRIVING OR TAKE A TAXI, HERE IS THE FULL ADDRESS:**

The Golden Hall, Huwan Hotel (East), Hot Spring Leisure City  
55 Wangfu Street, Zhenggezhuang Village, Qijia Town, North Changping District, Beijing  
Address in Chinese (to show to cab driver):

温都水城 湖湾酒店（东区）金色大厅  
北京市昌平区北七家镇王府街55号

Thank You

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Cheung Kong Graduate School of Business

Chinese University of Hong Kong, Dept. of Systems Engineering & Engineering Management

Key Research Institute of Humanities and Social Sciences at Universities, Research Center for Contemporary Management

Nanjing University, School of Management & Engineering

Nankai University, Business School

National Natural Science Foundation of China

Tsinghua University, School of Economics and Management

University of Electronic Science and Technology of China, School of Management & Economics

Xiamen University, School of Management

**TOURS TO BEIJING  
& CHINA ATTRACTIONS**

A number of fascinating tours are offered to Beijing's most famous and interesting sights, including the Great Wall, Forbidden City, Xi'an and the Terracotta Army, and more. You can sign up with the INFORMS tour agency, MCI Group Beijing, at their tour desk in the INFORMS registration area during these hours:

Saturday, 8:00am-7:00pm

Sunday-Tuesday, 7:00am-6:00pm

Wednesday, 7:00am-1:30pm

## MONDAY

## OMEGA RHO DISTINGUISHED LECTURE

9:50am-10:50am  
Function Hall AB

### Systemic Risk and the Replumbing of the Financial System

Darrell Duffie

Dean Witter Distinguished Professor of Finance,  
Graduate School of Business, Stanford  
University

The financial crisis of 2007-2009 has spurred significant ongoing changes in the "pipes and valves" through which cash and risk flow through the center of our financial system. These changes include major adjustments to forms of lender-of-last-resort financing from central banks, and difficult changes in the infrastructure of the market for overnight financing of major dealer banks. Regulations across G20 nations to mandate the central clearing of standardized over-the-counter derivatives could theoretically lead to improved financial stability, but a proliferation of central clearing parties threatens instead to increase counterparty risk, as can be shown by a network-based analysis. This talk will focus on how systemic risk is being altered by changes in the plumbing of the financial system, and raise some of the associated modeling challenges.

**OMEGA RHO**, the official Honor Society of INFORMS, was founded in 1976 to recognize superior scholarship and encourage leadership in operations research, management science and related disciplines. The society has 39 active collegiate chapters, more than 5,000 student and faculty members and is a member of the Association of College Honor Societies. In addition to sponsoring OMEGA RHO Distinguished Lectures at INFORMS International and Annual meetings, OMEGA RHO provides financial support to the annual INFORMS Colloquium. Honorary Membership in OMEGA RHO is bestowed upon individuals who provide leadership and extraordinary support for the encouragement of operations research and management science through their professional activities. Prior to delivering the OMEGA RHO Distinguished Lecture, Darrell Duffie will be inducted as an Honorary Member of OMEGA RHO.



**Darrell Duffie** is the Dean Witter Distinguished Professor of Finance at Stanford University's Graduate School of Business. Duffie, the author of *Dynamic Asset Pricing Theory*

(Princeton University Press, Third Edition), is a Fellow of the American Academy of Arts and Sciences and a past President of the American Finance Association. He serves on the board of directors of Moody's Corporation and on the Financial Advisory Roundtable of the Federal Reserve Bank of New York. His most recent books are *How Big Banks Fail* (Princeton University Press, 2010), *Measuring Corporate Default Risk* (Oxford University Press, 2011), and *Dark Markets: Asset Pricing and Information Transmission in Over-the-Counter Markets*, (Princeton University Press, 2012).

## PLENARY

3:00pm-3:50pm  
Function Hall AB

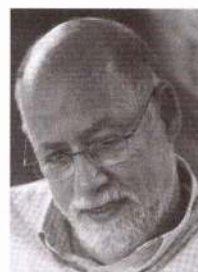
### Data-Based Service Networks: A Research Framework for Asymptotic Inference, Analysis and Control of Service Systems

Avishai Mandelbaum

Benjamin & Florence Free Professor of Industrial Engineering & Management, Technion, Israel

The lecture is on service systems, pertaining to telephone call centers, hospitals, public services, banks, airports, supermarkets and more. The focus is on operational performance, e.g. customer flow and system congestion (with operational characteristics serving also as surrogates for financial, psychological and clinical performance). The mathematical framework is asymptotic queueing theory, specifically fluid approximations and their diffusion refinements. Queueing theory is ideally suitable to capture the operational tradeoff that is at the core of any service-quality vs. efficiency. Asymptotic analysis has the potential to accommodate service characteristics which are otherwise intractable. Two cases in point are the Erlang-A and Erlang-R models: the first has become the most prevalent call center model, and the second applies to emergency departments—both are simple models that valuably portray complex realities. This raises several fundamental research questions: why are such simple models

robust; what are the limitations of their robustness; and which alternative models would overcome the limitations. These questions will be addressed within the asymptotic framework, developing models *directly* from data and validating their *value* against actual service systems. (This is in contrast to prevalent practice where models are typically *remote* from data, and asymptotic approximations are validated for *accuracy* against their originating mathematical models.) The ultimate goal is a platform for *automatic* creation of data-based asymptotic models, which will be universally accessible for applications by researchers, students and ultimately practitioners. This goal is currently pursued at the Technion SEE Laboratory.



**Avishai Mandelbaum** is the Benjamin & Florence Free Professor of Industrial Engineering and Management, Technion, Israel. He has a BSc in Mathematics and

Computer Science and an MA in Statistics, both *summa cum laude* from Tel-Aviv University. His PhD is in Operations Research, from Cornell University. After graduation in 1983, he joined the Graduate School of Business at Stanford University. He assumed a position at the Technion in 1991. Mandelbaum, an INFORMS fellow, was an associate editor of the leading journals in his field, and his research and teaching have enjoyed various prizes, in particular the inaugural Yanai Prize for Academic Excellence at the Technion. His research has focused on stochastic models (analysis, asymptotics, control) and statistics, with applications to service systems, notably tele-services (e.g. telephone call centers) and healthcare (e.g. patient flow through emergency departments). He is the founder and director of the Technion SEE Laboratory (SEE = Service Enterprise Engineering). This lab maintains a unique rich repository of data from service operations, and serves as a hub for service science and engineering research.

## TUESDAY

## IFORS DISTINGUISHED LECTURE

9:50am-10:50am  
Function Hall AB

**Analytics for the Next Era of Computing**

Brenda Dietrich  
IBM Fellow, Vice President and Chief  
Technology Officer for Business Analytics  
IBM Corporation

New applications of computing are being enabled by instrumentation of physical entities, aggregation of data, and the analysis of the data. The resulting integration of information and control permits efficient and effective management of complex man-made systems. Examples include transportation systems, buildings, electrical grids, health care systems, governments and supply chains. Achieving this vision requires extensive data analysis, modeling, and optimization—in short, the application of operations research. In this talk some early examples of the use of O.R. to enable this vision will be described. The field's potential and some emerging challenges will also be discussed.



**Brenda Dietrich** is an IBM Fellow, and Vice President and Chief Technology Officer for Business Analytics at IBM. She provides technical guidance for IBM's Business Analytics software strategy and

products, and provides leadership for the analytics software community within IBM. Previously she led IBM's research activities in Business Analytics and Mathematical Sciences, and supports software products and consulting in these areas. She was responsible for both basic research in computational mathematics and related fields, and the development of novel business applications based on the application of mathematical models within industry. Dietrich has been the president of INFORMS and is an INFORMS Fellow. She serves on the Board of Trustees of SIAM. She has served on university advisory boards for Northwestern, CMU, MIT, and UC Berkeley, and on advisory boards for NSF sponsored Math Research Institutes. Dietrich holds more than a dozen patents, has co-authored numerous publications, and co-edited the book *Mathematics of the Internet: E-Auction and Markets*. She holds a BS in Mathematics from UNC and an MS and

Ph.D. in OR/IE from Cornell. Her personal research includes manufacturing scheduling, services resource management, transportation logistics, integer programming, and combinatorial duality.

## PLENARY

3:00pm-3:50pm  
Function Hall AB

**Exploration of the Optimum Solution to the Chinese Energy Plight**

Yuzhuo Zhang, President and CEO  
Shenhua Group Corporation

Eating up 3.48 billion TEC in 2011 makes China become one of the largest energy consumers in the world. One major challenge China's energy supply faces is the coal-dominant primary energy mix (accounting for nearly 70%, which is about 48% of the total coal used in the world). Consequently, over-reliance on coal results in a substantial emission of SO<sub>2</sub>, NO<sub>x</sub>, TSP and CO<sub>2</sub>. Therefore, optimizing China's energy mix has become a pressing task.

Through solid data, references and project practices, we have done a thorough analysis according to the developing trend of the global low-carbon economy and energy industry with a view of the technical advancement of clean coal technologies in the past decade. Based on this analysis, we proposed an energy optimization model under the dual constraints of economy and environment, and obtained a comprehensive solution that emphasizes "control on total consumption, clean conversion and structural optimization." The target is to decrease the share of China's coal consumption to under 50% of its total energy consumption in the next 30 years. In the meantime, with green and efficient coal-based energy technologies, China will effectively control the pollutants and greenhouse gas emissions during the energy conversion and will build a sustainable and optimum energy system.



**Yuzhuo Zhang** is President and CEO of Shenhua Group Corporation. He received a BSc degree from Shandong University of Science and Technology, a master's degree from

China Coal Research Institute, and a PhD from the University of Science and Technology Beijing and Tsinghua University. From 1992 to 1996, he worked as a post-doctoral fellow at the University of Southampton and as a Research Fellow at Southern Illinois University at Carbondale. Since 2002, he has been in charge of the development and construction of China's Direct Coal Liquefaction Demonstration Project as well as other large-scale coal chemical projects. Patented Chinese Shenhua DCL technology has been adopted by the Demonstration Project. Following mechanical completion in 2007, the first coal-in commissioning of the plant was successfully conducted in December 2008. The first commissioning of the Baotou MTO project was successfully conducted in August 2010. Zhang is a Member of the Chinese Academy of Engineering, a member of the Advisory Board of China's National Energy Leading Group, Vice-Chairman of the China Coal Society, Vice-Chairman of the China Energy Research Society, and a member of IEA Coal Industry Advisory Board.

All tutorials take place in Room 215 of the Convention Center unless indicated otherwise.

## SUNDAY

### ■ SB01

11:00am-12:30pm

Room 202B

#### **Carlson Rezidor Hotel Group Maximizes Revenue with Improved Demand Management and Price Optimization**

Bob Garner, Carlson Rezidor Hotel Group

Carlson Rezidor Hotel Group collaborated with JDA Software Group on a highly innovative revenue optimization project that started with enterprise demand forecasting in 2007. It was followed by a large-scale network optimization solution to dynamically optimize stay night rates based on price elasticity, competitor rates, remaining inventory, demand forecast and business rules. Compliant hotels consistently showed a 2-4% revenue improvement, and increased revenue by more than \$16 million annually.

### ■ SB19

11:00am-12:30pm

#### **Model Uncertainty, Robust Optimization and Learning**

George J. Shanthikumar, Purdue University; Andrew E.B. Lim and Max Z. Shen, University of California-Berkeley

We will present approaches to address possible statistical and structural errors in modeling. The standard approaches used to address statistical errors are to develop better statistical estimation procedures or use robust Bayesian models. Model validation and ranking of models are used to minimize the effect of structural (and statistical) errors. Statistical errors can become significant because classical modeling under uncertainty assumes a full probabilistic characterization. The learning needed to implement the policies derived from these models is accomplished either through (1) classical statistical estimation procedures or (2) subjective Bayesian priors. Different models of model uncertainty will be discussed and different approaches to robust optimization with and without bench-marking will be presented. Two alternative learning approaches, Objective Bayesian Learning and Operational Statistical Learning, will be discussed.

To address structural errors and avoid death spiraling effects, we will introduce Objective Operational Learning approaches that incorporate exploration and exploitation phases. Throughout this tutorial we will consider queueing control, inventory control, product portfolio selection, call center staffing, financial asset allocation and medical decision making problems as examples to illustrate these ideas.

### ■ SD19

4:00pm-5:30pm

#### **Unlocking the Hidden Value in Your Data with SAS Analytics**

Udo Sglavo and Jinxin Yi, SAS Institute Inc.

Organizations have been faced with the challenge to deal with data for decades. The enormous growth in the amount of data that the global economy now generates—transactional data, demographic data, data from social media and web sources, and more—has become overwhelming. More than ever it is critical to understand how the information locked in that data can be leveraged to drive actionable decisions for the business. Analytics is the key that can unlock that hidden value. The power of analytical models is integral to organizational dynamics and has direct impact on company performance. Companies across the globe are employing analytics for exploring and analyzing data to help uncover patterns and insights that can drive evidence-based decision making. This tutorial provides an overview of analytical methods, such as inventory optimization and statistical forecasting, with a focus on applications of those methods to solve specific business problems.

## MONDAY

### ■ MB19

11:00am-12:30pm

#### **Recent Linear Programming Developments for Operations Research and Management Science**

Yinyu Ye, Stanford University

Linear programming (LP) has been a core operations research and management science model since 1947. Due to the relentless research effort in LP algorithms, a linear program can be solved today one million times faster than it was done twenty years ago. Businesses, large and small, now use LP models to control manufacture inventories, price commodities, design civil/communication networks and plan investments. LP even becomes a popular subject taught in undergraduate and MBA curriculums, advancing human knowledge and promoting science education. Now many new important computational problems are emerging or reemerging. In particular, there has been a growing trend in models, theories and algorithms on problems arisen in Internet economics, information network, auction/game, stochastic and on-line decision making, as well as social organization issues enabled through the Web. The aim of the tutorial is to describe several modern linear programming developments and applications in today's service economy, such as auction, pricing, mechanism design and information aggregation. We also present a few recent algorithmic developments and future research directions of linear programming.

## ■ MC19

1:30pm-3:00pm

**Optimization Software: Algorithms, Computation and Applications**

Zonghao Gu, Gurobi Optimization

We will focus on linear, quadratic and integer programming, discuss briefly the history of math programming software and review important algorithms, such as primal and dual simplex and barrier for linear and quadratic programming, and the branch-and-cut algorithm for mixed integer programming. Computation is always a crucial part of software development; this talk will discuss different technologies used in the commercial optimization solvers to determine the degree of algorithmic progress. We will also give computational results indicating the current state of the art. Finally we will talk about several applications to show the benefits this progress in software brings to real world problems.

**TUESDAY**

## ■ TB19

11:00am-12:30pm

**Marriage of Simulation and Optimization: Theories and Examples**

Jeff Hong, Hong Kong University of Science and Technology

Simulation and optimization are two widely used operation research tools. The marriage of them, often known as optimization via simulation (OvS), provides a unique and powerful combination that may solve many problems that are previously considered difficult. Based on information available on simulation models, we categorize OvS problems into two categories: white-box and black-box OvS. This tutorial introduces difficulties and latest theoretical developments of both types of problems, provides examples on problem formulations as well as solution algorithms, shows how to translate black-box problems into white-box ones under certain situations, and offers my view on possible future research directions of this exciting area.

## ■ TC19

1:30pm-3:00pm

**Challenges in Modern Data Analysis**

Ming Yuan, Georgia Institute of Technology

The way science is done today is very different from the past, and big data are becoming the new microscope for big science. Immediate access to copious amount of interesting and important data presents unprecedented opportunities, but also creates unique challenges. A distinctive characteristic that often sets these massive data apart from the usual subject of traditional statistical analysis is their high dimensionality, which means that information can be abundant yet at the same time elusive. The difficulty in dealing with high dimensional data stems from the apparent intractability in approximating, integrating, optimizing and consequently estimating a high dimensional function. Development of statistical theory to understand the nature of such characteristic, and methodology to address the associated issues will advance our intellectual exploration and knowledge, and undoubtedly benefit a multitude of scientific and technological fields. In this tutorial, I will discuss some the recent advances and challenges ahead in tackling these problems, and their potential impact in other areas.

## ■ TD19

4:30pm-6:00pm

**The Recent Financial Crisis and Two Related Financial Engineering Research Problems**

Xuedong He, Columbia University; Xianhua Peng, Hong Kong University of Science &amp; Technology

Some main causes of the recent financial crisis are excessive risk taking due to the limited liability of fund managers and corporations, which means profits are shared, but not losses, and the inability of valuing the housing market fairly, which partly lead to the housing bubble. In this tutorial we will present some broad research questions in financial engineering related to these. In particular, we will discuss how to design a better hedge fund performance fee scheme to improve the satisfaction of regulators, fund managers and fund investors simultaneously, and how to model housing prices. No finance background is assumed in this tutorial.

**EXHIBITORS****AIMMS – Paragon Decision Technology**

AIMMS is an optimization technology that enables you to make complex decisions faster, more accurately and more consistently by suggesting and comparing optimal solutions. It is used for mathematical programming problems (linking to top solvers like CPLEX and Gurobi), and also contains advanced algorithmic capabilities like robust optimization and constraint programming.

**AMPL Optimization LLC**

AMPL Optimization develops and supports the AMPL modeling language, a powerful and natural tool for creating and managing the large, complex optimization problems that arise in numerous applications. AMPL is notable for supporting a broad range of linear and nonlinear problem formulations and a large selection of popular large-scale solvers.

**Beijing Carila Tech Ltd. – AnyLogic**

Beijing Carila Tech Ltd. is the exclusive distributor of AnyLogic in China. AnyLogic is the only simulation tool that supports process-centric, system dynamics and agent-based modeling approaches. More than 350 companies and 400 universities worldwide are our customers.

**Beijing Knowledge Way Technology Ltd. – LINDO**

With 22 years' experience, LINDO is a leader in mathematical optimization. Our linear, integer, nonlinear and quadratic programming products are in use at over half of Fortune 500 companies—including 23 of the top 25. Beijing Knowledge Way Technology Ltd. is the exclusive reseller of LINDO in China to provide the best service.

**Edgestone Information Technologies, Inc.**

Edgestone Information Technologies is the authorized reseller of world-class simulation and optimization products in China, including Gurobi, AIMMS, ExtendSim, Demo3D, and more. Edgestone also provides high quality simulation and optimization services.

**FlexSim Software Products**

Flexsim is a 3D process flow simulation software used to model and simulate production and material handling processes for the express purpose of increasing throughput at less cost. "What if" conditions can be input into a model and their impact simulated and verified before implementing them on the actual system.

**GAMS Development Corp.**

The General Algebraic Modeling System (GAMS) is a high-level modeling system for mathematical programming and optimization. It consists of a language compiler and a stable of integrated high-performance solvers. GAMS is tailored for complex, large-scale modeling applications, and allows you to build large maintainable models that can be adapted quickly to new situations. Learn more about our new GAMS distribution 23.8 and ask for a trial CD.

**IBM**

Attend the IBM software tutorial to learn about integrating different technologies based on IBM CPLEX Optimization Studio, IBM ILOG ODM Enterprise and the IBM SPSS product suite and the latest on CPLEX. Throughout the conference, come by our exhibit to meet with our experts to learn how to use CPLEX Optimization Studio.

**INFORMS**

Visit the INFORMS table for sample copies of our 13 scholarly journals and membership magazines *ORMS Today* and *Analytics*, as well as information on our world-class conferences, communities and subdivisions, and member benefits and how to become an INFORMS member.

**SAS**

SAS provides a full spectrum of integrated analytic capabilities, including data integration, statistics, data and text mining, econometrics and forecasting, and operations research (optimization, simulation, scheduling). SAS can help you build models, populate them with relevant data and analytic insights, communicate recommended decisions effectively, and surface these capabilities within accessible, business-oriented interfaces.

**Wiley-Blackwell**

Wiley-Blackwell was formed in 2007 as a result of the acquisition of Blackwell Publishing by John Wiley & Sons, and its merger with Wiley's scientific, technical and medical business. Together, the companies have created a global publishing business with deep strength in every major academic and professional field. Wiley-Blackwell publishes approximately 1,400 scholarly peer-reviewed journals and an extensive collection of books with global appeal.

**SOFTWARE TUTORIALS**

All software tutorials will be held on Tuesday in Room 207.

**TA20 - 8:00AM-9:30AM**

FlexSim Software Products  
**Flexsim 3D Process Flow Simulation**

AIMMS-Paragon Decision Technology  
**Enjoy the Mathematical Modeling Experience with AIMMS**

**TB20 - 11:00AM-12:30PM**

GAMS Development Corp.  
**Fundamentals and Recent Developments of the GAMS System**

AMPL Optimization  
**Alternatives for Scripting in the AMPL Modeling Language**

**TC20 - 1:30PM-3:00PM**

Edgestone Information Technologies  
**Better Tools for Better Decisions**

IBM  
**IBM ILOG CPLEX Optimization Studio and Advanced Analytics**

**TD20 - 4:30PM-6:00PM**

SAS  
**Optimization and Discrete-Event Simulation with SAS**

AnyLogic  
**Simulation Modeling of the Supply Chain**

## SUNDAY

Track Room	SA 9:00-10:30	SB 11:00-12:30	SC 2:00-3:30	SD 4:00-5:30
1 Room 202B	Transportation Science & Logistics	Tutorial	TSL	TSL
2 Room 202A	Data Mining	Data Mining	Data Mining	Data Mining
3 Room 203B	Artificial Intelligence	Artificial Intelligence	Artificial Intelligence	Artificial Intelligence
4 Room 203A	Simulation	Simulation	Simulation	Simulation
5 Room 205B	Energy, Natural Resources & the Environment	ENRE	ENRE	ENRE
6 Room 205A	Supply Chain Mgt. in China	Supply Chain Mgt. in China	Supply Chain Mgt. in China	Supply Chain Mgt. in China
7 Rooms 206A	Computational Opt. & Apps. (Joint- Computing & Health Apps.)	Computational Opt. & Apps. (Computing Society)	Computational Opt. & Apps. (Computing Society)	CPMS-The Practice Section
8 Room 206B	Optimization Software	Optimization & Complementarity	Integer Programming	Gurobi Optimization
9 Room 208A	Computational Opt. & Apps. (Computing Society)	Computational Opt. & Apps. (Computing Society)	Computational Opt. & Apps. (Computing Society)	Computational Opt. & Apps. (Computing Society)
10 Room 208B	Decision Analysis Society	Manufacturing & Service Ops. Mgt.	MSOM	MSOM
11 Room 209A	Manufacturing & Service Ops. Mgt.	Multi-Echelon Systems	Supply Chain & Risk Mgt.	Scheduling in Health Care
12 Room 209B	Sustainable Dev. & Supply Chain	Global Supply Chains	Electronic Commerce	Electronic Commerce
13 Room 210A	INFORMS Intl. Activities/Board	INFORMS Intl. Activities/Board	CPMS-The Practice Section	Performance Measurement & Assess.
14 Room 210B	Applied Probability	Applied Probability	Supply Chain Mgt.	Applied Probability
15 Room 212A	Marketing Science	Marketing Science	Marketing Science	Marketing Science
16 Room 212B	Interface Between Operations Mgt. & Marketing	Interface Between Operations Mgt. & Marketing	Interface Between Operations Mgt. & Marketing	Interface Between Operations Mgt. & Marketing
17 Room 213A	Scheduling in Health Care	Scheduling in Health Care	Modeling Sustainable Energy	Healthcare Applications
18 Room 213B	Transportation Science & Logistics	Financial Services	Analysis of Systemic Risk	DEA in Financial Services
19 Room 215	Queuing Theory	Tutorial	Reliability	Tutorial

## MONDAY

Track Room	MA 8:00-9:30	Plenary 9:50-10:50	MB 11:00-12:30	MC 1:30-3:00	Plenary 3:00-3:50	MD 4:30-6:00
1 Room 202B	Trans. Science & Logistics		Aviation Applications	Aviation Applications		Aviation Applications
2 Room 202A	Data Mining		Data Mining	Data Mining		Data Mining
3 Room 203B	Artificial Intelligence		Artificial Intelligence	Service Science		Service Science
4 Room 203A	Simulation		Simulation	Simulation		Simulation
5 Room 205B	Energy, Natural Resources & the Environment	Omega Rho Distinguished	Energy, Natural Resources & the Environment	ENRE	Plenary Avishai	Manufacturing & Service Ops. Mgt.
6 Room 205A	Supply Chain Mgt. in China	Lecture	Supply Chain Mgt. in China	Supply Chain Mgt. in China	Mandelbaum	Supply Chain Mgt. in China
7 Rooms 206A	OR/MS & Social Science	Darrell Duffie	Decision Analysis Society	Decision Analysis Society	Data-Based	Decision Analysis
8 Room 206B	Computational Opt. & Apps (Computing Society)	Systematic Risk of the Financial System	Computational Opt. & Apps. (Computing Society)	Computational Opt. & Apps. (Computing Society)	Service Networks	Computational Opt. & Apps. (Computing Society)
9 Room 208A	Computational Opt. & Apps (Computing Society)		Computational Opt. & Apps. (Computing Society)	Computational Opt. & Apps. (Computing Society)	Function Hall AB	Computational Opt. & Apps. (Computing Society)
10 Room 208B	Mfg. & Service Ops. Mgt.	Function Hall AB	Mfg. & Service Ops. Mgt.	Mfg. & Service Ops. Mgt.		Mfg. & Service Ops. Mgt.
11 Room 209A	Optimization Models		Optimization Models	Optimization Models		Supply Chain
12 Room 209B	Pricing & Customer Service		Dynamic Control of Inventory	Supply Chain & Inventory		Innovative Topics-Ops. Mgt.
13 Room 210A	Scheduling		Scheduling	Scheduling		Business Analytics
14 Room 210B	Applied Probability		Applied Probability	Applied Probability		Applied Probability
15 Room 212A	Marketing Science		Marketing Science	Marketing Science		Marketing Science
16 Room 212B	Interface Between Operations Mgt. & Marketing		Interface Between Operations Mgt. & Marketing	Interface Between Operations Mgt. & Marketing		Interface Between Operations Mgt. & Marketing
17 Room 213A	Joint: Health Applications & OR/MS in Medicine		Health Applications	Health Applications		Health Applications
18 Room 213B	Financial Engineering		Financial Modeling & Risk. Mgt.	Financial Optimization		Finance
19 Room 215	Stochastics		Tutorial	Tutorial		No Session

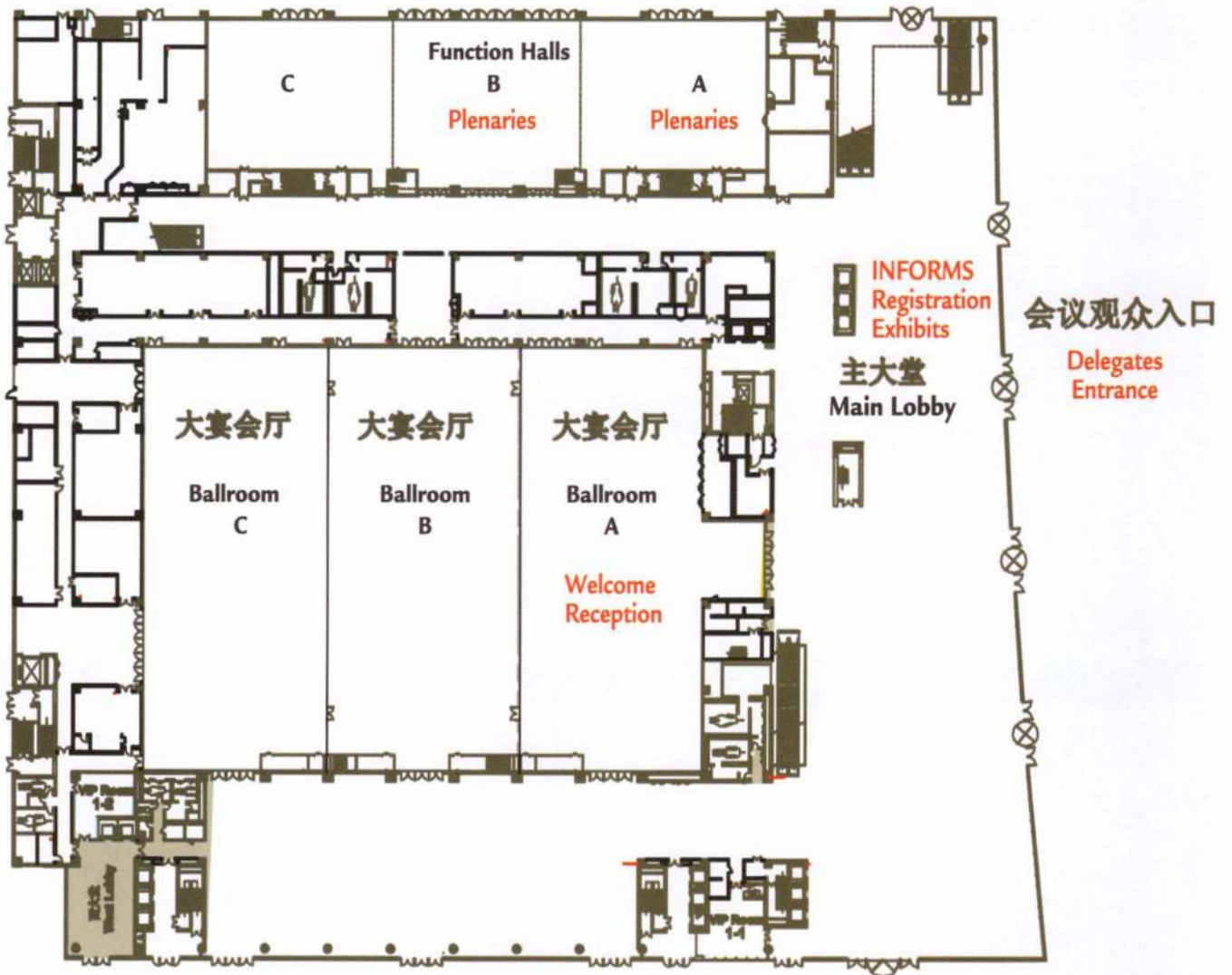
## TUESDAY

Track Room	TA 8:00-9:30	Plenary 9:50-10:50	TB 11:00-12:30	TC 1:30-3:00	Plenary 3:00-3:50	TD 4:30-6:00	
1 Room 202B	Aviation Applications	<b>IFORS</b> Distinguished Lecture Brenda Dietrich Analytics for the Next Era of Computing Function Hall AB	Comp. Opt. & Applications ( ICS)	Aviation Applications	Plenary Yuzhuo Zhang Exploration of the Optimum Solution to the Chinese Energy Plight Function Hall AB	Transportation & Logistics	
2 Room 202A	Data Mining		Data Mining	Data Mining		Data Mining	
3 Room 203B	Service Science		Service Science	Service Science		Service Science	Metaheuristics Applications
4 Room 203A	Maritime, Trade & SC Logistics		Maritime, Trade & SC Logistics	Maritime, Trade & SC Logistics		Maritime, Trade & SC Logistics	Maritime, Trade & SC Logistics
5 Room 205B	Supply Chain		Stochastic Opt. for Energy	Power Generation & Environ.		Energy: China Studies	
6 Room 205A	Supply Chain Mgt. in China		Supply Chain Mgt. in China	Supply Chain Mgt. in China		Healthcare	
7 Rooms 206A	OR//MS in Industrial Applications		Sustainability & Green Logistics	Multi-Criteria Decision Making		Comparison of Mobile Businesses in China & Korea	
8 Room 206B	Computational Opt. & Applications ( ICS)		Computational Optimization & Applications ( ICS)	Computational Optimization & Applications ( ICS)		Computational Optimization & Applications ( ICS)	
9 Room 208A	Computational Opt. & Applications ( ICS)		Computational Optimization & Applications ( ICS)	Computational Optimization & Applications ( ICS)		Computational Optimization & Applications ( ICS)	
10 Room 208B	Mfg. & Service Ops. Mgt.		Mfg. & Service Ops. Mgt.	Mfg. & Service Ops. Mgt.		Mfg. & Service Ops. Mgt.	
11 Room 209A	OR//MS in Med. & Healthcare		Stochastic Modeling- Mfr. & SC	Logistic Network Decision		Monitoring & Control in Cloud	
12 Room 209B	Pricing & Financial Issues in SC		Supply Chain	Opt. & Competition in SC		Consumer Behavior & RM	
13 Room 210A	Real Options, Asymmetric Info.		Forecasting & Applications	Rolling Horizon Scheduling		Inventory Control	
14 Room 210B	Applied Probability		Applied Probability	Applied Probability		Applied Probability	
15 Room 212A	Marketing Science		Marketing Science	Marketing Science		Business Analytics	
16 Room 212B	Interface Between Ops. Mgt. & Marketing		Interface Between Operations Mgt. & Marketing	Marketing Applications		Marketing: . eCommerce Apps	
17 Room 213A	Health Applications		HAS / OR/MS in Medicine	HAS / OR/MS in Medicine		OR/MS in Medicine & HC	
18 Room 213B	Financial Engineering		Financial Modeling	Risk Mgt.		Linear Optimization	
19 Room 215	Technology Mgt.		Tutorial	Tutorial		Tutorial	
20 Room 207	Software Tutorials		Software Tutorials	Software Tutorials		Software Tutorials	

## WEDNESDAY

Track Room	WA 8:00-9:30	WB 10:00-11:30	WC 11:45-1:15
1 Room 202B	Sustainable Dev. in Transportation	Vehicle Routing	Global Supply Chain
2 Room 202A	Information Systems	Information Systems	Supply Chain Operations
3 Room 203B	Auctions, Bidding & Games	Knowledge Mgt.	Financial Modeling
4 Room 203A	Quality Control	Ethical, Team & Social Issues	Quality & Business Decisions
5 Room 205B	Decision Analysis Society	Production Planning	Project Mgt.
6 Room 205A	Service Operations	Innovation Mgt.	Optimization Applications
7 Rooms 206A	Decision Analysis	Decision Analysis	No Session
8 Room 206B	Integer/Combinatorial Opt. Models	Optimization/Game Theory	Algorithms for Integer Programming
9 Room 208A	Optimization Theory	Optimization Models	No Session
10 Room 208B	Capacity Flexibility	Dynamic Pricing	Revenue Management
11 Room 209A	Information, Coordination in SC	Pricing in Supply Chains	No Session
12 Room 209B	Seasonality, Variability in SC	Supply Chain Competition	Fuzzy Sets
13 Room 210A	Reverse Logistics & Sustainability	Business Analytics	e-Business
14 Room 210B	Applied Probability	Queueing Systems	Applied Probability
15 Room 212A	Marketing & the Internet	Marketing/OM Interface	Marketing & Business/Finance
16 Room 212B	Marketing: New Product Dev.	Marketing & Economic Modeling	No Session
17 Room 213A	Health Applications	Health Applications	Healthcare
18 Room 213B	OR/MS in Medicine & Healthcare	Business Analytics	No Session
19 Room 215	Business Analytics	Business Analytics	No Session

## CHINA NATIONAL CONVENTION CENTER - LEVEL 1



National Stadium North Road

国家体育场北路

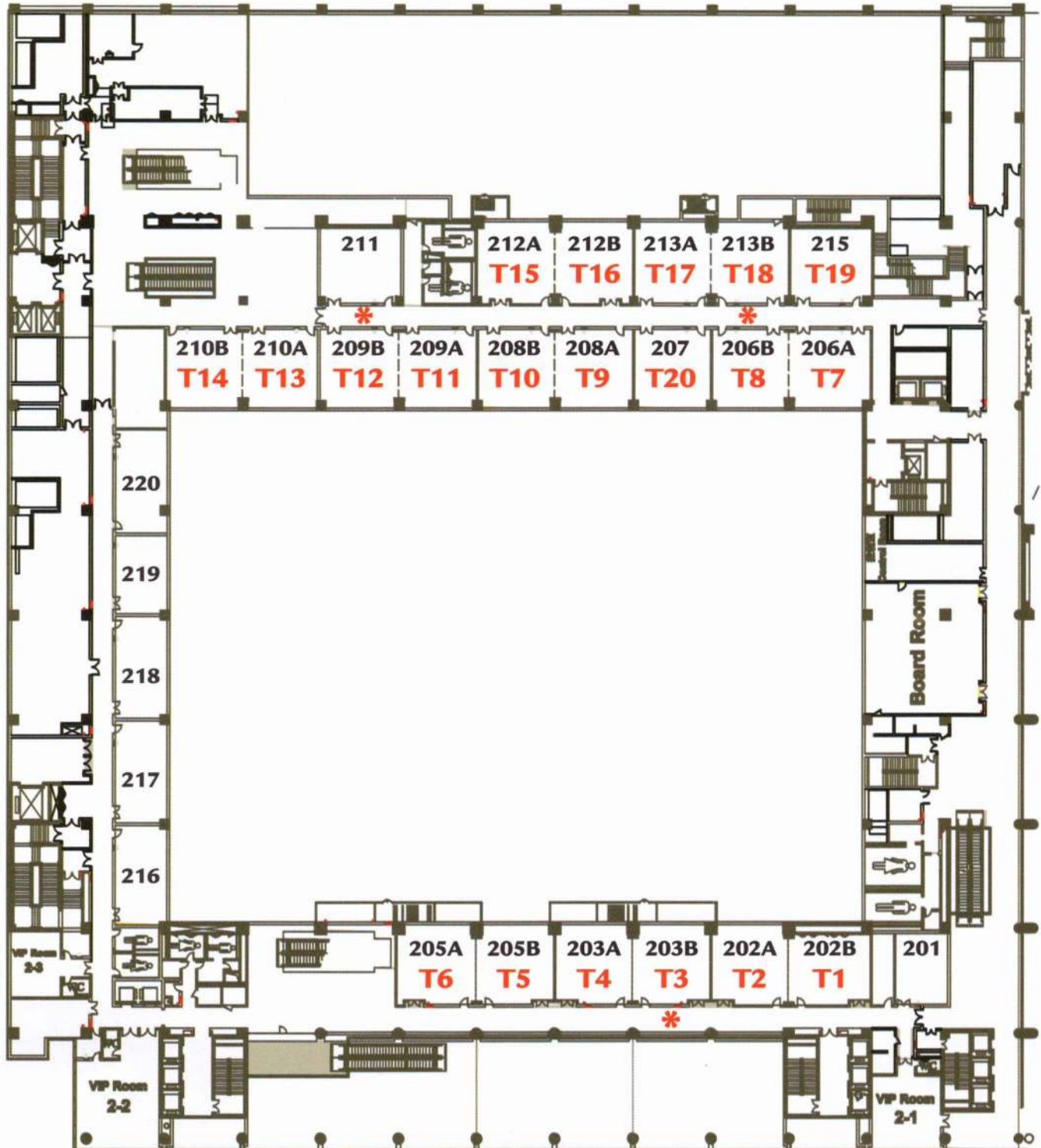
CHINA NATIONAL CONVENTION CENTER - LEVEL 2

TRACKS

I-I9

Track numbers shown for Technical Session Rooms

\* Session Monitor Desk



**INVITED CLUSTER CHAIRS****Comparison of Mobile Businesses in China & Korea**

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**Transportation Science & Logistics**

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## How to Navigate the Technical Sessions

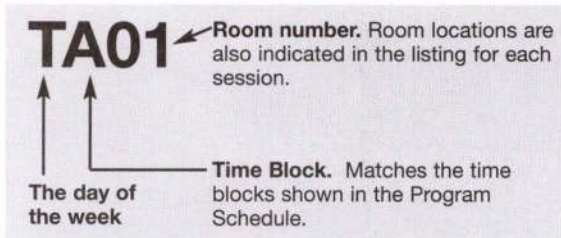
There are four primary resources to help you understand and navigate the Technical Sessions:

- This Conference Session listing, which provides the most detailed information. The listing is presented chronologically by day/time, showing each session and the papers/abstracts/authors within each session.
- The Author and Session indices provide cross-reference assistance (pages 122-135).
- The "Master Track Schedule" is on pages 12-13. This is an overview of the tracks (general topic areas) and where/when they are scheduled.

## Quickest Way to Find Your Own Session

Use the Author Index (page 122) — the session code for your presentation will be shown along with the room location. You can also refer to the full session listing for the room location of your session.

## The Session Codes



## Time Blocks

### Sunday

- A — 9:00am - 10:30am
- B — 11:00am - 12:30pm
- C — 2:00pm - 3:30pm
- D — 4:00pm - 5:30pm

### Monday

- A — 8:00am - 9:30am
- B — 11:00am - 12:30pm
- C — 1:30pm - 3:00pm
- D — 4:30pm - 6:00pm

### Tuesday

- A — 8:00am - 9:30am
- B — 11:00pm - 12:30pm
- C — 1:30pm - 3:00pm
- D — 4:30pm - 6:00pm

### Wednesday

- A — 8:00am - 9:30am
- B — 10:00am - 11:30am
- C — 11:45am - 1:15pm

## Sunday, 9:00am - 10:30am

### ■ SA01

Room 202B

### Pricing and Equilibrium Problems in Low-Carbon Transportation Operations

Sponsor: Transportation Science and Logistics  
Sponsored Session

Chair: Tian-Liang Liu, Assistant Professor, Beihang University, School of Economics and Management, Beijing, China, liutianliang@buaa.edu.cn

#### 1 - Simultaneous Optimization of Fuel Surcharges and Transit Service Runs in a Multi-modal Network

Zhi-Chun Li, Professor, Huazhong University of Science and Technology, School of Management, Wuhan, China, smzcli@gmail.com

This paper investigates the simultaneous optimization problem of fuel surcharges and transit service runs for energy sustainability of multi-modal transport network using an activity-based approach. A time-dependent activity and multi-modal travel choice equilibrium problem is formulated as an equivalent variational inequality problem. A model for optimizing the fuel surcharges and transit vehicle runs is proposed to maximize total social net benefit of the multi-modal transport system.

#### 2 - Tackling Congestion and Traffic-related Pollution in Urban Areas with Tradable Driving Rights

Meng Xu, Associate Professor, Beijing Jiaotong University, School of Traffic and Transportation, Beijing, China, mengxu@bjtu.edu.cn, Ziyou Gao

In this study, we will examine greenhouse gas emissions as a function of traffic congestion. Using the velocity patterns of vehicles operating under different levels of congestion, the energy and emission impacts of traffic congestion can be estimated. We further study the implementation of tradable driving rights for urban transport demand management in order to limit the increase of vehicle-kilometers travelled, particularly during peak periods.

#### 3 - A Dynamic System Model Formulating Day-to-day Traffic Dynamics in Link Variables

Ren-Yong Guo, Associate Professor, Inner Mongolia University, College of Computer Science, Hohhot, China, buaa\_guorenyong@126.com

A dynamic system model formulating the process of achieving equilibrium from non-equilibrium state in a traffic network with fixed demand is built upon link-based variables. Several desirable mathematical properties of the model are proved, including the equivalence between its stationary state and user equilibrium state, the invariance of its evolutionary trajectory, and the uniqueness and stability of its stationary state.

#### 4 - Congestion Behavior and Toll in a Bottleneck Model with Stochastic Capacity

Ling-Ling Xiao, Doctor Candidate, Beihang University, School of Economics and Management, Beijing, China, lingsayok@163.com

This paper develops a novel bottleneck model which assumes that the capacity of the bottleneck is stochastic and follows uniform distribution. Both analytical and numerical results show that the capacity uncertainty would indeed change the commuters' travel behavior. We proved that the proposed piecewise time-varying toll is non-negative and can effectively cut down the queues. We also find that the single-step coarse toll may advance or postpone the earliest departure time.

## SA02

Room 202A

### Data Mining Techniques in Multiple Areas

Sponsor: Data Mining

Sponsored Session

Chair: Xi Zhang, Assistant Professor, Peking University, 5 Yiheyuan Rd., Beijing, China, xi.zhang@pku.edu.cn

#### 1 - Detection of Approximate Periodicity in Categorical Time Series with Time Intervals

Jian Liu, University of Arizona, 1127 E. James E. Rogers Way, Tucson, AZ, United States of America, jianliu@email.arizona.edu, Mingyang Li, Zhenrui Wang, Sean Dessureaul

Operational records often contain approximate periodic patterns that provide valuable information for management decision making. Existing studies mainly focus on periodicity detection in categorical time series records without time intervals. To handle time series with time intervals, this paper employs the clustering method and wavelet transformation to capture and detect approximate periodicity. A case study from mining industry demonstrates the effectiveness of the proposed approach.

#### 2 - An Efficient Online Approach for Piecewise Linear Segmentation of Time Series

Shouyi Wang, Research Scientist, University of Washington, 3311 NE 65th Street, Seattle, WA, 98115, United States of America, shouyi@u.washington.edu, Art Chaovalitwongse

Piecewise linear segmentation (PLS) is popular to monitor and summarize time series streams online. However, the current segmentation algorithms generally require a tedious parameter-tuning procedure and have high computational complexity. We propose an efficient online segmentation algorithm that can be easily applied to various time series using a data-independent decomposition strategy, and is capable of processing time series streams online efficiently using a closed-form update formula.

#### 3 - Statistical Analysis and Modeling of Wafer Variation

Lulu Bao, Tsinghua University, Department of Industrial Engineering, Beijing, 100084, China, baolulu11@163.com, Kaibo Wang

The aim of this work is to establish a statistical model for silicon wafer thickness which can be used to help monitor and control the quality of wafers. In the work, the failure mode of the wafer thickness data is discovered by statistics and analysis. And on that base, a model to describe wafer thickness is built. The within wafer variation is modeled using Gaussian Markov random fields while the wafer-to-wafer variation is reflected using the different changing directions of wafer thickness.

## SA03

Room 203B

### AI in Social and Economic Modeling

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Wenji Mao, Professor, Chinese Academy of Sciences, Institute of Automation, No.95 Zhongguancun East Road, Beijing, 100190, China, wenjimao@gmail.com

#### 1 - Click Fraud: Incentives and Consequences

Xiarong Li, Institute of Automation, Chinese Academy of Sciences, Room 515, Zhongguancun East Road No. 95, Beijing, China, lxr606@gmail.com, Danile Zeng

Click Fraud (CF) jeopardizes the pay-per-click (PPC) advertising. We game-theoretically analyze CF's incentives, characteristics and consequences. Computational experiments are conducted to extend the theoretical analyses and explore the influences of competitions. Results illustrate that, 1) CF behaviors are induced by the competitions among publishers, and amplified by the competitions among advertisers; 2) CF harms the market efficiency; 3) exogenous market factors have impacts on CF.

#### 2 - Extracting Opinion Explanations From Online Reviews

Yuequn Li, Graduate Student, Chinese Academy of Sciences, Institute of Automation, No.95 Zhongguancun East Road, Beijing, China, yuequn.li@gmail.com, Wenji Mao, Luwen Huangfu

Studies on opinion mining have shown great value in practical applications. However, existing works mainly focus on lexicon orientation and opinion targets. The explanations of opinions, which are potentially valuable for many applications, are ignored. In this paper, we propose a method to extract the explanation of reason and/or consequence behind an opinion via learning word pairs and using causal indicators. Experiments on a hotel review corpus show that our method is feasible and effective.

#### 3 - A Chinese Controlled Natural Language for the Semantic Web

Wenzheng Cui, China, cuiwenzheng@gmail.com, Songmao Zhang

The mathematical nature of description logics often made domain experts hard to understand semantic techniques. CNL(controlled natural language) is a way to help domain experts reduce the difficulty authoring ontology. This report will introduce a Chinese CNL Yayan, and our system called YooAt(Yayan to OWL ontology authoring tool) which translate between Yayan and OWL ontologies. We also gave our evaluation of the system and proof of the consistency heritage from Yayan to OWL ontologies.

#### 4 - Limit the Lifespan of Adversarial Information in Social Networks

Chuan Luo, Institute of Automation, Chinese Academy of Sciences, No.95 Zhong Guan Cun East St., Haidian Dist, Beijing, China, luocreeks@gmail.com, Daniel Zeng, Jiesi Cheng

When a rumor about a company starts spreading in the social network, the company may want to take action to limit the effects of the rumor. In this work, we study the adversarial information lifespan limitation problem where a negative rumor starts propagating from a certain node in the network and the company needs to limit the lifespan of the rumor by selecting seed nodes to inject positive information about the company. We propose a greedy algorithm and evaluate its efficacy using simulation.

## SA04

Room 203A

### Simulation Optimization I

Sponsor: Simulation

Sponsored Session

Chair: Jeff Hong, Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong - PRC, hongL@ust.hk

#### 1 - Solving Large-scale Random Linear Programming via Sequential Statistical Approximation

Kuo-Hao Chang, Assistant Professor, National Tsing Hua University, No. 101, Section 2, Kuang-Fu Road, Hsinchu, 30013, Taiwan - ROC, birdhow@gmail.com

We develop efficient methods for handling large-scale random linear programs, in which the technology coefficients are random variables, and can be estimated by stochastic simulation. We prove that the developed methodology can achieve any desired level of optimality gap and feasibility confidence. Numerical experiments show the developed method is much computational efficient than existing approaches.

#### 2 - Revenue Management Games with Government Mandate

J.Q. Hu, Professor, Fudan University, 670 Guoshun Road, Siyuan Building, Room 508, Shanghai, 200433, China, hujq@fudan.edu.cn, Chenbo Zhu

In 2007, the Chinese aviation authority asked the five airlines with service between Shanghai and Beijing to form an express shuttle alliance so that their tickets could be interchanged. In this paper, we will study the impact of such government intervention on the competitiveness of the market and airline operations. We first investigate the existence of Nash equilibrium in such an environment. We then analyze how seat allocations, airfares, and revenues of the airlines will be affected.

#### 3 - Closed-form Expressions for Optimal Sampling Allocation on Large Finite Sets

Loo Hay Lee, NUS, Singapore, Singapore, iselee@nus.edu.sg, Nugroho Pujowidianto, Chun-Hung Chen, Raghu Pasupathy, Susan Hunter

We consider the constrained optimization problems where the main objective and the constraint measures of each system must be estimated via simulation. As simulation is time-consuming, the simulation budget needs to be efficiently allocated. Unlike previous works, we show that for large finite sets, the optimal sampling allocation can be approximated by the proposed closed-form expressions which are easy-to-implement while still accounting for the correlation between the performance measures.

#### 4 - CVaR Approximation to VaR Constrained Programs: A Remedy

Zhaolin Hu, Tongji University, No.1239, Siping Road, Shanghai, China, huzhaolin@gmail.com, Jeff Hong

We investigate the CVaR approximation of VaR Constrained Programs from a new perspective and demonstrate what is lost in this approximation. We then show the lost part of this approximation can be remedied using a sequential convex approximation approach, in which each iteration only requires solving a CVaR-like approximation that has the same complexity as the CVaR approximation.

## ■ SA05

Room 205B

### Emerging Topics in Energy Systems

Sponsor: Energy, Natural Resources & the Environment

Sponsored Session

Chair: Lizhi Wang, Iowa State University, 3016 Black Engineering, Iowa State Univ, Ames, IA, 50011, United States of America, lzwang@iastate.edu

#### 1 - Quantify Benefits of In-Home Energy Management System under Dynamic Electricity Pricing

Andrew Liu, Assistant Professor, Purdue University, 315 N. Grant St., West Lafayette, United States of America, liu334@purdue.edu

To realize real-time pricing of electricity, enabled by Smart Grid technologies, we believe that automation devices (aka smart energy management devices) are essential. We propose an Approximate Dynamic Programming (ADP)-based modeling and algorithm framework to be coupled with smart devices. Such a framework will realize the full benefits of demand response and distributed generation, and aid renewable and PHEV integration.

#### 2 - A Supply Chain Management and Operational Planning Model for Biomass to Drop-in Fuel

Guiping Hu, Iowa State University, 3033 Black Engr, Ames, IA, 50011, United States of America, gphu@iastate.edu, Leilei Zhang

Renewable energy is attracting increasing attention as substitute of petroleum. US Department of Energy has identified pyrolysis based platform as a promising biofuel production pathway. The production pathway under investigation is corn stove fast pyrolysis with upgrading to transportation fuel. We present a biofuel supply chain model with Mixed Integer Linear Programming (MILP) methodology to investigate the facility location, facility capacity and gasoline distribution decisions.

#### 3 - A Game Theoretic Model for the Biorenewable Fuels Market

Lizhi Wang, Iowa State University, 3016 Black Engineering, Iowa State Univ, Ames, IA, 50011, United States of America, lzwang@iastate.edu, Yihsu Chen, Guiping Hu

We present initial results of our ongoing study on an integrative modeling approach to capturing the interactions among various entities of the biorenewable fuels market. The entities include farmers, biofuel manufacturers, biofuel refineries, biofuel consumers, etc. We use a game theoretic modeling framework to formulate the different decisions, objective, constraints, and interactions among the entities. We will present numerical results and point out future research needs.

#### 4 - Regulatory Design and Incentives for Renewable Energy

Alfredo Garcia, Associate Professor, University of Virginia, 151 Engineer's Way, Charlottesville, VA, United States of America, ag7s@virginia.edu

The intermittent nature of renewables, such as wind and solar, necessarily imposes complex trade-offs for regulatory objectives, such as resource adequacy (and system reliability) versus reductions in green house gas emissions. In this talk we analyze a highly stylized model of equilibrium investment in order to derive insights regarding the workings of two incentive schemes aimed to increase renewable energy (feed-in tariffs and renewable portfolio standards).

## ■ SA06

Room 205A

### Healthcare Operation Management

Cluster: Supply Chain Management in China

Invited Session

Chair: Xiaodan Wu, Dr., Hebei University of Tech., Dingzigu, No.1 Str.#8, Hongqiao District, Tianjin, China, wxdan2000@yahoo.com.cn

#### 1 - Discrete-Event Simulation for Design and Evaluation of Infusion Chair Block Schedules

Mohammad T Khasawneh, Dr., State University of New York at Binghamton, Binghamton, NY 13902, United States of America, mkhasawn@binghamton.edu

Due to the need to "optimize" the use of outpatient chemotherapy treatment resources while simultaneously maintaining high patient satisfaction, this research focuses on infusion chair scheduling at an Ambulatory Infusion Center. The objective is to analyze the infusion treatment process and design efficient and effective infusion chair block schedules to minimize the average patient wait time. Discrete-event simulation was used to evaluate the proposed hybrid models (open and block).

#### 2 - Measurement Error and Resource Consumption Differences in Costing System

Xiaodan Wu, Dr., Hebei University of Tech., Dingzigu, No.1 Str.#8, Hongqiao District, Tianjin, China, wxdan2000@yahoo.com.cn, Yanbo Dong, Dianmin Yue

Costing systems provide the right product cost only under very stringent conditions. Few studies are about the nature of the measurement error of cost. This paper induces measurement error and resource consumption differences into costing system, find out how they impact the accuracy of cost by using analytical modeling.

#### 3 - On-line Model and Competitive Analysis for Radiotherapy Appointment Allocation

Li Luo, Sichuan University, No.24 South Section 1, 1st Ring Road, Chengdu, China, luolicc@163.com, Ding Hongwei, Nan Li, Lang Xiaoling, Rongmei Li

Radiotherapy appointment shares some common characteristics with outpatient appointment. However, it has key differences too. This paper develops an on-line model to deal with radiotherapy appointment allocation which demand is coming dynamically. There are  $n$  slots in a day, which are going to be appointed for ahead. On-line model establishes optimizing strategies to help managers generate high quality allocation with minimizing the weighted waiting time of patients.

#### 4 - Resource Allocation and Patient Scheduling for Multiple Medical Diagnostic Equipment

Weifen Zhuang, Assistant Professor, Xiamen University, School of Management, Xiamen, 361005, China, wfzhuang@xmu.edu.cn

We examine a capacity management problem in which multiple identical medical diagnostic facilities are used to serve three patient segments: emergency patients, inpatients and outpatients. It involves two interrelated tasks: outpatient appointment scheduling and dynamic resource allocation. We formulate it by MDP and prove that an optimal dynamic resource allocation policy, and develop an optimal outpatient schedule under a myopic facility allocation policy.

#### 5 - Improving Patient Flow at Hospital Emergency Services – A Simulation Study

Xiaofang Wang, Renmin University of China, School of Business, Beijing, China, xiaofang\_wang@ruc.edu.cn

Emergency departments, as the gateway and the major source of outpatients in hospitals, have experienced yearly increase in patient visits and crowding, which jeopardizes quality of care. In this paper, aiming at understanding when and how the hospital system become crowded, we develop a queueing model and numerically test possible strategies to alleviate crowding. Finally, we propose a plan for further research and some open questions.

## ■ SA07

Room 206A

### Set Covering and Partitioning

Sponsor: Computational Optimization & Applications (Sponsored by the Computing Society)

Sponsored Session

Chair: Gregory Rozal, VP Analytics, Mobiquity Inc., 16 Laurel Ave, Suite 300, Wellesley, MA, 02481, United States of America, grozal@mobiquityinc.com

#### 1 - Subsea Wells Partitioning as a Mixed Integer Nonlinear Program

Gregory Rozal, VP Analytics, Mobiquity Inc., 16 Laurel Ave, Suite 300, Wellesley, MA, 02481, United States of America, grozal@mobiquityinc.com, Alvin Lim, Jiefeng Xu

The layout of cluster manifolds and assignment to subsea wells is an essential part of deepwater oil and gas production process. The problem is typically solved using custom heuristics that do not take advantage of equivalent formulations that can be solved using existing more general algorithms. We formulate the problem as a mixed integer nonlinear program and solve it using existing solvers available on NEOS. We compare the quality of solutions versus those obtained from published algorithms.

#### 2 - Candidate Groups Search for K-harmonic Means Data Clustering

Hua-Min Chiou, PhD Student, National Taiwan University of Science and Technology, 43, Sec. 4, Keelung Rd., Taipei, Taiwan - ROC, d9509301@mail.ntust.edu.tw, Cheng-Huang Hung, Wei-Ning Yang

K-means is a popular method in clustering. However, it suffers from two drawbacks, sensitive to initialization and convergent to local optimum. K-harmonic means clustering is introduced to solve the first problem, but the second problem still remains. We propose a new algorithm, candidate groups search (CGS) method, combining with K-harmonic means to solve the remaining problem. Computational results on the Iris and the other well known data sets show CGS can get better performance.

### 3 - An Exact Algorithm for the Energy-efficiency Relay Routing Problem in Two-tiered Sensor Networks

Xiangyong Li, School of Economics and Management,  
Tongji University, No. 1239 Siping Road, Shanghai, China,  
xyli@tongji.edu.cn, Y.P. Aneja

We study the energy-efficiency relay routing problem in two-tiered sensor networks. This problem is to find a suitable data gathering schedule such that the network lifetime is maximized. We first present a set-covering formulation. Our second model strengthens the first one by adding lifted directed-connectivity constraints. We present two branch-and-cut algorithms. Computational results are reported to verify the efficiency and effectiveness of our methods.

## ■ SA08

Room 206B

### Optimization Software

Cluster: Super/Special Sessions

Invited Session

Chair: Yan Xu, Analytical Solutions Manager, SAS Institute Inc.,  
SAS Campus Drive, Cary, NC, 27513, United States of America,  
Yan.Xu@sas.com

#### 1 - Solving Hard Mixed Integer Programs with the Gurobi Optimizer

Zonghao Gu, Gurobi Optimization, 4050 Walnut Creek Trail,  
Alpharetta, GA, 30005, United States of America, gu@gurobi.com

After several decades of improvements in algorithms and computer technologies, people are solving harder and harder mixed integer programs. Usually large models, especially those with tens of millions of variables or constraints, are harder to solve, but there are still many small hard MIP models. We will examine several hard instances and talk about technologies, tricks and tuning approaches for solving or obtaining good solutions to these instances.

#### 2 - Progress in SAS Optimization Tools and Solutions

Yan Xu, Analytical Solutions Manager, SAS Institute Inc.,  
SAS Campus Drive, Cary, NC, 27513, United States of America,  
Yan.Xu@sas.com

SAS provides a suite of optimization tools which includes a powerful algebraic modeling language and a set of optimization solvers for linear, mixed-integer, quadratic and nonlinear programming. Based on these tools, a number of solutions have been successfully developed for tackling industrial problems. In this talk, we first present the latest techniques that we used to improve SAS solvers. Then, we show how to model and solve real world optimization problem by using SAS optimization tools.

#### 3 - Dynamic Optimal Reserve Price in Sponsored Search Advertising

Wei Yang, Associate Professor, LIU Post/Management Department,  
720 Northern Blvd, Brookville, NY, 11548, United States of  
America, wei.yang@liu, Youyi Feng, Baichun Xiao

The generalized second-price auction (GSP) is widely used by major search engines to sell sponsored ad links. We study how the search engine should adjust the reserve price in a GSP auction with entry and exit of advertisers. Initial study shows that when all ad links are sold in the first page, the new optimal reserve price should be at least as high as the original with an entrant; Otherwise, it is a function of the number of links already sold and the new advertiser's willingness to pay.

## ■ SA09

Room 208A

### Joint Session ICS/MAS: Military and Defense Applications and Infrastructure Security

Sponsor: Computational Optimization & Applications /  
Military Applications

(Sponsored by the Computing Society)

Sponsored Session

Chair: Anna Doro-on, Senior Consultant, RAMCO Companies Inc.,  
2060 Knoll Drive, Ventura, CA, United States of America,  
anna@annaforhomelandsecurity.com

#### 1 - United States Aqueducts and Agriculture Terrorism

Anna Doro-on, Senior Consultant, RAMCO Companies Inc.,  
2060 Knoll Drive, Ventura, CA, United States of America,  
anna@annaforhomelandsecurity.com, Chia Shun Shih

Terror attacks against aqueducts and agriculture in the United States can likely disrupt the downstream industry infrastructure and cause economic aftershocks comparable to those from the use of a weapons of mass destruction. This paper illustrates a risk analysis methodology based upon cumulative prospect theory, analyze alternative protection approaches and respective probabilistic impact on urban water supply system and agriculture.

#### 2 - Military Support for Homeland Security: Iranian WMD

Martin Hershkowitz, Chief Executive Officer, Hershkowitz  
Associates, 19819 Maycrest Way, Germantown, MD, 20876,  
United States of America, martin.hershkowitz@verizon.net,  
Anna Doro-on

Iranian weapons of mass destruction (WMD) is a threat against United States, that has created the government to initiate both military and civil support. This paper demonstrates risk assessment based on cumulative prospect theory, analyzes the alternatives for effectiveness of military operations in the event of attacks for risk acceptability.

#### 3 - Planning Pilot Training at Turkish Naval Air Force

Bulent Catay, Sabanci University, FENS, Istanbul, Turkey,  
catay@sabanciuniv.edu, Tefvik Aktinalev

We address the pilot training planning problem at Turkish Naval Air Force. Our aim is to determine weekly flight training plans such that the number of combat-ready pilots is maximized at the end of the planning horizon. We formulate a 0-1 mixed-integer linear program and discuss heuristic methods based on LP relaxation, Lagrangean relaxation, and Lagrangean decomposition. Our experimental results show that the Lagrangean decomposition with subgradient optimization provides good bounds.

#### 4 - An Integrated Methodology of Wind Energy Time Series Modeling: Part of Enermetrics

Heping Liu, University of Wisconsin at Madison,  
3270 ME Building, 1513 University Avenue, Madison, WI, 53706,  
United States of America, hepingliu@yahoo.com

An integrated methodology to perform the interval estimation of wind speed, monitor the operation of wind turbine, and forecast the corresponding wind power output is developed. The empirical investigation on the methodology is conducted, and the results show that the developed methodology is very effective. It is expected that this work can motivate the development of a new principle coined as Enermetrics.

## ■ SA10

Room 208B

### Panel: The Challenges of Practicing "Scientific Decision-Making" in Chinese Organizations

Sponsor: Decision Analysis Society

Sponsored Session

Moderator: Yong Tao, Chairman, SDR Consulting (Strategic Decision Research), 2602 Tower A, Jianwai SOHO, No.39, Dongsanhuan Zhonglu, Chaoyang District., Beijing, 100022, China, taoyong@sdr.com.cn

#### 1 - Challenges to Apply the "Scientific Decision-making" into Practices

Panelist: Hongmei Wang, General Manager, Strategy Development Department, China Mobile, No. 29, Financial Street, Xicheng District, Beijing, China, wanghongmei@chinamobile.com

China Mobile is the 5th largest company in China and the largest mobile operator in the world in terms of number of subscribers (more than 600 million) and market cap. It is also a pioneer in introducing modern decision-making principles into its strategic decision management practice in large Chinese corporations. Ms. Wang will share with the audience some of her stories and cases when it is particularly challenging to apply the 'scientific decision-making' in practices.

#### 2 - Differences in Decision-making Styles between a Large State Owned Company and a Privately Owned Company

Panelist: Min Liu, Vice President, ENN Group, Huaxiang Road, Economic, and Technological Development Zone, Langfang, 065001, China, liumini@enn.cn

ENN is one of the largest privately -owned clean energy groups in China. Mr. Liu was formerly the General Manager, Strategic Research Center, China Guangdong Nuclear Power Corporation, Shenzhen, China. Guangdong Nuclear Power Corporation is the largest nuclear power operator in China. It also has the largest nuclear power unit fleet under construction in the world today. Mr. Liu will share his cases and stories after embarking on a course of scientific decision-making.

**3 - Differences between a Financial Organization and the Government Regulatory Body**

Panelist: Lingwu Xia, General Manager, Strategic Management Department, China Everbright Bank, No. 25, Taipingqiao Avenue, Xicheng District, Beijing, China, xialingwu@cebbank.com

Everbright Bank is one of the top ten national banks in China and known for its innovative Sunshine Asset Management Services in China. Mr. Xia also has broad experience working with the China Bank Regulatory Commission before he joined Everbright Bank. He will share his experiences trying to applying 'scientific decision-making' methodology in tackling some key strategic decisions.

**4 - The Challenges of Practicing "Scientific Decision-Making" in Chinese Organizations**

SDR is a leading strategic decision and management consulting firm assisting clients in China to provide world class products and services. The Central Government of China has been promoting the application of "Scientific Decision-Making" in Chinese organizations in the past decade. However, it is not quite clear what "scientific" means – everyone has his or her own interpretation. In addition, Chinese decision making has been as mysterious to the outside world as its culture. In spite of these, this session attempts to share the cases and stories of the challenges of scientific decision-making by a representative group of the most forward thinking organizations in China. No doubt in the challenges there will be a good dose of Chinese cultural impacts on the way decision-making is practiced. The hope is that this session will trigger a series of global and Chinese academic research and study interests that will ease these challenges in the future.

**SA11**

Room 209A

**Competition Models in Supply Chain Management**

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Bintong Chen, University of Delaware, Lerner College of Business and Economics, Newark, DE, 19716, United States of America, bchen@udel.edu

**1 - Competing with Customer Returns Policies**

Jing Chen, Assistant Professor, Faculty of Business & Economics, University of Winnipeg, 460 Portage Ave, Winnipeg, MB, R3B 2E9, Canada, jc200808@gmail.com

Products returned have gained an increasing attention in the retailing industry. We consider a supply chain in which a manufacturer supplies a product to two competing retailers. Both retailers allow for customer returns. We evaluate the equilibrium pricing decision and customer returns policies. We find that in the presence of competition, a full refund customer returns policy is not necessarily increase the profit.

**2 - Responsible Operations in Competitive Supply Chain**

Yu Xia, Associate Professor, Northeastern University, Hayden Hall 214, 360 Huntington Ave., Boston, MA, 02115, United States of America, Y.Xia@neu.edu, Xingxing Zu

Organizations should not only be managed efficiency, but also behave responsibly to our environment and to our society. This research tries to investigate how responsible operations influence an organization's performance and market segmentation in a competitive supply chain. In particular, we study the responsible operations that require higher operations cost that may be controversial to an organizations' financial goal in short term.

**3 - Research on the Mode and Motivation for Integration of Manufacturing and Marketing in Pork Industry**

Jinrong Zheng, Professor, Shanghai Ocean University, 999, Hu Chenghun Road, Linggang New City, Shanghai, China, jrzheng@shou.edu.cn

It is one of the effective ways to solve the problem of pork quality and safety by SCM strategy. But the traditional SC model can't resolve the problem satisfactorily. In recent years, it is a new hot spot to research food safety issues from the perspective of integration of manufacturing and marketing (IMM). Based on food safety and economics, it analyzes the motivation of IMM in pork supply chain. And it proves that IMM is an effective way to resolve food safety.

**4 - Distribution Free Decisions and Business Applications**

Jinfeng Yue, Professor, United States of America, jinfeng.yue@mtsu.edu

We provide some new development in distribution free business models. For different penalty functions, we study the business decisions based on different objectives. For some models, we obtain not only the decisions but also the distribution information values. With the development, we can better understand the distribution information and parameters' impact to the business decisions and the trade offs between various information costs and improvement's value in the business decisions.

**SA12**

Room 209B

**Sustainable Development and Green Supply Chain**

Cluster: Super/Special Sessions

Invited Session

Chair: Haiqing Song, Prof, Sun Yat-Sen University, No. 135, Xingang Xi Road, Guangzhou, China, songhq@mail.sysu.edu.cn

**1 - A Study on Low-carbon Product Pricing and Carbon Emission Problem under Carbon Trading Mechanism**

Haiqing Song, Prof, Sun Yat-Sen University, No. 135, Xingang Xi Road, Guangzhou, China, songhq@mail.sysu.edu.cn

A system with a government, a regulated production organization and a targeted market is considered. In the presence of different low-carbon awareness among the consumers and subsidies upon low-carbon product, a profit maximization objective function is formulated with decision variable of total target carbon emission, exogenous parameters of carbon price and emission quota.

**2 - Carbon Emissions Implications in an Aligned Supply Chain**

Weixin Shang, Associate Professor, Fudan University, 670 Guoshun Road, Shanghai, 200433, China, shangwx@fudan.edu.cn

Retailer giants such as Tesco and Walmart have gone a long way in greening their supply chains, taking active actions that influence both their suppliers and consumers. We seek to analyze the interesting interactions in-between linking environment, operations, marketing and so forth, which could shed light on management of the aligned supply chain for researchers and practitioners alike.

**3 - Optimal Operating Policies for a Carbon Constrained Power Plant**

Yanzhi Li, City University of Hong Kong, Tat Chee Ave, Kowloon Tong, Kowloon, Hong Kong - PRC, yanzhili@cityu.edu.hk, Yimin Yu

We study the optimal fuel procurement and power generation policy for a power plant which is subject to carbon constraints. The power plant, in addition to a long-term contractual demand (base load) that has to be fulfilled, generates and sells electricity in response to volatile fuel and electricity prices. We characterize the structure of the optimal fuel procurement and power generation policies for the power plant. Numerical experiments further illustrate some managerial insights.

**4 - Approximation Balancing Policies for Inventory Systems with Remanufacturing**

Sean Zhou, The Chinese University of Hong Kong, Hong Kong - PRC, zhoux@se.cuhk.edu.hk, Zhijie Tao

We consider a single-product periodic-review inventory system with remanufacturable returned products. Demand and returns follow some general stochastic processes and may be correlated, non-stationary and evolving across different periods. We propose an approximation algorithm for computing manufacturing and remanufacturing quantities in each period and show that the expected cost under this approximation policy is at most twice of the optimal one.

**SA13**

Room 210A

**IAC Invited Panel Discussion: Recent Development of Industrial Engineering in Asia**

Cluster: INFORMS International Activities/Board

Invited Session

Moderator: Fugee Tsung, Professor, HKUST, Clearwater Bay Road, Kowloon, Hong Kong - PRC, season@ust.hk

**1 - CIIE 50th Anniversary**

Panelist: Paul Hsing Luh, National Chengchi University, Taipei, Taiwan - ROC, orlab63@gmail.com

The Chinese Institute of Industrial Engineers (CIIE) in Taiwan established in 1962 and is its 50th anniversary in 2012! The milestones and major accomplishments will be reported as follows. 1. Registration of CIIE in 1962 2. Official Journal (JCIE) 3. Certification Program 4. The IE&M program in NSC 5. Contributions to Industrial and Economic Development.

**2 - Strategic Models of Industrial Engineering**

Panelist: Tae-Eog Lee, Professor, Department Head, KAIST, Dept. of Industrial & Systems Eng., 373-1 Guseong-dong, Yuseong-gu, Daejeon, 305-701, Korea, Republic of, telee@kaist.ac.kr

We review evolution history, roles and demand of industrial engineering. We also explain how IE discipline and its roles in Korea have changed. We discuss recent issues and challenges for the future economy and industry. We then propose a new model of IE education and research.

### 3 - Challenges in IE Education and Research: Global Trends and How Asia Should Respond

Loon Ching Tang, Professor, National University Singapore, Department of Ind & Sys Engrg, Singapore, isetlc@nus.edu.sg

Globalization has brought about unprecedented changes in the economic structure of developed countries. As ISyE education and research are typically motivated by real world issues, there is a shift from focusing on traditional IE methodologies to areas related to complex systems. In this presentation, we discuss some of the recent trends and highlight some changes to our ISyE curriculum. Some thoughts on future challenges will also be presented.

### 4 - IE Education and Research in Mainland China

Li Zheng, China, lzheng@tsinghua.edu.cn

From three IE programs in 1993 to more than 200 IE programs, the IE education and research in mainland China has made a great progress in recent 20 years, a brief introduction on the history and situation of IE in mainland China will be given, after that a challenge faced by IEers in mainland China will be discussed.

## SA14

Room 210B

### Large-scale Service Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Jiheng Zhang, HKUST, Clear Water Bay, Hong Kong, China, j.zhang@ust.hk

#### 1 - Design and Control of Customer Service Chat Systems with Customer Abandonments

Tolga Tezcan, Assistant Professor, University of Rochester, Simon Hall, Rochester, NY, United States of America, Tolga.Tezcan@simon.rochester.edu, Jiheng Zhang

We consider customer service chat systems where customers receive service from agents using an instant messaging application. In these systems agents can serve multiple customers simultaneously and customers have limited patience. We propose a routing policy and show that it is asymptotically optimal for large systems.

#### 2 - Staffing and Control of an Instant-messaging Based Customer Service Center

Jun Luo, HKUST, Clear Water Bay, Hong Kong, China, jluolawren@ust.hk, Jiheng Zhang

A new kind of customer contact centers, in which agents communicate with customers via instant-messaging (IM) over the Internet, is prevalent nowadays. A distinctive feature of IM-based service centers is that one agent can serve multiple customers in parallel. We model such a center as a server pool consisting of many limited processor sharing (LPS) servers. We characterize the underlying stochastic processes by establishing a fluid approximation in the many-server heavy traffic regime.

#### 3 - Diffusion Approximation for Queueing Systems with Customer Abandonment

Jiheng Zhang, HKUST, Clear Water Bay, Hong Kong, China, j.zhang@ust.hk, Junfei Huang, Hanqin Zhang

We propose a unified approach to the diffusion approximation of many-server queues with abandonment in two heavy traffic regimes: non-degenerate slowdown (NDS) and Halfin-Whitt (QED). The key is to establish an asymptotic relationship between the abandonment process and the queue length process under a mild assumption, which will be verified. This relationship, via the continuous-mapping theorem, leads to the diffusion approximation for both queue length and virtual waiting time processes.

#### 4 - Mean-Field Approximation for Supermarket Models with PH Service Times

Quan-Lin Li, Professor, Yanshan University, Qinhuangdao, HB, 066004, China, liquanlin@tsinghua.edu.cn, John C.S. Lui

We analyze a supermarket model of  $N$  identical servers with phase-type service times. As  $N$  goes to infinity, we apply the operator semigroup to provide a mean-field approximation for the sequence of Markov processes describing the supermarket model. Also, we provide an effective algorithm for computing the fixed point by means of the matrix-analytic methods, this gives performance analysis of the supermarket model.

#### 5 - A Numerical Scheme for Invariant Distributions of Constrained Diffusions

Jiang Chen, University of North Carolina-Chapel Hill, 480 Melanie Ct, Chapel Hill, NC, 27514, United States of America, jiangc@live.unc.edu, Amarjit Budhiraja, Sylvain Rubenthaler

Reflected diffusions in polyhedral domains are commonly used as approximate models for stochastic processing networks in heavy traffic. In this work we propose and analyze a Monte-Carlo scheme based on an Euler type discretization of the reflected stochastic differential equation using a single sequence of time discretization steps which decrease to zero as time approaches infinity.

## SA15

Room 212A

### Bayesian Estimation in Marketing

Sponsor: Marketing Science

Sponsored Session

Chair: Yang Li, Assistant Professor, Cheung Kong Graduate School of Business, 3rd Floor, Tower E3, Oriental Plaza, 1 East Chang An Avenue, Beijing, 100738, China, yli14@gsb.columbia.edu

#### 1 - Bayesian Estimation of Non-Stationary Discrete Choice Dynamic Programming Model

Masakazu Ishihara, New York University, Tisch 818, 40 West 4th Street, New York, NY, 10012, United States of America, mishihar@stern.nyu.edu, Andrew Ching

We develop a Bayesian Markov chain Monte Carlo algorithm for estimating non-stationary discrete choice dynamic programming (DDP) models. Our algorithm extends Imai, Jain and Ching (2009). It proposes to solve value functions at only one randomly chosen state point per period, and approximate expected value functions nonparametrically using the set of those partially solved value functions. Monte Carlo exercises show its ability to estimate computationally demanding non-stationary DDP models.

#### 2 - Dynamic Targeted Pricing in B2B Settings

Jonathan Zhang, Assistant Professor of Marketing, University of Washington, 547 Paccar Hall, University of Washington, Seattle, WA, 98195, United States of America, zaozao@uw.edu, Oded Netzer, Asim Ansari

We model the multifaceted impact of pricing decisions in B2B contexts and show how a seller can develop optimal inter-temporal targeted pricing strategies to maximize long-term customer value. We empirically model the B2B customer's purchase decisions in an integrated fashion and capture the short and long-term dynamics. Our modeling framework weaves together in a multivariate hierarchical Bayesian manner, a non-homogeneous hidden Markov model, and control functions for price endogeneity.

#### 3 - A Bayesian Semiparametric Approach for Endogeneity and Heterogeneity in Choice Models

Yang Li, Assistant Professor, Cheung Kong Graduate School of Business, 3rd Floor, Tower E3, Oriental Plaza, 1 East Chang An Avenue, Beijing, 100738, China, yli14@gsb.columbia.edu, Asim Ansari

Extant treatments of endogeneity using likelihood-based estimators impose parametric distributions on the source of endogeneity. Misspecified distributions impact parameter estimates and are inconsistent with price-setting behaviors. We propose a Bayesian semiparametric approach to allow uncertainty on the distribution of endogeneity (and heterogeneity) errors. Using simulated data and real panel data we demonstrate the new approach offers a flexible and robust alternative to parametric methods.

## SA16

Room 212B

### Retail Innovations and Supply Chain Performance

Cluster: Interface between Operations Management and Marketing

Invited Session

Chair: Jun Zhang, Assistant Professor, University of Texas-Dallas, School of Management, Richardson, TX, United States of America, jun.zhang@utdallas.edu

#### 1 - Item Level Evidence: An Empirical Analysis of the Bullwhip Effect

Oliver Yao, Lehigh University, 621 Taylor Street, Bethlehem, PA, United States of America, yuy3@Lehigh.EDU, Yongrui Duan, Jiazhen Huo

Using a unique, Item level data set obtained from a large Chinese retail chain, we estimate the bullwhip effect using different measures, and examine how it may be masked or dampened when aggregating at Item level, store level, and time level. We also examine the potential drivers for the bullwhip effect including demand characteristics, price, product variety, etc.

## 2 - Retailer vs. Vendor-managed Inventory and Customers' Store Loyalty

Jun Ru, Assistant Professor, University at Buffalo, Dept. of Operations Mgmt. & Strategy, Buffalo, NY, 14260, United States of America, junru@buffalo.edu, Ruixia Shi, Jun Zhang

It has been widely accepted in the industry that retailers improve profitability by implementing vendor-managed inventory (VMI). We, however, demonstrate that a retailer may be worse off by adopting VMI when retail competition is present. Moreover, the examination of the impact of customers' store loyalty on the value of VMI to the retailer reveals that a retailer with a high customer loyalty benefits from VMI for a wider range of wholesale prices than a retailer with a low customer loyalty.

## 3 - Store Brand and Supply Chain Power

Jun Zhang, Assistant Professor, University of Texas-Dallas, School of Management, Richardson, TX, United States of America, jun.zhang@utdallas.edu, Jun Ru, Ruixia Shi

In this paper, we study how a retailer's power vis-a-vis its supplier affects its store brand introduction decision.

## SA17

Room 213A

## Planning and Scheduling in Health Care I

Cluster: Super/Special Sessions

Invited Session

Chair: Michael Pinedo, Stern School of Business, New York University, New York, NY, United States of America, mpinedo@stern.nyu.edu

### 1 - Sequencing and Scheduling Appointments with Potential Call-in Patients

Rachel Chen, University of California-Davis, Graduate School of Management, Davis, CA, United States of America, rachen@ucdavis.edu, Lawrence Robinson

Clinics typically face two types of patients: routine patients who book ahead of time and same-day patients who call for an appointment later that day. This paper considers the sequencing and scheduling for both routine patients and a random number of same-day patients. We find that no-shows and the variability in the number of patient call-ins are significant drivers for the sequencing decision.

### 2 - Long-term Planning Policies for Elective Surgery Management

Gabriella Dellino, IMT Institute for Advanced Studies, Piazza San Ponziano 6, Lucca, 55100, Italy, gabriella.dellino@imtlucca.it, Alessandro Agnetis, Alberto Coppi, Matteo Corsini, Carlo Meloni, Marco Pranzo

This talk deals with operating room planning. We analyze different policies for defining the weekly master surgical schedule, for assigning surgical disciplines to operating rooms and allocating elective surgeries for each session. The objective is to find the best tradeoff between operational efficiency and organizational complexity. We evaluate the performance of various policies throughout one year, w.r.t. different indicators, including operating room utilization, throughput and lateness.

### 3 - Appointment Scheduling with Limited Distributional Information

Jiawei Zhang, New York University, New York, NY, United States of America, jzhang@stern.nyu.edu, Ho-Yin Mak, Rong

In this paper, we develop distribution-free models that solve appointment scheduling and sequencing problems by assuming only moment information. In the special case where the first two marginal moments are given, the problem can be reformulated as a second-order cone program. Based on the structural properties of the two-moment model, we prove that, under a mild condition, it is optimal to sequence jobs in increasing order of duration variance.

### 4 - Appointment Scheduling with No-Shows – Priority Rules and Heuristics

Michael Pinedo, Stern School of Business, New York University, New York, NY, United States of America, mpinedo@stern.nyu.edu, Christos Zacharias

Consider a server with  $n$  timeslots and  $m$  customers to be scheduled. Each customer has a no-show probability and a weight. Since customers may not show up, the scheduler may overbook. The server may work overtime, beyond the  $n$  slots, to serve all scheduled customers. The objective is the sum of expected idle time, overtime, and waiting time. We establish properties of optimal schedules and the overall structure for the offline problem and propose a heuristic for the online problem.

## SA18

Room 213B

## Advances in Traffic Signal Control and Optimization

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Yue Liu, Assistant Professor, University of Wisconsin-Milwaukee, P.O. Box 784, Civil Engineering and Mechanics, Milwaukee, WI, 53201, United States of America, liu28@uwm.edu

### 1 - A Two-Step Optimization Model for Dynamic Lane Assignment at Isolated Signalized Intersections

Jing Zhao, Tongji University, No.4800, Caoan Road, Shanghai, 201804, China, angelezhao@hotmail.com, Wanjing Ma, Xiaoguang Yang

This paper presented a two-step optimization model for dynamic lane assignment at isolated signalized intersections. The first step was to obtain the best lane assignment scheme by an arm-group based Integer-Non-Linear-Programming model. The second step was to identify a suitable implementation scheme by determining a binary-type threshold. The performance of this method has been validated by VISSIM simulation.

### 2 - Robust Optimal Traffic Signal Timing for Roundabout

Wanqing Ma, Tongji University, No.4800, Caoan Road, Shanghai, China, mawanjing@tongji.edu.cn

This paper presents a model to determine robust optimal signal timings for roundabout that are less sensitive to fluctuations of traffic flows or perform better against the worst-case scenario without losing much optimality. Both signals at entering approaches and circulatory lanes are considered in a unified framework. Computational experiments are conducted to validate the model formulations and solution algorithms.

### 3 - A Mixed-flow and Signal Optimization Model for Urban Network Emergency Evacuation

Xin Zhang, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, United States of America, leadaming@gmail.com, Gang-Len Chang

The difficulty of modeling the urban evacuation lies in the complex interrelations, where the vehicle flows generated from parking garages or pick-up locations are dependent of arriving pedestrians which, also emerge as the conflict flows at critical intersections. Most existing optimization studies deals with either on-road vehicles or in-building pedestrians. This paper presents a model to optimize the mixed-flow distributions and the intersection signal timing plans in the mixed-flow network.

### 4 - Optimization Control Model for Lane-Based Signal Merge Control at Freeway Work Zone

Jing Mao, University of Wisconsin-Milwaukee, 1522 E Newport Ave, Milwaukee, WI, 53211, United States of America, jingmao@uwm.edu, Yue Liu

This paper provides an optimization control model for Lane-Based signal merge control at freeway work zone. Optimization formulations based on the concept of cell transmission model have been presented. The applicability of the proposed model has been illustrated by a simulation-based experiment with a hypothetical freeway work zone.

## SA19

Room 215

## Queueing Theory and Applications

Contributed Session

Chair: Chun Qiu, Assistant Professor of Marketing, McGill University, 1001 Sherbrooke Street W, Montreal, QC, Canada, chun.qiu@mcgill.ca

### 1 - Yield Management with M/M/s in Restaurant Industry

Xin Li, University of Macau, University of Macau, B1-B211, Macau, Macau, robinli@umac.mo, Zhaotong Lian

Restaurant revenue management has the three characteristics of the yield management: perishability of the product, fixed capacity and possible to segment customers. Therefore, some methods in yield management, like the price discrimination, can be used in restaurant industry. However, the service process in restaurant is on queue in system. Therefore, we will use optimal pricing and resource allocation with M/M/s process to maximize its profit and the numerical results will show the performance.

## 2 - Queueing System Problem under Fake Information: Optimization Model and its Application

Chen Xiaohong, Central South University, Business School, Changsha, 410083, China, hanhaha12@hotmail.com, Han Xiaomei

For invisible queueing system, the paper initially puts forward how fake information affects system profit and constructs an optimization model. We get average queue length according to birth and death process, with conditional probability method we get average stay time of system and demonstrate final object function of system profit. The example gives reason why some systems provide fake information and some who pay attention on long-term development reject fake information.

## 3 - Simulation Study Examining Queueing Methods for Early and Late Arrivals in an Outpatient Clinic

Karolina Glowacka, Assistant Professor, Stevens Institute of Technology, Howe School of Technology Management, Babbio 427, Hoboken, NJ, 07030, United States of America, kglowack@stevens.edu, Jerrold May, Luis Vargas

Early and late patient arrivals can greatly disrupt clinic operations and create inefficiencies. We examine the effect of early and late patient arrivals based on data collected at a multiple specialty clinic within the VA Pittsburgh Hospital System and suggest changes in the way such patients should be handled. We examine strategies that would remove incentives for late or very early arrivals thus encouraging more patients to arrive on time for their scheduled appointments.

## 4 - M/M/1 with External Power Supply

Ho Woo Lee, Dr., Sungkyunkwan University, 300 Cheon-Cheon, Su Won, Korea, Republic of, hwlee@skku.edu, Jung Woo Baek, Liyan Feng, Se Won Lee

This talk outlines the analytical approach for the analysis of the M/M/1 queueing system in which the server is power-supplied to serve the customers. If the server is short of power, it stops serving the customers and immediately enter the recharge period.

## 5 - The Strategic Implications of Long Queues in Seasonal Shopping

Chun Qiu, Assistant Professor of Marketing, McGill University, 1001 Sherbrooke Street W, Montreal, QC, Canada, chun.qiu@mcgill.ca, Wenqing Zhang

This study investigates two marketing implications of customer queuing in seasonal shopping. We focus on the exit queue that customers take to finishing shopping. We show that a long queue helps retailers effectively target price-sensitive but time-insensitive customers during holiday seasons. In addition, a long queue prompts customers who stay to purchase more. It is therefore beneficial for retailers to maintain a certain length of the queue.

**Sunday, 11:00am - 12:30pm**

## SB02

Room 202A

### Data Mining Modelling and Applications

Sponsor: Data Mining

Sponsored Session

Chair: Li Zhang, Royal Bank of Scotland, Norwalk, CT, 06851, United States of America, lieezhang@gmail.com

#### 1 - Sector Rotation in China Equity Market

Ying Deng, ying1deng@gmail.com

SW industrial classification is widely used in China which contains 23 catalogs. Anyhow it shows some obvious co linearity. This paper compares different classification algorithms by different clustering methods. It focuses on Ward method with consideration of both economics meaning and Statistical Significance results. It then generates new industrial factors by PCA. Finally it tries to discover the movements among the new industrial sectors by granger causality analysis.

#### 2 - Intensity Models and Transition Probabilities for Credit Card Loan Delinquencies

Jonathan Crook, Professor, University of Edinburgh, Credit Research Centre, 29 Buccleuch Place, Edinburgh, EH8 9JS, United Kingdom, j.crook@ed.ac.uk, Mindy Leow

We estimate the probability of delinquency and default for a sample of credit card loans using intensity models, via semi-parametric multiplicative hazard models with time-varying covariates. It is the first time these models, previously applied for the estimation of rating transitions, are used on retail loans. The probabilities estimated for each type of transition are then used to make out-of-sample predictions over a specified period of time.

## SB03

Room 203B

### AI in Healthcare

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Lin Lin, Lehigh University, 621 Taylor Street, Bethlehem, PA, United States of America, lil204@Lehigh.edu

#### 1 - Targeting and Segmentation Models to Maximize ROI for Sales and Marketing Operations for Pharma Companies

Sophia Wang, Business Analytics and Optimization Center of Competency, IBM, 9 Jia Feng Road, WaiGaoQiao Free Trade Zone, Shanghai, China, sophiawang@cn.ibm.com, Palash Bhattacharya

Under financial pressures of promotion and operational costs, it is important for pharma companies selling generic drugs to embrace multiple channels including e-detailing and social media, and target campaign deployment to segments based on factors such as therapeutic classes, distribution of physicians by specialty / Rx volume / response to promotions, contribution of Rx vs OTC sales, etc. We share our experience on how to use advanced analytics and optimization to maximize ROI on marketing.

#### 2 - Health Information in West China Hospital, Our Experience and Exploration

Jialin Liu, West China University of Medicine, Renmingnan Road, Chengdu, China, jialinliu6@gmail.com

West China Hospital's health information strategy includes: 1. Build Digital Hospital 2. Build Regional Health Information Network Center 3. Medical Informatics Education We discuss how to implement health information in China. We also pass on the most important practical lessons in design and implementation from our experience in doing this work. Finally, we discuss the importance of regional health information network and medical information education.

## SB04

Room 203A

### Monte Carlo Simulation in Financial Engineering

Sponsor: Simulation

Sponsored Session

Chair: Ning Cai, Assistant Professor, Hong Kong University of Science & Technology, Industrial Eng. & Logistics Mgmt., Clear Water Bay, Hong Kong - PRC, ningcai@ust.hk

#### 1 - A Multilevel Simulation Method to Portfolio Risk Measurement

Nan Chen, Chinese University of Hong Kong, Systems Engineering & Engineering Management, Room 609, William M W Mong Engineering, Shatin, N.T, Hong Kong - ROC, nchen@se.cuhk.edu.hk, Yanchu Liu

In this paper we propose a Monte Carlo method to estimate various nonlinear risk measures for financial portfolios. We present a multilevel scheme to resolve the tradeoff between the bias and the variance of the estimator. We show that the complexity of our method is  $O(\epsilon^{-2} (\log \epsilon)^2)$  in the cases of Lipschitz risk measures and  $O(\epsilon^{-7/3})$  in the cases of loss probabilities, if we require the target mean square error (MSE) to be less than  $\epsilon^2$ .

#### 2 - Rare-event Simulation in Portfolio Credit Risk

Xiaowei Zhang, Assistant Professor, Hong Kong University of Science and Technology, HKUST, Hong Kong - PRC, xiaoweiz@ust.hk

We consider a portfolio exposed to credit risk and partition the constitute firms into several homogeneous groups. The default dynamics of each group is governed by a systematic risk and an idiosyncratic risk factor. All the risk factors form a multivariate affine jump-diffusion process. In this talk, we will present explicit calculation of large deviations asymptotics of default loss process and apply it to develop an asymptotically optimal rare-event simulation scheme.

#### 3 - Exact Simulation of the SABR Model

Ning Cai, Assistant Professor, Hong Kong University of Science & Technology, Industrial Eng & Logistics Mgmt, Clear Water Bay, Hong Kong - PRC, ningcai@ust.hk, Nan Chen, Yingda Song

The SABR model enjoys great popularity in the financial industry due to its strong capability of capturing the volatility smiles. However, there exists no analytical solution for the SABR model that can be simulated directly. This paper proposes a method for the exact simulation of the forward price and the volatility under the SABR model, which can be used to generate unbiased estimators for derivative prices. Numerical experiments indicate the method is efficient and simple to implement.

## ■ SB05

Room 205B

### Bioenergy Supply Chain and Market Models

Sponsor: Energy, Natural Resources & the Environment

Sponsored Session

Chair: Guiping Hu, Iowa State University, 3033 Black Engr, Ames, IA, 50011, United States of America, gphu@iastate.edu

#### 1 - Costs and Emissions of Optimal Midwestern Pretreatment and Upgrading Biofuel Technologies

Mark Mba Wright, Massachusetts Institute of Technology, 112 Charles River Rd., Watertown, MA, 02472, United States of America, markmw@mit.edu, William Morrow, Robert Brown, Guiping Hu, Yanan Zhang

This study compares the economic and environmental performance of novel biomass pretreatment technologies using a mixed integer linear programming formulation for U.S. Midwestern counties. We identify optimal locations for distributed and centralized facilities and the allocation of raw and pretreated feedstock to biomass conversion facilities. We conduct economic and well-to-wheel environmental assessments of all scenarios. Biofuel prices ranged \$2 - \$5/gal with 18 - 109 gm CO<sub>2</sub>/km emissions.

#### 2 - A Mean-risk Stochastic Programming Model for Cellulosic Biofuel Supply Chain Problem

Yongxi Huang, Assistant Professor, Clemson University, 110 Lowry Hall, Clemson, SC, 29634, United States of America, yxhuang@clemson.edu, Steven Chen, Yueyue Fan

A two-stage mean-risk stochastic programming model is developed for a cellulosic biofuel supply chain problem to balance the overall system efficiency and reliability against feedstock seasonality and uncertainty. This mix-integer stochastic program is computationally challenging due to the large size of problem and it is solved by a scenario decomposition based progressive hedging method. The model is tested in a case study of producing cellulosic biofuel from biowastes in California.

#### 3 - Designing Optimal Contracts for Biomass Production on Conservation Reserve Program Lands

Hayri Onal, Professor, University of Illinois at Urbana-Champaign, 326 Mumford Hall, 1301 W. Gregory Drive, Urbana, IL, 61801-3605, United States of America, h-onal@illinois.edu

In US, 12 million hectares of agricultural lands are retired to protect natural resources, environment, and biodiversity. Targeted increases in bioenergy production and demand for feedstocks may return some of those lands back to agriculture. This paper introduces a mathematical programming model for determining optimal contracting alternatives for biomass production on CRP lands. Empirical results are presented.

#### 4 - Multi-scale Correlations between Tanker Freight Rate and Oil Price

Xiaolei Sun, Institute of Policy and Management, No. 15, Zhongguancun Beiyitiao, Beijing, China, sxltracy@163.com, Ling Tang, Yuying Yang

Taking time-dependent features into account, this paper focuses on the multi-scale correlations between tanker freight rate and oil price. Multi-scales are extracted from tanker freight rate using Ensemble Empirical Mode Decomposition, and the correlations between multi-scale components and oil price are examined. Empirical results show that major and long-term trends are close correlated to the oil price in opposite dependent structures while the short-term fluctuation is nearly uncorrelated.

## ■ SB06

Room 205A

### Dynamic Models in Operations Management

Cluster: Supply Chain Management in China

Invited Session

Chair: Yongbo Xiao, Associate Professor, Tsinghua University, School of Economics and Management, Tsinghua University, Beijing, BJ, 100084, China, xiaoyb@sem.tsinghua.edu.cn

#### 1 - Cold Chain Coordination Based on a Combined Contract

Lei Yang, Associate Professor, School of Economics and Commerce, South China University of Technology, Guangzhou, China, yang@scut.edu.cn

This paper proposes a combined contract to coordinate a cold chain composed of one supplier and one distributor where the temperature-controlled cost is taken into account. The results show that under the combined contract, the sales target

affects each member's profit; the decentralized supply chain can behave as a centralized one; using the bargaining model, the paper proves that the distributor is willing to decrease the temperature to keep the product in a high-level state.

#### 2 - Dual Sourcing and Contingent Backup with Reliability Improvement

He Huang, Chongqing University, Chongqing University, Chongqing, China, Chongqing, China, huanghe@cqu.edu.cn, Hongyan Xu

We consider a scenario that a buyer faces two prime suppliers and one backup supplier. Prime suppliers have supply risks and backup supplier can offer the orders exactly but with a higher cost. However, prime suppliers can exert efforts to improve their reliabilities. The buyer first orders from prime suppliers and then decides whether to order from backup supplier with updating information of supply risks. We'll show the buyer's optimal strategy and the role of the update information.

#### 3 - Managing the Portfolio of Probabilistic Goods

Yongbo Xiao, Associate Professor, Tsinghua University, School of Economics and Management, Tsinghua University, Beijing, BJ, 100084, China, xiaoyb@sem.tsinghua.edu.cn

We extend the idea behind probabilistic selling by developing a menu of PGs. The retailer dynamically controls the offering of the PG portfolio, which is a subset of the m available PGs. We study the optimal admission decisions for the retailer and develop a fluid policy based on the corresponding fluid control problem. We show that this fluid policy is asymptotically optimal.

## ■ SB07

Room 206A

### Air, Rail, and Vessel Operations

Sponsor: Computational Optimization & Applications

(Sponsored by the Computing Society)

Sponsored Session

Chair: Wenbin Wei, San Jose State University, One Washington Square, San Jose, CA, United States of America, wenbin.wei@sjsu.edu

#### 1 - Optimizing Airport Surface Operations under Uncertainties

Wenbin Wei, San Jose State University, One Washington Square, San Jose, CA, United States of America, wenbin.wei@sjsu.edu

We develop mathematical models to optimize airport surface operations in the presence of uncertainties. Two different approaches are explored: simulation-based approach and mathematical programming-based approach. Uncertainties are considered through simulation and stochastic programming respectively. The developed models are applied in case studies.

#### 2 - Train Dispatching Model with Stochastic Capacity Breakdowns on an N-tracked Rail Network

Lingyun Meng, Beijing Jiaotong University, School of Traffic and Transportation, Beijing, 100044, China, lymeng@bjtu.edu.cn, XueSong Zhou

This paper presents a mixed integer programming formulation based on cumulative flow count variables for the N-tracked network train dispatching issue, with segment capacities as side constraints and applying 'capacity aggregation' technique to formulate the uncertainty of perturbations. A Lagrangian relaxation based solution approach is used to solve this problem. Illustrative examples and numerical experiments are conducted to demonstrate the performance of the proposed solution approach.

#### 3 - Seat Inventory Control Methods for High-speed Trains

Yun Bao, Beijing Jiaotong University, No.3 Shang Yuan Cun, Hai Dian District, Beijing, China, 08114193@bjtu.edu.cn, Jun Liu

Based on the analysis of the demand characters of high-speed trains, this paper proposed a deterministic linear model and a stochastic nonlinear model to solve the seat inventory control issues of high-speed trains. Lingo 11.0 was used to solve the deterministic linear model. A heuristic algorithm, GA, was developed to solve the stochastic nonlinear model. A high-speed train from Guangzhou south station to Wuhan station was applied to validate the models and the algorithms.

#### 4 - A Green Berthing Strategy in the Tidal Port

Yuquan Du, Nankai University, 94 Weijin Road, Tianjin, Tianjin, 300071, China, duyuquan2006@gmail.com, Qiushuang Chen, Ya Xu, Xiongwen Quan

With a green berthing strategy, the variable arrival time (VAT) strategy, the berth allocation problem in the tidal port is considered. The optimization problem is to minimize the departure delay time of the vessels, and the fuel consumption and vessel emissions during sailing. Extensive numerical experiments show that the VAT strategy is an applicable substitute for deepening the navigation channel in the tide port, and is competent to considerably reduce fuel consumption and vessel emissions.

## ■ SB08

Room 206B

### Optimization and Complementarity Problems with Economics Applications

Cluster: Super/Special Sessions

Invited Session

Chair: Che-Lin Su, Assistant Professor, University of Chicago Booth School of Business, 5807 S. Woodlawn Ave., Chicago, IL, 60605, United States of America, che-lin.su@chicagobooth.edu

#### 1 - On Pure Characteristics Models

Jong-Shi Pang, Professor, University of Illinois at Urbana-Champaign, 104 South Mathews Avenue, Urbana, IL, 61801, United States of America, jspang@illinois.edu, Che-Lin Su

We consider pure characteristic demand models proposed in Berry and Pakes (2007). The absence of the logit error term in these models leads to a nonsmooth formulation of the predicted market share equations. We reformulate the estimation problem of a pure characteristics model as a mathematical program with equilibrium constraints (MPEC). We discuss the computational challenges in estimating these models with the MPEC approaches.

#### 2 - Shadow Prices in Territory Division

Raghuvver Devulapalli, Research Assistant, University of Minnesota, 111 Church Street SE, L100, Minneapolis, MN, 55455, United States of America, devul002@umn.edu, John Carlsson

We consider a geographic optimization problem in which we are given a region, a probability density function defined on the region, and a collection of utility density functions defined on the region. Our objective is to divide the region into sub-regions so as to "balance" the overall utilities on the regions. Using a simple complementary slackness argument, we show how to solve the problem of optimally partitioning the region by reducing it to a low-dimensional convex optimization problem.

#### 3 - Estimating Discrete-Choice Games of Incomplete Information: A Simple Static Example

Che-Lin Su, Assistant Professor, University of Chicago Booth School of Business, 5807 S Woodlawn Ave, Chicago, IL, 60605, United States of America, che-lin.su@chicagobooth.edu

I investigate the problem of estimating discrete-choice games under incomplete information. I formulate the maximum-likelihood estimation problem as a constrained optimization problem. I use a simple, static-game example to demonstrate this approach, conducting Monte Carlo experiments to evaluate the finite-sample performance of the maximum-likelihood estimator, two-step estimators, and the nested pseudo-likelihood estimator.

## ■ SB09

Room 208A

### Assignment and Scheduling

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Xing Li, student, Industrial and Operations Engineering, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48105, United States of America, xingli@umich.edu

#### 1 - A Relaxed Schedule for an Amateur Indoor Football League

Dries Goossens, Dr., KU Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Dries.Goossens@econ.kuleuven.be, Frits Spieksma

We develop a schedule for an amateur indoor football league, consisting of 4 divisions, each with 16 teams playing a 2RR tournament. Each team has a number of dates available to play its home games. Away games can be played at any time, except on a limited number of days that each team can specify. The schedule is relaxed: teams do not play on each available round. The goal is to develop a schedule where the minimum number of days between 2 successive games for any team is maximal.

#### 2 - A General Formulation of Workforce Skill Constraints in Simple Assembly Line Balancing Models

Tamas Koltai, Professor, Budapest University of Technology and Economics, Department of Management and Corporate Economics, Magyar tudosok korutja 2, Budapest, 1117, Hungary, koltai@mvt.bme.hu

The objective of assembly line balancing (ALB) is to minimize the number of workstations organized to perform tasks with precedence constraints. An important element of proper assignment of tasks to workstations is the consideration of skill requirement of tasks, and skill level of workers. The paper summarizes the mathematical description of the different skill constraints, and shows how simple assembly line balancing models can be completed with skill considerations.

#### 3 - Scheduling Demand Information Sharing in Distribution Systems with Balanced Ordering

Sheng Hao Zhang, Associate Professor, School of Management, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, 710049, China, shzhzhang@mail.xjtu.edu.cn, Lin Yan Sun, He Xu

This paper considers a two-echelon distribution system with one supplier and multiple retailers, where the supplier replenishes retailers according to a balanced ordering scheme. Assuming all entities utilize base-stock policies and some retailers communicate to the supplier their point-of-sale data, we study how to schedule retailers' replenishment sequence to fully exploit shared demand information for stochastically comparable end-customer demands (convex order and stochastic order).

#### 4 - Assigning Women to Rooms and Roommates in a Sorority

Xing Li, student, Industrial and Operations Engineering, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48105, United States of America, xingli@umich.edu, Mark Daskin, Zixiao Chen, Jon Lee

We present optimization-based models for the assignment of women to rooms and roommates in a college sorority. Models are formulated. The problem is shown to be NP-hard. Heuristic and optimal algorithms including tightening constraints are discussed. The implementation of the modeling framework at the sorority is also outlined.

## ■ SB10

Room 208B

### Scheduling Applications

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Norbert Trautmann, Professor, University of Bern, Department of Business Administration, Schuetzenmattstrasse 14, 3012 Bern, 3012, Switzerland, norbert.trautmann@pqm.unibe.ch

#### 1 - A Hybrid Approach to Large-scale Short-term Scheduling in Make-and-pack Production

Philipp Baumann, University of Bern, Schuetzenmattstrasse 14, Bern, Switzerland, philipp.baumann@pqm.unibe.ch, Norbert Trautmann

We consider the short-term scheduling of a make-and-pack production process of the Procter & Gamble Company. The planning problem consists of minimizing the production makespan while meeting given product demands. We present a hybrid MIP-based solution approach and report on computational results for instances provided by P&G.

#### 2 - A Two-step Procedure for Maximizing the Benefit of Multiple Resource-constrained Projects

Gianluca Brandinu, University of Bern, Department of Business Administration, Schützenmattstrasse 14, 3012 Bern, Switzerland, gianluca.brandinu@pqm.unibe.ch, Norbert Trautmann

In this paper we consider the task of selecting and scheduling a set of projects, such that the total benefit of the selected projects completed before a common due date is maximized. Each project consists of multiple sub-projects which require scarce resources. We present a two-step procedure. Firstly, a subset of projects is selected by solving a MIP. Secondly, we schedule this subset using a novel schedule-generation scheme. We report on computational results for PSPLIB instances.

### 3 - Applying the Evolutionary Solver of Microsoft Excel to Scheduling Problems

Norbert Trautmann, Professor, University of Bern, Department of Business Administration, Schuetzenmattstrasse 14, 3012 Bern, 3012, Switzerland, norbert.trautmann@pqm.unibe.ch, Philipp Baumann, Gianluca Brandinu

For many scheduling applications, MILP formulations are intractable even for relatively small instances. Instead, evolutionary algorithms have proved to be appropriate. Since the 2010 version, the Solver-Add-In of Microsoft Excel includes such an evolutionary algorithm. We report on our experiences with the application of this algorithm to various scheduling problems.

### ■ SB11

Room 209A

#### Multi-echelon Systems

Cluster: Super/Special Sessions

Invited Session

Chair: Ton de Kok, Professor, Eindhoven University of Technology, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, A.G.d.Kok@tue.nl

#### 1 - Emergency Lateral Transshipments in Inventory Systems with Positive Transshipment Leadtimes

Fredrik Olsson, Dept of Industrial Management and Logistics, Division of Production Management, Lund University, Box 118 - SE-221 00 Lund, Sweden, www.pm.lth.se

We consider a single-echelon continuous review inventory system for spare parts with two parallel locations. Each location faces Poisson demand and backorders are allowed. Lateral transshipments with positive and deterministic leadtimes between the locations are allowed. We suggest a transshipment policy which is based on the timing of all outstanding orders, and develop and solve a heuristic model by using theory from nonhomogeneous Poisson processes and partial differential equations.

#### 2 - Emergency Inventory Pooling

Fang Liu, Nanyang Business School, Nanyang Technological University, Singapore, liu\_fang@ntu.edu.sg, Jeannette Song, Jordan Tong

We consider the problem of how to manage pre-positioned stocks of key relief items for disaster preparedness among multiple locations in order to minimize inventory holding and back order costs. The analytical model is motivated by a common problem faced by humanitarian and governmental organizations such as FEMA (Federal Emergency Management Agency) and the IFRC (International Federation of Red Cross and Red Crescent). In order to respond effectively to a disaster, these organizations contract with suppliers, obliging them to maintain a minimum level of inventory at all times. If there is only one location, this inventory is essentially stockpiled and incurs holding costs. Nevertheless, we show that if there are multiple locations, this emergency inventory can provide significant cost savings through a type of virtual pooling we call emergency inventory pooling. We identify a policy that optimally utilizes emergency inventory while maintaining the 100% availability requirement, and derive an algorithm that efficiently implements the policy. We conclude by examining for which firms and what kinds of products emergency inventory pooling are most valuable.

#### 3 - A Class of Policies for General Assembly Networks

Ton de Kok, Professor, Eindhoven University of Technology, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, A.G.d.Kok@tue.nl

In literature various approaches have been proposed to deal with the control of multi-echelon inventory systems under stationary demand. It has been shown that echelon order-up-to-policies are optimal for serial systems and pure assembly systems under periodic review and linear holding and penalty costs. This result can be extended to pure divergent systems under the so-called balance assumption. It is commonly accepted that optimal policies for general assembly networks are intractable. This motivated us to develop control policies that generate feasible orders for general assembly networks and allow for optimization of control parameters under the balance assumption. We show how assembly networks with non-integer Bill-Of-Material relations and cycles can be translated into related divergent networks.

### ■ SB12

Room 209B

#### Global Supply Chains

Cluster: Super/Special Sessions

Invited Session

Chair: Margaret Pierson, Assistant Professor, Dartmouth, Hanover, NH, United States of America, mpierson@hbs.edu

#### 1 - Modeling and Analysis of Flexibility in the Food Supply Chain

Rowan Wang, University of Minnesota, 111 Church St. SE, Minneapolis, MN, 55455, United States of America, wang1075@umn.edu, David Chen, Saif Benjaafar

We study flexibility in food supply chains where products are subject to contamination. Production flexibility improves the resiliency of the supply chain in the face of contamination but increases the difficulty of tracing this contamination. We characterize the optimal flexibility configuration and compare it to other common flexibility configuration including full flexibility and chaining.

#### 2 - Quality Improvement with Endogenous Spillovers

Yixuan Xiao, PhD Student, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, xiaoy@wustl.edu, Yimin Wang, Nan Yang

The prevalence of outsourcing makes it easier for suppliers to tacitly acquire buying firm's proprietary product design and to manufacture and sell similar products to other customers, undercutting the buying firm's market position. We examine important factors that influence a supplier's tendency to copy buying firm's design and technology, which we term as "endogenous spillovers". We study how such endogenous spillovers affect buying firm's desire to pursue technology and design innovations.

#### 3 - Global Sequential Production Model: Advantages and Risks

Willy Shih, Professor of Management Practice, Harvard Business School, Morgan Hall 487, Soldiers Field, Boston, MA, 02162, United States of America, wshih@hbs.edu, Margaret Pierson

Many industries like electronics use a sequential production model in which work-in-progress is passed between vertical specialists across borders, facilitated by rapid and inexpensive communication, transport, and declines in trade barriers. While firms can capture low costs by creating complex transshipment schemes, this model exposes end product producers to risks of disruption that have not been priced into their cost models. We will discuss some of the risks and costs of mitigation.

#### 4 - Inventory Monitoring in Micro Retailing

Margaret Pierson, Assistant Professor, Dartmouth, Hanover, NH, United States of America, mpierson@hbs.edu, Garrett van Ryzin

Micro-retail supply chains in developing economies face many operational challenges. One major concern of manufacturers is the lack of visibility into product availability at the store level and the consequences for lost sales. We propose a novel method for estimating out-of-stock status using only sales transaction data. The method is tested on data from a pilot project using handheld point-of-sale technology at micro-retailers in Colombia.

### ■ SB13

Room 210A

#### INFORMS IAC/Board: Overview of INFORMS and Analytics Initiatives

Cluster: INFORMS International Activities/Board

Invited Session

Chair: Judy Jin, Professor, University of Michigan, Dept. of Industrial & Operations Eng., Ann Arbor, MI, 48109, United States of America, jhjin@umich.edu

Co-Chair: Nicholas G. Hall, Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hall\_33@cob.osu.edu

#### 1 - Overview of INFORMS and Analytics Initiatives

Judy Jin, Professor, University of Michigan, Dept. of Industrial & Operations Eng., Ann Arbor, MI, 48109, United States of America, jhjin@umich.edu, Nicholas G. Hall

This is a special session jointly sponsored by INFORMS-IAC (International Activities Committee) and the INFORMS Board. In order to face the globally increasing challenges in operations research and management science, INFORMS leaders will share information and their views about INFORMS history, present, and future. The session will include (a) an overview of INFORMS history, organizational structure, and member benefits; (b) INFORMS international

activities and leadership opportunities; and (c) new INFORMS initiatives on Analytics and resulting benefits to INFORMS members.

## SB14

Room 210B

### Asymptotics and Optimization of Stochastic Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Hengqing Ye, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong - PRC, lgyehq@inet.polyu.edu.hk

#### 1 - Optimal Rate Scheduling for J-User MIMO Markov Fading Wireless Channels with Cooperation

Wanyang Dai, Professor, Nanjing University, 22 Hankou Road, Nanjing, 210093, China, nan5lu8@netra.nju.edu.cn

We design a dynamic rate scheduling policy of Markov type via the solution (a social optimal Nash equilibrium point) to a utility-maximization problem over a randomly evolving capacity set for a class of generalized processor-sharing queues living in a random environment and establish a diffusion model with regime-switching to justify its optimality of performance.

#### 2 - Fluid Limit of a Multiclass Many-server Queueing Network with Abandonment and Feedback

Weining Kang, Assistant Professor, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD, 21250, United States of America, wkang@umbc.edu, Guodong Pang

We consider a multiclass many-server queueing network with impatient customers and Markovian feedback, where external and feedback customers in each queue may have different patience time distributions. Under the i.i.d. assumptions on service and patience times for external (resp. feedback) customers at each station, all having general continuous distribution functions, we establish the fluid limit for the network in the many-server heavy-traffic regime and characterize its invariant manifold.

#### 3 - Stationarity and Control of a Stochastic Fluid Tandem Network Driven by Fractional Brownian Motions

Chihoon Lee, Colorado State University, 102 Statistics Building, Fort Collins, CO, 80523-1877, United States of America, chihoon@stat.colostate.edu, Ananda Weerasinghe

A stochastic control model driven by a two-dimensional fractional Brownian motion is considered. This model serves to approximate a controlled tandem network with heavy tailed sources in heavy traffic. We establish the weak convergence results of the state process and construct an explicit stationary state process. Based on suitable coupling arguments, the ergodic cost functional can be represented in terms of the stationary process, which leads to the existence of an optimal control.

#### 4 - Heavy Traffic Stationary Approximation of a Network under Proportional Fair Allocation

Hengqing Ye, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong - PRC, lgyehq@inet.polyu.edu.hk, David D. Yao

We study a stochastic network with multiple job classes and multiple bottlenecks, operating under the proportional fair resource control. We will discuss the stationary distributions of both the diffusion limit and pre-limit processes, and the interchange of limits – the limit in time and the limit in diffusion scaling – for both the stationary distributions and the p-th moment.

## SB15

Room 212A

### Behavioral Economics Models in Marketing

Sponsor: Marketing Science

Sponsored Session

Chair: Teck-Hua Ho, Tan Chin Tuan Centennial Professor, National University of Singapore, ODPRT, University Hall, Lee Kong Chian, Wing, #05-02, 21 Lower Kent Ridge Road, Singapore, 119077, Singapore, dprhoth@nus.edu.sg

#### 1 - Inequity Aversion and Fair Selling

Liang Guo, Associate Professor, HKUST, Department of Marketing, HKUST, Hong Kong, Hong Kong - PRC, mkguo@ust.hk

This study investigates a firm's optimal selling strategy and equilibrium welfare implications when some consumers are inequity averse and ex ante about the firm's variable cost. It highlights the endogenous impact of consumers' rational

expectation about the firm's profit on their willingness to pay. The firm's ex ante profit may increase as more consumers become inequity averse. Finally, the influences of direct cost disclosure and consumer dynamic learning are examined.

#### 2 - Unraveling Decision Making in Search

Juin-Kuan Chong, National University of Singapore, Singapore, bizcjk@nus.edu.sg, Pil-Hwa Yoo

Faced with the problem of searching for the best price, 18% of the participants still searched more than they should have and 10% searched less than they should have after eight rounds of experience, even though the participants know the price distribution. It is evident from the experimental data that a lot of people do not behave according to optimal rules. This research unravels the decision making process that belies this deviation from optimal behavior. Three aspects of the decision making process were investigated: the value functions used, the decision rules used and the potential bias in the value functions. After each draw of a price, one can employ the expected net gain for the next draw as the value function; alternatively, one might potentially consider expected net earnings for next draw, taking into account the sunk cost of past draws. In decision rules, one might look to the future and decide to stop if the expected value does not exceed a certain lower bound; or one might look at the past draws and decide to stop if the current value exceed a certain upper bound. In evaluating the value function, one may inject some optimism or pessimism into the value of next draw, thereby introducing bias into the value function. Our empirical model suggests that there was no sunk cost fallacy but people tend to be pessimistic when the price distribution is unknown and optimistic when the distribution is known. People facing unknown distribution were willing to search even when expected loss might be incurred. People did move closer to optimal behavior with experience but the optimism (pessimism) bias persists. With experience, people used both future expected gain and current value to decide when to stop.

#### 3 - A Dynamic Level-k Model in Centipede Games

Teck-Hua Ho, Tan Chin Tuan Centennial Professor, National University of Singapore, ODPRT, University Hall, Lee Kong Chian, Wing, #05-02, 21 Lower Kent Ridge Road, Singapore, 119077, Singapore, dprhoth@nus.edu.sg, Xuanming Su

Backward induction is the most widely accepted principle for predicting behavior in dynamic games. In centipede game experiments, however, players frequently violate this principle. We develop a form of alternative to Backward induction in order to capture these violations.

## SB16

Room 212B

### Customer Behavior and Supply Chain Contracting

Cluster: Interface between Operations Management and Marketing  
Invited Session

Chair: Qingning Cao, The University of Texas at Dallas, 800 West Campbell Rd, SM30, Richardson, TX, 75080, United States of America, qingning.cao@utdallas.edu

#### 1 - Competing with Bandit Supply Chains

Meng Li, University of Texas at Dallas, Richardson, TX, United States of America, meng.li@utdallas.edu, Jun Zhang

In this paper we examine the bandit phenomenon by studying the competition between an integrated supply chain and a decentralized supply chain. We demonstrate that the structural difference between the two supply chains reduces the competition intensity and quality differences between their products. A mainstream firm's profit as a function of the free riding effect is U-shaped; free riding by bandit supply chains may consequently benefit mainstream firms.

#### 2 - Buyback vs. Revenue-sharing Contracts: Influence of Supplier's Loss Aversion

Yinghao Zhang, PhD Candidate, University of Minnesota, Suite 3-150, 321 19th Ave S, Minneapolis, MN, 55455, United States of America, zhang786@umn.edu, Karen Donohue, Tony Haitao Cui

Prior analytical research shows that buyback and revenue-sharing contracts achieve equivalent channel-coordinating solutions when applied in a single supplier-buyer setting. We examine how loss aversion can lead suppliers to prefer one contract type over the other. The model predicts that loss averse suppliers prefer buyback contract in low profit margin environment while prefer revenue-sharing contract in high profit margin environment. The results of a human experiment confirm our theory.

**3 - Analysis of Endogenous Price Leadership When Outsourcing to a Competitive ODM**

Baozhuang Niu, Assistant Professor, Lingnan College, Sun Yat-Sen University, 135 Xingangxi Road, Guangzhou, GD, 510275, China, bzniuscut@yahoo.com.cn, Pengfei Guo, Yulan Wang

Consider a supply chain where an original equipment manufacturer (OEM) outsources its production to a competitive original design manufacturer (ODM). The ODM acts as an upstream partner and a downstream competitor of its OEM. We focus on when the two parties should determine the selling prices for their products in the ODM-local-market and OEM-local-market. We study their optimal pricing and outsourcing decisions. We also study the ODM's decision on keeping the manufacturing business or not.

**4 - Intellectual Property Licensing in a Production Sourcing Environment**

Tingting Jiang, Northwestern University, 2145 Sheridan Road Room C217, Evanston, IL, 60202, United States of America, tingting-jiang@northwestern.edu

This paper studies the optimal licensing contract of an Intellectual Property (IP) vendor that generates profit from licensing innovation to a production sourcing market: the buyers that design the new product and the suppliers that manufacture the product. We show that the optimal contract depends on the market expectation on the profitability of the technology. We find that subsidy strategy is often used to encourage technology adoption.

**SB17**

Room 213A

**Planning and Scheduling in Health Care II**

Cluster: Super/Special Sessions

Invited Session

Chair: Michael Pinedo, Stern School of Business, New York University, New York, United States of America, mpinedo@stern.nyu.edu

Co-Chair: Erik Demeulemeester, Professor, Catholic University Leuven, FEB, KBI, Naamsestraat 69, Leuven, B-3000, Belgium, Erik.Demeulemeester@econ.kuleuven.be

Co-Chair: Jiawei Zhang, New York University, New York, NY, United States of America, jzhang@stern.nyu.edu

**1 - An Appointment Scheduling System with Exponential Service Time Considering Overtime Work**

Jiafu Tang, Professor, Northeastern University, No 3-11, Wenhua Road, Heping District, Shenyang, 110004, China, jftang@mail.neu.edu.cn, Chongjun Yan

An appointment scheduling system is designed, by which a specified number of patients are booked in advance with no-show probability. An optimal schedule is obtained to minimize the overall cost of patients' waiting time and practitioners' idle time as well as overtime. We compared the results with a schedule designed for the same expected number of patients without no-show on the condition that the service time of each patient is exponentially distributed, and analyze the effect of no-show.

**2 - Outpatient Sequencing and Scheduling with Service Level Commitment**

Jin Qi, PhD Student, Department of Decision Sciences, Business School, National University of Singapore, 1 Business Link, Singapore, 117592, Singapore, qijin@nus.edu.sg, Melvyn Sim

This study distinguishes the outpatients into different types according to their service time distribution, and tolerable waiting time. Given the number of patients, we consider the sequencing and scheduling problem simultaneously by maximizing the confidence level such that the Conditional Value-at-Risk of waiting time is less than the patients' tolerable waiting time. Moreover, only partial information about the probability distribution of service time for each type of patients is available.

**3 - Hospital Case Mix and Capacity Planning: A Case Study in Belgium**

Guo-xuan Ma, KU Leuven, Naamsestraat 69, Leuven, B-3000, Belgium, Guoxuan.Ma@econ.kuleuven.be, Erik Demeulemeester

Hospital case mix and capacity planning concerns the long-term decision on patient volume and mix that can be treated and the medium-term decision on resource allocation. The objective is to advance the resource efficiency and to improve the patient flow. For this purpose, an integrative methodology is developed on the basis of operational research methods. This paper presents a real case study on a Belgian hospital to illustrate the efficiency and the effectiveness of the proposed methodology.

**4 - Due Time Driven Patient Scheduling**

Michael Samudra, PhD Candidate, KU Leuven, Naamsestraat 69, Leuven, Be, 3000, Belgium, Mihaly.Samudra@econ.kuleuven.be, Brecht Cardoen, Erik Demeulemeester

We deal with a real life problem found at the Belgian hospital UZ Leuven, where elective patients are assigned to a surgery date given a medical criterion called due time. The criterion defines the latest time at which a surgery of a given pathology is to be performed. In practice, this translates into a strategy where patients are served in the latest possible two weeks. We will show extensive computational results that evaluate the quality of this approach.

**SB18**

Room 213B

**Financial Markets**

Sponsor: Financial Services

Sponsored Session

Chair: Xian Sun, Assistant Professor, Johns Hopkins University, 2077 Hopewood Drive, Falls Church, VA, 22043, United States of America, xian.sun@jhu.edu

**1 - Do Institutions Matter? Evidence from the Going Public Process in China**

Xian Sun, Assistant Professor, Johns Hopkins University, 2077 Hopewood Drive, Falls Church, VA, 22043, United States of America, xian.sun@jhu.edu, Bill Francis, Iftexhar Hasan, Mingming Zhou

Using provincial data on the rule of law, property rights, law enforcement and political pluralism and expropriation risk as proxies for local legal and political institutional development in China, this paper reports a strong association between the quality of institutions and the demand for initial public offerings (IPOs), its underpricing and long-run return, as well as the fixed cost of going public by local firms.

**2 - Exchange Rate Exposure and the Cost of Debt: Evidence from Bank Loans**

Bill Francis, Professor, Rensselaer Polytechnic Institute, Troy, NY, United States of America, francb@rpi.edu, Delroy Hunter

We find that foreign exchange rate exposure has a statistically significant and economically meaningful impact on loan spreads. Specifically, a one standard deviation increase in positive exposure increases loan spreads by as much as 39 basis points and a one standard deviation increase in the magnitude of negative exposure results in a decrease in spreads of more than 15 basis points.

**3 - Simulation-based Pricing of Mortgage-backed Securities**

Jian Chen, Modeling Director, Freddie Mac, 8200 Jones Branch Drive, McLean, VA, United States of America, jian\_chen@freddiemac.com

Mortgage-Backed-Securities (MBS), as the largest investment class of fixed income securities, have always been hard to price. Monte Carlo simulation is the best approach to price MBS. In order to hedge MBS efficiently and effectively, we need to calculate hedging measures quickly and correct.

**4 - Arbitrage and Spread in the Foreign Exchange Market: An Extended Glosten and Milgrom Model**

Ming Ma, Chairman, Beijing Institute of Technology, 5 South Zhongguancun Street, Beijing, 100088, China, mark.ming.ma@gmail.com, Yufei Zhang

Based on the arbitrage index developed by Ming Ma (2005), we analyze the impact of information asymmetry on bid-ask spreads in foreign exchange market and focus on asymmetry induced by differences of analytical power. Those who have private information might still suffer from noise trader risk before the true value is finally realized. However, arbitrageurs won't. Hence, the arbitrage index as a measure of average arbitrage opportunity is positively correlated with bid-ask spreads.

**5 - Change Point Analysis of Dependence Structure and Dynamic Pricing of CDO**

Ping Li, Associate Professor, Beihang University, 37 Xueyuan Road, Haidian District, Beijing, China, liping124@buaa.edu.cn, Zezheng Li

In this paper we employ goodness-of-fit test and binary segmentation procedure to analyze the change of dependence structure between financial assets, including the change of copula family and the change of copula parameters. In our numerical work, we use the change point analysis to detect the change points of dependence structure, and calculate the fair spread for each tranche of a CDO. We also compare the results obtained from static copula, dynamic Gaussian copula and dynamic copula model.

## ■ SB19

Room 215

### Model Uncertainty, Robust Optimization and Learning

Cluster: Tutorials

Invited Session

Chair: George J. Shanthikumar, Purdue University, West Lafayette, IN, United States of America, jshanthi@purdue.edu

#### 1 - Model Uncertainty, Robust Optimization and Learning

George J. Shanthikumar, Purdue University, West Lafayette, IN, United States of America, jshanthi@purdue.edu, Max Z. Shen, Andrew E.B. Lim

In this tutorial we will present approaches to address possible statistical and structural errors in modeling. The standard approaches used to address statistical errors are to develop better statistical estimation procedures or use robust Bayesian models. Model validation and ranking of models are used to minimize the effect of structural (and statistical) errors. Statistical errors can become significant because classical modeling under uncertainty assumes a full probabilistic characterization. The learning needed to implement the policies derived from these models is accomplished either through (i) classical statistical estimation procedures or (ii) subjective Bayesian priors. Different models of model uncertainty will be discussed and different approaches to robust optimization with and without bench-marking will be presented. Two alternative learning approaches Objective Bayesian Learning and Operational Statistical Learning will be discussed. To address structural errors and avoid death spiraling effects, we will introduce Objective Operational Learning approaches that incorporate exploration and exploitation phases. Throughout this tutorial we will consider queueing control, inventory control, product portfolio selection, call center staffing, financial asset allocation and medical decision making problems as examples to illustrate these ideas.

**Sunday, 2:00pm - 3:30pm**

## ■ SC01

Room 202B

### Advancement in Traffic Network Modeling

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Henry Liu, Associate Professor, University of Minnesota, Minneapolis, MN, United States of America, henryliu@umn.edu

#### 1 - A Stochastic Model of Traffic Flow

Henry Liu, Associate Professor, University of Minnesota, henryliu@umn.edu

In a variety of applications of traffic flow, one requires a probabilistic model of traffic flow. The usual approach to constructing such models involves the addition of random noise terms to deterministic equations, which could lead to negative traffic densities and mean dynamics that are inconsistent with the original deterministic dynamics. In this talk, we will present a new stochastic model of traffic flow that addresses these issues.

#### 2 - An Improved Ant Colony System for Real Time Dispatching Strategy of AGVs in Dual Track Bidirectional

Hannaneh Rashid-Bajgan, Ms., Young Researchers Club, Islamic Azad University, Karaj Branch, Iran., # 4, 5th East Street, Shahinville, Karaj, Alborz, 31938-7749, Iran, hannaneh.rashidi@gmail.com

This research intends to design of real-time responding-request methodology in the flexible manufacturing environment by using automated guided vehicles (AGVs) on the dual track bidirectional path layout. When new requests come into the system, an improved ant colony system (ACS) included in the dispatching strategy of the multi-load AGVs is applied to find the shortest path in bidirectional topology.

#### 3 - Boundary Effects of the London Congestion Charging Scheme, 2003-2012

Ying-en Ge, Professor, Dalian University of Technology, 2 Linggong Road, Ganjingzi District, Dalian, China, y.e.ge@dut.edu.cn

Before the implementation of London Congestion Charging Scheme (LCCS) on 17 Feb 2003, attention had been paid to its potential boundary effects, including growth in rat running on residential streets around the charged area, additional parking on the edge of the charging zone, new peaks outside charging periods and migration of businesses. This presentation is to review these by means of available observed data with an aim to seek insights into potential improvements of the scheme.

## ■ SC02

Room 202A

### Humanitarian Logistics Management

Sponsor: Data Mining

Sponsored Session

Chair: Nan Liu, Zhejiang University, School of Management, Zijingang Campus, Gudun Road, Hangzhou, 310058, China, nliu@zju.edu.cn

#### 1 - Research on Manufacturer's Emergency Strategies of Dual-source under Disruption

Wenjie Zhang, Shanghai Jiao Tong University, 535, Fahua Road, Shanghai, China, scarecrow376@163.com, Jianwen Luo

Based on single-sourcing, the effects of two different sourcing strategies including risky dual-sourcing and mixed dual-sourcing on responding to supply disruption risk are analyzed. The optimal ordering decision and expected profit of the manufacturer in two different dual-source strategies is compared. Finally, some numerical examples demonstrate the impact of supply disruption probability on the sourcing decision and expected profit of the manufacturer.

#### 2 - Improving the Life Saving Performance of Emergency Logistics

Yiping Jiang, Doctoral Student, Southeast University, Nanjing, China, yipingjiang@yeah.net, Lindu Zhao, Kai Huang, Yufei Yuan

In this paper, we characterize the important features of emergency resource allocation and distribution in disaster relief operations, and propose some models to capture these features. Then, an effective algorithm is proposed to solve these models based on Lagrangian Relaxation. Finally, a numerical example is used to explain the important parameters and highlight the management intuitions.

#### 3 - Relief Resources Allocation Planning for Typhoon Response with Damage Information Updates

Shalei Zhan, Doctor student, Zhejiang University, Zijingang Campus, Gudun Road, Hangzhou, China, settler1943@yahoo.com.cn, Nan Liu

The present paper addresses a real case for relief resources allocation planning for typhoon response. A typhoon named Saomai attacked Wenzhou in Eastern China in 10 August 2006, and caused enormous damage. A multi-objective stochastic optimization model with damage information updates is proposed. The model can determine the maximum length of time for which typhoon response has to be postponed because accurate damage information should be gathered before making any rescue decision.

## ■ SC03

Room 203B

### Joint Session AI/DM: Data Mining in Social Computing

Sponsor: Artificial Intelligence & Data Mining

Sponsored Session

Chair: Huimin Zhao, University of Wisconsin-Milwaukee, P.O. Box 742, Milwaukee, WI, 53201-0742, United States of America, hzhao@uwm.edu

#### 1 - A Random-walk-based Recommendation Algorithm for Folksonomies

Zhu Zhang, Institute of Automation, Chinese Academy of Sciences, No.95 ZhongGuanCun East St, Haidian Dist, Beijing, China, zhu.zhang@ia.ac.cn, Daniel Zeng, Cai Chen, Chuan Luo

The sparsity of ternary <user, tag, item> interaction data limits the performance of tag-based collaborative filtering in social tagging system. We propose a random-walk-based algorithm to deal with the sparsity problem, implemented on basis of Hadoop MapReduce for good scalability, which captures the potential transitive associations among users, items and tags. Experiments demonstrate the efficacy of the proposed algorithm.

#### 2 - Breadth and Depth of Online Helpful Consumer Reviews

Lina Zhou, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD, 21250, United States of America, zhou@umbc.edu, Yueyang Jiang, Dongsong Zhang, Yin Kang

As user generated content becomes increasingly available, the helpfulness of online consumer reviews has attracted growing attention. Despite extensive research on this issue, breadth of online reviews has not been explored in explaining their helpfulness. This study fills this void by investigating the breadth and other features of online reviews.

**3 - Work and Leisure: Weekly Patterns and Affect Display**

Lina Zhou, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD, 21250, United States of America, zhou@umbc.edu, PJ Disclafani, Abdulrahman Alothaim, Amir Karami

Microblogging sites have been used for tracking events, topics, and related opinions in real time. In this study, we identified the daily and weekly patterns of work and leisure orientations using data from public Twitter messages. In addition, we analyzed the associations between these orientations and affective expressions.

**4 - A Text Mining-based Approach in Studying Culture Using Social Media Data**

Yuan Xue, The George Washington University, Funger Hall, 515 2201 G Street, Washington D.C., United States of America, xueyuan@gwmail.gwu.edu, Yilu Zhou

Associative Group Analysis (AGA) is an effective method to study culture. However, it suffers from intensive human effort and many types of biases. We propose an innovative model to study culture by analyzing social media data using both AGA methodology and text mining techniques. Our result suggests a promising direction of using social media data in supplementing social studies.

**SC04**

Room 203A

**Simulation Applications**

Sponsor: Simulation

Sponsored Session

Chair: Evin Uzun Jacobson, Postdoctoral Research Associate, Imperial College Business School, Tanaka Building, South Kensington Campus, London, sw7 2az, United Kingdom, e.uzun@imperial.ac.uk

**1 - Using Object Oriented Simulation to Support Multi-Criteria Analysis of Service Systems**

Peer-Olaf Siebers, Lecturer in Computer Science, Nottingham University, School of Computer Science, Nottingham, NG8 1BB, United Kingdom, peer-olaf.siebers@nottingham.ac.uk, Uwe Aickelin

Multi criteria analysis is a relatively new tool for the appraisal of options that allows taking monetary and non-monetary inputs into account. The latter is particularly useful for assessing service systems as factors like service quality cannot easily be expressed in monetary terms. With the help of a case study (ferry port operation) we investigate the suitability of using cost benefit analysis for estimating monetary inputs and object oriented simulation for estimating non monetary inputs.

**2 - An Agent-based Simulation Platform for Local Energy Decision-making in the UK**

Tao Zhang, Research Fellow, School of Computer Science, University of Nottingham, Jubilee Campus, Wollaton Road, Nottingham, NG8 1BB, United Kingdom, txz@cs.nott.ac.uk, Peer-Olaf Siebers, Uwe Aickelin

UK national level energy policies are devolving into local level energy interventions. However city councils in the UK lack effective tools for local energy decision-making. In this talk we present a simulation platform for aiding local energy decision-making in the UK. This simulation platform models residential energy consumers as intelligent agents. By considering the consumer learning effects, the simulation platform shows how it can assist local energy intervention design in the UK.

**3 - The Effect of Delays for Hyperacute Stroke in Scotland**

Evin Uzun Jacobson, Postdoctoral Research Associate, Imperial College Business School, Tanaka Building, South Kensington Campus, London, sw7 2az, United Kingdom, e.uzun@imperial.ac.uk

We have analysed the Scottish Stroke Care Audit data that covers all stroke patients. A significant relationship exists between delays in the patient pathway and patient characteristics. The time between admission to the hospital and brain imaging differs with the time between the onset of stroke and the hospital admission. To quantify the effects of faster brain imaging or reduced delays between onset and admission, the stroke care network in Scotland is modeled as a discrete-event simulation.

**SC05**

Room 205B

**International Energy Trading**

Sponsor: Energy, Natural Resources & the Environment

Sponsored Session

Chair: Xinxin Bai, IBM Research - China, Diamond Building, Zhongguacun Softward Park, Beijing, China, baixx@cn.ibm.com

**1 - Analysis of a Sustainable Bioenergy Feedstock Supply Chain Using Rail Transportation**

Daniela Gonzales, Graduate Assistant, Mississippi State University, 302 Worley St, Starkville, MS, 39759, United States of America, dsg42@msstate.edu, Sandra Eksioglu, Md Roni, Erin Searcy

We developed a mathematical model to optimize the transportation of feedstock from the preprocessing locations, where biomass is densified, to existing coal plants for co-fire. Although there is a cost associated with densifying biomass, we foresee cost advantages further down the supply chain, including potentially reduced transportation costs.

**2 - Analysis of Ultra-short and Short Term Forecasting of Wind & Solar Power: The Case in China**

Xinxin Bai, IBM Research- China, Diamond Building, Zhongguacun SoftwarePark, Beijing, China, baixx@cn.ibm.com, Dengfeng Guo, Jun Liu, Tao Zhang, Wen Jun Yin, Rong Fu Sun, Haifeng Wang

Power forecasting is vital for the scheduling of power grid. In this paper, the ultra-short term prediction is made through a linear combination of alternative competing models, where weight of each model is based on its forecasting performance. Physical approach and data mining method are used for short term prediction on the basis of NWP. The forecasting system was deployed at a world-largest wind-solar-storage project at Zhangbei, China. Results of this application will be presented.

**SC06**

Room 205A

**Theoretical and Empirical Research Stemming from Practice in China**

Cluster: Supply Chain Management in China

Invited Session

Chair: Jun Shan, Nankai University, Business School, Nankai University, 94 Weijin Road, Tianjin, 300071, China, jshan@nankai.edu.cn

**1 - A Supply Chain Analysis of the "Firm + Farms" Model**

Yanzhi Li, City University of Hong Kong, Tat Chee Ave, Kowloon Tong, Kowloon, Hong Kong - PRC, yanzhili@gmail.com, Kekun Wu

We analyze the popular "firm + farms" business model, in particular for poultry business. Using a two-period dynamic model, we investigate the pros and cons of such a model for both the firm and farms. We identify conditions under which the model will prosper or will lose its advantage.

**2 - Inventory Management in China: An Empirical Study**

Jun Shan, Nankai University, Business School, Nankai University, 94 Weijin Road, Tianjin, 300071, China, jshan@nankai.edu.cn, Kaijie Zhu

In this paper, we apply an empirical method to investigate the inventories of 1286 firms listed on the two stock exchanges in China, the Shanghai Stock Exchange and the Shenzhen Stock Exchange. We find that on average the inventory levels have declined over time and that the firm-level data is well consistent with several implications derived from classical inventory models.

**3 - Collaborative Procurement under Stackelberg Game**

Ke Fu, Associate Professor, Lingnan College, Sun Yat-sen University, 135 Xingang Xi Road, Haizhu District, Guangzhou, 510275, China, fuke@mail.sysu.edu.cn, Jiayan Xu, Vernon Hsu

We consider the collaborative procurement between two retailers who procure a product from the same supplier. The supplier offers single-price-break incremental discount and sells the product to the two retailers who are facing independent stochastic demands. We study collaborative procurement under wholesale price contract between the two retailers. We analyze the optimal decisions of two retailers and the conditions under which both retailers have incentives to procure jointly.

## ■ SC07

Room 206A

### Replenishment and Pricing

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Amir Hossein Ansariipoor, PhD Candidate, ESSEC Business School, 100 Victoria Street, NLB, #13-02, Singapore, 188064, amirhossein.ansariipoor@essec.edu

#### 1 - A Decision Support System for Sustainable Fleet Replenishment

Amir Hossein Ansariipoor, PhD Candidate, ESSEC Business School, 100 Victoria Street, NLB, #13-02, Singapore, 188064, amirhossein.ansariipoor@essec.edu, Fernando Oliveira

In this article we consider the problem of technology choice in vehicle fleet management, considering the petrol, diesel, and electrical vehicles. Specifically, this paper contributes to the literature on fleet replenishment and sustainable operations in framing a general decision support system for the fleet replenishment problem using stochastic programming. We analyze how the different uncertainty factors, and CO2 emissions, affect the value of the different technologies.

#### 2 - Optimal Replenishment and Pricing Decision with Collect-on-Delivery Scheme

Jie Zhang, Assistant Professor, Guangdong University of Business Studies, International School, GUBS, 21 Luntou Rd, Guangzhou, GD, 510320, China, jiezhang@gdcb.edu.cn

In this paper, we study the joint replenishment and pricing optimization problem and assume backlog consumers pay upon receiving their goods, referred to as collect-on-delivery scheme as opposed to the instant payment scheme commonly assumed in the literature. We show that a base-stock list price policy is optimal without fixed cost, and provide a sufficient condition for an  $(s, S, p)$  policy to be optimal with a positive fixed cost. We also compare this system to the one with instant payment.

#### 3 - Robust Design of Multi Period Supply Contracts with Differential Pricing

Ashok Mittal, IIT Kanpur, IME Department, Kanpur, 208016, India, mittal@iitk.ac.in, Nikhilesh Dwivedi

In this research we have discussed design of a multi-period contract for a single retailer single supplier market in which demand for the product is uncertain. In this contract a retailer will receive a fixed quantity of product in each period at a pre determined price. Supplier further guarantees supply of additional quantities at a premium price. The contract design includes identification of fixed order quantity, premium supply price and buyback price.

#### 4 - Evaluating Security Price Sensitivities Using Closed-form Asymptotic Expansions

Chenxu Li, Assistant Professor, Peking University, Guanghua School of Management, Peking University, Beijing, 100871, China, cl2288@caa.columbia.edu, Zeyu Zheng

We propose a flexible computational method for approximating security price sensitivities in multivariate diffusion models. By untangling a puzzle arising from the pathwise differential forms of sensitivities of any arbitrary order, our method develops the idea of the pathwise Monte Carlo simulation method proposed in Broadie and Glasserman (1996) from an analytical perspective. New closed-form asymptotic expansions containing only basic and explicit calculations are proposed.

## ■ SC08

Room 206B

### Integer Programming

Cluster: Super/Special Sessions

Invited Session

Chair: Duan Li, Professor, The Chinese University of Hong Kong, Dept of Syst. Eng. & Eng. Mgmt., Shatin NT, NT, Hong Kong - PRC, dli@se.cuhk.edu.hk

#### 1 - Successive Convex Approximations to Cardinality-Constrained Quadratic Programs: A DC Approach

Xiaoling Sun, Professor, Fudan University, School of Management, Fudan University, 670 Guoshun Road, Shanghai, 200433, China, xls@fudan.edu.cn, Xiaojin Zheng, Duan Li

In this paper we propose a successive convex approximation method for cardinality-constrained quadratic programs. The method first approximates the cardinality function by a piecewise linear DC function and then constructs a

sequence of convex subproblems by successively linearizing the concave terms of the DC function. We establish convergence to a KKT point of the approximate problem and report some promising computational results when compared with other local solution methods.

#### 2 - Convex Relaxations for Quadratic Assignment Problem

Yong Xia, Professor, Beihang University, Beijing, China, dearyxia@gmail.com

Quadratic assignment problem (QAP) is one of the great challenges in combinatorial optimization. It is known to be strongly NP-hard. Convex relaxation techniques play a great role in solving the quadratic assignment problem. In this talk, we survey some most popular efficient convex relaxation approaches (e.g., linear programming, eigenvalue optimization, convex quadratic programming, second-order cone programming, semidefinite programming), and show how they can be further improved.

#### 3 - Closest Vector Problem (CVP) Formulation for Binary Linear Diophantine Equation

Duan Li, Professor, The Chinese University of Hong Kong, Dept. of Syst. Eng. & Eng. Mgmt., Shatin NT, NT, Hong Kong - PRC, dli@se.cuhk.edu.hk, Bojun Lu

0-1 Diophantine equations arise naturally in both real applications and theoretical studies. We investigate in this study a new closest vector problem (CVP) formulation in lattices and present some preliminary numerical results.

#### 4 - The Generalized Quadratic Assignment Problem: Convexification and Solution

Monique Guignard-Spielberg, Professor, University of Pennsylvania, OPIM Department, the Wharton School, 3730 Walnut Street, Philadelphia, PA, 191046340, United States of America, guignard@wharton.upenn.edu, Lucas Letocart, Gerard Plateau

One can theoretically convexify the objective function of a GQAP problem using an SDP model and its dual. We will discuss the numerical difficulties one may encounter, and will show that for small to medium size instances, one may be able to obtain an equivalent convex model and a reasonable lower bound. One can then try to solve the convex model using standard MIQCP software, or to generate improved bounds and good feasible solutions, for instance by using the convex hull relaxation (CHR).

#### 5 - Mixing a Polyhedral Approach and a Nonlinear Optimization Algorithm for Integer Quadratic Programs

Frederic Roupin, Professor, Université Paris-Nord, LIPN - UMR 7030, 99, Avenue Jean-Baptiste Clément, Villetaneuse, 93430, France, roupin@lipn.univ-paris13.fr, Nathan Krislock, Jerome Malick

We present an exact algorithm for Integer Quadratic Programming. This algorithm uses standard valid inequalities and nonlinear bounds computed by an efficient quasi-Newton method. Experiments show that our method outperforms the Biq Mac solver for Unconstrained Binary Integer Quadratic Problems. Moreover, our approach can handle models with linear equalities and inequalities constraints, and the ratio of the tightness of the bounds to the time required to compute them can be controlled.

## ■ SC09

Room 208A

### Sustainability in Waste and Water

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Lenka Hudrlikova, University of Economics, Prague, W. Churchill Sq. 4, Prague 3, 13067, Czech Republic, lenka.hudrlikova@vse.cz

#### 1 - Sustainable Development Ranking for OECD Countries

Lenka Hudrlikova, University of Economics, Prague, W. Churchill Sq. 4, Prague 3, 13067, Czech Republic, lenka.hudrlikova@vse.cz, Ludmila Petkovova

The set of indicators of sustainable development contains large number of social, environmental and economic indicators. To make ranking of OECD countries we propose composite indicator approach with a fully nonparametric robust methodology for assigning weights. Benefit of Doubt method gives each country its own weights that maximize the impact of the criteria where the country performs relatively good and vice versa.

**2 - Sustainable Minimum Cost Irrigation by Treated Wastewater**

Yulia Tseytlin, IBM Haifa Research Labs, Haifa University, Haifa, 31905, Israel, yuliat@il.ibm.com, Segev Wasserkrug, Eitan Israeli, Ran Weisman

We discuss applying optimization to two interconnected problems of providing treated wastewater for agricultural use: finding a sustainable policy for annual storage and distribution of the wastewater, and providing hourly equipment settings that minimize the cost of providing the water, while satisfying hydraulic, quality, and demand constraints. These two use cases are example of the generic water supply problem, where the quality and cost of the supply and demand are time and place dependent.

**3 - Sustainable Municipal Collection of Household Plastic Waste**

Xiaoyun Bing, Wageningen University, Room 6029, Hollandseweg 1, Wageningen, Netherlands, xiaoyun.bing@wur.nl, Jack van der Vorst, Jacqueline Bloemhof

This paper investigates strategic municipal collection alternatives by scenario study, based on vehicle routing model built on a representative Dutch municipality. Scenarios are designed with various assumptions on collection method, vehicle type, frequency and points, quantity, etc. Results in transportation costs and emissions are compared to find out which scenario fits the future demand better and has the best performance, which provides decision support for municipalities.

**4 - Designing a Connected Nature Reserve Using a Linear Integer Programming Approach**

Yicheng Wang, Assistant Professor, Qingdao Agricultural University, 700 Changcheng Road, Chengyang District, Qingdao, 266109, China, qdawangyc@yahoo.com.cn, Hayri Önal

We present a linear integer programming model which determines a connected conservation reserve network. Computational experience with the model shows that problems with several hundred potential reserve sites can be solved conveniently. An empirical application to the protection of habitats of endangered/threatened bird species in Fox River watershed, USA, is presented.

**SC10**

Room 208B

**Quality Management and Lean Six Sigma I**

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Zhen He, Professor & Deputy Dean, College of Management and Economics, Tianjin University, #92, Weijin Rd, Nankai District, Tianjin, China, zhhe@tju.edu.cn

**1 - Statistical Diagnosis for Auto-correlated Processes**

Jing Sun, Professor, Tsinghua University, Beijing, China, sunj3@sem.tsinghua.edu.cn, Jian Lou

A method is proposed to diagnose the change of autocorrelated processes based on autoregression T2 statistic and the effect of diagnosis is analyzed.

**2 - Prediction on the Operator-induced Defects for Automobile Engine Assembly Production**

Qiang Su, Professor, Tongji University, 50 Chifeng Rd, Yangpu District, Shanghai, 200092, China, servicequality@163.com, Huiting Dou, Na Wei, Le Yang

Assembly plays an important role in modern manufacturing. Based on the field investigation in an automobile engine assembly plant, the assembly processes are studied and the quality data are collected and analyzed. Thereafter, a novel defect-rate prediction model is derived based on two complexity factors. With this model, the assembly defect rate induced by operators can be calculated out easily. Moreover, the model can be used to support the assembly quality prediction and improvement control.

**3 - Causes Diagnosis System on Abnormal Pattern of Quality Control Chart Based on Fuzzy Neural Network**

Keqin Wang, Associate Professor, School of Management, Northwestern Polytechnical University, No.127 Youyi Xilu, Xi'an, 710072, China, keqinwang@nwpu.edu.cn, Shurong Tong, Wen He

For uncertainties and fuzziness in mapping from abnormal patterns of control chart to causes, a diagnosis system is developed with fuzzy neural network (FNN). The abnormal patterns are classified into sets. The causes set of each pattern is identified. With pattern data as input and the value of causes' abnormality as output, the FNN is developed and the inference is realized. With FNN outputs and sequencing and clustering module, the causes are sequenced and the optimum sequence is achieved.

**SC11**

Room 209A

**Supply Chain and Risk Management**

Cluster: Super/Special Sessions

Invited Session

Chair: Ming Zhao, SAS Institute, 100 SAS Campus, Cary, NC, United States of America, Ming.Zhao@sas.com

**1 - Accelerating Nested Simulation via Graphic Processing Unit Computing**

Lan Hai, Assistant Professor, Shanghai Jiao Tong University, 535 Fahuazhen Rd Bldg. 10, Room 307, Shanghai, China, lanhai@sjtu.edu.cn

Nested simulation has attracted plenty of interest from researchers in simulation. One biggest drawback of nested simulation is its slowness. In our work, we accelerate nested simulation with screening procedure by parallelize it on manycore Graphic Processing Units and multicore Central Processing Units. A "divide-and-conquer" scheme is adopted to reduce the communication between different processes. Experimental results show an improvement of 70 to 80 times faster in computing CVaR.

**2 - Phantom Capacity in Option Contract: A Coordination Approach under Supply Disruption**

Xiaofeng Nie, Nanyang Technological University, 50 Nanyang Avenue, School of Mechanical and Aerospace Eng., Singapore, 639798, Singapore, xiaofengnie@ntu.edu.sg, Sobhan Asian

In supply disruption literature, little attention considers the effectiveness of backup strategy. Here, a manufacturer uses an unreliable main source and signs an option contract with a backup supplier. Results reveal that while the backup supplier targets a production quantity equal to the optioned amount, the system-wide efficiency is not maximized. Moreover, the total expected profit is optimized under coordination conditions, although the backup supplier underinvests in capacity installment.

**3 - Real-time Business Process Improvement Methodology**

Xiaoyi Xu, General Manager, June Intelligence WUXI, WUXI, China, ben.xu@juneintelligence.com

We have developed a real-time business process improvement methodology that works around the life cycle of BPM activities. Rule-based solutions are implemented to identify "As-Is" and "To-Be" processes. These solutions, including monitoring and analysis mechanics are automatically converted into Java code and therefore can establish both the monitoring and real-time data analysis upon system deployment. The outcome can be used as starting point of the next round of process improvement.

**SC12**

Room 209B

**Electronic Commerce I**

Cluster: Super/Special Sessions

Invited Session

Chair: Qiang Ye, Harbin Institute of Technology, 92 Xidazhi Street, Harbin, China, yeqiang2006@gmail.com

**1 - A Dollar for Your Thoughts: Feedback-Conditional Rebates on eBay**

Lingfang (Ivy) Li, Shanghai University of Finance and Economics, 777 Guoding Road, School of Economics, Shanghai, China, lingfangivy.li@gmail.com, Luis Cabral

We run field experiments on eBay where buyers are rewarded for providing feedback. We find that buyers provide feedback more frequently and the fraction of positive feedback increases when feedback is rewarded. The distortionary effect of feedback reward is particularly noticeable when shipping is delayed: buyers fail to review a transaction that they would otherwise review and rate positively. Also, buyers bid higher in anticipation of a reward, but the bid increases smaller than the reward.

**2 - Investigating the Impact of Online Buzz on Book Sales From Multiple Sources**

Weifang Wu, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, Hong Kong - PRC, ww@ust.hk, Rong Zheng

Online buzz has been found important in extant studies. A lot of studies show that online reviews can be used to predict movie sales and book sales. However, extant studies typically investigate the effect of online buzz on sales from single source. Our paper tries to study this effect from a more comprehensive way. We collect data from online reviews, blogs and tweets, and find that reviews, blogs and tweets have orthogonal impacts on book sales.

### 3 - How to Make Friends in Professional SNSs: Concentrative or Continuous Participation

Guoxin Li, Associate Professor, Harbin Institute of Technology,  
13 Fayuan St., Nangang Dist., Harbin, 150006, China,  
lisappleheart@gmail.com, Yanxue Wang

Online professional SNSs are playing important role on business opportunity or career development for more people. But how can benefit users to make more friends by their specific behavior? With the data recorded five months from 2400 samples, the paper found that concentrative participation has an inverted U curve effect on and continuous participation a positive linear relationship with users' increasing networks. Also, work position has significant negative moderating role.

### ■ SC13

Room 210A

#### **Analytics in Sustainability**

Sponsor: Business Analytics, CPMS-The Practice Section

Sponsored Session

Chair: Erica Klampfl, Ford, 2101 Village Rd, Dearborn, MI,  
United States of America, eklampfl@ford.com

#### **1 - Sustainability Analytics at Ford**

Erica Klampfl, Ford, 2101 Village Rd, Dearborn, MI,  
United States of America, eklampfl@ford.com

In order to preserve our world for future generations, all business sectors must do their part to employ sustainable business processes and develop sustainable products. Ford's strategic sustainability efforts are supported by analytical methodology. We will provide examples of these modeling efforts, such as constructing global energy models, defining CO2 targets over time, optimizing the future new vehicle fleet, and predicting consumer's willingness to pay for emerging technology.

#### **2 - Public Transportation or Private Vehicle: What Would You Opt For?**

Yimin Liu, Technical Expert, Ford Motor Company,  
2101 Village Road, Research Center, Dearborn, MI, 48121,  
United States of America, yliu59@ford.com, Erica Klampfl

In China, consumers are striving for new vehicle ownership. On the other hand, many cities have subsidized public transportation that could satisfy a majority of transportation needs. This project estimates consumer's choices between private vehicles and public transportation and also provides insights into what drives consumers' purchase choices and the relative value they assign to different transportation attributes.

#### **3 - Modeling and Optimization of Hybrid Renewable Energy Systems: Challenges and Opportunities**

Kuo-Hao Chang, Assistant Professor, National Tsing Hua  
University, No. 101, Section 2, Kuang-Fu Road, Hsinchu, 30013,  
Taiwan - ROC, birdhow@gmail.com, Grace Lin

A hybrid renewable energy system (HRES) refers to an energy system with more than one type of power generators, usually a conventional generator powered by diesel and a renewable energy source such as photovoltaics, wind etc. The matching of electrical generation with power consumption based on HRES is very challenging due to the intermittent and highly variable characteristics of renewable energies and unknown demand. In this talk, we provide a mathematical formulation for HRES, discuss the solution methodology and point out the challenges and opportunities existing in the problem.

#### **4 - Exploring User Needs and Interactive Models on Internet of Things**

Pei-Luen Rau, Dept. Industrial Engineering, Tsinghua University,  
Shunde Building, Beijing, China, rpl@mail.tsinghua.edu.cn,  
Eva Huang, Qin Gao, Joakim Formo, Mao Mao, Caroline  
Höglund, Marcus Gardman, Chenyue Feng

This study explores human aspect of service engineering for Internet of Things (IoT) in China. Prototypes of IoT services are designed and developed on mobile tablet based on findings of Chinese users' experience with things and ICT retrieved by in-depth interview and photo-diary. Results of user testing with representative users reveal that usefulness, perceived control, effectiveness, and privacy are among the most important considerations.

### ■ SC14

Room 210B

#### **Supply Chain Management II**

Cluster: Super/Special Sessions

Invited Session

Chair: Qing Ye, Assistant Professor, Tsinghua University, Beijing, China,  
yeqing@sem.tsinghua.edu.cn

#### **1 - Subsidizing Supplier Capacity Investment: Theory and Experiment**

Qing Ye, Assistant Professor, Tsinghua University, Beijing, China,  
yeqing@sem.tsinghua.edu.cn

We studied how upstream capacity investment could be facilitated by downstream firms through financial subsidy. We developed a two-stage game model, and showed that properly designed subsidy schemes could induce high capacity investment and significantly improve the buyer's profitability. The theoretic results were supported by the results of lab experiments, which, however, also indicated that subjects tended to invest higher capacity and bid lower prices compared to the theory predictions.

#### **2 - Managing Capacitated Multiechelon Systems with Domain-Optimal Policies as Heuristic**

Wanshan Zhu, Associate Professor, Tsinghua University, Beijing,  
China, zhuws@tsinghua.edu.cn, Alexandar Angelus

We consider a multiechelon system with stochastic demand and processing capacity constraints at each stage. We identify a domain of high inventory level, where this system preserves additive convexity of the objective function and the optimal policy is characterized by a small number of constants. We use numerical study to test the effectiveness of this policy.

#### **3 - Supply Chain Coordination with Strategic Customers**

Tian Li, Postdoctoral Fellow, Hong Kong University of Science and  
Technology, Dept. ISOM, HKUST, Hong Kong - PRC,  
litian@ust.hk, Man Yu

In this paper we examine the impact of strategic customer behavior on supply chain coordination. Our results suggest that some fundamental lessons in supply chain coordination may change when strategic customer behavior is taken into consideration.

#### **4 - Lateral Transshipment Strategy under Customer Requests and Switching**

Wenjing Shen, Assistant Professor, Drexel University,  
Philadelphia, PA, United States of America, ws84@drexel.edu,  
Xinxin Hu, Yi Liao

We consider the inventory replenishment and transshipment decisions in the presence of customer requests and stochastic "customer switching" behavior, for two retailers who are either under centralized control or operated independently. We find that both transshipment and inventory replenishment decisions may differ from those under classical setting without these customer behaviors.

### ■ SC15

Room 212A

#### **Cause Marketing, Green Marketing, and Corporate Social Responsibility**

Sponsor: Marketing Science

Sponsored Session

Chair: Tony Haitao Cui, Assistant Professor of Marketing, University of  
Minnesota, 321 19th Ave. S, Suite 3-150, Minneapolis, MN, 55455,  
United States of America, tcui@umn.edu

#### **1 - Corporate Social Responsibility, Innovativeness Capability, and New Product Introductions**

Xueming Luo, University of Texas at Arlington, S. West St,  
Arlington, TX, United States of America, luoxm@uta.edu,  
Shuili Du

This research investigates the link between corporate social responsibility (CSR) and firm innovation performance. In line with stakeholder theory and the knowledge-based view, our results suggest that, compared to firms with fewer CSR activities, firms with greater CSR activities exhibit higher innovativeness capability and launch more new products. Furthermore, such positive impact of CSR is contingent upon internal R&D intensity and external market competitive intensity.

## 2 - Transparency of Cause Marketing Campaigns

Yu Wang, Assistant Professor of Marketing, University of Texas at Dallas, 800 West Campbell Rd. SM32, Richardson, TX, United States of America, yuwang@utdallas.edu, Aradhna Krishna, Uday Rajan

We consider a signaling game where firms engage in transactional cause marketing (CM) to maximize their payoff from profit and consumer goodwill. Consumers' purchase decision is affected by their belief of firms' social consciousness, which is affected by CM campaigns. In this context, we explore how government should optimally regulate CM-related marketing campaigns.

## 3 - The Differential Effects of Adding "Green" Attributes on Hedonic versus Utilitarian Products

Yuhuang Zheng, Associate Professor of Marketing, Tsinghua University, Beijing, China, zhengyh@sem.tsinghua.edu.cn, Wei Wei

The current research shows that adding green (environment friendly) attributes has differential effects on hedonic versus utilitarian products: 1) when consumers face a choice decision, adding green attributes to both products increases the choice likelihood of utilitarian over hedonic products; 2) when consumers face a purchase decision of either hedonic or utilitarian products, adding green attributes also has a stronger positive effect on utilitarian than hedonic products.

## 4 - The Cost of Social Pressure on Corporate Social Responsibility

Tony Haitao Cui, Assistant Professor of Marketing, University of Minnesota, 321 19th Ave. S, Suite 3-150, Minneapolis, MN, 55455, United States of America, tcui@umn.edu, Paola Mallucci, George John

We build a model to explore the relationship between consumers' preferences and the effectiveness of Corporate Social Responsibility (CSR). In particular, we study the effect of warm glow, i.e., positive feeling from donating to a public good, and social pressure to adhere to the norm of reciprocity on consumers' utility, CSR level and firm profits. While warm glow has a positive effect on consumers' utility and firms' profit, a profit maximizing firm should manage social pressure carefully.

## ■ SC16

Room 212B

## Pricing Strategies and Supply Chain Management

Cluster: Interface between Operations Management and Marketing  
Invited Session

Chair: Kathryn E. Stecke, Ashbel Smith Professor of OM, University of Texas-Dallas, 800 West Campbell Road, Richardson, TX, United States of America, KStecke@utdallas.edu

### 1 - Waiting for Information or Waiting for a Price Decrease when Quality is Unknown

Laurens Debo, Associate Professor, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60302, United States of America, Laurens.Debo@chicagobooth.edu, Man Yu, Roman Kapuscinski

We analyze pricing of goods whose quality is unknown to the firm, but, is imperfectly assessed by consumers that purchased the good and who transmit their assessment to consumers that did not buy yet the good. We compare static pricing policies with dynamic pricing.

### 2 - Optimality on the Joint Decisions of Inventory Control and Advance Pricing Strategy

Ying Wei, Associate Professor, Jinan University, School of Management, Huiquan Building, Huangpu Dadao Xi, 601#, Tianhe District, Guangzhou, 510632, China, yingwei@jnu.edu.cn, Minghui Xu

This paper studies an inventory control problem with pricing decision determined in advance. In each period, demand is stochastic and dependent on the selling price, which is determined at the previous period. Order replenishment is issued at sometime of the period and arrives at the beginning of the period followed, that is, delivery lead time is nonzero. With the objective to maximize the discounted total finite horizon profit, we show that a base stock list price type policy is optimal.

### 3 - Impact of Gray Markets on a Decentralized Supply Chain

Jing Shao, Cheung Kong Graduate School of Business, 20F, Tower E2, Oriental Plaza, 1 East Chang An Avenue, Beijing, 100738, China, jshao@ckgsb.edu.cn, Harish Krishnan, S. Thomas McCormick

Gray markets are unauthorized channels that distribute branded products without manufacturers' sanction. We investigate the impact of gray markets in a decentralized supply chain, where a manufacturer distributes a product via independent retailers. We show that the manufacturer as well as retailers may be

better off or worse off due to the emergence of a gray market. We also find that if both retailers are willing to sell in the gray market, then this may lead to a prisoner's dilemma situation.

## 4 - Experiments on Supply Chain Contracting: Effects of Contract Type and Relationship Length

Murat Kaya, Assistant Professor, Sabanci University, Sabanci University MDBF, Orhanli Tuzla, Istanbul, 34956, Turkey, mkaya@sabanciuniv.edu, Nukte Sahin

We conduct human experiments on a manufacturer-retailer supply chain where the retailer faces the newsvendor problem. We find the retailer's order quantity and total profit under the buyback contract to be significantly lower than theoretical predictions. The wholesale price contract, on the other hand, performed better than expected. We explain the deviations with behavioral biases. We also find experiments with short-run interaction between pairs to result in higher profits than long-run ones.

## ■ SC17

Room 213A

## Modeling Sustainable Energy

Cluster: Super/Special Sessions

Invited Session

Chair: Ying Fan, Professor, Chinese Academy of Sciences, 55 Zhongguancun Donglu, Haidian District, Beijing, 100190, China, ying\_fan@263.net

### 1 - Environmental Dynamic Efficiency Study for Power Systems: Evidence from 23 OECD Countries and China

Bai-Chen Xie, Assistant Professor, Tianjin University, College of Management and Economics, Tianjin, 300072, China, xiebaichen@tju.edu.cn, xiebaichen@126.com, Yi-Shu Wang

Taking the electricity generated and industry value-added as desirable outputs and carbon emission as undesirable output, this paper employs the Malmquist index, to dynamically evaluate the efficiency of power systems of 23 OECD countries and China from 1996 to 2007. The empirical results indicate that economic level influenced the static efficiency of power systems greatly; comparatively the international treaty plays a critical role in improving their dynamic efficiency.

### 2 - Analysis and Application of a Novel Three-dimensional Energy-saving and Emission-reduction System

Guochang Fang, Lecturer, Jiangsu University, No 301, Xuefu Road, Zhenjiang, China, fgchang79@163.com

A novel three-dimensional energy-saving and emission-reduction chaotic system is proposed. The dynamic behavior of the system is analyzed by means of Lyapunov exponents and bifurcation diagrams. Artificial neural network is used to identify the quantitative coefficients in the simulation models according to the statistical data of China, and an empirical study of the real system is carried out with the results. Numerical simulations are presented to demonstrate the results.

### 3 - Studies on Complexity of China a Shares, Based on Evolving Model of Hushen 300 Stock Index

Shangjun Ying, Professor, Shanghai Institute of Foreign Trade, Shanghai, China, shjying@163.com

This paper discusses an evolving model of stock market through Hushen 300 stock index by tool of cellular automata, genetic algorithm and method of system simulation. Then several studies on complexity based on model are carried out including fractal, stability, chaos and Sensitivity.

### 4 - How Policies Stimulate the Evolution of Carbon-free Energy Technologies

Ying Fan, Professor, Chinese Academy of Sciences, Beijing, China, yfan@casipm.ac.cn, Hong-Bo Duan

Carbon capture and sequestration (CCS) technology is induced in the E3METL model in this paper. We explore the most cost-effective way of target CO<sub>2</sub> abatement to reach specific climate stabilization targets by comparing three climate policies including subsidies, carbon tax and a combination of both, and investigate the impacts of policy mix on the energy demand, welfare, consumption and R&D activities.

## ■ SC18

Room 213B

### Analysis of Systemic Risk

Cluster: Super/Special Sessions

Invited Session

Chair: Andreea Minca, Assistant Professor, Cornell University, 222 Rhodes Hall, Ithaca, NY, 14853, United States of America, acm299@cornell.edu

#### 1 - Default and Systemic Risk in Equilibrium

Martin Larsson, Cornell University, 290 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, mol23@cornell.edu, Agostino Capponi

We develop a dynamic equilibrium model where heterogeneous terminal utility maximizers invest in a risk-free asset, a stock written on a default-free dividend, and a defaultable bond. We show how agent preferences and cyclicity of the default intensity affect the interaction between the stock and the bond. We also analyze the market price of risk and the investors' default exposure.

#### 2 - Failure and Rescue in an Interbank Network

Luitgard Veraart, London School of Economics, Houghton Street, London, WC2A2AE, United Kingdom, L.Veraart@lse.ac.uk, L.C.G. Rogers

We consider systemic risk in an interbank market, modelled as a directed graph of interbank obligations. We extend the model of Eisenberg & Noe (2001, Management Sci., 47) by introducing costs for default. We find that there is a greatest clearing vector, arrived at by letting banks fail in succession until only solvent banks remain. Such a collapse should be prevented if at all possible; we study situations in which consortia of banks may have the means and incentives to rescue failing banks.

#### 3 - Resilience to Contagion in Financial Networks

Hamed Amini, Swiss Finance Institute-EPFL, Quartier UNIL-Dorigny, Extranef 249, Lausanne, 1015, Switzerland, hamed.amini@epfl.ch

We derive rigorous asymptotic results for the magnitude of contagion in a large financial network and give an analytical expression for the asymptotic fraction of defaults, in terms of network characteristics. We use our result to obtain a criterion for the resilience of a large financial network to the default of a small group of financial institutions.

#### 4 - Controlled Defaults in Financial Networks

Andreea Minca, Assistant Professor, Cornell University, 222 Rhodes Hall, Ithaca, NY, 14853, United States of America, acm299@cornell.edu

Distress propagation in financial systems may be modeled by epidemics on a random graph in which nodes represent financial institutions and edges the exposures between them. We study the optimal intervention strategy by a lender of last resort with objective to minimize the size of contagion under budget constraints. Our results show that the optimal strategy strongly depends on the proportion of banks that use unstable sources of funding.

## ■ SC19

Room 215

### Reliability

Contributed Session

Chair: Zhiguo Li, IBM T J Watson Research Center, 1101 Kitchawan Road, Route 134, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, zhiguo.li.wisc@gmail.com

#### 1 - Reliability Analysis for a Phase-type Geometric Process Repair Model with Spare Device Procurement

Miaomiao Yu, Mr. Sichuan University of Science and Engineering, Zigong, 643000, China, mmyu75@163.com, Yinghui Tang

This paper analyzes a phase type geometric process repair model with spare device procurement lead time and repairman's multiple vacations. The lifetimes and the repair times of the device are governed by PH distributions, and the condition of device following repair is not as good as new. After a prefixed number of repairs, the system is replaced by a new one. The spare device for replacement is available only by an order.

#### 2 - Research on Reliability of Equipments Based on Interval Prediction Method

Jianfang Liu, University of Science and Technology Beijing, 30 Xueyuan Road, Haidian District, Beijing, China, 852808573@qq.com, Jianhua Yang

While reliability is an important aspect of equipment quality, it has a remarkable effect on the usability of equipments. Reliability can reflect equipments' ability of keeping property. As a method of design, reliability prediction is the fundamental of design decisions. In this paper, the grey system theory is used to deal with the data of reliability, and the method of interval prediction is used to predicate the reliability of equipments and analyze how to improve its reliability.

#### 3 - A Generalized Procedure for Monitoring Right-Censored Failure Data

Zhiguo Li, IBM T J Watson Research Center, 1101 Kitchawan Road, Route 134, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, zhiguo.li.wisc@gmail.com

Right censored failure data is a common data type in industrial applications. This paper develops a generalized statistical procedure to monitor the right censored failure data by using the one-sample rank test. The OC functions are derived based on the asymptotic properties of the rank statistic, and the procedure to set up the control chart is illustrated. Case studies are presented to show the effectiveness of the approach, and its performance is compared with the CEV weights based charts.

## Sunday, 4:00pm - 5:30pm

## ■ SD01

Room 202B

### Transportation and Logistics System Planning under Uncertainty

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Yueyue Fan, Associate Professor, University of California, Dept. of Civil & Environmental Eng., Davis, CA, 95616, United States of America, yyfan@ucdavis.edu

#### 1 - Intermodal Flexible Liner Shipping

Johan Oppen, Associate Professor, Molde University College, P O Box 2110, Molde, 6402, Norway, Johan.Oppen@himolde.no

We present an intermodal transportation problem taken from the shipping industry. The application is transport of palletized frozen fish from Russia and Norway to terminals in Europe. The problem can be viewed as a flexible liner shipping problem, as some terminals along the route are fixed, while other terminals may also be served by truck via another terminal. We present a mathematical model and show that small problem instances can be solved to optimality using standard software.

#### 2 - Supply Network Configuration with Demand Uncertainty

Guoqing Zhang, University of Windsor, 401 Sunset Avenue, Windsor, ON, N9B 3P4, Canada, gzhang@uwindsor.ca

In this talk, we consider a manufacturer's supply network with multi-suppliers for each material, where the suppliers offer volume discount and has a capacity limit, and the manufacturer faces uncertain demands. The problem is to find optimal acquisition allocation and manufacturing plan that maximize the manufacturer's profit. A Lagrangian approach is developed to solve the problem.

#### 3 - A Mean-risk Stochastic Programming Model for p-hub Median Problem

Wei Ge, Nanjing University of Aeronautics and Astronautics, Yifu Museum 503A, Yudao Road 29, Nanjing, 210016, China, nuua\_simon@yahoo.cn, Jinfu Zhu, Yueyue Fan

A Mean-CVaR stochastic programming model is developed for a p-hub median problem to balance the overall system efficiency and robustness under demand and cost uncertainties. A solution algorithm based on scenario decomposition, the progressive hedging method, is designed to overcome computational challenges brought by the large size of the problem. The proposed modeling and computing methods are tested in two case studies using the classic CAB dataset and China aviation data.

**4 - Sensor Location under Uncertain Sensor Failure**

Yueyue Fan, Associate Professor, University of California, Dept. of Civil & Environmental Eng., Davis, CA, 95616, United States of America, yyfan@ucdavis.edu, Ning Zhu

In this talk, we will present a stochastic programming model for finding effective and reliable strategies for deploying sensors over a traffic network, considering possible failure/malfunction of sensors. A mean-risk objective is adopted to ensure the effectiveness and reliability of decision making under uncertainty. Numerical implementation and case studies will be included to demonstrate the applicability of the proposed model in real-world applications.

**SD02**

Room 202A

**Supply Disruption Management**

Sponsor: Data Mining

Sponsored Session

Chair: Nan Liu, Zhejiang University, School of Management, Zijingang Campus, Gudun Road, Hangzhou, 310058, China, nliu@zju.edu.cn

**1 - Dealing with Supply Disruption: Dual Sourcing or Single Sourcing with Emergency Option**

Bin Li, Shanghai Jiao Tong University, Shanghai, China, li.tbin@163.com, Jianhua Ji

In this paper, we analyze single period, single product sourcing decisions under supply disruption and demand uncertainty. We study two supply chain modes to deal with supply disruption and share demand risk in a decentralized supply chain. We characterize the optimal procurement quantities and emergency option quantities, and generate important insights. Then, we compare the two modes, and study how to choose between the two modes to deal with supply disruption.

**2 - A Robust Optimization Model for Flexible Capacity Investment and Management under Supply Disruption**

Cuicui Meng, Shanghai Jiao Tong University, Shanghai, China, mengc2009@163.com

Robust Optimization is used to analyze flexible capacity investment and management problem under supply disruption. Through a two-level make-to-order supply chain setting, we formulate the problem as a two-stage robust optimization program, characterize the optimal flexible capacity investment and management policy, and analyze the effect of cost and demand parameters on optimal solution via numerical experiments.

**3 - A CvaR Model and Coordination Mechanism of Supply Chain Ordering Decision under Disruption**

Chuanbo Zhu, Shanghai Jiao Tong University, Shanghai, China, chuanbozhu@163.com, Jianhua Ji

This paper introduces CvaR to depict the firm's operation goal under disruption, and then establishes revenue sharing contract model to achieve supply chain coordination. The objective is to gain the retailer's optimal ordering quantity and its sensitivity to supplier reliability within CvaR criterion. The results show that retailer's optimal quantity is decreasing in supplier reliability Mean which is analogous to the risk neutral case. Meanwhile, the optimal quantity's sensitivity to supplier reliability's Standard deviation(SD) depends on itself risk aversion coefficient. The quantity is decreasing in SD in the case of the coefficient of retailer's risk-averse exceeding a threshold value, and vice versa, the retailer will raise ordering quantity to avoid disruption risk.

**SD03**

Room 203B

**Social Network**

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Bin Zhu, Assistant Professor, Oregon State University, Bexell 422 E., Corvallis, OR, United States of America, Bin.Zhu@bus.oregonstate.edu

**1 - The Effect of Location Information on Friend Recommendation in Online Social Networks**

Jiayi Luo, University of Wisconsin-Milwaukee, 3528 N. Oakland Ave, Milwaukee, WI, 53211, United States of America, jiayiluo@uwm.edu, Huimin Zhao, Atish Sinha

An online social network can help its members expand their personal networks by recommending potential friends. Existing friend recommendations have mainly used profile and networking information to infer possible friends. Now online SNS can collect the location when a user checks in using a mobile device. Location patterns may carry information about life style and taste of the user. In this study, we investigate how such location info can be used to improve the accuracy of friend recommendation.

**2 - Finding People Who Forward Your Messages**

Bin Zhu, Assistant Professor, Oregon State University, Bexell 422 E., Corvallis, OR, United States of America, Bin.Zhu@bus.oregonstate.edu, Michael Chau

Micro-blogging provides the opportunity of quickly reaching millions of people at nearly zero cost. But messages a company sends always reach the same people unless people forward the messages received. This paper seeks to uncover circumstances under which message forwarding occurs. The results indicate that information overload, interest in the communication topic, desire to participate in micro-blogging, and self-identification with a company have significant impact on message forwarding.

**3 - Reputation Mechanism in an Open Source Software Community**

Yuanfeng Cai, Iowa State University, Gerdin Business Building, Ames, IA, United States of America, yinyumoran@gmail.com, Dan Zhu

We develop a theoretical model and conduct a two-level analysis for reputation mechanism in a large OSS community. We find that work quality, participation experience and time spent affect developer's reputation. Further, the group level reputation affects team performance but it is moderated by the variance of individual's reputation level.

**SD04**

Room 203A

**Simulation Optimization II**

Sponsor: Simulation

Sponsored Session

Chair: Sujin Kim, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Singapore, Singapore, iseks@nus.edu.sg

**1 - Model-based Annealing Random Search with Stochastic Averaging**

Jiaqiao Hu, Assistant Professor, State University of New York at Stony Brook, Math Tower 1-107, Stony Brook, NY, 11794, United States of America, jqhu@ams.sunysb.edu

We propose a new algorithm for black-box optimization. The algorithm is based on the recent Model-based Annealing Random Search (MARS) for global optimization, but aims to improve the computational efficiency of MARS by using a stochastic averaging scheme. We show that the algorithm converges to the global optimizer even when the sample size per iteration is fixed at a constant value. This is in contrast with MARS, which requires a computational effort that grows polynomially for convergence.

**2 - Analysis of Direct Search Methods Combined with a Local Metamodeling Approach in Simulation Optimization**

Sicong Ma, National University of Singapore, 07-17 QRE Lab, Blk E1, ISE Dept., Singapore, 117576, g0800238@nus.edu.sg, Sujin Kim, Wendy Xu

We propose a framework to include local metamodels to direct search methods for both deterministic and stochastic optimization problems to improve the algorithm efficiency without affecting the convergence. We discuss the conditions on the metamodels and the objective functions under which the effectiveness of using metamodels is guaranteed. Numerical results with a wide variety of test problems show that local metamodeling can help even when the regularity conditions are not fully satisfied.

**3 - A New Framework for Combining Global and Local Surrogates in Black-box Optimization**

Yibo Ji, Graduate Student, National University of Singapore, E1-07-17, QRE Lab, Dept ISE, NUS, Singapore, 119260, jiyibo@nus.edu.sg, Sujin Kim, Wendy Xu, Myun-Seok Cheon

We propose a new framework for optimizing computationally expensive black-box problems, where neither closed forms nor derivatives are available. We first build a global metamodel to identify the promising area and then conduct a local search to ensure local optimality. One of key performance factors is balance of the two procedures, where this work mainly focuses. The framework is designed to adapt various global and local search methods. Numerical studies reveal the feasibility of our work.

**4 - An Entropy Based Sequential Calibration Approach for Stochastic Computer Models**

Jun Yuan, National University of Singapore, 1 Engineering Drive 2, Singapore, jyuan@nus.edu.sg, Szu Hui Ng

In practical calibration, it is important to allocate limited resources to more appropriate design points and to find the best follow up design points when additional resources are available. To address this problem, we present a Bayesian sequential calibration approach for stochastic computer models based on a maximum entropy criterion, which can sequentially optimize the calibration parameter and therefore improve the predictive performance of the computer model.

## ■ SD05

Room 205B

**Operations Research in Sustainability**

Sponsor: Energy, Natural Resources &amp; the Environment

Sponsored Session

Chair: Ulku Gurler, Professor, Bilkent University, Industrial Engineering Department, Ankara, 06800, Turkey, ulku@bilkent.edu.tr

**1 - Optimization Models for Biorefinery Supply Chain Networks Design under Uncertainty**

Guiping Hu, Iowa State University, 3033 Black Engr, Ames, IA, 50011, United States of America, gphu@iastate.edu, Narges Kazemzadehardestani

Biofuel industry has attracted much attention due to its potential to reduce dependency on fossil fuels. This study aims to determine the optimal design of supply chain+biofuel+refineries considering uncertainty in fuel market price, feedstock yield and logistic costs. To deal with the stochastic nature of parameters, different modeling approaches including+CVaR, stochastic programming and robust optimization have been investigated. A case study for the state of Iowa will be presented.

**2 - An Optimization Model for the Facility Sizing and Location of Thermochemical Biofuel Production**

Yihua Li, Iowa State University, 0074 Black Engr, Ames, IA, 50011, United States of America, yihuali@iastate.edu, Guiping Hu, Tristan Brown

This paper investigates the fast pyrolysis – upgrading – refining pathway, with corn stover being the feedstock and gasoline being the end product. Mixed integer linear programming (MILP) model is formulated to optimize the fast pyrolysis and upgrade facility location and capacity to minimize total production cost. The economic feasibility of building a new bio-refinery in Iowa is analyzed with the comparison to the existing bio-refinery in Louisiana.

**3 - Carbon Permit Contract Design for a Manufacturer with Multiple Inputs**

Emre Berk, Associate Professor, Bilkent University, Management Department, Ankara, Turkey, eberk@bilkent.edu.tr, Sibel Sozuer, Ulku Gurler

We consider the optimal carbon permit contract policy of a manufacturer in a dynamic carbon permit market. The production process uses multiple inputs with nonlinear yield and emission structures. The manufacturer may commit to an initial carbon allowance purchased at a contract price prior to the order realization. The surplus/deficit amount after the demand is revealed is sold/bought at the spot market price. We derive the optimal contract policy structure in this setting.

**4 - A Production Model under Carbon Emission Restrictions and Stochastic Demand**

Ulku Gurler, Professor, Bilkent University, Industrial Engineering Department, Ankara, 06800, Turkey, ulku@bilkent.edu.tr, Emre Berk, Sibel Sozuer

This paper studies production input quantity decisions under carbon emission restrictions and stochastic demand. We consider the production of a single product in a single period setting with arbitrary random demand. We maximize the expected profit function under carbon constraint. We derive some structural properties and provide numerical examples.

## ■ SD06

Room 205A

**Supply Chain Management with Behavior Issues**

Cluster: Supply Chain Management in China

Invited Session

Chair: Houcai Shen, Professor, Nanjing University, No 22, Hankou Road, Nanjing, 210093, China, hcshen@nju.edu.cn

**1 - Revenue Management in the Aircraft Leasing Business**

Xiutian Shi, Nanjing University, Department of Management Science &amp; Engin, Nanjing, China, shirley2716@gmail.com, Qing Ding, T.C.E. Cheng, Houcai Shen

We consider a problem from aircraft leasing business that develops rapidly in the industry. We consider one lessor and multiple airlines in multiple periods, and find the following optimal decisions: leasing rate, leasing number, and ticket pricing policy. The benefit of the leasing business is from the special pooling effect. And the airlines' initial capacity plays significant role in reducing operational risk. Moreover, the deterministic approximation may be too aggressive to apply.

**2 - Procurement by Option Contracts with Supply Risk and Spot Markets**

Xue Weili, School of Engineering Management, Nanjing University, Hankou Road 22, Nanjing University, Nanjing, 210093, China, wxue1981@gmail.com

This paper considers the optimal portfolio of option contracts with spot markets. In our model, reservation decision by option contracts has a leadtime, and there is supply risk when executing the contracts, i.e., the required delivery quantity would be not fully fulfilled. Moreover, the spot market has its own risk: price and liquidity risk. We synthesize these uncertainties and identify a class of optimality conditions. Numerical studies are implemented to dig out more managerial insights.

**3 - Overconfidence and Threshold Incentive**

Juan Li, Nanjing University, No 5 Ping Cang Xiang, Nanjing, China, juanli@nju.edu.cn

The effects of overconfidence on incentive contracts are studied. The first form of the incentive scheme comprises an additional marginal payment on crossing a specified sales threshold and the second form of the incentive scheme comprises a lump sum bonus payment on crossing the predetermined sales threshold. This paper derives two mechanisms with differing priors will tend to be relatively overconfident about their estimates and predictions.

**4 - The Newsvendor Problem and Price-only Contract When Bankruptcy Costs Exist**

Wenhui Zhao, Shanghai Jiao Tong University, 535 Fa Hua Zhen Rd., Shanghai, 200052, China, zhaownh108@gmail.com

We study a supply chain of a supplier selling to a capital constrained retailer, who can borrow from a bank. The bank offers a fairly priced loan. Failure of loan repayment leads to a costly bankruptcy. We identify the retailer's optimal order quantity as a function of the wholesale price and his wealth. The analysis of the supplier's optimal wholesale price leads to unique equilibrium solutions in wholesale price and order quantity, with the quantity smaller than the traditional newsvendor one.

**5 - How Bounded Rationality and Fairness Influence Supply Chain Operations**

Di Zhang, Nanjing University, No 22 Hankou Road, Nanjing, 210093, China, zhduhuiyi@126.com, Houcai Shen, Juan Li

A supply chain consisting one supplier and one retailer is considered. Full rationality members with fairness concerning are assumed, and one wholesale price also could coordinate the supply chain given the certain intervals of reference point coefficients. Bounded rationality members with fairness concerning are analyzed, in which logit choice models are used to characterize members' bounded rationality, the retailer's order behavior can be proved as a truncated normal distribution.

## ■ SD07

Room 206A

**Smart System Service Enabled Business Transformation**

Sponsor: Business Analytics, CPMS-The Practice Section

Sponsored Session

Chair: Ko-Yang Wang, Institute for Information Industry (III), Taiwan - ROC, kyw@iii.org.tw

**1 - Smart System Service for Business Transformation**

Brick Tsai, Grace Lin, Paul Chou, Henry Meng, Ko-Yang Wang, Wen-Jen Su, Shan Lo

In this talk, Dr. Wang will discuss a Smart System Service initiative that was designed to support business transformation. The methods will help enterprises to formulate business model for continual growth; foster innovation in business operation design; support business capabilities with in-time IT; drive continual improvement through disciplined value-driven management.

**2 - Enabling Next-generation Healthcare Services with Smart System Service**

Yo-Cheng Chang, Advanced Research Institute, Institute for Information Industry, 1F, No. 133, Section 4, Minsheng E. Road, Taipei, Taiwan - ROC, markchang@iii.org.tw, Wisely Li, Kaison Huang, Grace Lin, Henry Meng, Shan Lo, Yi Wen Chen, Joseph Lin, Anson Liu

With the advent of aging society, current healthcare systems are heavily stressed by boosted needs and limited resources. We will show how S3 enables cost-effective, personalized and profitable healthcare services such as clinical patient monitoring for respiratory-care, personal assistant for chronic-disease care and horizontal business integration of international medical tourism.

### 3 - Enabling Smart Building Management Solution with Smart System Service

Anthony Chou, Institute for Information Industry, Institute for Information Industry, 1F, No. 133, Section 4, Minsheng E. Road, Taipei, Taiwan - ROC, Paul Chou, Guo-Guang Chiou, Shih-Yao Dai, Grace Lin, Ilma Chuang, Steven Lin, Sheng Po Tseng, Raymond Yu

A smart building is a building with intensively networked control-and-management of building environmental aspects. With these connected components, managing energy usage, cost and carbon emission has become an interesting topic. In this talk, we will show how to use S3 to design a smart building solution to achieve business goals.

### ■ SD08

Room 206B

### Gurobi Optimization Development and Applications

Cluster: Super/Special Sessions

Invited Session

Chair: Yanfeng Wang, Edgestone Information Technologies Co., Shanghai, Shanghai, China, yanfeng.wang@edgestone-it.com

#### 1 - Gurobi Optimization Software

Zonghao Gu, Gurobi Optimization, 4050 Walnut Creek Trail, Alpharetta, GA, 30005, United States of America, gu@gurobi.com

We will talk about the Gurobi optimizers: primal and dual simplex, parallel barrier and the parallel MIP solver, and the underlying technologies and algorithmic improvements in these solvers. We will discuss computational results that demonstrate that Gurobi Optimization is the performance leader. A hands-on demonstration will be given of how to use the Gurobi Python interactive system, Python modeling interface and libraries to build, solve and tune performance on real-world models.

#### 2 - Find Smallest Balanced Pathway in Large-scale Metabolic Networks in Pseudo-Steady State Condition

Zixiang Xu, Tianjin Institute of Industrial Biotechnology, Chinese Academy of Sciences, China, xu\_zx@tib.cas.cn

Metabolic pathways are important references in the design of industrial bacterium. At present, constraint-based method is the only way to simulate a genome-scale metabolic network. For computational difficulty, previous pathway finding approaches can't effectively find out the pathway we expect. By using Mixed Integer Programming we put forward an algorithm to identify the smallest balanced pathway. The result pathway can satisfy the stoichiometric constraints and non-decomposability condition.

#### 3 - Multiple-production-path Scheduling Problem in Semiconductor Assembly and Test Manufacturing

Chang Liu, Professor, Shenyang Institute of Automation, CAS, 114 Nanta Street, Shenhe District, Shenyang, China, changl@sia.cn

In semiconductor assembly and test manufacturing (ATM), Scheduling is a classic multiple-path scheduling problem. Taking into account the matching rule of products and equipment, a mathematical model of linear programming is set up for the multiple-path scheduling. The results of the Gurobi solver show that the multi-path planning algorithm has the following characteristics: high searching capability, rapid convergence and high reliability.

#### 4 - Solving Advanced Project Scheduling Problem with Gurobi

Yanfeng Wang, Edgestone Information Technologies Co., Shanghai, Shanghai, China, yanfeng.wang@edgestone-it.com

We will use a real case to show how to apply Gurobi optimization in complex project scheduling problem, which involves varying resource calendar, multiple resource modes, complex task precedence, etc. We will also demo different modeling approaches that lead to significant performance gap.

### ■ SD09

Room 208A

### Computational Problems on Graphs

Sponsor: Computational Optimization & Applications (Sponsored by the Computing Society)

Sponsored Session

Chair: Igor Averbakh, Professor, University of Toronto Scarborough, 1265 Military Trail, Toronto, M1C 1A4, Canada, averbakh@utsc.utoronto.ca

#### 1 - The Flowtime Network Construction Problem

Igor Averbakh, Professor, University of Toronto Scarborough, 1265 Military Trail, Toronto, M1C 1A4, Canada, averbakh@utsc.utoronto.ca, Jorge Pereira

Given a network whose edges need to be constructed, it is required to find a construction schedule that minimizes the weighted sum of the times when vertices get connected to a designated node. The construction speed is much slower than the travel speed of the construction crew in the already constructed part of the network. Applications, complexity and algorithmic results are discussed.

#### 2 - Computing the Cutwidth of a Graph

Dag Haugland, University of Bergen, Department of Informatics, Bergen, Norway, dag@ii.uib.no

The cutwidth of a graph is defined as the smallest integer  $k$  for which there exists an arrangement of the vertices on a horizontal line, such that there are no more than  $k$  edges crossing any vertical line separating two consecutive vertices. Computing the cutwidth is an NP-hard problem with applications in e.g. scheduling. In this work, we analyze and compare different integer programming formulations for the problem, and show how tight bounds can be computed by means of Lagrangean relaxation.

#### 3 - Hub Number and Connected Hub Number on Chessboard Graphs

Cheng-Huang Hung, Assistant Professor, National Taiwan University of Science and Technology, 43, Sec. 4, Keelung Rd., Taipei, Taiwan - ROC, alexhung.cs@gmail.com, Jia-Jun Wang

Chessboard graph is a class of graphs related to the movement of specific chess on chessboard, including Knight, Rook, Bishop, Queen, and King graph. A hub set of a graph means any two vertices outside of the set are either directed connected or connected by only the vertices in the hub set. The (connected) hub number is the size of the minimum (connected) hub set. We explore the (connected) hub number on Rook, Bishop, and Queen graph. Preliminary result on Knight graph is also introduced.

#### 4 - On the Blowout Preventer Testing Problem: An Approach to Checking for Leakage in BOP Networks

Diptesh Ghosh, Indian Institute of Management, Ahmedabad, Vastrapur, Ahmedabad, 380015, India, diptesh@iimahd.ernet.in

Blowout Preventers (BOPs) prevent the uncontrolled release of hazardous formation fluids to surface. The blowout prevention testing problem is that of testing BOP valves to check if they are functional or not. Several type of testing is done on these valves. This paper deals with the check if the valves are capable of holding pressure. We present a decision model that allows a structured and time saving approach to minimize the number of test sets in order to identify leakage.

### ■ SD10

Room 208B

### Quality Management and Lean Six Sigma II

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Zhen He, Professor & Deputy Dean, College of Management and Economics, Tianjin University, #92, Weijin Rd, Nankai District, Tianjin, China, zhhe@tju.edu.cn

#### 1 - Statistical Process Control on Time Delay Feedback Controlled Processes

Haiyu Wang, Associate Professor, Zhongyuan University of Technology, Box. 293, No. 41 of Zhongyuan Road, Zhengzhou, 450007, China, wanghy1979@126.com

Statistical process control and Automatic Process Control can be integrated to produce an efficient tool for process variation reduction. The main goal of this article is to suggest a method using to monitoring process with different time delay feedback controlled processes. A quality control model based on delay feedback controlled processes is set up. And the calculating method of ARL of steps delay feedback controlled processes is provided to evaluate control charts performance.

## 2 - Identify Key Quality Characteristics in Multistage Manufacturing Process Based on PLS Method

Yumin Liu, Prof., Zhengzhou University, ZhengZhou, China, zzyuminliu@126.com

The paper discussed some issues about key quality characteristics analyzing in the environment of multistage manufacturing process. Firstly, a state space model is used in modeling multi-stage manufacturing process. Then utilizing partial least squares regression analysis method to solve the issues, such as multicollinearity, of the model and apply the variable importance in projection indicator to identify the key quality characteristics. A cigarette production case is given at last.

## 3 - Learning from our Experience: How People Learn from Six Sigma and Lean Projects

Xingxing Zu, Associate Professor, Morgan State University, 1700 E Cold Spring Lane, Baltimore, MD, 21251, United States of America, zuxingx@yahoo.com, He Zhen

This study takes a project-based view to examine employee participation and learning in Six Sigma or Lean projects. It aims to identify the organizational and individual characteristics that support employees to actively learn from their participation in improvement projects and to apply the knowledge in their routine jobs.

## SD11

Room 209A

## Planning and Scheduling in Health Care III

Cluster: Super/Special Sessions

Invited Session

Chair: Jiawei Zhang, New York University, New York, NY, United States of America, jzhang@stern.nyu.edu

### 1 - Sequencing Surgeries for Operating Rooms with Inventory Approximations

Ho-Yin Mak, Assistant Professor, The Hong Kong University of Science and Technology, Dept. of IELM, HKUST, Sai Kung, Hong Kong, Hong Kong - PRC, hymak@ust.hk, Ying Rong, Jiawei Zhang

Managing surgery appointments for operating rooms (ORs) is a challenging task due to randomness in surgery durations. We propose new heuristics for the problem of surgery sequencing, i.e., determining the order in which a list of surgeries should be performed in an OR. The fundamental idea behind the development of these heuristics is the structural connection between OR appointment scheduling and stochastic inventory control in serial supply chains.

### 2 - Appointment Sequencing in Operation Rooms: Is Smallest Variance First Rule Optimal?

Chung Piau Teo, National University of Singapore, Singapore, 119245, bizteocp@nus.edu.sg

We study the sequencing of surgery operations to minimize the waiting time of the patients and the overtime usage of the OR. Is it optimal to put the operation with the smallest variance in surgery duration first? We develop distributionally robust model for the sequencing problem, and numerical evidence indicates that the optimal sequence in appointment sequencing has a V-shape structure instead.

### 3 - Organizing Multidisciplinary Care for Children with Neuromuscular Diseases

Nikky Kortbeek, University of Twente / AMC, Drienerloaan 5, Enschede, 7522 NB, Netherlands, n.kortbeek@utwente.nl, Nelly Litvak, Marjan van der Velde

The Academic Medical Center (NL) recently opened the 'Children's Muscle Center Amsterdam' (CMCA). The CMCA diagnoses and treats children with neuromuscular diseases. Through the establishment of the CMCA, the standard of care is increased while children and their parents will generally visit the hospital only once a year, which used to be six times on average. In this talk, I will describe how a combination of ILP, simulation and queuing theory supports the design and operations of the CMCA.

### 4 - An Implicit Enumeration Approach to Control Excessive Waits under Time-varying Demand

Mieke Defraeye, PhD Candidate, KU Leuven, Naamsestraat 69, Leuven, 3000, Belgium, mieke.defraeye@econ.kuleuven.be, Inneke Van Nieuwenhuysse

In many service systems (e.g. EDs and call centers), arrival rates are not constant, which complicates personnel capacity decisions. We present a simulation-based implicit enumeration method to determine shift requirements in small-scale single-stage multiserver systems with time-varying arrival rates, customer impatience and an exhaustive service policy. A service level constraint is imposed: the probability that a customer experiences an excessive wait must be low enough at any point in time.

## SD12

Room 209B

## Electronic Commerce II

Cluster: Super/Special Sessions

Invited Session

Chair: Qiang Ye, Harbin Institute of Technology, 92 Xidazhi Street, Harbin, China, yeqiang2006@gmail.com

### 1 - Privacy-Personalization Paradox in Adoption of Mobile Health Service: The Mediating Role of Trust

Xitong Guo, xitongguo@gmail.com, Jinqiao Yuan, Yongqiang Sun, Zeyu Peng

Customers usually have to disclose some of their personal information and preferences for personalized usage of mobile health service. To address the so called "privacy-personalization" paradox, this study proposes that trust is an key mediator between privacy, personalization and behavioral intention. A survey with 492 subjects in China was conducted to test the proposed research model and hypotheses. Theoretical and practical implications are discussed.

### 2 - The Trilogy of Reviews, Reviewers and Recommendations: The Impact of Competition on Consumer Choice

Xianjun Geng, Assistant Professor, UT Dallas, 800 West Campbell, SM 33, Richardson, TX, 75080, United States of America, gengxj@gmail.edu, Wael Jabr, Eric Zheng

Firm-generated recommendations usually refer customers to alternative products, and online reviews provide means for customers to further evaluate these competing products based on customer-generated recommendations. This study integrates these two IT artifacts to investigate consumer choice vis-à-vis competing products, using a dataset collected from Amazon.com.

### 3 - Effect of Hotel Star Ratings on the Impact of Online Customer Reviews: An Empirical Investigation

Qi Lu, Harbin Institute of Technology, No.92 West Dazhi Street, Harbin, China, loki.hoho@gmail.com

Based on signaling theory, we conducted an empirical model to investigate the moderating effect of hotel star ratings on the relationship between online customer reviews and hotel performance. Using a difference-in-difference approach with panel data collected from Ctrip.com and Elong.com, we found that customer reviews had a significant impact on sales, and that hotels with lower star ratings would get stronger impact from online reviews than those with higher star ratings.

## SD13

Room 210A

## Performance Measurement and Assessment

Contributed Session

Chair: Zeyi He, Doctoral Student, University of York, Department of Sociology, ICT Research Centre, York, United Kingdom, zeyi.he@gmail.com

### 1 - Identifying Attributes for Measuring the Performance of the Barley System-product in Mexico

Rafael Granillo-Macias, Professor, Universidad Autonoma de Hidalgo, Hidalgo, Pachuca, Ap, 43900, Mexico, rafaelgm@uaeh.edu.mx, Francisca Santana-Robles

In the agri-food production chain from barley in Mexico, 55 000 farmers, two beer manufacturers and 10 malt processing companies participate actively. Becoming the second largest exporters of beer. The purpose of this paper is to determine which attributes can be used by stakeholders in the Barley Product-System in MEXico to measure the performance of the objectives and goals in each of the links in the supply chain of barley and Product-System chain as a whole.

### 2 - Ownership Structure and Firm Performance of Chinese Multinationals

Xiaoming He, Associate Professor, Beijing Jiaotong University, 3 Shangyuancun Haidian District, Beijing, 100044, China, xmhe@bjtu.edu.cn, Subrata Chakrabarty

Since Chinese government launched its go-global policy, Chinese MNCs have been surprisingly successful. We use insights from agency and contingency theory to understand the determinants of their performance. We argue that ownership structure provides Chinese firms with the ability to improve performance, especially when more closely match the firm's context.

**3 - Some Queuing Problems in Shanghai World Expo**

Gu Jifa, Academy of Mathematics and Systems Science,  
Chinese Academy of Sciences, jfgu@amss.ac.cn, Xu Shanying

In Shanghai World Expo, we may find some interested topics on queuing: (1) if know the parameters: arrival rate  $\lambda$  and service rate  $\mu$ , how to determine the length of queue  $L$  and waiting time  $W$ , the inverse problem: if know the  $L$  and  $W$ , how can determine the  $\lambda$  and  $\mu$ , (2) the efficiency and effectiveness problems in various pavilions, especially later related to the psychology of visitors; (3) the aggregation phenomena behind in the districts, each district, like a complex network of queues has several tens of pavilions, ways and plazas, how can find their collective behaviors.

**4 - The Shift of Participation – Who is the Most Important Participant in Wikipedia**

Zeyi He, Doctoral Student, University of York, Department of  
Sociology, ICT Research Centre, York, United Kingdom,  
zeyi.he@gmail.com

Wikipedia is a collaborative platform to which millions of participants can contribute freely. It may provide a new pattern of organization in internet applications, however, is Wikipedia a democratic system where all participants have equal rights to contribute? The paper aims to answer it by examining and comparing the amount and the proportion of edits. The research suggests that Wikipedia is produced by a small group of participants regardless of their administrative status innovatively.

**SD14**

Room 210B

**Analysis and Control of Queues**

Sponsor: Applied Probability

Sponsored Session

Chair: Shuangchi He, National University of Singapore, 1 Engineering  
Drive 2, Industrial & Systems Engineering, 117576, Singapore,  
isehes@nus.edu.sg

**1 - Control of Patient Flow in Emergency Departments: Multiclass Queues with Feedback and Deadlines**

Junfei Huang, PhD Student, National University of Singapore, BIZ  
2 Building, B2-03, 1 Business Link, Singapore, 117592, Singapore,  
junfeih@nus.edu.sg, Boaz Carmeli, Avishai Mandelbaum

We consider the control of patient flow through physicians in emergency departments: a choice must be made between triage patients who are yet to be checked vs. those who are in-process (IP). Physicians' capacity is modeled as a multi-class queueing system with feedback, in which triage patients face deadline constraints while IP patients incur delay costs. We propose and analyze a scheduling policy that minimizes total queueing cost while satisfying all constraints, asymptotically.

**2 - Interpolation Approximations for Queues in Series**

Kan Wu, Assistant Professor, Nanyang Technological University,  
School of MAE, NTU, Singapore, 639798, Singapore,  
wukan@ntu.edu.sg, Leon McGinnis

Exact queue times of tandem queues are difficult to compute in general. We propose a new approximation approach, based on observed properties of the behavior of tandem queues, which we call the intrinsic gap and intrinsic ratio. The approach exploits what we call the nearly-linear and heavy-traffic properties of the intrinsic ratio, which appear to hold in realistic production situations. Across a broad range of examined cases, this new approach outperforms earlier approximation methods.

**3 - Analysis of a System of Parallel Multi-class Non-Homogeneous Queues**

Natarajan Gautam, Texas A&M University, 4012 ETB, College  
Station, TX, 77843, United States of America, gautam@tamu.edu

We consider multiple single-server queues arranged in a parallel formation. The arrivals to the system belong to multiple classes and each class' arrival is governed by a non-homogeneous Poisson process. The amount of work brought by each class is according to a given distribution. There are multiple control actions. Our objective is to perform these actions cost effectively so that quality-of-service guarantees can be provided.

**SD15**

Room 212A

**Market Responses and Consumer Metrics Models**

Sponsor: Marketing Science

Sponsored Session

Chair: Xueming Luo, University of Texas at Arlington, 5 west st,  
Arlington, United States of America, luoxm@uta.edu

**1 - The Impact of Social Networks on Innovation Success:****A Study of Hollywood Motion Picture Industry**

Yong Liu, Associate Professor of Marketing, University of Arizona,  
1130 E Helen Street, Tucson, AZ, 85721, United States of America,  
yoliu@email.arizona.edu, Yubo Chen, Jurui Zhang

Innovation drives the economy and is critical for firms' survival and growth. In this study, we develop a conceptual framework that enables us to make predictions on how different network structures may result in different market performance of the new product developed. In testing the predictions, we construct a collaboration social network of the Hollywood movie industry and focus on the roles of movie directors to examine the effects of social networks.

**2 - How Follower Entry Influences Consumer Acceptance of the Pioneer Brand**

Zhenfeng Ma, Assistant Professor, University of Ontario Institute  
of Technology, 2000 Simcoe St. North, Faculty of Business and IT,  
Oshawa, ON, L1H7K4, Canada, zhenfeng.ma@uoit.ca, Ying Jiang,  
Tripat Gill

Based on the market signaling theory, we posit that the market entry of a me-too follower can act as diagnostic cues to influence consumer acceptance of the pioneer, depending the newness of the products. Two experimental studies show that follower entry increases consumer adoption intention toward the pioneer of radically new products but tends to decrease consumer adoption intention toward the pioneer of incrementally new products.

**3 - Signal and Costly Search: Evidence from Chinese Mutual Funds**

Ping Jiang, associate Professor, University of International  
Business and Economics, Box 1203, UIBE, 10 huixin dongjie,  
Chaoyang, Beijing, 100029, China, ping.jiang.cn@gmail.com,  
Xueming Luo, Shu Tian

We investigate whether fund marketing efforts signal management skills and reduce search cost using a unique and comprehensive dataset of Chinese mutual funds from 2004 to 2010. We show that pricing scheme signal investment quality and predict future fund performance. Further evidence suggests that sales channels and product strategies significantly induce fund flows via reducing search cost. Moreover, regulatory changes influence the role of marketing in reducing search costs and signaling.

**4 - Modeling the Jump of "Star" Frontline Service Employees: Extreme Quantile Heavy-Tail Models**

Xueming Luo, University of Texas at Arlington, S. West St.,  
Arlington, TX, United States of America, luoxm@uta.edu

We use extreme quantile regressions (heavy tail) to depict the dynamic growth path of 'star' employees as well as their characteristics as the key drivers. We test our model by using the data from call centers of a leading life insurance company in China. The result highlights the "jump-up" point from an apprentice to being qualified and the "take-off" point from being qualified to being distinguished.

**5 - Modeling the Growth of "Star" Salespersons: An Extreme Quantile Regression Approach**

Yiping Song, Associate Professor, Fudan University, Room 605  
Siyuan Building, 670 Guoshun Road, Shanghai, 200433, China,  
ypsong@fudan.edu.cn, Xueming Luo, Zhongyi ZHU

The best of the best employees are valuable to companies. In this study, we use extreme quantile regressions to depict the growth path of "star" salespersons as well as 'stars' characteristics and the key drivers of being "stars" by using the data from a call center of a leading life insurance company in China. The result highlights the jump-up point of a star growing from an apprentice to a qualified salesperson and the take-off point from being qualified to being distinguished.

## ■ SD16

Room 212B

### Product Lines and Product Bundling

Cluster: Interface between Operations Management and Marketing  
Invited Session

Chair: Kathryn E. Stecke, Ashbel Smith Professor of OM, University of Texas-Dallas, 800 West Campbell Road, Richardson, TX, United States of America, KStecke@utdallas.edu

#### 1 - Restructuring Supply Chains to Incorporate Emerging Economies

Amiya Chakravarty, Phillip McDonald Chair and Professor, Northeastern University, 360 Huntington Avenue, Boston, MA United States of America, a.chakravarty@neu.edu

To reach emerging economies such as the BRIC, supply chains must be restructured by incorporating specific elements of the emerging market, unique product characteristics, and customer service expectations. Some options are splintering the value chain, hub-and-spoke network, and tailoring the flows of components and assemblies to match local production and distribution practices. In this presentation, I will discuss a framework for restructuring and elaborate on some modeling approaches.

#### 2 - Reserved Mixed Bundle Offerings with Strategic and Myopic Customers

Ashutosh Prasad, Assoc. Professor, University of Texas at Dallas, 800 W. Campbell Rd., SM 32, Richardson, TX, 75080, United States of America, aprasad@utdallas.edu, R. Venkatesh, Vijay Mahajan

With Reserved Mixed Bundling the firm sells products and gives a discount on the bundle. However, the discount is reserved for customers who buy one product at full price. RMB occurs in cross-selling and cross-promotions. When customers are myopic about the availability of the discount, RMB is more profitable than other bundling strategies. But with strategic customers, mixed bundling is more profitable. The customer mix for RMB to be optimal is obtained and its implications discussed.

#### 3 - Stochastic Inventory System with Discount-driven Backorders

Rowan Wang, University of Minnesota, 111 Church St., SE, Minneapolis, MN, 55455, United States of America, wang1075@umn.edu, David Chen, Saif Benjaafar

We consider a stochastic inventory problem with both backorders and lost sales. In the case of a stockout, the inventory manager offers a discount to the customers, and the probability that an unsatisfied customer would be backlogged depends on the quantity of the discount. For both periodic review model and continuous review models, we characterize the structure of the optimal policy and provide managerial insights.

#### 4 - In the Eyes of the Investors: Unpacking the Differential Bases of Market Responses to Licensing

Yusen Xia, Georgia State University, Robinson College of Business, Atlanta, GA, 30303, United States of America, yxia@gsu.edu, Rajiv Nag

In this paper, we report the findings of an event-study wherein we analyzed the economic value shared by licensors and licensees immediately following the announcement of a licensing agreement. We examined the differential abnormal returns derived by a licensor and licensee in the backdrop of two contextual factors: 1) whether a focal licensing agreement is a technology- or marketing-based and 2) if the agreement is horizontal or non-horizontal.

## ■ SD17

Room 213A

### Healthcare Tools

Sponsor: Health Applications  
Sponsored Session

Chair: Jie Song, Dr., Peking University, 608 Fangzheng Building, Beijing, 100871, China, songjie@coe.pku.edu.cn

#### 1 - Trade-offs Between Service and Cost in Allocating Community-based Health Services

Mengyu Guo, Tsinghua University, Shunde Building, Beijing, China, gmy56255@gmail.com, Zhihai Zhang, Su Wu, Jie Song, Binfeng Li

This paper formulates the community-based health services networks design problem as a P median-like model with both service and cost-related objectives. The model simultaneously determines the location, service mix and capacity of health services to optimise the service and cost objectives. We apply the model in two different problem settings in Beijing for community-based chronic disease prevention and control system design purpose.

#### 2 - Applying Innovative Input Analysis Tools to Improve Discrete Event Simulation in Healthcare

Steven Hoerning, University of Wisconsin-Madison, 521 W. Dayton St. # 2, Madison, WI, 53705, United States of America, shoerning@wisc.edu

Bottlenecks in the emergency department (ED) disrupt patient flow throughout an entire hospital. To improve efficiency, EDs model emergency care delivery systems using simulation. However, little guidance exists regarding effectively incorporating hospital data into simulation models. Here, we develop means by which hospital administrators can understand how the quality of hospital data and choices made during input analysis influence the results of ED simulation.

#### 3 - Operating Room Scheduling under Multiple Resource Constraints

Bofei Sun, Peking University, China, sunbofei@foxmail.com

Operating rooms are considered as the most important and valuable resource in hospital. This paper studies the week scheduling of operating rooms integrating other limited resources including ICU beds and surgeons. After scheduling, the utilization of operating rooms is balanced and maximized. A mixed integer programming model is built up and we use case studies and sensitivity analysis to show how this model can assist hospital managers in decision making.

#### 4 - Endoscopy Suite Utilization Analysis at Digestive Health Center

Jingshan Li, Associate Professor, University of Wisconsin - Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, jingshan@engr.wisc.edu, Jie Song, Lauren Fiedler, Xiang Zhong

In this paper, we develop a simulation model to model and analyze the endoscopy procedure area at the new Digestive Health Center of University of Wisconsin Medical Foundation to identify the potential bottlenecks and investigate scheduling policies. Based on the simulation results, the ideal staffing model and procedure schedule to accommodate anticipated demand and maximize resource utilization are recommended.

## ■ SD18

Room 213B

### Data Envelopment Analysis in the Financial Services Sector

Cluster: Super/Special Sessions  
Invited Session

Chair: Joseph Paradi, Professor Emeritus, University of Toronto, 200 College Street, Toronto, ON, M5S 3E5, Canada, paradi@mie.utoronto.ca

#### 1 - The Strategy of Promoting Operating Efficiency of Banks by NBG

Xiaopeng Yang, Centre for Management of Technology and Entrepreneurship, University of Toronto, Canada, Toronto, Toronto, Canada, xiaopeng.yang@ist.osaka-u.ac.jp, Hiroshi Morita

The current study focuses on operating efficiency improvement for banks from multiple perspectives, which have different definitions of input/output about various attributes of a banking system. We incorporate Nash bargaining game (NBG) theory into data envelopment analysis (DEA) to propose an appropriate improving scheme for inefficient banks to reconcile the conflicts from multiple perspectives.

#### 2 - Underwriting and Investment Efficiency of Life Insurance Industry: Evidence from China

Wei Huang, University of International Business and Economics, Chaoyang District, Beijing, 100029, China, wei.huang.uibe@gmail.com, Joseph Paradi

We propose a relational two-stage DEA approach with shared-inputs to measure life insurance firms' efficiency. The life insurers in China were studied over a period of 8 years using an approach that established two stages in the businesses - the underwriting and investment stages. The results show that the life insurance industry in China experienced significant growth in TFP, and the productivity advantage of foreign insurers is not evident in China, specifically not in the investment stage.

### 3 - ZSG-DEA Based Regional Allocation of CO2 Emissions Allowance in China by 2020

Ke Wang, Beijing Institute of Technology, 5 S. Zhongguancun St., Beijing, China, kewang2083@gmail.com

This research explore the possibility for realizing China's national emission reduction target of reducing the intensity of CO2 emissions by 40-45% by 2020. Based on a scenario of China's regional economic, emissions, and energy consumption by 2020, and through the implementation of an improved ZSG-DEA model, we proposed a new efficient CO2 emissions allowance allocation scheme on provincial level which supports the possibility of achieving national energy saving and emission reduction targets.

### 4 - A Multi-attribute Classification Model for Decision Making in Credit Applications

Haiyan Zhu, Research Analyst, University of Toronto, 200 College Street, Toronto, ON, M5S 3E5, Canada, haiyanzhu9@gmail.com, Joseph Paradi

This study introduced a Data Envelopment Analysis based classification model for evaluating credit applicants. Main advantages of this new classifier: each potential customer was evaluated against previously analysed customers with the most similar attributes; acceptance and rejection boundaries were identified instead of setting single cut-off points, the credit strengths or weaknesses of the applicant were provided. This new classifier was applied on a Canadian bank's credit applicant dataset.

## ■ SD19

Room 215

### Unlocking the Hidden Value in Your Data with SAS Analytics

Cluster: Tutorials

Invited Session

Chair: Udo Sglavo, SAS Institute Inc., 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Udo.Sglavo@sas.com

Co-Chair: Jinxin Yi, SAS Institute Incorporated, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Jinxin.Yi@sas.com

#### 1 - Unlocking the Hidden Value in Your Data with SAS Analytics

Udo Sglavo, SAS Institute Inc., 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Udo.Sglavo@sas.com, Jinxin Yi

Organizations have been faced with the challenge to deal with data for decades. The enormous growth in the amount of data that the global economy now generates – transactional data, demographic data, data from social media and web sources, and more – has become overwhelming. More than ever it is critical to understand how the information locked in that data can be leveraged to drive actionable decisions for the business. Analytics is the key that can unlock that hidden value. The power of analytical models are integral to organizational dynamics and have direct impact on company performance. Companies across the globe are employing analytics for exploring and analyzing data to help uncover patterns and insights that can drive evidence-based decision making. This tutorial provides an overview of analytical methods, such as inventory optimization and statistical forecasting, with a focus on applications of those methods to solve specific business problems.

## Monday, 8:00am - 9:30am

### ■ MA01

Room 202B

#### Traffic Congestion Pricing

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Ying-en Ge, Professor, Dalian University of Technology, 2 Linggong Road, Ganjingzi District, Dalian, China, y.e.ge@dlut.edu.cn

#### 1 - The Past, Present and Future of the London Congestion Charging Scheme

Olga Feldman, David Simmonds Consultancy, 14 Millers Yard, CB2 1RQ, Cambridge, United Kingdom, OlgaFeldman@tfl.gov.uk

This presentation is to investigate what forces have driven the London Congestion Charging Scheme (LCCS) changed over the years. By means of this analysis, we show the past and present of the LCCS, with an emphasis on its limitations as well as performance. On the basis of this, we look into the future of this scheme and implications for other cities to implement/operate congestion charging.

#### 2 - Discriminatory and Anonymous Link Toll for Multiclass, Multicriteria and Mixed Network Equilibrium

Xiaoning Zhang, Tongji University, Siping Road 1239, Shanghai, China, cexzhang@tongji.edu.cn

We consider a unified framework of multiclass, multicriteria and mixed (3M) equilibrium, and the existence of practically feasible link tolls supporting such a 3M equilibrium as a system optimum. Toll have to be anonymous for different classes whose distinct features are observably undistinguishable. But tolls should be discriminatory for user classes driving different types of vehicles. We establish the existence of practical link tolls decentralizing a system optimum as a 3M equilibrium.

#### 3 - Singapore's Experience in Managing Urban Congestion – Practical and Theoretical Perspectives

Michael Li, Nanyang Technological University, S3-B1A-19, Nanyang Business School, Singapore, 639798, Singapore, zfli@ntu.edu.sg

I will first present Singapore's experience in implementing congestion pricing schemes over the years. I will then discuss a trial-and-error method in deriving the optimal tolls without knowledge of demand function. Finally, I will highlight some research issues in the China context.

#### 4 - Pareto-Improving Tradable Credit Scheme for Transportation Networks

Feng Xiao, evan.fxiao@gmail.com

This study proposes a credit-based toll & subsidy scheme to improve the system performance and simultaneously achieve pareto-improvement. At the equilibrium, the universal credit price is determined by the credit market, and the amounts of credit points given out to the travelers and charged from the travelers are break-even.

### ■ MA02

Room 202A

#### Risk Management

Sponsor: Data Mining

Sponsored Session

Chair: Nan Liu, Zhejiang University, School of Management, Zijingang Campus, Gudun Road, Hangzhou, 310058, China, nliu@zju.edu.cn

#### 1 - Research on Evolving Model of Transmission Network in Cosmopolitans

Bin He, Shanghai Jiao Tong University, No 535, Fahuazheng Road, Shanghai, China, hebing\_qh@163.com

Based on evolution data of Shanghai transmission network in recent years, according to characteristic of Cosmopolitan, present one new weighted complex network model, with which we can better analysis the power outages induced by external force.

## 2 - Activating Point Recognition of Supply Chain Contingency Plan under Unsymmetrical Information

Jianwen Luo, Shanghai Jiaotong University, Shanghai Jiaotong University, Shanghai, China, daocaoren376@163.com, Wenjie Zhang, Jianxia Gong

In this paper, we research on how to distinguish activating point of contingency plan in disruptive events. An activating point identification method based on Rough Sets (RS) and Support Vector Machine (SVM) is proposed. The recognition model based on RS and SVM is built considering supply chain links affected by disruptive events. The results show that the activating point recognition of contingency plan is crucial to controlling the impact and costs of disruptive events on supply chain.

## 3 - Tri-level Multiobjective Condition Value-at-Risk Model of Supply Chain

Zhiqing Meng, Zhejiang University of Technology, Hangzhou, China, mengzhiqing@zjut.edu.cn

Based on the conditional value-at-risk (CVaR) model, in the risk procession in supply chain, since a multi-product problem of supply-production-sale is a tri-level multiobjective problem under the terminal demand of market, we set up the tri-level CVaR model for all parts of the whole supply chain including production, ordering, inventory and sales parts. And, we give a method to solve the tri-level multiobjective CVaR model by transforming it into a coordination linear programming.

## 4 - Robust of High Cluster Supply Chain Network: A Perspective of Complex Network and Structure Analysis

Peihua Fu, Professor, Zhejiang Gongshang University, #18 Xuezheng Str., Xiasha, Hangzhou, 310018, China, fph@mail.zjgsu.edu.cn, Anding Zhu, Yanchu Liu

Cluster supply chain network is a relation structure of industry cluster. Robust of industry cluster can be studied in a perspective of complex network. An evolving dynamic model based on the preferential attachment of path and degree (DPPA) is used to study relationship between robust and uncertainty. Attack strategy of random removal is more robust than selected removal of enterprise nodes. So, to optimize supply chain, the alliance of core enterprises can enhance the robustness of network.

## MA03

Room 203B

### Behavior Informatics

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Hongyan Liu, Professor, School of Economics and Management, Tsinghua University, Qinghuayuan, Haidian district, Beijing, 100084, China, liuhy@sem.tsinghua.edu.cn

## 1 - Large Sample Evidence on the Informativeness of Text in Analyst Reports

Rong Zheng, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, Hong Kong - PRC, rzheng@ust.hk, Allen Huang, Amy Zang

This study is the first to use the naïve Bayes machine learning approach to extract opinions from the text in analyst reports. We find significant market reactions to textual opinions conditional on all of the quantitative forecasts released contemporaneously, consistent with the prediction that the text in analyst reports provides additional information about firm values. We also find that investors attach twice as much weight to negative textual opinions as to positive textual opinions.

## 2 - Social Network Simplification for Effective Information Diffusion Analysis

Hongyan Liu, Professor, School of Economics and Management, Tsinghua University, Qinghuayuan, Haidian District, Beijing, 100084, China, liuhy@sem.tsinghua.edu.cn, Jun He, Hongbo Zhang

In twitter social network, when a user posts a status, the potential retweet trajectory usually consists of 'follow' links between friends and followers. However, some of them are impossible to propagate the status. Detecting and eliminating these links is important for information dissemination analysis and retweet behavior study. In this paper, we define the problem, and propose algorithms to solve it. Experimental study shows that the simplification process is both efficient and effective.

## 3 - Search Engine Advertising Snippet Recommendation Using Feature Extraction from Customer Reviews

Qiang Wei, Associate Professor, Tsinghua University, Tsinghua University, Beijing, 100084, China, wei@sem.tsinghua.edu.cn, Jin Zhang, Jiawei Lei

Snippet content significantly impacts the performance of search engine advertising and understanding customers' preference can help improve designing snippet content. This paper will propose a new approach to extract the preference features from customer reviews in online shopping websites and further recommend a set of extracted feature keywords to help advertisers design better snippets. Experiments will be conducted to illustrate the effectiveness of the proposed approach.

## 4 - A Text Mining Based Approach in Discovering Features of Successful Strategic Alliances from News

Yuan Xue, The George Washington University, Fungler Hall, 515 2201 G Street, Washington D.C., United States of America, xueyuan@gwmail.gwu.edu, Elias G. Carayannis, Yilu Zhou

Strategic alliances facilitate aggregation of resources, diffusion and sharing of knowledge, and nourishing of technological innovations. We hypothesize that there are seven factors that influence the outcome of strategic alliances. We test hypotheses using alliance information extracted from news articles and provide decision makers with guidance in searching for business alliances.

## MA04

Room 203A

### Simulation in Financial Engineering

Sponsor: Simulation

Sponsored Session

Chair: Guangwu Liu, Assistant Professor, City University of Hong Kong, P7609 Academic Building, City University of Hong Kong, Kowloon Tong, Hong Kong - PRC, guanliu@cityu.edu.hk

## 1 - A Bootstrap-based Algorithm for Rare-event Simulation for Markov Chains

Xiaowei Zhang, Assistant Professor, Hong Kong University of Science and Technology, HKUST, Hong Kong - PRC, xiaoweiz@ust.hk, Peter Glynn

Rare-event simulation (RES) is concerned with estimating small probabilities, which appear very often in risk management. In this talk, we will present a novel RES algorithm for Markov chains. Our method exploits the regenerative structure of a Markov chain and involves importance resampling. This new method attempts to resolve the common problem for many existing RES algorithms, namely numerically solving an eigenvalue problem, which is challenging in general.

## 2 - American Option Sensitivities Estimation via a Generalized IPA Approach

Nan Chen, Chinese University of Hong Kong, Systems Engineering & Engineering Manage, Room 609, William M W Mong Engineering, Shatin, N.T, Hong Kong - ROC, nchen@se.cuhk.edu.hk, Yanchu Liu

We introduce a generalized IPA approach for estimating American option sensitivities, in a more general setting about the sensitivity analysis of a stochastic optimization problem. Our unbiased price-sensitivity estimators demonstrate significant advantages numerically and can easily be embedded into many popular pricing algorithms without extra simulation effort. We also investigate how the estimation quality of sensitivities will be affected by the quality of approximated exercise times.

## 3 - Simulation-Based Estimation of Poisson Arrival Rate for Queueing System

Jing Fang, HKUST, Clear Water Bay, Hong Kong - PRC, jfang@ust.hk, Jeff Hong

In this paper we look the arrival rate of a Poisson process and show that the maximum likelihood estimate of arrival rate may lead to very poor estimates of queueing performances especially when the sample size of the interarrival time is not large. To improve the estimates of performance, we design a simulation-based estimation approach to estimate the arrival rate and show that the resulting estimate may lead to significantly better estimates of queueing performances.

**4 - Fast Simulation of Greeks for Options with Discontinuous Payoffs**

Guangwu Liu, Assistant Professor, City University of Hong Kong, P7609 Academic Building, City University of Hong Kong, Kowloon Tong, Hong Kong - PRC, guanliu@cityu.edu.hk, Shaolong Tong

The Greeks are derivatives of option prices with respect to market parameters and play an important role in financial risk management. However, when payoffs of the options are discontinuous, simulating Greeks is difficult. In this paper, we show that the Greeks for options with discontinuous payoffs may be written as ordinary expectations, and develop unbiased estimators which achieve the fastest rate of convergence.

**MA05**

Room 205B

**Optimization Models and Applications in Energy Systems**

Sponsor: Energy, Natural Resources & the Environment

Sponsored Session

Chair: Dali Zhang, Analyst, Singapore Health Services Pte. Ltd., Connection One, Jln Bt Merah, Tower3 #06-08, Singapore, 150168, Singapore, zhang.dali@singhealth.com.sg

**1 - Parallel Branch and Fix Coordination Implementation**

Gerardo Perez-Valdes, Postdoc, NTNU, Alfred Getz 3, Trondheim, 7491, Norway, gerardo.valdes@iot.ntnu.no

Branch and Fix coordination helps us to solve large multi-stage stochastic mixed integer optimization problems. Parallelizing BFC is advantageous: it allows us to deal with otherwise intractable instances, and scenario cluster solution is seemingly well suited for parallel settings. We have applied BFC to energy infrastructure settings, where investment decisions are binary, and economic parameters are uncertain. Results on the implementation are presented and discussed.

**2 - A Generalized Nash Equilibrium Model for a Network of Interlinked Oligopolistic Markets**

Yibo Ji, Graduate Student, National University of Singapore, E1-07-17, QRE Lab, Dept ISE, NUS, Singapore, 119260, Singapore, jiyibo@nus.edu.sg, Sujin Kim, Dali Zhang

We propose a generalized Nash equilibrium model for an economic network of interlinked oligopolistic markets. Firms in the network supply a homogeneous product to meet both home and foreign demands in a noncollaborative way under trading limit regulations. We develop an algorithm for the sensitivity analysis of model parameters such as trade quotas and tariff rates. This allows us to investigate the firms' strategic behaviors and provides a guide to setting up appropriate trade restrictions.

**3 - Extending Conditional Value at Risk to Multi-Period Models with Application to Managing Strategic Performance**

Frederic Murphy, Professor, Fox School of Business, Temple University, North Broad St., Philadelphia, PA, 19122, United States of America, fmurphy@temple.edu, Fernando Oliveira

We extend CVaR to infinite-horizon Markov models. Because the model has a nonconvex objective function, we present a solution algorithm to find the global optimum. A petroleum supply disruption induces an asymmetric economic loss, modeling the downside risk is best done using tools such as CVaR. We show how the SPR policy changes as the objective function weights downside losses and expected losses and how one CVaR parameter must be treated as a policy.

**4 - Resources of the Coordinated Development of Mineral Resources Exploitation, the Economy, the Environment**

Dong Mu, Professor, Beijing Jiaotong University, 3 Shangyuan, Haidian District, Beijing, 100044, China, mueast@gmail.com

The natural environment is an order and low entropy system. This paper constructs the mineral resources exploitation, economy, environment linkage model between three system entropies, and design different scenario according to the natural environment response ability and investment environment improvement, and economic development needs, simulate and analysis to determine reasonable mineral extraction. The results provide reference production and policy suggestions for clean energy.

**MA06**

Room 205A

**Supply Chain Modelling and Applications**

Cluster: Supply Chain Management in China

Invited Session

Chair: Yongwu Zhou, Professor, South China University of Technology, 381 Wushan Road, Tianhe district, Guangzhou, China, zyw\_666@hotmail.com

**1 - The Roles of Bank and Trade Credits: Theoretical Analysis and Empirical Evidence**

Xiangfeng Chen, Associate Professor, Fudan University, 670 Guoshun Road, School of Management, Shanghai, China, chenxf@fudan.edu.cn, Zhiguo Xiao, Gangshu Cai

This paper investigates the roles of bank and trade credits in a supply chain with a capital constrained retailer, where the retailer can borrow credit from a bank and/or from the supplier who allows delayed payment. We provide both analytical results and empirical evidence in China.

**2 - Modelling Port Choice Behaviour in South China**

Yongzhong Wu, Lecturer, South China University of Technology, School of Business Administration, SCUT, Guangzhou, 510000, China, okwyz@hotmail.com

In South China, a great amount of ocean-going containers are generated each year, and handled by three ports, i.e., Hong Kong, Shenzhen, and Guangzhou. A good understanding of the port choice behavior is unique for relevant policy making and infrastructure building. In this paper, a multiple logit model was built for modelling the port choice behavior in this area. As an example, the model was used to evaluate the impact of a committed project, i.e., the Hong Kong - Zhuhai - Macao Bridge.

**3 - A Dynamic Inventory and Finance Problem under Partial Payment Scheme**

Zongliang Wen, South China University of Technology, School of Business Administration, SCUT, Guangzhou, China, mathwzl@hotmail.com, Xiaoli Wu, Yongwu Zhou

In this article, we consider a dynamic inventory and finance problem of a retailer who periodically replenishes from a supplier and sells it to the market with uncertain demand. If order goods, the retailer must pay for a certain percentage of the purchase cost while receiving trade credit for unpaid purchase cost. We characterize the optimal inventory policy and present comparative static results on the optimal policy.

**4 - Sales Effort Incentives under Dual Asymmetric Information**

Huaming Song, Dr, Nanjing University of Science and Technology, 200, Xiaolingwei Street, Nanjing, 210094, China, huaming@njust.edu.cn

In this paper, in the scenario that sales effort and its cost are private information which cannot be observed by the sales principle, we study the incentives mechanism under the dual asymmetric information. First, a linear mechanism with discrete cost of sales effort is modeled, then a continuous case is studied and more complicated mechanism is put forward. Through this mechanism, the true information is revealed and it can be self forced by the sales agent.

**MA07**

Room 206A

**OR/MS and Social Science Applications**

Contributed Session

Chair: Adewoye Olabode, Senior Lecturer, Yaba College of Technology, Department of Mathematics, Yaba, Lagos Mainland, +234, Nigeria, boka152002@yahoo.com

**1 - Mathematics, Operations Research, Computer Science and Statistics: The Relationship**

Adewoye Olabode, Senior Lecturer, Yaba College of Technology, Department of Mathematics, Yaba, Lagos Mainland, +234, Nigeria, boka152002@yahoo.com

Many people have difficulty in seeing any difference between, Mathematics, Operations Research, Computer Science, Statistics and other disciplines while others are just plain confused. In this work, OR and its applications are being exposed and then comparison made between OR and Mathematics, Computer, Statistics and other fields. It has been realised, that all these areas of knowledge are interrelated with other areas such as Engineering, Physics, Microbiology, Economics etc.

**2 - Measuring Happiness: Method and Test**

Jae H. Min, Professor, Sogang Business School, 1, Sinsu-dong, Mapo-gu, Seoul, 121-742, Korea, Republic of, jaemin@sogang.ac.kr

We propose a method of measuring happiness of individual and that of a nation composing of individuals. From empirical tests, we show some statistical relationships between happiness index and other demographic measures.

**3 - Social Media for Effective Organizational Decision Making**

Toshizumi Ohta, Professor, University of Electro-Communications, 1-5-1 Choufugaoka, Choufu-shi, Tokyo, 182-8585, Japan, ohta@is.uec.ac.jp, Hirohiko Suwa, Namie Kato, Yuki Ogawa

In order to explore the effectiveness of social media in organizational decision making, we employed a process model of decision making and a structural model of organizational problem solving. These models may be able to describe a new pattern of exchanges in information and knowledge among employees in organizational decision making.

**4 - Strategies for Global Information Systems Development: Perspective From MNCs Headquartered in China**

Biao Liu, Peking University, #5 Yiheyuan Road, Beijing, China, lbison126@gmail.com

With the globalization of firms based in developing countries, IT managers from these areas find it difficult to successfully develop global information systems (GIS). This article applies a technology-organization-environment framework to identify factors that impact the selection of alternative GIS development strategies. The relationship between GIS development strategies and the quality of GIS is also examined.

**5 - Certification & Inspection Service Quality: Applying the Fuzzy SERVQUAL Method**

Lixin Cui, School of Management and Economics, Beijing Institute of Technology, Beijing, China, cuilixin@bit.edu.cn, Bingyan Yan, Ru Liu, Shan Yan, Chengjie Wang, Hongyan Wu, Guangfeng Zeng

This paper applied fuzzy set theory based on modified SERVQUAL model to analysis service quality in certification & inspection industry in China. The study consists of 405 randomly selected participants who are customers of China Certification & Inspection Company (CCIC). It includes four parts: introduction, methodology, a case study of certification & inspection service quality and conclusions. Study shows that the five dimensions of tangible have the biggest gap between the service quality expectations and perceptions. So, the company we studied (CCIC) need to increase investment in tangible aspects in order to improve their service quality.

**MA08**

Room 206B

**Decision Support for Design Optimization**

Sponsor: Computational Optimization & Applications (Sponsored by the Computing Society)

Sponsored Session

Chair: Parviz Ghandforoush, Professor & Director, Virginia Tech, 7054 Haycock Road, Suite 341, Falls Church, VA, 22043, United States of America, pghandfo@vt.edu

**1 - A Decision Support System to Plan Electric Utility Supply and Demand**

Parviz Ghandforoush, Professor & Director, Virginia Tech, 7054 Haycock Road, Suite 341, Falls Church, VA, 22043, United States of America, pghandfo@vt.edu, Titian Ghandforoush

This paper describes the design of a decision support system (DSS) to plan electric utility generation and distribution (supply) in order to forecast market demand. The proposed DSS will consider both short-term and long-term forecasts of electric utility markets using regional economic and demographic data such as population and market growth.

**2 - Designing Public Storage Warehouses with Customer Choice**

Yeming Gong, EM Lyon Business School, Professor Office 1033, Building-B,, 23 Avenue Guy de Collongue, Ecully, 69130, France, gong@em-lyon.com

Customer choice behavior, such as buy-up and buy-down, is an important element in revenue management of public storage warehouses. To consider this behavior, the customer choice model is used to specify the probability of purchase for each fare product as a function of the set of fare products offered. This paper proposes models and solving algorithms to design public storage warehouses with considering the choice behavior of customers.

**3 - Optimal Design of Wireless Charging Electric Vehicle – Case Study**

Young Jang, Assistant Professor, KAIST, Department of Industrial and Systems Eng, Daehak-ro 291, Daejeon, Korea, Republic of, yjang@kaist.ac.kr

The system design and integration issue of the revolutionary transportation system called On-Line Electric Vehicle (OLEV) recently developed by KAIST are introduced. The OLEV utilizes an innovative wireless charging solution. The OLEV system consists of vehicle units and charging units, which are the road-embedded power transmitters. The mathematical model for allocating the power transmitters and determining the battery size using mathematical optimization techniques are presented.

**4 - Efficiency Improvement Strategy under Constant Sum of Inputs**

Surya Majumdar, Indian Institute of Management Calcutta, F8/2 Karunamoyee, Salt Lake, Kolkata, 700091, India, surya.majumdar@gmail.com, Sanjeet Singh

In this paper, we have formulated Data Envelopment Analysis (DEA) models to reduce the input in an inefficient Decision Making Unit (DMU) when the specific input is under the constant sum. We have also extended the models to transfer the excess input only to the Increasing Returns to Scale (IRS) DMUs. Case of reallocation of excess input without any reduction in efficiency of other DMUs has also been discussed. Theoretical results have been illustrated with the help of numerical examples.

**MA09**

Room 208A

**Scheduling Models and Algorithms**

Sponsor: Computational Optimization & Applications (Sponsored by the Computing Society)

Sponsored Session

Chair: Kris Coolen, KULeuven Faculty of Business and Economics, Naamsestraat 69, Leuven, Belgium, Kris.Coolen@econ.kuleuven.be

**1 - Scheduling Modular Projects on a Bottleneck Resource**

Kris Coolen, KULeuven Faculty of Business and Economics, Naamsestraat 69, Leuven, Belgium, Kris.Coolen@econ.kuleuven.be, Fabrice Talla Nobibon, Roel Leus, Wenchao Wei

We model an R&D project as consisting of several modules, with each module containing one or more jobs. We examine how to schedule the jobs of such a project in order to maximize the expected profit when the jobs have a probability of failure. A module succeeds when at least one of its constituent jobs is successful. We describe various policy classes, establish the relationship between them, develop exact algorithms, and examine its computational performance on a randomly generated data set.

**2 - Sequential Testing Policies for Complex Systems under Precedence Constraints**

Wenchao Wei, F.E.B Faculty of Business and Economics, Naamsestraat 69, Leuven, 3000, Belgium, wenchao.wei@econ.kuleuven.be, Kris Coolen, Roel Leus

We study the problem of sequentially testing a k-out-of-n system, which functions if at least k of its n components are functional. The tests are subject to precedence constraints and we minimize the expected cost of the inspections required to learn the state of the system. We distinguish different classes of scheduling policies and describe exact algorithms to find an optimal member of each class. To the best of our knowledge, we are the first to provide exact algorithms for this problem.

**3 - Dual-resource Scheduling in a Flowshop**

Rasaratnam Logendran, Professor, Oregon State University, School of Mech., Indust., and Mfg. Engr, 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, logendrr@engr.orst.edu, Yasaman Mehravaran

We propose a mathematical model for solving a non-permutation flowshop with dual resources. The goal is to minimize the work-in-process inventory while maximizing the service level. There are different skill levels for labor and the setup times are considered to be sequence-dependent. Three different search algorithms are developed to solve the proposed NP-hard problem. Effectiveness and efficiency of the search algorithms is demonstrated by applying the algorithm to an example problem.

## ■ MA10

Room 208B

### Operations Economics

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Fuqiang Zhang, Olin Business School, Washington University in St. Louis, St. Louis, MO, United States of America, FZhang22@wustl.edu

#### 1 - Managing Disruption Risk: The Interplay Between Operations and Insurance

Lingxiu Dong, Washington University-St. Louis, One Brookings Drive, Operations/Manuf, Campus Box 1133, St. Louis, MO, 63130, United States of America, dong@wustl.edu, Brian Tomlin

Business interruption (BI) insurance offers firms a financial mechanism for managing their exposure to disruption risk. Firms can also avail of operational measures to manage the risk. We explore the use of and the interplay between BI insurance and operational measures in managing disruption risk.

#### 2 - Improving Supplier Reliability under Competition and Knowledge Spillover

Nan Yang, Washington University, Washington University, St. Louis, MO, United States of America, yangn@wustl.edu, Yixuan Xiao, Yimin Wang

We consider two manufacturers that compete with imperfectly substitutable products and they share a common component supplier which, due to variations in production quality or yield, is unreliable. We characterize the manufacturers' equilibrium improvement efforts and provide managerial insights on market characteristics that influence the manufacturers' equilibrium improvement efforts.

#### 3 - The Role of Information in Outsourcing Competition

Fuqiang Zhang, Olin Business School, Washington University in St. Louis, St. Louis, MO, United States of America, FZhang22@wustl.edu, Xiaole Wu

We study an outsourcing game where two firms choose between the efficient and responsive outsourcing strategies. We show how the information structure and other problem parameters affect the equilibrium of the outsourcing game.

#### 4 - Sourcing for Quality: Pricing, Inspection, and Cooperation

Cuihong Li, University of Connecticut, 2100 Hillside Road, Storrs, CT, United States of America, Cuihong.Li@business.uconn.edu, Hsiao-Hui Lee

A buyer may use different instruments to manage the quality of a sourced product: She can provide price incentive for the supplier to exert quality improvement effort, use inspection to screen out nonconforming products, or spend her own resource on cooperating with the supplier to improve the product quality. We investigate the use of the three instruments, considering both complementary and substitutable relationships between the buyer's cooperation effort and supplier's improvement effort.

## ■ MA11

Room 209A

### Optimization Models in Logistics Management and Supply Chain Management I

Cluster: Super/Special Sessions

Invited Session

Chair: Xiangpei Hu, Dalian University of Technology, No.2 Liohgong Road, Ganjingzi District, Dalian City, 116024, China, drhxp@dlut.edu.cn

#### 1 - Collaboration Decisions for Efficient Disruption Recovery Service in Public Tram Systems

Yan Fang, Dalian University of Technology, China, fangyan51@gmail.com, Amy Zeng, Xiangpei Hu, Christian Durach

Trams are prone to unexpected events such as vehicle breakdowns, track misalignment and power outages. This research explores ways of collaborating with taxi providers during disruptions for efficient recovery. Particularly, decision models for answering when and how to use taxis or buses or hybrid to ensure efficient replacement service are studied. Our research presents a first step in delving into the intricacy of the practical problem in public tram systems

#### 2 - A Delivery Tour-based Order Batching and Order Picking Method for Online Supermarkets

Minfang Huang, North China Electric Power University, China, hmf1006@126.com

For online supermarkets, warehouse management, especially picking operation with high efficiency and accuracy are very difficult. In this paper, Group

Technology and JIT is introduced. And cluster analysis-based order grouping, storage unit-based order partitioning, picking strategies, decomposition and path strategy, the lead-time of packaging are studied in the paper. This paper aims at providing a reasonable and operational order sorting method for online supermarkets.

#### 3 - A Context-based Modeling Method for Generating the Distribution Plans of Product Oil

Lijun Sun, Dalian University of Technology, No. 2 Linggong Road, Ganjingzi District, Dalian, 116023, China, slj@dlut.edu.cn, Xiangpei Hu, Youquan Sun

This research focuses on a modeling method for generating the distribution plans of product oil based on context, which intends to improve the deployment of scheduling resources and generate distribution plans in real time and online. The research content includes context-based knowledge representation, context-based reasoning and modeling processes, and the development of a context-based decision support system for generating distribution plans.

## ■ MA12

Room 209B

### Pricing and Customer Service

Cluster: Super/Special Sessions

Invited Session

Chair: Rachel Zhang, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong - PRC, rzhang@ust.hk

Co-Chair: Qian Liu, Hong Kong University of Science and Technology, IELM, HKUST, Clear Water Bay, Kowloon, Hong Kong - PRC, qianliu@ust.hk

#### 1 - Managing Returns Policy and Product Resale

Yong Lei, Student, IELM, HKUST, Rm3208, Academic Building, HKUST, Clear Water Bay, Kowloon, Hong Kong - PRC, ylei@ust.hk, Stephen Shum, Qian Liu

We consider the firm's problem when product can be resold either by firm or by consumers. The firm sells products with returns policy. Consumers have uncertain valuations on the product before they purchase, and decide whether to return products to the firm or resell on their own if products don't fit their needs after purchases. The firm's optimal pricing decision is derived. Furthermore, we demonstrate the consumer resale behavior will generally harm the firm's profit.

#### 2 - Dynamic Pricing and Inventory Control in the Presence of Strategic Consumers with Reference Effects

Shining Wu, PhD Candidate, Department of Industrial Engineering and Logistics Management, The Hong Kong University of Science and Technology, Room3208, Academic Building, HKUST, Clear Water Bay, Hong Kong - PRC, shiningwu@ust.hk, Rachel Zhang

We consider a firm that sells the same versions of the product season after season. At the beginning of each season (stage 1), the firm places an order and sells the product at full price. As the sales unfolds, the firm has an opportunity to mark down the price (stage 2). Such markdowns may motivate strategic consumers to delay purchases in the future. We show that a strategic firm tends to stock less and discount less. Under some conditions, the optimal strategy has a mean-reverting property.

#### 3 - Dynamic Price and Service Competition when Customers Learn

Song Zheng, IELM, HKUST, Dept. of IELM, HKUST, Clear Water Bay, Hong Kong - PRC, zhengs@ust.hk, Qian Liu

We study the dynamic price and service competition in a market with a large number of firms. Firms provide services at different prices and different waiting times. Consumers make decisions based on the price and the estimated waiting time via previous shopping experiences. We analyze firms' optimal strategies on price and service in a limiting regime, and how they are affected by market conditions and consumer characteristics.

#### 4 - Should Event Organizers Prevent Resale of Tickets?

Yao Cui, PhD Candidate, University of Michigan, 2007 Huron Pkwy., Apt. 6, Ann Arbor, MI, 48104, United States of America, cuiyao@umich.edu, Izak Duenyas, Ozge Sahin

We are interested in whether preventing consumer resale of tickets benefits capacity providers for sporting and entertainment events. Consumers' purchasing decisions take into account their inter-temporal valuations as well as their potential opportunity to resell the tickets. We study fixed pricing, dynamic pricing and pricing with options, and consider how the capacity provider's revenue changes with respect to the transaction cost of consumer resale under each pricing strategy.

### 5 - Proactive Transshipment Coupled with Price Commitment Postponement Does More than Stock Balancing

Li Li, Department of Industrial Engineering and Logistics Management, Hong Kong University of Science and Technology, HKUST, Clear Water Bay, Hong Kong - PRC, ielli@ust.hk, Li Jiang, Rachel Zhang

We analyze a setting of two retailers each serving a local market. The retailers can postpone pricing decisions to influence demands until market uncertainties are revealed and have the option to relocate stocks between themselves either before or after price setting. We show that the timing of stock relocation relative to price setting have significant implications retailers to improve service levels and profits, and further investigate their effects on various parties in the network.

### MA13

Room 210A

#### Scheduling I

Contributed Session

Chair: Uttarayan Bagchi, Professor, The University of Texas at Austin, McCombs School of Business, 1 University Station, B6500, Austin, TX, 78712-0212, United States of America, Uttarayan.Bagchi@mcombs.utexas.edu

#### 1 - Minimizing the Total Completion Time in Two-stage Flexible Flowshop with Parallel Machines and a Single Batch Machine

Hua Gong, The Logistics Institute, Northeastern University, Shenyang, China, hgong@tli.neu.edu.cn, Lixin Tang

We address a flexible flowshop scheduling problem with parallel machines in stage 1 and a single batching machine in stage 2. The objective is to find a sequence that minimizes the total completion time. We prove that the general problem is strongly NP-hard and the problems with unbounded batch size or identical processing times on the batching machine are NP-hard. A heuristic algorithm along with its worst-case performance ratio is provided.

#### 2 - An Improved DE for a Single Machine Dynamic Scheduling Problem with Sequence Dependent Setup Times

Zhao Yue, The Logistics Institute, Northeastern University, Shenyang, China, yzhao@tli.neu.edu.cn, Lixin Tang

In this work, we consider a single machine dynamic scheduling problem with sequence-dependent setup times to minimize the maximum lateness. This problem is strongly NP-hard. We develop a mixed integer programming model to deal with such scheduling problem in a given time window and an improved differential evolution algorithm for the problem. To evaluate its performance, the proposed algorithm is tested on a set of benchmark instances and compared against the best methods from the literature.

#### 3 - Robust Unit Commitment under Demand Uncertainty

Ping Che, The Logistics Institute, Northeastern University, Shenyang, China, pche@tli.neu.edu.cn, Lixin Tang

We investigate the robust unit commitment problem with uncertain electric demand. The objective is to minimize the generating cost under the worst demand scenario. The problem is formulated as a mixed integer nonlinear programming model in which the random demand is modeled by an uncertainty set. An effective decomposition algorithm is developed for the problem.

#### 4 - Scheduling Problems with Common Flow-allowance

Gur Mosheiov, Hebrew University, Mount Scopus, Jerusalem, Israel, msomer@mscc.huji.ac.il, Baruch Mor

We study a due-date assignment problem with a common flow-allowance. The minsum version of the problem is studied with the option to perform a rate-modifying maintenance activity. We consider the setting that the maintenance duration and the job processing times are position-dependent. The minmax version is also studied.

#### 5 - Scheduling the Assembly Flow Shop to Minimize Makespan

Uttarayan Bagchi, Professor, University of Texas at Austin, McCombs School of Business, 1 University Station, B6500, Austin, TX, 78712-0212, United States of America, Uttarayan.Bagchi@mcombs.utexas.edu

We consider two- and three-stage assembly flow shop problems with parallel, non-identical machines in the first, one machine in the second, and one machine in the third stage. The scheduling objective is to minimize makespan. For the two-stage problem, we present new results on permutation schedules and heuristic performance. The results for the two-stage problem are then extended to the three-stage problem.

### MA14

Room 210B

#### Optimization- Theory and Applications

Sponsor: Applied Probability

Sponsored Session

Chair: James Ang, National University of Singapore, Decision Sciences Department #02-01, 15 Mochtar Riady Bldg 15 Kent Ridge Drive, Singapore, 119245, Singapore, bizangsk@nus.edu.sg

#### 1 - Two-stage Stochastic Linear Programs with Incomplete Information on Uncertainty

Jie Sun, Professor, National University of Singapore, School of Business, 15 Kent Ridge Drive, 119245, Singapore, jsun@nus.edu.sg, James Ang, Fanwen Meng

Two-stage stochastic linear programming is a classical model in operations research. Assuming the availability of the first and second order moment information of the random variables and using duality of semi-infinite programming, we show that a deterministic equivalence of the two-stage problem can be reformulated as a second-order cone optimization problem. A numerical example is presented to demonstrate the convenience and computational advantage of this approach.

#### 2 - Multiple Objectives Satisficing under Uncertainty

Melvyn Sim, Associate Professor, NUS, NUS Business School, 1 Business Link, Biz2 Building, B1-02, Singapore, 119260, dcsimm@nus.edu.sg

We propose a class of functions, called multiple objective satisficing (MOS) criteria, for evaluating the level of compliance of a set of objectives in meeting their targets collectively under uncertainty. We focus on a class of MOS criteria that favors diversification, which has the potential to mitigate severe shortfalls in scenarios when any objective fails to achieve its target.

#### 3 - Managing Operational and Financing Decisions to Meet Consumption Targets

Zhuoyu Long, PhD Student, NUS, Singapore, longzhuoyu@nus.edu.sg, Melvyn Sim, Lucy Gongtao Chen

We study dynamic operational decision problems with uncertainty. Financing decisions are available to smooth out consumptions with the goal of achieving prescribed consumption targets. We show that if borrowing and lending are unrestricted, it is optimal to finance consumptions at the target levels for all periods except the last; otherwise, the optimal policies correspond to those maximizing expected utilities. We also analyze the optimal policies of joint inventory-pricing decision problems.

#### 4 - Alternating Direction Methods for Latent Variable Gaussian Graphical Model Selection

Shiqian Ma, Postdoctoral Associate, University of Minnesota, 400 Lind Hall, 207 Church Street SE, Minneapolis, MN, 55455, United States of America, sm2756@gmail.com

We propose alternating direction methods for solving latent variable Gaussian graphical model selection, which is a convex optimization problem that aims to estimate an inverse covariance matrix that can be decomposed into a sparse matrix plus a low-rank matrix from sample data. Global convergence results are established for our proposed methods. Numerical results are shown.

### MA15

Room 212A

#### Practices of Interactive Marketing in the Digital World

Sponsor: Marketing Science

Sponsored Session

Chair: Jeongwen Chiang, Professor of Marketing, China Europe International Business School, 699 Hong Feng Rd, Shanghai, 201206, China, jwchiang@ceibs.edu

#### 1 - Optimal Design of Crowdsourcing Services

Zhong Wen, Tsinghua University, Beijing, China, wenzh@sem.tsinghua.edu.cn

This paper studies optimal fee schedules of crowdsourcing services. The paper finds that service fees should be an increasing concave function of task prizes. This result implies that optimal service fee rates, measured as the ratios of fees to prizes, decrease with task prizes. The paper shows that low-type crowdsourcing contest sponsors might be priced out of the market under the optimal fee schedule.

**2 - Virtual Property Trade in Online Games**

Yi Xiang, CEIBS, 699 Hongfeng road, Shanghai, China, yixiang@ceibs.edu, Liang Guo

A unique phenomenon in the online gaming market is the significant volume of trade among game users, who exchange real money for virtual goods that do not exist in the real world. The market of virtual goods has two distinctive characteristics: 1) the resold virtual items normally involve no quality loss since the attributes are digitally defined, and 2) the game companies can impose measures to control the trade. This paper studies the optimal trade policy from a game provider's perspective.

**3 - Modeling Competition Among Paid-Search Advertisers**

Sha Yang, Professor of Marketing, University of Southern California, 3660 Trousdale Parkway, ACC 306E, Los Angeles, CA, United States of America, shayang@marshall.usc.edu, Shijie Lu, Xianghua Lu

We propose a structural model to study keyword competition and position competition in paid-search advertising. The keyword competition examines advertisers' keyword portfolio decision. The position competition examines the realized cost-per-click (CPC) of competing advertisers. One of the key findings is that number of entrants has a strong indirect effect on an advertiser's click volume and CPC. We investigate the profit implication of two policies to the paid-search host.

**4 - Does Mere Connection Lead to Social Interaction in Online Social Networks?**

Yuxin Chen, Professor, Northwestern University, 2001 Sheridan Road, Evanston, IL, 60201, United States of America, yuxin-chen@kellogg.northwestern.edu

Once people become connected in online social networks, do they really influence each other? We address this interesting question using a within-subjects design with a unique data set from Flickr.com. Our findings reveal that friends do influence one another, though the influence is asymmetric. We also show that the social interaction is enhanced by users' offline closeness, but not affected by their characteristics in the social network. (Coauthors: Xiaohua Zeng and Xinlei (Jack) Chen)

**MA16**

Room 212B

**Integrated Pricing and Inventory Models**

Cluster: Interface between Operations Management and Marketing  
Invited Session

Chair: Peng Hu, Huazhong University of Science and Technology, 1037 Luoyu Road, Wuhan, 410037, China, hupeng81@yahoo.com

**1 - Manufacturer's Rebate Strategies in Supply Chains with Heterogeneous Consumers**

Shiming Deng, Professor, Huazhong University of Science & Technology, School of Management, 1037 Luoyu Road, Wuhan, 430074, China, smdeng@mail.hust.edu.cn, Asif Muzaffar

In a manufacturer-retailer supply chain, the manufacturer can either send mail-in-rebates directly to customers or offer retailer rebates to the retailer, who may in turn offer discounts to customers. We compare the two rebate strategies in a heterogeneous customers market and provide conditions under which one rebate strategy becomes more efficient than the other. We also exam the supply chain efficiency for the two strategies.

**2 - Integrated Pricing and Inventory Control with Reference Price Effects**

Peng Hu, Huazhong University of Science and Technology, 1037 Luoyu Road, Wuhan, 410037, China, hupeng81@yahoo.com, Xin Chen

We will discuss a periodic-review dynamic pricing model where the demand depends not only on the selling price but on the historic prices through the so-called reference price. Under a certain mild conditions a polynomial time algorithm is provided to solve the problem when demand is deterministic; and when demand is stochastic, the structures of the optimal solution and its asymptotic property are characterized.

**3 - Consignment Contracts with Revenue Sharing for a Capacitated Retailer and Multiple Suppliers**

Yun Fong Lim, Assistant Professor of Operations Management, Lee Kong Chian School of Business, Singapore Management University, Singapore, yflim@smu.edu.sg, Yunzeng Wang, Yue Wu

We consider a retailer with limited storage capacity selling multiple products. Each product is produced by a different manufacturer. We study the performance of the supply chain under consignment contracts with revenue sharing subject to the capacity constraint. We also investigate the interaction between different manufacturers.

**MA17**

Room 213A

**Joint Session HAS/OR/MS in Medicine:  
Panel Discussion: Healthcare OR Around the World:  
Past, Present, and Future**

Sponsor: Health Applications & OR/MS in Medicine and Healthcare  
Sponsored Session

Moderator: Nan Kong, Purdue University, 206 South Martin Jischke Drive, West Lafayette, IN, 47907, United States of America, nkong@purdue.edu

**1 - Panel Discussion: Healthcare OR around the World: Past, Present, and Future**

Nan Kong, Purdue University, 206 South Martin Jischke Drive, West Lafayette, IN, 47907, United States of America, nkong@purdue.edu, Panelists: Joris van de Klundert, Xiaolan Xie, Xun Jia, Margaret Brandeau, Eva Lee

Healthcare OR is a rapidly emerging area with great successes and potentials. Healthcare OR researchers from academia and industry, representing many parts of the world, will get together for a panel discussion. The panelists will first introduce themselves, their background. Then they will be asked about their research, teaching, and outreach activities and their experiences on healthcare OR. Finally, the panelists will open for questions from the audience.

**MA18**

Room 213B

**Financial Engineering: Modeling and Computation**

Cluster: Super/Special Sessions  
Invited Session

Chair: Steven Kou, Professor, Columbia University, New York, NY, United States of America, sk75@columbia.edu

**1 - Portfolio Selection with an Unobservable Bull-Bear Regimes**

Min Dai, Associate Professor, National University of Singapore, Dept of Math, Singapore, Singapore, matdm@nus.edu.sg, Yingshan Chen

We consider the portfolio selection with transaction costs in a bull-bear switching market. We show that the optimal strategy is determined by two time-dependent free boundaries relying on the fraction of wealth in stock and the conditional probability in the bull market. A thorough theoretical analysis is provided. Simulation results and empirical analysis reveal that the strategies perform better than those in Dai et al. (2010, 2011).

**2 - Closed-Form Expansions of Discretely Monitored Asian Options in Diffusion Models**

Ning Cai, Assistant Professor, Hong Kong University of Science & Technology, Industrial Eng & Logistics Mgmt, Clear Water Bay, Hong Kong - PRC, ningcai@ust.hk, Chenxu Li, Chao Shi

We propose a closed-form asymptotic expansion approach to pricing discretely monitored Asian options in one-dimensional diffusion models. This expansion method has two appealing features. First, it is possible to explicitly calculate any correction term systematically. Second, the expansion convergence is proved rigorously under some regularity conditions. Numerical results suggest the closed-form expansion formula up to the third order is accurate and fast for a broad range of diffusion models.

**3 - Default Clustering and Valuation of Collateralized Debt Obligations**

Xianhua Peng, Assistant Professor, Hong Kong University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong - PRC, maxhpeng@ust.hk, Steven Kou

The recent financial crisis has witnessed the powerful impact of the default clustering (i.e., one default event tends to trigger more default events in the future and cross-sectionally), especially on the CDO market. We propose a model based on cumulative default intensities that can incorporate default clustering. Furthermore, the model is tractable enough to provide a direct link between single-name and multi-name credit securities.

**4 - Myopic Loss Aversion, Reference Point, and Money Illusion**

Xuedong He, Assistant Professor, Columbia University, 316 S. W. Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States of America, xh2140@columbia.edu, Xunyu Zhou

We provide a rigorous treatment of Benartzi and Thaler's myopic loss aversion theory. We find that in addition to the agent's loss aversion and evaluation period, his reference point also has a significant effect on optimal asset allocation. We then examine the implications of money illusion for asset allocation and pricing. Finally, we extend the model to a dynamic setting.

## ■ MA19

Room 215

**Stochastics**

Contributed Session

Chair: David Teng Wu, Research Assistant, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, tengwu@usc.edu

**1 - Beyond Fisher's Discriminant Analysis**

Shuichi Shinmura, Professor, Seikei University,  
3-3-1 Kichijoji-kitamachi, Musashino-shi, Japan,  
shinmura@econ.seikei.ac.jp

Optimal Linear Discriminant Function (OLDF) based on MNM (minimum number of misclassifications) criterion resolves many problems of discriminant analysis. OLFDF is defined by integer programming. One of them is Fisher's Linear Discriminant Function and Quadratic Discriminant Function can't recognize the linear separable data such as pass/fail of examination. This is explained by my statistical examination test data.

**2 - Stochastic Impulse Control: A Computational Approach**

Haolin Feng, Assistant Professor, Lingnan College, Sun Yat-sen University, Xin Gang Xi Road 135, Guangzhou, China,  
FengHaoL@mail.sysu.edu.cn, Kumar Muthuraman

We develop a unified computational method that solves stochastic impulse control problems of various diffusion processes including Brownian motion, geometric Brownian motion and the mean-reverting processes. We also provide necessary theoretical guarantees for the method. Application examples in operations management and financial engineering will be presented.

**3 - Intrinsic Location Functionals of Stationary Processes**

Yi Shen, Cornell University, 206 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, ys437@cornell.edu, Gennady Samorodnitsky

We analyze a large family of location functionals of stationary processes over any given interval. This family contains locations such as the location of the path supremum/infimum, the first/last hitting times, the largest jump, etc. Various distributional properties are proved to be shared by all these locations. Moreover, we also show that all the possible distributions form a convex set, with extreme points explicitly given. This is a joint work with Gennady Samorodnitsky.

**4 - Generalized Coupon Collector's Problem**

David Teng Wu, Research Assistant, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, tengwu@usc.edu

We propose a new model for Coupon Collector's Problem and an optimal strategy associated to it. In this model, each coupon might be eligible for multiple boxes, and goes to one box; or dropped if not eligible to any box. The collecting process continues until all boxes are filled. Since each arrival may be eligible to multiple boxes, we are interested in the policy that stochastically minimizes the number of arrivals needed, which was found by high efficient simulation.

**5 - Little's Law: Statistical Analysis with Data**

Song-Hee Kim, PhD Student, IEOR, Columbia University, Mudd 325, 500 West 120th Street, New York, NY, 10027, United States of America, sk3116@columbia.edu, Ward Whitt

Little's law relates limits of averages and expected values of stationary distributions, but we often consider averages from data over a finite time interval. With these empirical averages, we propose adjusted estimates to reduce bias when the system does not start and end empty. For stationary intervals, we advocate estimating confidence intervals. Data from simulations and a call center are used.

**Monday, 11:00am - 12:30pm**

## ■ MB01

Room 202B

**Resource Planning Applications in Aviation**

Sponsor: Aviation Applications

Sponsored Session

Chair: Jeroen Belien, Hu Brussel, Warmoesberg 26, Brussels, Belgium, jeroen.belien@hubrussel.be

**1 - A Method for Work Force Needs: An Application in Airport Authority Company**

Baris Carikci, TUBITAK, 41404, Turkey,  
bcarikci@yahoo.com, Ilkan Sarigol

The mission and work definitions of organizations and departments changes in reorganization's projects. Determining number of person for each department

becomes a common problem after this kind of projects. On the other hand, it is hard to evaluate number of necessary employees in the service sector, where work evaluation methods are hard to apply. This paper presents a method for determining the number of employee in a service sector company, which has been restructured recently.

**2 - A Tabu Search Heuristic for Building Aircraft Maintenance Personnel Rosters**

Philippe De Bruecker, PhD Student, Catholic University Leuven, Naamsestraat 69, Leuven, 3000, Belgium,  
philippe.debruecker@econ.kuleuven.be, Jeroen Belien,  
Erik Demeulemeester

A fast heuristic approach is presented to optimize staffing and scheduling at an aircraft maintenance company located at Brussels Airport. Two linked Tabu Search algorithms are proposed to minimize the labour costs and to maximize employee satisfaction. To enhance the performance of the algorithm, strategic oscillation and pattern creation are used. We illustrate the performance of the algorithms with a computational experiment and compare the results to a mixed integer linear programming model.

**3 - Analyzing the Performance of Personnel Rosters with Stochastic Timing of Workload**

Jorne Van den Bergh, PhD Student, HU Brussel, Warmoesberg 26, Brussels, Belgium, jorne.vandenbergh@hubrussel.be,  
Jeroen Belien, Liesje De Boeck, Erik Demeulemeester

We present a simulation approach for the evaluation of personnel rosters of an aircraft maintenance company located at Brussels Airport. When constructing the rosters, the timing of the workloads was considered to be deterministic. The simulation model is used to evaluate the performance of the rosters with respect to the uncertainty of the arrival times. The performance depends on the allocation decision of workers to maintenance jobs. We compare the real-world allocation method to other rules.

## ■ MB02

Room 202A

**Mining Data for Quality and Reliability Improvement**

Sponsor: Data Mining

Sponsored Session

Chair: Jian Liu, University of Arizona, 1127 E. James E. Rogers Way, Tucson, AZ, United States of America, jianliu@email.arizona.edu

Co-Chair: Qingyu Yang, Wayne State University, 1805 4th Street, Detroit, MI, United States of America, ek8363@wayne.edu

**1 - Reliability Evaluation with Life Data From Similar Products**

Qingpei Hu, Chinese Academy of Sciences, 55 East Zhongguancun RD, Haidian, Beijing, China, qingpeihu@amss.ac.cn, Lingjiang Li

High reliability products have few failure data observed from life testing, but data from similar products can be incorporated for reliability evaluation. In this paper, a confidence distribution approach is taken to combine life data from similar products for reliability evaluation. Comparison with likelihood approach is conducted in a comprehensive way. Case studies with practical life testing data show the better performance of our proposed approach.

**2 - Service Safety Assessment on Natural Gas Pipeline**

Weidong Zhang, Deputy Director, Associate Professor, National Center for materials Service Safety, University of Science & Technology Beijing, 30 Xueyuan Road, Haidian District, Beijing, 100083, China, zwd@ustb.edu.cn, Bin Shen

Project of natural gas transmission from West to East China is a key infrastructure in China. How to guarantee the service safety of the pipeline is very important for the project. In order to assess the reliability of the pipeline, we have constructed a multi-model by experimental data and monitoring data. The future status of the pipeline could be forecasted by the model. The multi-model could be optimized by the future monitoring data.

**3 - Quality Problem Closed Loop Based on Characteristic Linkage Model**

Guijiang Duan, Beihang University, Box 7968, Beihang University, No.37, Xueyuan Road, Beijing, 100191, China,  
gjduan1970@gmail.com, Yang Wang

Quality Problem Closed Loop (QPCL) is an effective process framework for quality problem resolving in complex product development, which aims at not only diagnosing and clarifying the current quality problems, but also screening and avoiding the potential problems with similar contexts. In this presentation, the characteristic linkage model is to be introduced into QTCL framework to construct a structured description model and quantitative analysis method for quality problem.

#### 4 - Reliability Analysis of Dependent Competing Risks under Imperfect Repair

Nailong Zhang, Wayne State University, 4815 4th Street, Detroit, MI, United States of America, eo9364@wayne.edu, Qingyu Yang

Reliability analysis of repairable systems subject to dependent competing risks has received increasing attention in recent years. Most existing research, however, assumes a perfect repair action for the failed component or the whole system. In this research, statistical methods are developed to model the repairable systems subject to dependent component failures under imperfect component repair actions. The developed methods are illustrated using an automotive manufacturing process.

### ■ MB03

Room 203B

#### Search Engine Marketing

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Yinghui Yang, Assistant Professor, University of California, Davis, One Shields Ave., Gallagher Hall, Davis, CA, 95616, United States of America, yiyang@ucdavis.edu

##### 1 - Gender Targeting in Keyword Advertising

Jim Jansen, Associate Professor, Pennsylvania State University, College of Information Sciences and Tech, 321G IST Building, University Park, PA, 16802, United States of America, jjansen@ist.psu.edu

We classify nearly 7,000,000 records from a 33 month keyword advertising campaign by gender. We compare the performance among gender categories using impressions, clicks, cost-per-click, sales revenue, orders, items, and return on advertising. Gender neutral phrases perform the best overall, calling into question the benefits of demographic targeting based solely on gender. Insights can result in keyword advertising efforts being more effectively in the use of advertising dollars.

##### 2 - A Budget Optimization Framework for Search Advertisements Across Markets

Yinghui Yang, Assistant Professor, University of California, Davis, One Shields Ave., Gallagher Hall, Davis, CA, 95616, United States of America, yiyang@ucdavis.edu, Yanwu Yang

We investigate budget optimization problems in search auctions and propose a budget optimization framework (BOF), considering the entire lifecycle of advertising campaigns. Then, we formulate BOF framework, discuss properties and solution algorithms. Moreover, we establish an instantiation of BOF framework. With field logs from real-world campaigns, we also conduct computational experiments to evaluate our framework and identified strategies.

##### 3 - Keyword Research: A Practical Framework for Optimization in Search Auctions

Jie Zhang, Institute of Automation, Chinese Academy of Sciences, 95 Zhongguancun East Road, Beijing, 100190, China, zhangjie.isec@gmail.com, Yanwu Yang

Keyword optimization is a basic issue for advertisers in search auctions. We propose a hierarchical keyword optimization framework (KOF) to support various keyword-related decisions during the entire life-cycle of search advertising campaigns, including: domain-specific keywords generation and expansion, target market-driven keywords allocation, keywords selection and grouping based on search advertising structures, and dynamical adjustment according to the realtime advertising performance.

### ■ MB04

Room 203A

#### Contemporary Advances in Simulation and Optimization

Sponsor: Simulation

Sponsored Session

Chair: Xiaoyun Xu, Assistant Professor, Peking University, Chengfu Road 298, Founder Building Room 608, Beijing, 100871, China, xiaoyun.xu@pku.edu.cn

##### 1 - Efficient Coverage in Centralized and Distributed Wireless Sensor Networks

Xiaoyun Xu, Assistant Professor, Peking University, Chengfu Road 298, Founder Building Room 608, Beijing, 100871, China, xiaoyun.xu@pku.edu.cn, Zihuan Zhou

This research considers a field coverage problem of wireless sensor network. The objective is to maintain a reasonable sensing coverage while making it more

resilient to failures. Two deployment methods, one centralized and one distributed respectively are proposed. Analytical solutions are found for both methods. The global behavior is explored through simulation. The results demonstrate that both methods increase the network resilience while maintaining a reasonable coverage over time.

##### 2 - Exact Sampling of Steady-state Infinite Server Queues and Multi-server Loss Systems

Jing Dong, Columbia University, 500 West 120th Street, RM 313, New York, NY, United States of America, jd2736@columbia.edu, Jose Blanchet

The Markovian description of infinite-server queues is measure valued. We develop a "Coupling from the Past" procedure to simulate these queues in steady state. We also extend our method to multi-server loss systems. The algorithm can be applied to a large class of systems with general light-tailed arrivals and service time distributions. Our algorithm is shown to be efficient in a heavy traffic asymptotic sense.

##### 3 - Recent Development of Optimal Computing Budget Allocation for Efficient Simulation Optimization

Chun-Hung Chen, Professor, National Taiwan University, Department of Electrical Engineering, No.1, Sec. 4, Roosevelt Road, Taipei, 106, Taiwan - ROC, cchen9@gmu.edu, Loo Hay Lee

The technique of Optimal Computing Budget Allocation can significantly enhance the efficiency of stochastic simulation optimization. We will present some recent developments.

### ■ MB05

Room 205B

#### Sustainable Biofuel System Planning and Management

Sponsor: Energy, Natural Resources & the Environment

Sponsored Session

Chair: Yongxi Huang, Assistant Professor, Clemson University, 110 Lowry Hall, Clemson, SC, 29634, United States of America, yxhuang@clemson.edu

##### 1 - Competition Among Food, Energy and Environment: Sustainable Biofuel Supply Chain Design

Yanfeng Ouyang, Associate Professor, University of Illinois at Urbana-Champaign, IL, United States of America, yfouyang@illinois.edu, Xin Wang, Michael K. Lim

Recent expansion of biofuel industry resulted in significant raise in food price. We propose a biofuel supply chain model which captures the impact of biofuel production on the food market and environment. Using the model, we provide relevant managerial insights for the biofuel firms as well as the government.

##### 2 - Minimizing the Carbon Footprint of Biofuel Supply Chains

Sandra Eksioglu, Assistant Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, sde47@ise.msstate.edu, Mohammad Marufuzzaman, Yongxi Huang

This study presents mathematical models that capture the impact of different carbon emission-related policies on the design of biofuel supply chains. We use a two-stage stochastic programming model that identifies locations and production capacities for biofuel production plants (first stage), and facility assignments and transportation mode selection (second stage). These decisions are impacted by the tradeoffs between transportation costs, investment costs, and emissions in the supply chain.

##### 3 - A Prospective Economic Analysis of Biofuels Feedstock Production in US and Supply Chain Network

Hayri Onal, Professor, University of Illinois at Urbana-Champaign, 326 Mumford Hall, 1301 W. Gregory Drive, Urbana, IL, 61801-3605, United States of America, h-onal@illinois.edu, Xiaoguang Chen

We present an economic simulation model, a large scale quadratic MIP, that determines the simultaneous equilibrium in US agricultural commodity markets together with the biofuel processing facility locations and optimum supply chain network. A two step procedure is used to solve the model numerically. Empirical results will be presented.

#### 4 - Multistage Expansion Planning of Biofuel Supply System with Sustainable Development Criteria

Yongxi Huang, Assistant Professor, Clemson University,  
110 Lowry Hall, Clemson, SC, 29634, United States of America,  
yxhuang@clemson.edu, Fei Xie

We develop a Multiple Criteria Decision Analysis modeling framework to integrate two sustainability objectives of cost and environmental impact in optimizing the process of expanding and managing biofuel production and distribution system over a planning horizon. This is a multi-objective mixed integer linear programming model. Best-compromise solutions between system cost and greenhouse gas emissions are achieved in a case study of cellulosic biofuel production in California.

### ■ MB06

Room 205A

#### Sustainable Transport Planning and Scheduling

Cluster: Supply Chain Management in China

Invited Session

Chair: Qiushuang Chen, Professor, Nankai University,  
94 Weijin Road, Tianjin, Tianjin, China, chenqs@nankai.edu.cn

##### 1 - On the Optimization of the Route Programming for Container Liner Ship

Junqing Sun, Professor, Tianjin University of Technology,  
Tianjin, China, jqsun506@163.com

This paper addresses the optimization problem of a container liner ship's routing programming and scheduling. Firstly, the mathematical model of the problem is proposed. Then the optimization model is verified to be NP-hard problem. Finally the heuristic approach based on ACO is designed to solve the problem. Finally the simulation results show that the the hub-and-spoke transporting mode can make the container liner corporation get more profit than traditional transporting mode.

##### 2 - Passenger Route Choice Behavior on Transit Networks with Electronic Bus Stop Information

Jun Li, Southwest Jiaotong University, No.111,  
Beiyidian, Erhuanlu, Chengdu, Chengdu, China,  
swjtulijun@gmail.com, Ying Zeng

It has been shown that if vehicle headway is exponential distribution, an optimal subset of lines can be determined, which is based on the assumption that passengers would board the first arriving bus of the attractive set at a given stop. While common lines and information on the next arriving bus are considered, the assumption can't be held. A general framework suitable for this situation is proposed. The model without information can be interpreted as a particular instance of this method.

##### 3 - Berth Allocation with Green Berthing Strategy in the Tidal Terminal Container Port

Qiushuang Chen, Professor, Nankai University, 94 Weijin Road,  
Tianjin, China, chenqs@nankai.edu.cn, Yuquan Du,  
Xiongwen Quan, Ya Xu

The berth allocation problem with variable arrival time (VAT) strategy in the tidal port is considered. The optimization problem is to minimize the departure delay time of the vessels, the fuel consumption and vessel emissions during vessel sailing. Extensive numerical experiments show that the VAT strategy is an applicable substitute for deepening the navigation channel in the tide port, and is competitive to considerably reduce fuel consumption and vessel emissions.

### ■ MB07

Room 206A

#### Risk Perception and Social Impact

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Tianjun Feng, School of Management, Fudan University,  
670 Guoshun Road, Shanghai, 200433, China, tfeng@fudan.edu.cn

##### 1 - Recycling Gone Bad: When the Option to Recycle Increases Resource Consumption

Yitong Wang, Assistant Professor, Department of Industrial  
Engineering, Tsinghua University, Beijing, 100084, China,  
wangyitong@tsinghua.edu.cn, Jesse Catlin

In this study, we propose that the ability to recycle may lead to increased resource usage. Our first study shows that consumers used more paper while evaluating a pair of scissors when the option to recycle was provided (vs. not provided). In the next field experiment, we find that the per person restroom

paper hand towel usage increased after the introduction of a recycling bin compared to when a recycling option was not available. We conclude by discussing implications for policies.

##### 2 - Impacts of Earthquake Perceived Risk on Consumer's Decision-Making

Chunmei Fan, Southwest Jiaotong University, No.111  
North Section One Erhuan Road, Chengdu, SC, 610031, China,  
hqlix@163.com, Huaqiang Li, Jianmin Jia

A theoretical model of the impacts of earthquake perceived risk on consumer's decision-making process from psychological perspective was developed in this study. It was found that earthquake perceived risk did play a crucial role in consumer's value evaluation and purchase behavior in real estate market after the earthquake.

##### 3 - Counteracting the Uncertainty Effect Bias

Tianjun Feng, School of Management, Fudan University,  
670 Guoshun Road, Shanghai, 200433, China,  
tfeng@fudan.edu.cn, L. Robin Keller, Yitong Wang

When exhibiting the uncertainty effect, individuals value a binary lottery less than the lottery's worst outcome. Our paper explores how to counteract the uncertainty effect bias by investigating a plausible underlying anchoring-and-adjustment process. Two experiments were conducted to examine if providing an anchor prior to judgments, or introducing additional cognitive load is able to counteract the uncertainty effect bias.

### ■ MB08

Room 206B

#### Computational Finance

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Gangshu Cai, Kansas State University, Department of  
Management, Manhattan, KS, 66506, United States of America,  
gcai@k-state.edu

##### 1 - Time-consistent Investment-reinsurance Policies for Insurers under Mean-variance Criterion with Jump

Yan Zeng, Sun Yat-sen University, Lingnan (University) College,  
Sun Yat-se, Guangzhou, China, zengy36@mail.sysu.edu.cn,  
Zhongfei Li, Yongzeng Lai

We study time-consistent investment-reinsurance policies for an insurer under mean-variance criterion with jump. The surplus of the insurer follows a jump diffusion model; the financial market consists of one risk-free asset and one risky asset, whose price is described by a Levy process; the insurer can purchase proportional reinsurance and invest in the financial market. The explicit expressions for the time-consistent policies and value function are derived by solving HJB equation system.

##### 2 - On the GRS Test for Asset Pricing Models in Case of the Japanese Equity Market

Jun Takemata, Student, The University of  
Electro-Communications, 1-5-1 Chofugaoka, Chofu-shi, TO,  
182-8585, Japan, milanista8@live.jp, Koichi Miyazaki

GRS test is a popular statistical test of evaluating the asset pricing model (APM) focusing on the existence of the unexplained excess return. However, our empirical and simulation analyses suggest that the GRS test sometimes may not correctly evaluate APMs and the magnitude of the intercept and the coefficient of determinant should be also examined.

##### 3 - Equilibrium Financing in a Distribution Channel with Capital Constraint

Gangshu Cai, Kansas State University, Department of  
Management, College of Business Administration, Manhattan, KS,  
66506, United States of America, gangshu@gmail.com, Bing Jing,  
Xiangfeng Chen

We examine a channel consisting of one manufacturer and one retailer, where the retailer is capital constrained. The retailer may fund its business by borrowing credit either from a competitive bank market or from the manufacturer. When only one credit type is viable, the retailer prefers bank credit to trade credit. When both bank and trade credits are viable, the unique equilibrium is trade credit financing when production cost is relatively low and is bank credit financing otherwise.

## ■ MB09

Room 208A

### Facility Layout and Location

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Fan Jia, University of Minnesota, 111 Church Street S.E.,  
Minneapolis, MN, 55455, United States of America, fanjia@ie.umn.edu

#### 1 - Minimizing Emissions in Facility Location

Fan Jia, University of Minnesota, 111 Church Street S.E.,  
Minneapolis, MN, 55455, United States of America,  
fanjia@ie.umn.edu, John Carlsson

We consider a continuous facility location problem in which our objective is to minimize the total emissions. We first analyze the limiting behavior of this model and give an asymptotically optimal configuration - Archimedean spiral. We show that the total emissions can be reduced by over 27% this way compared to the popular honeycomb configuration. Finally, we give a fast constant-factor approximation algorithm for finding the emissions-optimal placement of facilities in any convex polygon.

#### 2 - Iterated Tabu Search for the Single Source Capacitated Facility Location Problem

Sin C. Ho, Aarhus University, Department of Economics and  
Business, Fuglesangs Allé 4, Aarhus V, 8210, Denmark,  
sinch@asb.dk

The Single Source Capacitated Facility Location Problem (SSCFLP) consists in finding a subset of capacitated facilities to be opened in order to satisfy the customers' demands such that total costs are minimized. We propose an iterated tabu search heuristic to solve the SSCFLP. Experimental results show that this heuristic is capable of generating solutions close to the optimal ones. Moreover, it is also competitive with other metaheuristic approaches for solving the SSCFLP.

#### 3 - Insertion Based Lin-Kernighan Heuristic for Single Row Facility Layout

Ravi Kothari, Indian Institute of Management,  
Ahmedabad, Vastrapur, Ahmedabad, 380015, India,  
ravikothari@iimahd.ernet.in, Diptesh Ghosh

The single row facility layout problem (SRFLP) is one of arranging facilities with given lengths on a line, while minimizing the weighted sum of the distances between all pairs of facilities. The problem is NP-hard. In this paper, we present a neighborhood search heuristic called LK-INSERT which uses a Lin-Kernighan neighborhood structure built on insertion neighborhoods. Our computational experiments show that LK-INSERT is competitive for all benchmark SRFLP instances.

## ■ MB10

Room 208B

### Emergency Management of Pharmaceutical Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt  
Sponsored Session

Chair: Lian Qi, Rutgers Business School, 1 Washington Park, Newark,  
NJ, 07059, United States of America, lianqi@andromeda.rutgers.edu

#### 1 - An Incentive-based Method for Hospital Capacity Management in a Pandemic: the Assignment Approach

Lihui Bai, Assistant Professor, University of Louisville,  
Dept. of Industrial Engineering, Louisville, KY, 40223,  
United States of America, lihui.bai@louisville.edu, Jiang Zhang

We consider a hospital capacity management problem that addresses asymmetric demands among hospitals. Our analysis allows patients to choose hospitals on their own, instead of being assigned by officials, and it uses two assignment models. One describes patients' choice of hospital, while the other maximizes the resource utilization of all hospitals. We show that when responding to incentive programs at hospitals, system resources are used more efficiently. Numerical examples are reported.

#### 2 - Optimal Responses to Pharmaceutical Supply Chain Emergencies

Lei Lei, Rutgers Business School, 1 Washington Park, Newark, NJ,  
United States of America, llei@andromeda.rutgers.edu,  
Kangbok Lee, Lian Qi

We consider a general pharmaceutical supply chain that includes hospitals, distribution centers, packaging centers, manufacturers and suppliers. We are interested in the optimal responses of this pharmaceutical supply chain in the case if any emergencies happen. Specifically, two problems are investigated in

our research: an integrated production and distribution problem during an emergency, and a resource allocation problem that considers both renewable and non-renewable resources.

#### 3 - Risk Mitigation Studies for Pharmaceutical Supply Chains

Lian Qi, Rutgers Business School, 1 Washington Park,  
Newark, NJ, 07059, United States of America,  
lianqi@andromeda.rutgers.edu, Lei Lei, Kangbok Lee

We consider a general pharmaceutical supply chain that includes hospitals, distribution centers (DC), packaging centers (PC), manufacturers and suppliers. We investigate the optimal sourcing and inventory strategies as well as the capacity decisions at the manufacturer, PC and DC echelons, which consider the potential supply uncertainties. Expedited shipment with additional cost is allowed in case if any delay is incurred due to the supply uncertainty.

## ■ MB11

Room 209A

### Optimization Models in Logistics Management and Supply Chain Management II

Cluster: Super/Special Sessions

Invited Session

Chair: Xiangpei Hu, Dalian University of Technology,  
No.2 Liohgong Road, Ganjingzi District, Dalian City, 116024, China,  
drhxp@dlut.edu.cn

#### 1 - The Decisions on Backup Capacity Reservation under Supply Disruption Risks

Jing Hou, Hohai University, China, penguihj@163.com

We focus on the problem of backup capacity reservation for the manufacturer who faces supply disruption risks. The expected cost of the manufacturer is first obtained, and the optimal reservation quantity is deduced; then models are given to describe the games between the backup suppliers and the manufacturer.

#### 2 - A Class of Vehicle Scheduling Problems (VSPs) with Carbon Emission

Mingzheng Wang, Dalian University of Technology, DUT Faculty  
of Management and Economics, Dalian, China,  
mzhwang@dlut.edu.cn, Zili He

Based on considerations of environmental protection, we build up a 0-1 integer programming model for VSPs under cap and trade mechanism and analyze effects of carbon emission on total operating cost. On the one hand, decreasing carbon emission allowance can cause increase of the operations costs. On the other hand, the high price can force company to buy more new energy vehicles to reduce carbon emission and to further save mixed costs integrating operations and environment.

#### 3 - The Performance of Supply Chain Inventory Management under Step-deterministic Demand

Haiyan Wang, School of Economics and Management,  
Southeast University, 2# Si Pai Lou, Nanjing, 210096, China,  
hywang@seu.edu.cn, Xiaoling xu

The paper builds a state space model for a supply chain system consisted of a supplier and a retailer. The stability of the supply chain system is analyzed. Two distinct supply chain volatility metrics are introduced to measure the ability to respond to a demand shock. Simulation and analytical results suggest the relationship between these two metrics with demand forecasting parameters, the adjustment range between net stock and desired net stock, the strength of this demand shock.

#### 4 - A BEAM-ACO for Vehicle Routing Problem with Loading Cost and Analysis

Jiafu Tang, Professor, Northeastern University, No 3-11,  
Wenhua Road, Heping District, Shenyang, 110004, China,  
jftang@mail.neu.edu.cn, Jing Guan, Yang Yu

In some situations such as delivering perishable food and dangerous goods, carriers need to pay distance cost and loading cost generated by cooling devices or packaging. VRP neglects loading cost, so Vehicle Routing Problem with loading cost (VRPWLC) is proposed. This paper designs a Beam-aco algorithm to solve VRPWLC. Computational results of benchmark instances are shown to analyze the rationality and adaptability of VRPWLC model, and the performance of the algorithm.

## ■ MB12

Room 209B

### Dynamic Control of Inventory and Supply Chains

Contributed Session

Chair: Liang Lu, Université Catholique de Louvain, CORE, Voie du Roman Pays 34, L1.03.01, Louvain-La-Neuve, NA, B-1348, Belgium, nicowish@gmail.com

#### 1 - Dynamic Analysis of Co-Brand Marketing Efforts

Yongquan Lan, PhD Student, City University of Hong Kong, P7524, AC1, City U. of HK, Hong Kong, China, yongqlan2@gmail.com, Yanzhi Li, Zhongsheng Hua

We synthesize kinds of co-brand marketing efforts into a Stackelberg differential game to characterize brand partners' optimal own-brand and co-brand marketing efforts as well as cost sharing issues. Explicit feedback equilibriums help to understand some interesting phenomena, such as why there exist opposite cost sharing schemes in reality and how to explain 'semi-inconsistent' claims we term appeared in distinct published papers. Besides, some interesting managerial insights are revealed.

#### 2 - Dynamic Routing in Parallel Queues: An Application of Product Returns for Remanufacturing

Li Ding, Dr, Durham University, Durham Business School, Durham, United Kingdom, li.ding@durham.ac.uk

This paper deals with the dynamic routing of product returns in distinguishable parallel queues. We develop models and index-based heuristics to support the dynamic routing decisions so as to minimize the overall recovering costs. Both theoretical and simulation studies demonstrate the effectiveness of the Restless Bandit (RB) approach deployed to the dynamic routing of product returns among multiple vendors.

#### 3 - Dynamic Supply Risk Management

Long Gao, Assistant Professor, UC Riverside, 221 AGSM, UCR, Riverside, CA, United States of America, long.gao@ucr.edu, Nan Yang

We study a multiperiod procurement planning and order acceptance problem in the presence of supply disruptions, where multiclass supply and demand information is forecasted dynamically via a Markov model. We characterize the structure of both procurement policy and order acceptance policy by a sequence of thresholds.

#### 4 - Robust H8 Control of Bullwhip Effect for Supply Chain System Based on Networked Manufacturing

Liang Tang, Shenyang Aerospace University, 37#, Shenyang Aerospace University, Shen Yang, 110136, China, erictangliang@163.com, Ke Jing

Aiming to inhibit the un-stability of supply chain system caused by uncertain demands for the system based on networked manufacturing, we employ robust H8 control to reduce bullwhip effect. A time-varying linear model for NM-based supply chain system is presented. The linear matrix inequality is used to obtain feedback controller  $u(k)$ . The simulation results show that our designed controller can inhibit bullwhip effect and make the fluctuations of product, order, inventory, and profit more stable.

#### 5 - Order Acceptance for Two Classes of Demand with Heterogeneous Lead Time

Liang Lu, Université Catholique de Louvain, CORE, Voie du Roman Pays 34, L1.03.01, Louvain-La-Neuve, NA, B-1348, Belgium, nicowish@gmail.com, Alejandro Lamas, Tanja Mlinar, Philippe Chevalier

We consider an infinite horizon order acceptance problem with two classes of demands for a make-to-order manufacturer. One class of demand generates a higher profit but poses a stringent lead time, while the other class generates a lower profit but only require a loose lead time. We formulate the problem as a multi-dimension Stochastic Dynamic Programming (SDP) and provide two heuristic approaches, namely, a threshold-based policy and a state reduction approach via partial state aggregation.

## ■ MB13

Room 210A

### Scheduling II

Contributed Session

Chair: Junqiang Wang, Northwestern Polytechnical University, Box 554, NPU, Xi'an, 710072, China, siemwjq@gmail.com

#### 1 - Developing an Assessment Model of R&D Capability: An R&D Process Approach

Gyungmi Jin, Dongguk University-Seoul, E407, 3-26 Pil-dong, Chung-gu, Seoul, 100-715, Korea, Republic of, jingyungmi@gmail.com, Byungun Yoon

This research aims to develop an assessment model of R&D capability reflecting the characteristics of the R&D process. A standard R&D process is defined by reviewing existing process models and then an assessment model are derived by investigating current process assessment models such as CMMI, ISO and the Malcolm Baldrige model. After that, a process to decide a level of R&D capability is developed. The proposed approach will contribute to planning R&D strategy by evaluating the R&D process.

#### 2 - Clustering Heuristics for LED Plantation Optimization on High-speed Hybrid Assembly Machines

Jiaxiang Luo, School of Automation Science and Engineering, South China University of Technology, 381 Wushan Road, Tianhe District, Guangzhou, China, luojx@scut.edu.cn, Jiyin Liu

This paper considers a scheduling optimization problem arising in a printed circuit board (PCB) assembly line to plant LEDs into the positions on PCBs. To minimize the completion time, a mixed integer programming model is presented and two heuristics are proposed, one for the PCBs with regularly arranged positions and the other, based on clustering method and path relinking, for the PCBs with irregularly arranged positions. Computational experiments show the efficiency of the heuristics.

#### 3 - Rescheduling with Random Machine Unavailability and Processing Time Reductions in an Open Shop

Hong Zhou, Professor, Beihang University, 37 Xueyuan Road, Haidian District, Beijing, 100191, China, h\_zhou@buaa.edu.cn, Le Liu

This work focuses on generating efficient and stable reschedules in an open shop subject to single machine unavailability for a duration and its concurrent disruption, i.e., reduction of processing times for affected operations. Efficiency is measured by the makespan, while the stability measures are sequence deviation and completion time deviation. Three specific approaches are proposed and implemented. Extensive experiments show the diverse performance of the approaches in different aspects.

#### 4 - Integrated Order Acceptance and Machine Scheduling in a Make-to-Order Environment

Gen-Han Wu, Assistant Professor, National Dong Hwa University, Graduate Institute of Logistics Mgmt., 1, Sec. 2, Da Hsueh Rd., Shou-Feng, Hualien, 974, Taiwan - ROC, genhanwu@mail.ndhu.edu.tw, Chung-Te Chen

In a make-to-order environment, many rush orders often come in a short time. The manufacturing plant needs to reject the low-profit orders and adequately schedule the accepted orders in its limited machine capacity. In this study, the integrated problem of order acceptance and multiple machine scheduling is studied. Numerical results have shown that the proposed algorithm developed by the particle swarm optimization can obtain very good performance.

#### 5 - Shifting Economic Bottleneck Identification

Junqiang Wang, Northwestern Polytechnical University, Box 554, NPU, Xi'an, 710072, China, siemwjq@gmail.com, Jian Chen

Considering both throughput effect and active duration of machine, a new active throughput and duration is presented and new concave-convex Gantt chart is given for scheduling representation. Then the shifting economic bottleneck identification (SEBI) method is presented to identify either the momentary economic bottleneck or statistically stable bottleneck. What's more, it also works well when facing the sole economic bottleneck, multiple economic bottlenecks and shifting economic bottleneck.

## ■ MB14

Room 210B

### Performance Analysis for Queueing Models

Sponsor: Applied Probability

Sponsored Session

Chair: Jinting Wang, Beijing Jiaotong University, #3 Shang Yuan Cun, Haidian District, Beijing, China, jtwang@bjtu.edu.cn

#### 1 - Analysis of a Two-Server Queueing System with a Bernoulli Vacation Schedule

Dequan Yue, Professor, Yanshan University, College of Science, Yanshan University, Qinhuangdao, 066004, China, ydq@ysu.edu.cn, Wenjie Xu, Ruiling Tian

In this paper, we study a two-server Markovian queueing system with a Bernoulli schedules and a single vacation policy, where servers have different service rates. After a service completion both servers may take a vacation of heterogeneous exponential duration. For this system, we obtain the stationary condition of the system. We also obtain the stationary distribution of the system size and the mean system size by using a matrix-geometric method. Extensive numerical illustrations are provided.

#### 2 - Functional Law of Iterated Logarithm for Single Server Queue with Bernoulli Feedback

Yongjiang Guo, Beijing University of Posts and Telecommunications, #91, XiTuCheng Road, No.19, Haidian, Beijing, China, yongjiangguo@163.com, Junfei Huang

In this paper, we consider the single server queue with Bernoulli feedback. We transfer the problem of functional law of iterated logarithm for queue length process, busy time process and the workload process into problems related to reflected Brownian Motion. By using properties of reflected Brownian Motion, we get the functional law of iterated logarithm for queue length process, busy time process and the workload process and determine the parameters there.

#### 3 - Reliability Analysis of a Parallel Repairable System Operating in a Random Environment

Zai-Ming Liu, Central South University, Changsha, Hunan, 410075, China, Changsha, China, math\_lzm@mail.csu.edu.cn, Jinbiao Wu

We consider a parallel repairable system operating in a finite state Markovian random environment with  $L$  identical components subject to failures and with  $N$  repairmen. Accidental failures arrive to each component following a PH renewal process. The algorithms for calculating the stationary state probabilities of the system, the busy period of the repairmen and reliability measures are elaborated.

#### 4 - Equilibrium Balking Strategies in Markovian Queues with Working Vacations

Jinting Wang, Beijing Jiaotong University, #3 Shang Yuan Cun, Haidian District, Beijing, China, jtwang@bjtu.edu.cn, Feng Zhang

We consider a single server queueing system with working vacations in which the server takes the original work at a lower rate rather than completely stops during the vacation period. We assume that arriving customers decide whether to join the queue or balk based on observation of the queue length and status of the server, along with the consideration of waiting cost and the reward after finishing their service. We study the balking behavior of the customers and derive the corresponding Nash equilibrium and the equilibrium social benefit for all customers.

## ■ MB15

Room 212A

### Marketing Science is a Work in Progress

Sponsor: Marketing Science

Sponsored Session

Chair: John D C Little, Institute Professor, M.I.T., Room E62-534, 100 Main St., Cambridge, MA, 02142, United States of America, jlittle@mit.edu

#### 1 - Learning from Experience, Simply

Song Lin, PhD Candidate, MIT Sloan School of Management, E62-580, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, songlin@mit.edu, Juanjuan Zhang, John Hauser

Optimal solutions to forward-looking learning problems are exponentially complex, limiting their behavioral plausibility. Based on theories of cognitive simplicity, we propose index strategies as a new solution concept. We prove the theoretical applicability of the index solution, establish its intuitive properties, and present empirical evidence that it fits consumer behavior well, provides plausible parameter estimates, and predicts out-of-sample as well as or better than alternative models.

#### 2 - Rational Herding in Microloan Markets

Juanjuan Zhang, Associate Professor, Massachusetts Institute of Technology, Cambridge, MA, United States of America, jjzhang@MIT.EDU, Peng Liu

In microloan markets, a borrower can raise funding from multiple lenders. We find evidence of rational herding among lenders on Prosper.com, the largest microloan market in the U.S. Lenders infer borrower creditworthiness from peer lending, and use borrower characteristics to moderate the inference. Interestingly, defects (e.g., poor credit grade) amplify herding and merits (e.g., friend endorsement) weaken it. Rational herding is found to beat irrational herding in predicting loan performance.

#### 3 - Generalized Little's Law for Marketing Global Financial Services

Maria Luisa Ceprini, Research Associate, M.I.T., E62-534, 100 Main St, Cambridge, MA, 02142, United States of America, mceprini@mit.edu, John D C Little

A portfolio of financial assets may be thought of as a queue. Each newly bought asset joins the queue and each sold asset departs it. Generalized Little's Law keeps track of the assets and their attributes. An advisor and a client, working together, use decision rules to trade-off risk vs. expected return over time.

#### 4 - Marketing Science is a Work in Progress

John D C Little, Institute Professor, M.I.T., Room E62-534, 100 Main St., Cambridge, MA, 02142, United States of America, jlittle@mit.edu

A timeline of marketing science might go back to the invention of writing, but the field took off with the founding of the journal, Marketing Science. Looking ahead, we seem to be entering an era of "Big Data" and models to match.

## ■ MB16

Room 212B

### Demand Information and Uncertain Consumer Valuation

Cluster: Interface between Operations Management and Marketing  
Invited Session

Chair: Xuan Zhao, Associate Professor, Wilfrid Laurier University, 75 University Ave. W., Waterloo, ON, N2J 4Y8, Canada, xzhao@wlu.ca

#### 1 - Information Updating in the Presence of Spot Market

Xuan Zhao, Associate Professor, Wilfrid Laurier University, 75 University Ave. W., Waterloo, ON, N2J 4Y8, Canada, xzhao@wlu.ca, Wei Xing

This paper studies the effect of asymmetric information on the members of a two-stage supply chain in the presence of spot market. Using a novel method, we model the information updating Stackelberg game and derive the unique equilibrium strategies. We further investigate how information updating accuracy affects the channel choice, how to choose information updating strategy and how the degree of risk-aversion makes a difference.

#### 2 - Service Quality Dilemma in the Online Dating Market

Yuanping Ying, Assistant Professor of Marketing, University of Texas at Dallas, 800 West Campbell Rd, SM32, Richardson, TX, 75093, United States of America, yingyp@utdallas.edu

Service quality has long been shown to have a positive impact on consumer behavior. However, online dating market faces a service quality dilemma: by offering better service, the customer may find her match quickly and cancel subscription; if the service quality is low, the customer may become dissatisfied with the service and leave. We propose a proportional hazard model to estimate the effects of service quality on customer tenure and find mixed impact of service quality on customer tenure.

#### 3 - Product Differentiation and Timing of Product Introduction under Uncertain Customer Valuations

Wei-yu Kevin Chiang, City University of Hong Kong, Department of Management Sciences, Hong Kong - PRC, wchiang@cityu.edu.hk, Lu Qiang

We consider a firm offering two component products to a market with taste heterogeneity. The firm, who must determine the degree to which the products are differentiated, is uncertain a priori about the customer base valuation for each product. The uncertain valuations are characterized by means of two random variables with a correlation dependent on product differentiation. We explore the conditions under which it is advantageous to introduce the products sequentially instead of simultaneously.

## ■ MB17

Room 213A

### Hospital Resource Planning and Scheduling

Sponsor: Health Applications

Sponsored Session

Chair: Xiaolan Xie, Professor, École Nationale Supérieure des Mines de Saint-Étienne, 158, Cours Fauriel, Saint Étienne Cedex 2, F-42023, France, xie@emse.fr

#### 1 - Promise Surgery Start Times and the Dynamic Control Rule for a Single Operating Room

Zheng Zhang, Shanghai Jiao Tong University,  
No.800 Dongchuan Rd, Shanghai, 200240, C, Shanghai, China,  
zzhang0409@gmail.com, Xiaolan Xie, Na Geng

This study focuses on determining start time for each of the pre-sequenced surgeries in order to release surgeons from endless waiting. The nature of surgery variability results in the waste of the operating room and surgeons, and makes the problem hard to solve. Considering the inpatient surgeries which can be either delayed or advanced, we propose a stochastic model for promising start times and present an analytical control rule for advancing surgeon arrivals during the course of the day.

#### 2 - Improving the Service Quality of an Emergency Department Using Simulation and Design of Experiment

Meiling Li, Shanghai Jiao Tong University, 800 Dongchuan Road,  
Minhang District, Shanghai, China, Emily2010@sjtu.edu.cn,  
Xiaolan Xie, Na Geng

This paper addresses the modeling and simulation of Emergency Departments in China, which differ from those in foreign countries. Petri net models are first proposed to describe patient flows and related resource's requirements. They are then implemented into a simulation model. Using data collected from a large hospital, numerical experiments are performed to show how the model can be used to improve resource usage and shorten patient waiting times.

#### 3 - How to Inform Patients Their Expected Admission Dates – A Simulation Analysis

Yuwei Lu, Shanghai Jiao Tong University, Dongchuan Rd 800,  
Minhang Dis, Shanghai, Shanghai, China, vera\_lu@live.cn

In this study, we propose a new concept of Generalized Length of Stay (GLoS) including both waiting for admission and hospitalization. While traditional length of stay (LoS) only accounts for patient's hospitalization, waiting time for admission affects not only patient satisfaction but also the medical costs. We use discrete event simulation to study how to control GLoS by informing patients their expected admission dates.

#### 4 - Simulation Study of Magnetic Resonance Imaging Examination Reservation Processes for Stroke Patients

Na Geng, Shanghai Jiao Tong University, 800 Dongchuan Road,  
Shanghai, China, gengna@sjtu.edu.cn, Xiaolan Xie

The timely imaging examinations are most important for stroke patients to have the further appropriate diagnosis and treatment. We have proposed a contract-based Magnetic Resonance Imaging (MRI) reservation process in order to reduce their waiting time for MRI examinations. This paper proposes a new reservation process. Computational results show that the improved method can greatly reduce the maximal waiting time and the deviation of average waiting time.

## ■ MB18

Room 213B

### Financial Modeling and Risk Management

Cluster: Super/Special Sessions

Invited Session

Chair: Yong Zeng, Professor of Finance, Dean, School of Management and Economics, University of Electronic Science and Technology of China, No.4, Section 2, North Jianshe Road, Chengdu, SC, 610054, China, zengy@uestc.edu.cn

#### 1 - International Portfolio Selection with Exchange Risk: A Behavioural Portfolio Theory Perspective

Yongkai Ma, Professor of Finance, UESTC(University of Electronic Science and Technology of China), No. 2 North Jianshe Road,  
Chengdu, China, mayongkai@uestc.edu.cn, Chonghui Jiang,  
Yunbi An

This paper analyzes international portfolio selection with exchange risk based on BPT. We characterize the conditions under which the BPT problem has an optimal solution, and show that the optimal portfolio contains the traditional mean-variance efficient portfolio in absence of exchange risk, and an

uncorrelated component constructed to hedge against exchange risk. We establish that international portfolio selection in the BPT with multiple foreign markets consists of two sequential decisions.

#### 2 - The Roles of Mixed Model of Order Cancellation Design in the Open Call Auction

Ping Li, School of Management and Economics, University of Electronic Science and Technology of China, No.4, Section 2,  
North Jianshe Road, Chengdu, China, lip@uestc.edu.cn,  
Yong Zeng

Using game theory, especially the cheap-talk game and the data from Chinese stock markets, this paper studies the equilibrium outcome of the open call auction with the feature that order is only permitted to be cancelled during the first half of order-collection period. We find that the design of mixed model of order cancellation plays two roles: to reduce asymmetric information among investors and to mitigate price manipulation.

#### 3 - The Impact of Algorithmic Trading on Execution Costs, Market Quality, and Trading System

Xindan Li, Professor, Nanjing University, School of Management and Engineering, 22 Hankou Road, Nanjing, JS, 210093, China,  
xdli@nju.edu.cn, Yuchao Wang

The prospect of algorithmic trading in China is magnificent due to the exigent demand on reducing trading cost. This paper builds a Data-driven Multi-Agent model to investigate the impact of algo trading and find that the execution costs of VWAP and IS algorithms are lower than the actual costs of institutional investors; algo trading can both decrease market volatility and improve market liquidity; the growing message traffic will not exceed the system capacity of SSE in the prometaphase.

#### 4 - Heterogeneous Beliefs: The Primacord of Credit Spread Puzzle and Arbitrage Violation

Pu Gong, Professor, Huazhoun University of Science & Technology, 1037 Luoyu Road, Wuhan, China,  
gongpu@hust.edu.cn

This paper examines the explanatory power of heterogeneous beliefs on credit spread puzzle and arbitrage violation with the findings of theoretical model after collecting the sample data of listed companies and controlling associated variables. The results show that there are significantly positive correlations between heterogeneous beliefs and the credit spread of CDS after controlling some variables. And the heterogeneous beliefs is the cause of arbitrage violation in securities market.

## ■ MB19

Room 215

### Recent Linear Programming Developments for Operations Research and Management Science

Cluster: Tutorials

Invited Session

Chair: Yinyu Ye, Professor, Stanford University,  
Huang Engineering Center, Stanford, CA, 94305,  
United States of America, yinyu-ye@stanford.edu

#### 1 - Recent Linear Programming Developments for Operations Research and Management Science

Yinyu Ye, Professor, Stanford University, Huang Engineering Center, Stanford, CA, 94305, United States of America,  
yinyu-ye@stanford.edu

Linear programming (LP) has been a core Operations Research and Management Science model since 1947. Due to the relentless research effort in LP algorithms, a linear program can be solved today one million times faster than it was done twenty years ago. Businesses, large and small, now use LP models to control manufacture inventories, price commodities, design civil/communication networks, and plan investments. LP even becomes a popular subject taught in under/graduate and MBA curriculums, advancing human knowledge and promoting science education. Now many new important computational problems are emerging or reemerging. In particular, there has been a growing trend in models, theories, and algorithms on problems arisen in Internet economics, information network, auction/game, stochastic and on-line decision making, as well as social organization issues enabled through World Wide Web. The aim of the tutorial is to describe several modern linear programming developments and applications in today's service economy, such as auction, pricing, mechanism design, and information aggregation. We also present a few recent algorithmic developments and future research directions of linear programming.

**Monday, 1:30pm - 3:00pm****■ MC01**

Room 202B

**Safety Risk Management and Emergency Management**

Sponsor: Aviation Applications

Sponsored Session

Chair: Mingliang Qi, Associate Professor, Institute of Policy and Management, Chinese Academy of Sciences, No. 15, Zhongguancun Bei-yi-tiao Road, Beijing, 100190, China, mlqi@casipm.ac.cn

**1 - Safety Risk Assessment in Civil Aviation**

Xueyan Shao, Assistant Professor, Institute of Policy and Management, Chinese Academy of Sciences, No.15 Zhongguancun Bei-yi-tiao, Beijing, China, xyshao@casipm.ac.cn

Safety risk management is one key component of ICAO safety management system. Besides risk matrix, the quantitative assessment methods need to be studied. We divide safety risk into two categories: caused by factors, such as quality of pilots, reliability of airplanes, etc and caused by error conduction through business processes. From that point, the descriptions of safety risk and quantitative analysis models are discussed respectively.

**2 - Research on Theoretical Methods of the Pilots' Human Resource Planning**

Mingang Gao, Assistant Professor, Institute of Policy and Management, Chinese Academy of Sciences, No.15 Zhongguancun Bei-yi-tiao, Haidian, Beijing, China, mggao@casipm.ac.cn

Aviation safety has been a major concern of government and airlines. The rapid development of the domestic civil aviation industry will cause the high demand for pilots. It is hard to make a good human resources planning for Chinese pilots because of their own characteristics. Considering the practical situation, we design a theoretical framework for pilot human resources planning and study the close-circle management of pilot training throughout their whole career in the paper.

**3 - Study on Emergency Management of Airways In China**

Mingliang Qi, Associate Professor, Institute of Policy and Management, Chinese Academy of Sciences, No. 15, Zhongguancun Bei-yi-tiao Road, Beijing, 100190, China, mlqi@casipm.ac.cn

We have researched emergency management of airways in China since 2008. This presentation will talk about the emergency management system, including organization, emergency plan, and emergency management information system (EMIS). The method on emergency plan reconfiguration and the method on flight delay have been developed in the EMIS. The first problem is how to reconfigure a new plan for the new situation based on the existing plans. The second one is based on postpone scenario.

**4 - Clustering-Based Anomaly Detection in Flight Data Recorder Data**

Lishuai Li, PhD Candidate, MIT, 16 Florence St., Cambridge, MA, 02139, United States of America, lishuai@mit.edu, R. John Hansman

Airlines routinely collect massive flight data, but need better ways to utilize the data to improve safety and efficiency. Data-driven approaches are developed to identify anomalies in flight data by cluster analysis, which do not require pre-specifications of anomalous events. Anomalies are detected based on the distribution of the flight data. The detected anomalies could help domain experts to identify latent patterns of emerging risks in flight operations.

**■ MC02**

Room 202A

**Data Mining for High-Dimensional Data**

Sponsor: Data Mining

Sponsored Session

Chair: Seoung Bum Kim, Associate Professor, Korea University, 5-ga, Anam-dong, Seoungbuk-gu, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

**1 - Spatial and Temporal Variability of Ground-Level Ozone in Seoul, Korea**

Kyujong Lee, Korea University, 5-ga, Anam-dong, Seoungbuk-gu, Seoul, Korea, Republic of, xtorm2@korea.ac.kr, Seoung Bum Kim

Various analyses of the complex behavior in ambient air pollutants have been conducted to extract their implicit patterns and meaningful information. In the present study we conducted some statistical analyses to identify spatial and temporal variability of ground-level ozone concentration profiles collected from 2005 to 2010 and observed at 25 different monitoring sites in Seoul, Korea.

**2 - Feature Selection for Identifying High Defect Density Sensors in Semiconductor Manufacturing**

Eunjeong Park, Seoul National University, 1 Gwanak-ro Gwanak-gu, Seoul, Korea, Republic of, ejpark04@snu.ac.kr, Dongil Kim, Taehoon Ko, Young-Hak Lee, Sungzoon Cho

In semiconductor manufacturing, it is crucial to keep its defect density low. As wafers go through hundreds of processes and sensors, however, it is difficult to identify the sensors that are correlated with the high defect density. We propose to build a regression model of defect density as a function of sensor values and apply variable selection methods to identify those sensors. The proposed approach was applied to a real world data set and achieved reduction from 386 variables to ten.

**3 - Filter-Wrapper Hybrid Feature Selection Algorithm**

Jaehong Yu, Korea University, Seoul, Korea, Republic of, dreamer7744@korea.ac.kr, Seoung Bum Kim

This paper proposes a filter-wrapper hybrid supervised feature selection algorithm. A comprehensive simulation study has been conducted to examine the characteristics of the proposed method and compare it with other feature selection methods.

**4 - Study on Man-hour Prediction System for Shipbuilding**

Minhoe Hur, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul, 151-741, Korea, Republic of, dninb.kr@gmail.com, Daehyung Lee, Seung-kyung Lee, Bongseok Kim, Sungzoon Cho, Dongha Lee

Man-hour is a unit widely used for production planning in shipbuilding. And systematic prediction of man-hour had become more importance for cost reduction. In this study, we proposed the system that predicted man-hour with deployable data in different times of manufacturing process and applied in practical shipbuilding. And the result showed possibilities that our prediction system could be the good alternative to previous prediction methods.

**■ MC03**

Room 203B

**Top Open Research Questions: Service Science Panel**

Sponsor: Service Science

Sponsored Session

Moderator: Victor Tang, Researcher, MIT, 55 Deerfield Lane South, Pleasantville, NY, 10570, United States of America, victor.w.tang@gmail.com

**1 - Open Questions About Services: A Survey**

Moderator: Victor Tang, Researcher, MIT, 55 Deerfield Lane South, Pleasantville, NY, 10570, United States of America, victor.w.tang@gmail.com

Panelists will discuss the findings of a survey, which had two goals: (i) reveal fundamental gaps impeding progress in the science or practice of services, and (ii) propose fresh actionable thrusts that can unlock new vistas in services. A distinguished expert panel will discuss: (i) key findings, uncovered insights, implications to our understanding (and misunderstanding) about services, managerial practice, design and engineering, and (ii) useful actionable initiatives and priorities.

## ■ MC04

Room 203A

### Applications of Simulations

Sponsor: Simulation

Sponsored Session

Chair: Jin Dong, IBM, Building 19, Ahongguancun Software Park,, Beijing, China, dongjin@cn.ibm.com

#### 1 - A GIS-Based Spatial Simulation Framework for Facility Location Optimization

Ming Xie, IBM Research - China, Building 19, Zhongguancun Software Park, ShangDi, Haidian District, Beijing, China, xieming@cn.ibm.com, Jin Dong, Wen Jun Yin

This paper presents GIS-based spatial simulation framework, which integrates GIS technology and discrete event simulation to solve facility network location optimization problems. This framework incorporates the customer behavior and provides performance measurements of the optimized facility network. This paper also demonstrated the application of this framework by presenting a real case study in banking industry.

#### 2 - Outlets Internal Design and Reconfiguration Based on Multi-agent Simulation

Jin Yan Shao, IBM Research-China, Diamond A, Zhongguancun Software Park, Beijing, China, shaojiny@cn.ibm.com, Yuhang Liu, Lili Zhao, Yuhui Fu

Facing fierce competition, service industries need realize customer-centric, benefit-oriented transformation to improve competitiveness. Optimal internal configuration can help service providers reduce cost and at the same time enhance customer experience and satisfaction. This paper provides a simulation based method and system which can help service providers analyze and optimize the internal configuration for their outlets. Experiments show the effectiveness and efficiency of our method.

#### 3 - A Hybrid Simulation Optimization Approach in Automotive Industry

Yusuf Tansel Ic, Baskent University, Baglica Kampusu Eskisehir Yolu, 20. km. Baglica/Etimesgut, Ankara, 06810, Turkey, ytansel@baskent.edu.tr, Berna Dengiz

In this paper, the optimum setting of a paint shop line design of an automotive company is determined using hybrid simulation optimization approach. In the optimization stage of the study Design of Experiment (DoE) is used to identify critical factors of the system by fitting a polynomial to the experimental data in a multiple linear regression analysis. The regression metamodel greatly reduced the cost, time and amount of the experimentation effort spent in analysing the simulation.

## ■ MC05

Room 205B

### Energy Performance Simulation and Optimization

Sponsor: Energy, Natural Resources & the Environment

Sponsored Session

Chair: Young Lee, Research Staff Member, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ymlee@us.ibm.com

#### 1 - Simulation and Optimization of Building Energy Performance

Young Lee, Research Staff Member, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ymlee@us.ibm.com, Lianjun An, Young Tae Chae, Fei Liu, Raya Horesh

Building energy performance models have been developed using physics-based inverse methods and integrated statistical methods. The models are used to simulate the impact of the structural and operational changes that can be made to the buildings on energy consumption and GHG emissions, and to optimize the changes that minimize energy consumption and costs. The analytic toolset identifies energy savings opportunities and quantifies the savings for a large portfolio of public buildings.

#### 2 - Assessing the Economics of Wind Power Penetration

Jorge Valenzuela, Associate Professor, Auburn University, 3301B Shelby Center, Auburn, AL, 36830, United States of America, valenjo@auburn.edu, Jianhui Wang

Understanding the long-term economics of wind energy is becoming more important due to the increasing penetration of renewable sources of energy in the generation mix of power systems. We present an analytical approach to assess how wind power penetration affects the statistical moments of the market clearing prices and the revenues of a wind farm. The approach is illustrated by using a 32-unit power system.

#### 3 - A Stochastic, Multi-Objective Optimization Model for Biogas Production from Wastewater

Steven Gabriel, University of Maryland, College Park, 1143 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, sgabriel@umd.edu, Chalida U-tapao

We present a stochastic, multi-objective optimization model for a wastewater treatment plant that considers operational and investment decisions under uncertainty such as solids end product, carbon credits, natural gas and electric power prices and consumption. The Blue Plains AWTP operated by DC Water will be used as a case study. These decisions involve converting uncertain amount of solids into biogas, and/or electricity for internal or external purposes.

#### 4 - An Improved Materials Demand Forecasting Method in Power Grid Construction

Hongbo Li, Researcher, IBM, Building 19 Zhongguancun Software Park, Beijing, 100193, China, hboli@cn.ibm.com, Wei Wang, Hongwei Ding, Jin Dong

The materials, which are used in power grid construction project, are influenced by lots of factors. Thus, the materials request is difficulty to forecast. This paper presents a new materials forecasting method, which is based on the virtual BOM (Bills of Materials) that learnt from the historical projects data, decomposes material into hierarchical unit and extracts the key factors that influence the material in different project to fore-cast materials request in power grid construction.

## ■ MC06

Room 205A

### Risk Management in Supply Chain

Cluster: Supply Chain Management in China

Invited Session

Chair: Yongkai Ma, Professor of Finance, UESTC(University of Electronic Science and Technology of China), No. 2 North Jianshe Road, Chengdu, China, mayongkai@uestc.edu.cn

#### 1 - Exchange Rate Risk Hedging Strategy and Wholesale Price Contract under Demand Uncertainty

Debing Ni, Professor, University of Electronic Science and Technology of China, No. 4 North Jianshe Road, Chengdu, China, nidb@uestc.edu.cn

Considering a two-echelon supply chain in a global environment, this paper establishes a dynamic game model and calculates the equilibrium. The comparative static results show that the risk due to the exchange rate volatility is to be transmitted downwards through the wholesale price in a supply chain while the risk due to the final market demand volatility is to be transmitted upwards through the order quantity, and further the manufacturer's risk-hedging makes a risk-return tradeoffs.

#### 2 - Choice of Operations and Marketing Interface Control Structures under Uncertainty Environment

Xingzheng Ai, University of Electronic Science and Technology of China, Department of Management Science and E-c, China, aixz@uestc.edu.cn, Jianhua Ma

By comparing the equilibria performance of the different organizational structures, we identified the dominant operations and marketing interface control structure for the two-product company, as well as revealed the evolution of the dominant control structure as various parameters. At last theoretical results are illustrated by numerical simulation.

#### 3 - The Risk Management Strategies in a Two-Level Global Supply Chain

Jingming Pan, Associate Professor, School of Management and Economics, University of Electronic Science and Technology of China, No.4, Sec. 2, North Jianshe Rd., Chengdu, 610054, China, pjingming@uestc.edu.cn, Fanghua Bao, Xiaowo Tang

This paper examines the impact of exchange-rate risk and supply risk upon the optimal ordering and pricing policies of a risk-averse newsvendor that is served by multiple suppliers in the global supply chain environment. We formulate a game model and derive the retailer's optimal policies. We find the retailer's optimal order quantity decreases with the exchange rate risk degree and the supply risk degree. Finally, we develop a hedging strategy to improve the performance of the supply chain.

#### 4 - Equilibrium Supply Contract in Global Supply Chain in Presence of Spot Market

Yiping Mu, Associate Professor, University of Electronic Science and Technology of China, School of Management and Economics, No. 4, Sec 2, Nor.Jianshe Road, Chengdu, SC, 610054, China, muyiping@uestc.edu.cn

The paper analyzes the equilibrium supply contract between a supplier and a manufacturer in the presence of spot market by describing two firms with mean-variance preferences over their profit which negotiate the supply contract through a Nash bargaining process. We derive the unique equilibrium supply contract under different scenarios. We show that the variances of exchange rate and spot market price do affect the equilibrium of the supply contract.

### ■ MC07

Room 206A

#### Weights in Multi-attribute Decision Making

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Ying-Ming Wang, Professor, Fuzhou University, School of Public Administration, Fuzhou University, Fuzhou, China, msymwang@hotmail.com

##### 1 - An Approach to Determining the Weights of Decision Criteria

Ying-Ming Wang, Professor, Fuzhou University, School of Public Administration, Fuzhou University, Fuzhou, China, msymwang@hotmail.com

Decision criteria weights play a significant role in multiple criteria decision analysis. They are usually provided by the decision maker. In this presentation, we propose an approach to determining the weights of decision criteria by decision data and an optimization model is formulated in light of the evidential reasoning approach. The proposed approach releases the burden of the decision maker and is tested and analyzed with a numerical example of motorcycle selection.

##### 2 - An Integrated Approach to Rank Order Weights

Dun Liu, Southwest Jiaotong University, School of Economic and Management, South, Chengdu, 610031, China, newton83@163.com, Jamie Jia

With the imprecise attribute weights situation such as only the can capture, there are several approximate weighting methods that have been proposed to deal with multi-attribute decision problems under the rank order information of weight. In this work, we develop an integrated and unified approach for the assessment of rank order weights based on the maximum-entropy principle. We illustrate the application of our approach by ranking business schools in the US.

### ■ MC08

Room 206B

#### Risk Management in Energy Systems

Sponsor: Computational Optimization & Applications (Sponsored by the Computing Society)

Sponsored Session

Chair: Dalen Chiang, Professor, California State University, Chico, College of Business, 400 W. First Street, Chico, CA, 95929, United States of America, dchiang@csuchico.edu

##### 1 - Outage Cause Analytics in Distribution Grid

Wei Wu, Staff Researcher, IBM Research China, 6/F, Bldg.10, 399 Keyuan Road, Zhangjiang, Pudong New District Shanghai, 31, 201203, China, wuweish@cn.ibm.com, Feng Jin, Ming Zhao, Wen Jun Yin

Trouble Call Center of the power supply company needs to determine the cause of the reported outage as quickly as possible so as to make the right decisions. Therefore, a method is introduced to analyze the outage cause with the maximum likelihood. The outage analysis matrix is first build to establish the relationship between outage zone and power supply device. Based on the analysis matrix, topology analysis and probability model, the method can quickly find out the causes of the outage.

##### 2 - A Fast Way to Diagnose the Reasons of Outage in Distribution Power Network

Ming Zhao, Staff Researcher, IBM Research China, Diamond, Zhongguangcun Software Park, Haidan District, Beijing, 11, 100193, China, zmzhao@cn.ibm.com, Hairong Lv, Wen Jun Yin, Qiming Tian, Feng Jin, Jin Dong

In this paper, a fast method to diagnose the reason behind outage is proposed. First, the approach is based on topology analysis technology to locate all possible

root of the supply power. Then we try to figure out the potential nodes that cause this failure. At the end, we will calculate the accurate reason of this outage according to history data and a genetic algorithm based method. This method have been applied to a local power company and showed its efficient to customer.

##### 3 - Proactive Crisis Management: A Case Study of BP Oil Spill

Dalen Chiang, Professor, California State University, Chico, College of Business, 400 W. First Street, Chico, CA, 95929, United States of America, dchiang@csuchico.edu, Ru-fang Chiang

We propose a framework on proactive crisis management. We examine the cases involved the crisis management practices in BP and ExxonMobil. By combining the related literature with the case studies, we construct an active crisis management mechanism which involves developing crisis leadership competences, organizing the effective crisis planning and management activities, and building the corporate social responsibility into the crisis management.

### ■ MC09

Room 208A

#### Optimal Design in Health Care

Sponsor: Computational Optimization & Applications (Sponsored by the Computing Society)

Sponsored Session

Chair: Haibo Wang, Associate Professor, Texas A&M International University, 5201 University Blvd, Laredo, United States of America, hwang@tamiu.edu

##### 1 - Optimal Design of a Pharmaceutical Price-Volume Agreement in the Presence of Unobservable Marketing

Hui Zhang, Associate Professor, Lakehead University, 955 Oliver Rd., Thunder Bay, ON, Canada, hzhang2@lakeheadu.ca, Greg Zaric, Tao Huang

Pharmaceutical marketing promotes drug sales but may decrease its health benefit on patients. Price-volume agreements, in which the manufacturer returns to the payer a portion of sales exceeding a threshold, have emerged as a way to manage this issue. We develop a principal-agent model to derive the optimal marketing decision with the volume threshold determined by the payer or by the manufacturer. We compare different cases to identify the impact of hidden action and decision-making processes.

##### 2 - Designing Resilient Supply Chains to Combat Drug Shortages and its Global Impacts

Raja Jayaraman, Assistant Professor, Khalifa University of Science, Technology and Research, P.O. Box 127788, Abu Dhabi, United Arab Emirates, raja.jayaraman@kustar.ac.ae, Young Seon Jeong

Over the recent years the frequency and impact of drug shortages has been rising globally and adversely affecting hospitals, pharmacies and patients. These disruptions point to crucial instabilities in healthcare supply chains and delivery logistics, in this presentation we shall discuss some of the causes, impacts and difficulties associated with drug shortage problem and present some of the strategies to design and operate a resilient supply chain.

##### 3 - Optimal Designs Approach to Resource Allocation for Effective Health Care Delivery in Niger Delta

Idorenyin Etukudo, Dr., University of Calabar, P.M.B. 1115, Calabar, CR, Nigeria, nseobongidorenyin@gmail.com

One particularly known problem that confronts operators of health care delivery system in the Niger Delta region of Nigeria is that of allocating scarce resources optimally in order to meet the objectives of the funding agencies. In order to aid such operators, a model for this purpose is hereby developed. Numerical illustration presented herein through optimal designs approach gives optimal allocation of available resources for effective health care delivery.

##### 4 - A Study on Children's Vaccines Transportation Problems with Acquisition Policy

Haibo Wang, Associate Professor, Texas A&M International University, 5201 University Blvd, Laredo, TX, United States of America, hwang@tamiu.edu, Runchang Lin, Bahram Alidaee, Gary Kochenberger, Wei Wang

This study aims to analyze the transportation problems and the criteria in the acquisition policy in the childhood immunization, proposes a multiple items multiple vendors model to accommodate these criteria with the objectives of lower cost and less wastage. This study analyzes data from CDC on the cost of vaccines. This study departs from the current practice by combining the probability management and data envelopment analysis approach to address the uncertainty and optimization issues.

## ■ MC10

Room 208B

### Advanced Quality Control Methods for Manufacturing and Service Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Wei Jiang, Shanghai Jiaotong University, jiangwei@sjtu.edu.cn

#### 1 - A Standardized Scan Statistic for Detecting Spatial Clusters with Unknown Parameters

Lianjie Shu, Faculty of Business Administration,  
University of Macau, Taipa, Macau, LJShu@umac.mo,  
Kwok-Leung Tsui, Wei Jiang

The scan statistic based on likelihood ratios have been widely discussed for detecting spatial clusters. However, it cannot take the varying mean and variance of the likelihood ratio statistic due to inhomogeneous background population sizes into account. This leads to the biased sensitivity of it towards clusters with large population sizes. In order to provide an overall good performance of detecting both small and large clusters, we suggest a standardized scan statistics.

#### 2 - A Sequential Change Point Approach for Monitoring the Mean Vector of High Dimensional Observations

Yanting Li, Assistant Professor, Shanghai Jiao Tong University,  
Room 628, Mechanical Building, Shanghai Jiao Tong University,  
Shanghai, China, ytli@sjtu.edu.cn, Yukun Liu

In recent decades, both economic and financial applications have encountered large data sets which contain high dimensional variables. In such setting, the application of Hotelling T<sup>2</sup> has many severe drawbacks. In this article, a statistical process control chart using change-point formulation for detecting shifts in mean vector of high dimensional multivariate individual observations is provided. The advantage of the new method is proved by simulation and theoretical proof.

#### 3 - Economic Design of Shewhart Q Chart for Process Means of Start-up Processes

Chao Li, Sino-US Globe Logistics Institute, Shanghai Jiao Tong  
University, 1954 Huashan Road, Xuhui District, Shanghai, China,  
excellentichao@yeah.net

Abstract not available at this time.

## ■ MC11

Room 209A

### Optimization Models in Logistics Management and Supply Chain Management III

Cluster: Super/Special Sessions

Invited Session

Chair: Xiangpei Hu, Dalian University of Technology,  
No.2 Liohgong Road, Ganjingzi District, Dalian City, 116024, China,  
drhxp@dlut.edu.cn

#### 1 - Negotiation Based Cost Allocation for Virtual Enterprise

Min Huang, Professor, Northeastern University,  
Box 135, Northeastern University, Shenyang, China,  
mhuang@mail.neu.edu.cn, Hongyu Jiang

In the view of the distribution feature of decision-making in a VE, a novel decision-making framework of cost allocation for VE in term of minimizing completion risk is proposed based on negotiation. According to the characteristics of the problem, the evaluation mechanism of the owner is designed based on PERT, and three concession tactics is proposed. The numerical analysis shows that this framework can achieve effective risk management during the cost allocation progress.

#### 2 - Plant Growth Simulation Algorithm for Solving Diophantine Equation

Tong Li, Professor, Hangzhou Dianzi University, Management  
College, Hangzhou Dianzi Univ, Hangzhou, 310018, China,  
litong@hdu.edu.cn, Cuihong Zhang, Weiling Su

Based on Plant Growth Simulation Algorithm (PGSA), an intelligence optimization algorithm for solving Diophantine equation is proposed herein. In this algorithm, the initial plant growth point is obtained after three times fractals of L system, the solution space of Diophantine equation is looked as plant growth environment, then the plant system evolution style based on growth regulation and the probability growth model based on plant phototropism theory are established.

#### 3 - System Thinking to Improve the Performance of Supply Chain

Xu Li, Professor, Fudan University, Shanghai, China,  
xuli@fudan.edu.cn

We study the impact factors and solutions for improving performance of supply chain inventory control like beergame based on system dynamics and artificial simulation. We summarize "System Structure", "Control Policy" and "Control Parameters" three factors, and probe the ways that their influence on inventory control performance. Results show that the effectiveness of the three factors is increasing under centralized control and decreasing under decentralized control in turn.

#### 4 - Service Pricing Strategies Based on Fairness in a Service Supply Chain

Junxiu Jia, Xidian University, Xi'an, Shaanxi, China,  
jiajunxiu@mail.xidian.edu.cn, Huiqiang Mao

We develop a service pricing model based on fairness in a supply chain with a manufacturer, a 3PL service provider (3PLSP) and the 3PLSP's two sub-contractors. After the 3PLSP receive the logistics outsourcing signal from the manufacturer, he makes service pricing policies and discusses other contract terms with the demander. After that, he outsources the business to his sub-contractors. We analyze supply chain members' pricing and service level strategies based on the fairness in the trade.

## ■ MC12

Room 209B

### Supply Chain and Inventory Analysis

Contributed Session

Chair: Fernando Oliveira, Professor, ESSEC Business School, 13-02  
National Library Building, 100 Victoria St, Singapore,  
oliveira@essec.edu

#### 1 - Two-product Newsboy Problem Based on Prospect Theory

Ren-ren Ying, Central South University, School of Business,  
Changsha, 410083, China, yingrenren@163.com, Yan-ju Zhou

Based on the framework of prospect theory, we analyze the value function, subjective probability and decision weighting function while considering two products under random demand. Then the order model is established. This model makes an important progress in the research of multi-product newsboy problem while using prospect theory. The numerical example shows that this model can describe the retailers' actual order behavior much better.

#### 2 - A New Formation of Controllable Lead Time in the Joint Replenishment Problem

Chen Zhen, Beihang University, Haidian District, Beijing, China,  
robert\_chen1988@163.com, Qiu-Hong Zhao

This paper presents a new formation of controllable lead time by assuming the supplier's lead time is a V type function of order quantity. This hypothesis can reflect the phenomenon in the real operations compared with past assumption. We also use this idea in the solution of joint replenishment problem.

#### 3 - Contract Design and Information Value in IT Service Outsourcing

Zong-ming Zhang, PhD, Xi'an Jiaotong University, No.28,  
Xianning West Road, Xi'an, China,  
zhang.zongming@stu.xjtu.edu.cn, Shu-lin Liu, Xiu-wu Liao

We analyze contracting issues and information value arising in IT service outsourcing. Depending on whether the service provider's effort information and cost information are symmetric or not, we investigate how service outsourcing contracts can be designed in four scenarios. And the value of effort information and cost information is discussed.

#### 4 - Cloud Service in Green Supply Chain Management

Ke Xing, Dr, School of Advanced Manufacturing & Mechanical  
Engineering, University of South Australia, Mawson Lakes  
Campus, Adelaide, SA, 5095, Australia, ke.xing@unisa.edu.au

A major technological and financial challenge for Green Supply Chain Management involving a large network of small-medium sized manufacturers is the lack of resources and ability in those companies to assess/manage the environmental impact of their operations. Cloud Computing and Cloud Service present a promising solution. It is proposed that the combination of providing LCA tools via SaaS and interactive energy data collection/exchange via RFIDs and IaaS, facilitated by linking community cloud and public cloud, can effectively reduce the technical barriers and costs for GSCM.

## 5 - Formalization of a Theory of Learning and Evolution in Supply Chain Ecology

Fernando Oliveira, Professor, ESSEC Business School, 13-02 National Library Building, 100 Victoria St, Singapore, oliveira@essec.edu

The formalization of theories in strategic management is important for the establishment of consistent causal relationships. For this reason, we develop a theory generation algorithm to analyze the interactions between learning, adaptation and selection in supply chain ecology. We prove that, in turbulent environments, learning and dynamic routines provide a competitive advantage.

## MC13

Room 210A

### Scheduling III

Contributed Session

Chair: Yuan Yuan, The Logistics Institute, Northeastern University, Shenyang, 110819, China, yyuan@tli.neu.edu.cn

#### 1 - An Outer Approximation Algorithm for Two-stage Flow Shop Problem to Minimizing Square of Idle Time

Qingxin Guo, The Logistics Institute, Northeastern University, Shenyang, China, qxguo@tli.neu.edu.cn, Lixin Tang

In this paper, we consider a two-stage flow shop scheduling problem to minimizing the sum of the square of idle time. This problem is motivated from the electrolysis and casting process in aluminum industry. With the idea of the square of idle time, we try to minimize the energy consumption. We formulate this problem as a mixed integer nonlinear programming model and show that it is a strongly NP-hard problem. An outer approximation algorithm is proposed to solve this problem.

#### 2 - Benders Decomposition Method for a Multi-stage Scheduling Problem in Steel Industry

Gongshu Wang, The Logistics Institute, Northeastern University, Shenyang, China, gshwang@tli.neu.edu.cn, Lixin Tang

The paper studies a multi-stage scheduling problem arising in the steel industry. The problem consists of assigning, sequencing and timing batches on the last stage and jobs on other stages. We formulate the problem as a mixed-integer programming model. A Benders decomposition method is then developed to solve the problem. The computational results demonstrate that the proposed method is capable of finding optimal solution within a reasonable CPU time.

#### 3 - Branch-and-price for an EOS Scheduling Problem with Downlink Contention Considerations

Pei Wang, Dr., College of Information Systems and Management, National University of Defense Technology, P.R.China, No.47 Deya Str., Changsha, 410073, China, peigongliu@hotmail.com

An earth observing satellite (EOS) scheduling problem with downlink contention considerations is introduced in this paper. We propose a constraint programming model and a branch-and-price algorithm for this NP-hard problem. The sub-problems are solved by a bidirectional dynamic programming and a column combination and adjustment heuristic. Problem instances of the Environmental and Disaster Small Satellite Constellation in China are used to test the effectiveness of the model and algorithm.

#### 4 - Improved Benders Decomposition Algorithm for a Batch Scheduling Problem

Wei Jiang, The Logistics Institute, Northeastern University, Shenyang, China, wjiang@tli.neu.edu.cn, Lixin Tang

We investigate a short-term scheduling of batch processes in batch chemical plants. A mixed integer linear programming model is developed and Benders decomposition algorithm is applied to solve it, some valid inequalities are proposed to restrict the solution space of the Benders master problem and a novel method is developed for further accelerating the convergence of the whole algorithm.

#### 5 - Crane Scheduling for Coils with Shuffle and Substitution

Yuan Yuan, The Logistics Institute, Northeastern University, Shenyang, 110819, China, yyuan@tli.neu.edu.cn, Lixin Tang

In warehouse management, retrieval request performed by crane highly affects the efficiency of production and transportation. In a scheduling horizon, a set of coils are required to be retrieved. This study is concerned with the sequence of the retrieval operations along with the shuffle and substitution decision. We formulate the problem as a mixed integer linear program and propose a two-stage heuristic to solve the problem.

## MC14

Room 210B

### Queueing Systems: Performance Analysis and Control

Sponsor: Applied Probability

Sponsored Session

Chair: Natarajan Gautam, Texas A&M University, 4012 ETB, College Station, TX, 77843, United States of America, gautam@tamu.edu

#### 1 - Exact Order Asymptotic Analysis of Closed Queueing Networks

Cathy Xia, Prof, Ohio State University, Columbus, OH, 43210, United States of America, xia.52@osu.edu, David George, Mark Squillante

We study the asymptotic behavior of a general class of product-form closed queueing networks as the population size grows large. We derive the asymptotic behavior of the normalization constant and establish the asymptotic behavior of a number of performance metrics in exact order. We then give new, computationally simple approximations for performance metrics that significantly improve upon existing approximations, and can be conveniently used for optimization decisions in large-scale networks.

#### 2 - Optimal Service Rate Control of M/M/s Queues with Application to Cloud Computing

Nelson Lee, University of North Carolina, Dept. of Stat. and OR., Chapel Hill, NC, 27599, United States of America, leent@email.unc.edu, Vidyadhar Kulkarni

We consider the problem of optimal control of an M/M/s queue with controllable service rates. This study is motivated by its potential application to the design and control of data centers or cloud computing facilities. The cost structure includes customer holding cost and server operating cost that is a convex function of the chosen service rate. We formulate the problem as a continuous time Markov decision process and derive structural properties of the optimal control policies.

#### 3 - Resource Management in Time-varying Multi-class Queueing Systems

Natarajan Gautam, Texas A&M University, 4012 ETB, College Station, TX, 77843, United States of America, gautam@tamu.edu

We consider a multi-class queueing system where each class has time-varying workload that could be correlated with or independent of other classes. Through effective resource management of configuring flexible servers, powering them on/off, and running them at various speeds we develop a strategy for energy conservation while guaranteeing high performance.

## MC15

Room 212A

### Brand and IP Management

Sponsor: Marketing Science

Sponsored Session

Chair: Yi Qian, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, yiqian@kellogg.northwestern.edu

#### 1 - Counterfeiters: Foes or Friends

Yi Qian, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, yiqian@kellogg.northwestern.edu

This paper combines a natural policy experiment with randomized lab experiments to estimate the heterogeneous impacts of counterfeiting on the sales and consumer purchase intent of branded products of various quality levels. Counterfeits have both advertising effects for a brand and substitution effects for authentic products.

#### 2 - Untangling Searchable and Experiential Quality Responses to Counterfeits

Qiang Gong, Associate Professor, Southwestern University of Finance and Economics, RIEM, Chengdu, China, qgongpku@gmail.com, Yi Qian, Yuxin Chen

In this paper, we untangle the searchable and experiential dimensions of quality responses to entry by counterfeiters. One of our key theoretical predictions is that entries by counterfeiters induce incumbents to upgrade the searchable quality (e.g. appearance) of their products more and improve the experiential quality (e.g. functionality) less. In addition, this model demonstrates that the pricing impacts of entry are twofold. These predictions are empirically validated using data in China.

**3 - Vice or Virtue? – The Shanzhai Product in China**

Xi Chen, Assistant Professor, China University of Political Science and Law, #27, Fuxue Rd., Changping District, Beijing, China, chelseatsinghua@gmail.com

Shanzhai products are perceived as imitator and pirated goods, disrupt business environment. This interpretive research addresses the bright side of shanzhai. By semistructured interviews with 15 consumers, I unpack the misunderstanding of shanzhai compared with counterfeit. I then reveal key appealing values that drive consumer purchases of shanzhai. Based on benefits consumers value of shanzhai products, I identify six consumer segments: imitator, showoff, curiouse, rationalist, admirer, hedonist.

**4 - How to Position Store Brands When Retailer Introduced Multiple**

Xiaojun Fan, Associate Professor, Nanjing University of Finance and Economics, Room 401 Building 42, No.51 East Beijing, Nanjing, JS, 210008, China, ardourfan@gmail.com, Yi Qian

When some retailers tried to introduce multiple store brands to increase the market share, how to position multiple store brands is a basic problem they must face. Positioning of multiple store brands will influence both the competition between store brands and national brands and the relationship of different store brands. In terms of horizontal and vertical positioning, we identify the retailer's optimal product line strategy under the combinations of multiple store brands and national brands.

**MC16**

Room 212B

**Competitive Channel and Supply Chain Management**

Cluster: Interface between Operations Management and Marketing

Invited Session

Chair: Gangshu Cai, Kansas State University, Department of Management, Manhattan, KS, 66506, United States of America, gcai@k-state.edu

**1 - Advertising in Competing Supply Chains**

Bin Liu, Professor, Henan Agricultural University, 63# Nongye Road, Zhengzhou, HN, 450002, China, liubhnau@163.com, Gangshu Cai

We examine the viability of each approach in a model of two competing manufacturer-retailer supply chains who sell partially substitutable products that may differ in market size. We show that the delegation of advertising to the retailers can buffer the competition between the manufacturers, and articulate conditions under which this is so, and the firms performing the advertising would rather bear the costs entirely, if this protects their unit profit margin.

**2 - The Impact of Hidden Add-On Fees and Consumer Bounded Rationality**

Xianjun Geng, UT Dallas, 800 W Campbell Rd, SM 33, Richardson, TX, 75080, United States of America, geng@utdallas.edu

After committing to purchase a product or service, consumers are often faced with add-on fees for additional features or services. This paper uses an analytical model to examine the consequences of add-on fees when there is a segment of boundedly rational consumers who were unaware of these fees at the time of initial purchase and inaccurately believed the posted price was all-inclusive.

**3 - Should Captive Sardines Be Compensated? Serving Customers in a Confined Zone**

Rachel Chen, University of California-Davis, Graduate School of Management, Davis, CA, United States of America, rachen@ucdavis.edu, Eitan Gerstner, Yinghui Yang

Many services are delivered to a number of customers simultaneously within a confined zone (e.g., restaurants, resorts, trains). Under unexpected high demand, customers experience discomfort from the "sardine effect" that arises when too many customers ("sardines") compete for space and service resources. We find that offering compensation to "sardines" can improve profit and social welfare. However, consumers do not benefit when compensated for the discomfort from crowding.

**4 - Channel Authorization with Warranty**

Xiaodong Yang, Lecturer, Beijing Foreign Studies University, No. 19 North Xisanhuan Avenue, Beijing, China, sheldon.yang123@hotmail.com, Gangshu Cai, Charles Ingene

When a manufacturer distributes its product downstream, it may choose a list of authorized retailers. The authorized retailers are endowed with a warranty whereas the unauthorized ones not. Through a model with a manufacturer and two retailers, we investigate whether it is beneficial for the manufacturer to adopt partial versus full authorization. Our analysis confirms that the manufacturer can benefit from partial authorization. Firms may or may not conflict on their authorization preferences.

**MC17**

Room 213A

**Joint Session HAS/ OR/MS in Medicine: Treatment Planning in Radiation Therapy**

Sponsor: Health Applications & OR/MS in Medicine and Healthcare Sponsored Session

Chair: Chunhua Men, Optimization Research Scientist, Elekta, Inc., 13723 Riverport Drive, Suite 100, Maryland Heights, MO, United States of America, Chunhua.Men@elekta.com

**1 - Beam Orientation Optimization for Intensity Modulated Radiation Therapy using Sparse Minimization**

Xun Jia, Assistant Professor, University of California-San Diego, 3855 Health Sciences Drive # 0843, La Jolla, CA, 92093, United States of America, xunjia@ucsd.edu, Chunhua Men, Yifei Lou, Steve Jiang

Beam orientation optimization (BOO) tries to find an optimal set of beam angles to achieve a dosimetric objective. For this purpose, we have developed an objective function that favors the sparsity of solutions at the level of beam angles. Starting with all angles, the optimization process identifies and removes unimportant orientations gradually without largely sacrificing the dosimetric objective, hence achieving the goal of BOO. Improved treatment plan quality is observed by our algorithm.

**2 - Dose-reactive Methods in Adaptive Robust Intensity-modulated Radiation Therapy**

Timothy Chan, University of Toronto, 5 Kings College Rd., Toronto, ON, Canada, tcychan@mie.utoronto.ca, Velibor Misic

We extend a previous adaptive robust IMRT optimization method to 'react', via re-optimization, to the remaining dose-to-go, based on estimates of the dose delivered. Results on a clinical lung case show that while cumulative dose performance may be improved, daily dose distributions are degraded.

**3 - Fast Techniques for Beam Orientation Optimization in Intensity Modulated Radiation Therapy**

Dionne Aleman, University of Toronto, Toronto, ON, Canada, aleman@mie.utoronto.ca, Michael Sharpe, C-H Jason Lee

Beam orientation optimization (BOO) is a fundamentally nonlinear problem in intensity modulated radiation therapy treatment planning, and the quality of BOO solutions can significantly impact the quality of the treatment for large treatment areas. We present a BOO approach using the set-cover problem (SCP) in combination with constraint programming (CP) to select good beams for total marrow irradiation. Pure CP methods are inadequate, but CP is useful to enforce geometric considerations in SCP.

**4 - Multi-criteria Robust Optimization for Intensity-modulated Proton Therapy**

Wei Chen, Research Scientist, Massachusetts General Hospital, Harvard Medical School, Boston, MA, 02114, United States of America, chen.wei@mgh.harvard.edu

The sensitivity of intensity-modulated proton therapy (IMPT) to setup errors and proton range uncertainties compromises its advantage of conformal dose distribution and target dose escalation. Constraints and objectives can be applied to a set of uncertainty scenarios to optimize robust IMPT plans. Multi-criteria optimization allows the planner to interactively trade off between conflicting objectives and plan robustness. The new approach is computationally fast and memory efficient.

**MC18**

Room 213B

**Financial Optimization**

Cluster: Super/Special Sessions

Invited Session

Chair: Duan Li Xun Li, Chair Professor/Assistant Professor, The Chinese University of Hong Kong/Hong Kong Polytechnic University, Shatin, Kowloon, Hong Kong, Hong Kong - PRC, malixun@inet.polyu.edu.hk

**1 - Discrete-time Behavioral Portfolio Selection under Prospect Theory and Incomplete Market**

Duan Li, Professor, The Chinese University of Hong Kong, Dept of Syst. Eng. & Eng. Manag, Shatin NT, NT, Hong Kong - PRC, dli@se.cuhk.edu.hk, Yun Shi

We formulate and study a prospect theory (PT) - based discrete-time behavioral portfolio selection model, featuring an S-shaped value function. Under the conditions for well-posedness, we derive, using some sophisticated optimization

schemes, the semi-analytical optimal policy that possesses a linear feedback form. Our proposed discrete-time behavioral portfolio selection model further provides a platform in revealing some PT investors' trading patterns.

## 2 - Nonlinear Portfolio Selection Using Approximate Parametric Value-at-Risk

Shushang Zhu, Sun Yat-Sen University, Xingangxi Road No.135, Guangzhou, China, sszhu@fudan.edu.cn, Xueting Cui, Xiaoling Sun, Duan Li

We use first-order and second-order approximations of VaR for constructing portfolio selection models, and show that the corresponding portfolio selection models can be reformulated as second-order cone programs, which are polynomially solvable using interior-point methods. Our simulation and empirical results suggest that the model using Delta-Gamma-normal VaR approximation performs the best in terms of balancing trade-off between approximation accuracy and computational efficiency.

## 3 - Calibrating Stochastic Volatility Models: An Optimal Control Approach

Min Dai, Associate Professor, National University of Singapore, Dept of Math, Singapore, Singapore, matdm@nus.edu.sg, Ling Tang

We calibrate stochastic volatility models through an optimal control for partial differential equations. An extensive numerical and empirical analysis is conducted to demonstrate our algorithm.

## 4 - Optimal Multiperiod Mean-Variance Policy under No-Shorting Constraint

Duan Li Xun Li, Chair Professor/Assistant Professor, The Chinese University of Hong Kong/Hong Kong Polytechnic University, Shatin, Kowloon, Hong Kong, Hong Kong - PRC, malixun@inet.polyu.edu.hk, Xiangyu Cui, Jianjun Gao

We consider in this paper the mean-variance formulation in multi-period portfolio selection under no-shorting constraint. Recognizing the structure of a piecewise quadratic value function, we prove that the optimal portfolio policy is piecewise linear with respect to the current wealth level. One prominent feature of our findings is the identification of a deterministic time-varying threshold for the wealth process and its implications for market settings.

## 5 - Knowing When to Run: An Optimal Stopping Time Formulation for Bank Runs

Gechun Liang, Postdoctoral Research Fellow, Oxford-Man Institute, University of Oxford, Eagle House, Walton Well Road, Oxford, United Kingdom, gechun.liang@oxford-man.ox.ac.uk, Min Dai, Yingshan Chen

In this talk, we propose a dynamic bank run model under the framework of optimal stopping times. A financial institution finances its risky project by issuing short-term debt, and the debt holders need to decide whether to roll over or to withdraw their debt (i.e. to run) when their contracts expire. This causes the potential rollover risk that the financial institution may not raise enough funding to payback the creditors and finally bankrupts.

## MC19

Room 215

## Optimization Software: Algorithms, Computation and Applications

Cluster: Tutorials

Invited Session

Chair: Zonghao Gu, Gurobi Optimization, 4050 Walnut Creek Trail, Alpharetta, GA, 30005, United States of America, gu@gurobi.com

### 1 - Optimization Software: Algorithms, Computation and Applications

Zonghao Gu, Gurobi Optimization, 4050 Walnut Creek Trail, Alpharetta, GA, 30005, United States of America, gu@gurobi.com

We will focus on linear, quadratic and integer programming, discuss briefly the history of math programming software and review important algorithms, such as primal and dual simplex and barrier for linear and quadratic programming, and the branch-and-cut algorithm for mixed integer programming. Computation is always a crucial part of software development; this talk will discuss different technologies used in the commercial optimization solvers to determine the degree of algorithmic progress. We will also give computational results indicating the current state of the art. Finally we will talk about several applications to show the benefits this progress in software brings to real world problems.

## Monday, 4:30pm - 6:00pm

## MD01

Room 202B

## Airline Economics and Operations I

Sponsor: Aviation Applications

Sponsored Session

Chair: Hai Jiang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, haijiang@tsinghua.edu.cn

### 1 - Joint Optimization of Airline Pricing and Seat Allocation

Claire Cizaire, Optimix, 434 Massachusetts Avenue, Cambridge, MA, United States of America, claire.cizaire@optimix.co

This paper develops a methodology to simultaneously optimize pricing and resource allocation for a company with multiple perishable products. The framework was originally designed for airlines with "fare families", a new fare structure recently implemented by large Asian carriers. MIT research shows revenues gains of the order of 3-4%. The approach can be used to refine the pricing strategy of the company. It can also be used as a starting point to conduct more analysis on competitive effects.

### 2 - Analysis on Competitiveness of International Airlines: New Evidences from Chinese Airlines

Xingli Fan, Vice Director, China Academy of Civil Aviation, Science and Technology, Xibahe Beili Jia 24, Chaoyang District, Beijing, 100028, China, fanxingli@126.com, Xiaowen Fu

This paper measures and compares the performance of Chinese airlines with the world's major airlines in terms of labor productivity, cost competitiveness and multifactor productivity during 2005-2010 for the purpose of identifying Chinese airlines' international competitiveness.

### 3 - Relative Interval Robust Optimization of Airline Network Designing

Wu Xiaohuan, Nanjing University of Aeronautics and Astronautics, Civil Aviation Department, Yudao Road 29, Nanjing, China, wuxiaohuan2003@163.com, Jinfu Zhu, Wu Weiwei

This paper introduces a scenario set of interval designing parameters, establishes a relative interval robust optimization model of hub-and-spoke airline network, modifies the shortest path algorithm, combines it with the simulated annealing algorithm, designs a mixed algorithm for the model, and finally, and uses the classic data set to test our model. The results show our network is more robust compared with deterministic optimization and robust discrete optimization methods.

### 4 - Impact of High Speed Rail on Intercity Travel in China

Hai Jiang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, haijiang@tsinghua.edu.cn, He Sun, Song Gao

The rapid development of High Speed Rail (HSR) has greatly changed the way passengers travel. This research studies how passengers choose among HSR and existing travel modes including conventional rail, aviation, and express bus. We also study how itinerary attributes (departure/arrival times, travel time, fare, and service) influence passengers' choices. By combining revealed preference and stated preference data in select OD markets in China, we quantify the impact of HSR on intercity travel.

## MD02

Room 202A

## Modelling in Analytics

Sponsor: Data Mining

Sponsored Session

Chair: Xiaoming Huo, Georgia Institute of Technology, 765 Ferst Dr, Atlanta, GA, 30332, United States of America, xiaoming@isye.gatech.edu

### 1 - A Comparison of One-Class Classification Techniques for Process Monitoring

Seoung Bum Kim, Associate Professor, Korea University, 5-ga, Anam-dong, Seoungbuk-gu, Seoul, Korea, Republic of, sbkim1@korea.ac.kr, Gulanbaier Tuerhong

Control charts are widely used in various industries to improve product quality. In this presentation we examine the characteristics of seven one-class classification techniques and compare them in terms of the control chart performance under various simulation scenarios.

## 2 - Motion Trajectories Mining from Anonymous Binary Sensors in Smart Environment

Chengliang Wang, Associate Professor, Chongqing University, Luneng Residential Quarter, Yulu Road, Chongqing, China, wangcl55@gmail.com

The smart environment deployed with anonymous binary sensors can contribute to find not only the behavior patterns of users, but also the functional relationships among these rooms in the environment. This paper focuses on how to mine valuable and trust-worthy trajectories from the huge amount of anonymous binary sensor data.

## 3 - The Sparse Signomial Classification and Regression Model

M.K. Jeong, Associate Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, mjeong@rci.rutgers.edu, Norman Kim, Kyungsik Lee

This talk presents the sparse signomial classification and regression (SSCR) model. SSCR employs the signomial function in the original variables that can explore the nonlinearity in the data. SSCR gives a sparse explicit description of the resulting function in the original input space, which will be useful for the interpretation purpose regarding which original input variables and/or interaction terms are more meaningful than others.

## 4 - Maximizing Information Diffusion Based on Bottleneck Limitation in Social Networks

Min Zhang, Associate Professor, School of Information Management, Wuhan University, Luo-jia-shan, Wuchang, Wuhan, 430072, China, zhangmin\_wuhu@hotmail.com, Xiaoming Huo

Diffusion efficiency depends on both inside social networks structure and outside information density. In our research, we define information degree to match these two parts and focus on the network bottleneck to form subnetworks by constructing a nondecreasing diffusion cost function. A tradeoff maximizing diffusion model is built and simple and efficient algorithms for solving this problem.

## MD03

Room 203B

### Service Science – Improving Complex Service Systems

Sponsor: Service Science

Sponsored Session

Chair: Gregory Heim, Associate Professor, Mays Business School at Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, gheim@mays.tamu.edu

#### 1 - The Service Method: Meta-Model for Developing Services

Victor Tang, Researcher, MIT, 55 Deerfield Lane South, Pleasantville, NY, 10570, United States of America, victor.w.tang@gmail.com

We propose our Service Method for developing services. Our method is widely applicable for simple, complex, low or high technology services. The method is application domain neutral and completely flexible to implementation mechanisms. As an example, we close with the Technology Services for the 1998 Winter Olympics, a high technology service costing >\$500 M with dozens of world-wide stakeholders. The author was the provider's senior executive before the International Organizing Committee.

#### 2 - Optimization of the Vehicle Route of SF Company with Multiple Dynamic Saving Algorithm

Junchao Liu, liujc0723@163.com, Wei Liu

Using the Saving Algorithm, which is the heuristic method, and with the actual situation in SF, giving the reason to choose circulation commuting or crossover commuting in ground transportation between first and second distribution station in SF company, making the vehicle routing and resources were optimized. Applying the Saving Algorithm in every distribution center, forming a "multi-dynamic" type of Saving Algorithm to ensure the unity of cost savings and the whole time in SF company.

#### 3 - The Development of Green Logistics in China's Shipping Enterprises under the 12th Five-Year Plan

Wen Cheng, Shanghai Maritime University, 1550th, Harbour Road, Shanghai, Shanghai, China, excellentswenz2011@163.com

The 12th Five-Year Plan has put forward the green requirements for the development of the logistics in China. In that context, combined with the connotation of green logistics, this paper analyzes the social and economic value advantages of implementing green logistics, and proposes the strategy and direction of development of China's shipping enterprises under the green requirements.

## MD04

Room 203A

### Simulation

Contributed Session

Chair: Allen Greenwood, Professor, Mississippi State University, Dept. of Ind. & Sys. Engr., 260 McCain Engr. Bldg., Mississippi State, MS, 39762, United States of America, greenwood@ise.msstate.edu

#### 1 - Insights into Practice of Simulation Modellers in the OR

Rizwan Ahmed, HoD Dept. of Information Systems, Faculty of Management Science, University of Central Punjab, 1-Khayabn-e-Jinnah, Johar Town, Lahore, Pu, 540000, Pakistan, rizwan1001@hotmail.com

We report some results from an empirical study of practices of expert simulation modellers in the OR. Generally, a three phased approach is identifiable. A number of contextual factors such as the problem domain, problem scope, the size and complexity of the model, may affect the way modellers develop their models. Model documentation largely depends on model life, client requirement, and type of model being developed. Model maintenance and reuse is generally not given much importance.

#### 2 - Implementable Optimal Linear-Combination Estimators in Simulation Output

Wheyming Song, Professor, National Tsing Hua University, 101, Sec. 2, Kuang-Fu Road, Hsinchu, 30013, Taiwan - ROC, wheyming\_song@yahoo.com

Motivated by the problem that the optimal linear combination (olc) weights, originally proposed in Song (1988), could not be implemented in practice, this paper proposes an implementable olc procedure in estimation of the variance of the sample mean. The results demonstrate mse reduction of above 40% for many stochastic processes. Refocusing future research on olc estimators has the potential to provide significant advancements in estimation of the variance of the sample mean.

#### 3 - Simulation as a Curriculum Integrator

Allen Greenwood, Professor, Mississippi State University, Dept. of Ind. & Sys. Engr., 260 McCain Engr. Bldg., Mississippi State, MS, 39762, United States of America, greenwood@ise.msstate.edu, Malcolm Beaverstock

An evolving approach for teaching simulation is providing a foundation for simulation to become an integrator of ideas, concepts, and applications across the IE curriculum. This new perspective emphasizes applications, yet maintains technical rigor. It leverages rich and easy-to-use simulation technologies for model building and analysis, industry's need for engineers with solid problem-solving skills, and the importance of understanding complex systems.

## MD05

Room 205B

### Impact of Customer Behavior on Service Systems

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Margaret Pierson, Assistant Professor, Dartmouth, Hanover, NH, United States of America, mpierson@hbs.edu

#### 1 - Impact of Price Fluctuations on Consumer Purchasing Behavior

Margaret Pierson, Assistant Professor, Dartmouth, Hanover, NH, United States of America, mpierson@hbs.edu

In gasoline retail, a significant fraction of consumer transactions are clustered at "bill-values", e.g., \$20. As a result, purchase volume per-transaction to decrease as prices increase even though aggregate U.S. demand for gasoline is relatively stable. Using transactional panel data this study examines the transaction-level consumer response to price changes.

#### 2 - Modelling Bounded Rationality in Operations Management: Some Recent Progress

Tingliang Huang, Assistant Professor, University College London, Department of Management Sci & Innovation, Gower Street, UCL, London, WC1E 6BT, United Kingdom, t.huang@ucl.ac.uk

The existing operations management literature typically assume that consumers are fully rational and form rational expectations. In contrast, in this talk, I present several of our recent and ongoing studies where consumers are boundedly rational. I discuss how to model bounded rationality and the managerial insights.

**3 - Measuring the Effect of Queues on Customer Purchases**

Yina Lu, PhD, Columbia Business School, 3022 Broadway,  
Uris Hall, New York, NY, 10025, United States of America,  
ylu13@gsb.columbia.edu, Marcelo Olivares, Andres Musalem

This is an empirical study on how waiting in a queue affects customer purchase using a novel technology: digital imaging of queuing systems. We find that customers appear to primarily focus on the queue length rather than the expected wait when making purchase decisions, and the impact is non-linear. We also find that customers' waiting sensitivity is heterogeneous and negatively correlated with price sensitivity. We discuss implications of these results in service design and category pricing.

**MD06**

Room 205A

**Scheduling and its Applications**

Cluster: Supply Chain Management in China

Invited Session

Chair: Lianmin Zhang, The Chinese University of Hong Kong, 709D,  
M.W.Mong Engineering Building, Shatin N.T, Hong Kong - PRC,  
lmzhang@se.cuhk.edu.hk

**1 - Stochastic Harvest Scheduling of Fresh Products under Weather Constraints**

Xian Zhou, Professor, The Chinese University of Hong Kong,  
Department of System Engineering and Eng, Shatin, NT,  
Hong Kong - PRC, xqcai@se.cuhk.edu.hk, Xian Zhou

We study the problem which involves harvest and delivery of fresh products with an unreliable transportation service. A storm is expected to arrive within the period of harvesting. Loss can occur on three fronts: (i) loss of product value due to decaying while waiting for the delivery; (ii) damage or extra storage cost if a product catches the storm; and (iii) loss of sale if it misses the transporter. We determine the optimal harvest policy to minimize the total expected loss.

**2 - A Group Strategyproofness Mechanism on Scheduling Problems**

Lianmin Zhang, The Chinese University of Hong Kong, 709D,  
M.W.Mong Engineering Building, Shatin N.T, Hong Kong - PRC,  
lmzhang@se.cuhk.edu.hk, Xian Zhou

In this paper, we study the truthful mechanism on scheduling setting. Based on the VCG mechanism, we derive a natural and intuitive class of mechanisms called SQS-pivotal mechanisms and prove it is weak group strategyproof. Besides, we prove that the property strongly group truthful and efficiency are incompatible for any mechanism.

**3 - Optimal Pricing under Consumer Regret**

Jun Jiang, The Chinese University of Hong Kong,  
Hong Kong - PRC, jjiang@se.cuhk.edu.hk

We investigate the optimal pricing and contract decision for a service provider who can adopt NYOP to salvage his excess capacity under emotional consumers. Channel selection and profit are largely affected by consumers' regret type and strength. Even capacity is very large, if consumers' inaction regret is weak, direct channel is profitable, dual channel will dominate when inaction regret is relatively strong. However, action regret will negatively affect the profit of the service provider.

**MD07**

Room 206A

**Decision Analysis I**

Contributed Session

Chair: Haiyan Xu, Professor, Nanjing University of Aeronautics and  
Aeronautics, College of Economics and Management, Nanjing,  
210016, China, xuhaiyan63@hotmail.com

**1 - Optimal Sequential Sampling Strategy Using Reinforcement Learning**

Wilkistar Otieno, Assistant Professor, University of Wisconsin-  
Milwaukee, 3200 N. Cramer Steer, RM 503, Milwaukee, WI,  
53211, United States of America, otieno@uwm.edu

The complexity of automated production necessitates the need for improved quality control strategies. We formulate an adaptive sequential monitoring plan that is based on reinforcement learning methodology, a simulation-based optimization technique that is commonly used to solve Markov and Semi-Markov decision problems. In our case, the monitoring plan optimizes the fraction of nonconforming products before a decision is made with the objective to minimize the aggregate quality costs.

**2 - Conflict Measure Model and its Application in Large Group Decision**

Qifeng Wan, School of Business, Central South University,  
Changsha, China, wanqf1989@126.com, Xuanhua Xu, Jinxin Liu,  
Zhili Huang

Aiming at the conflict measurements of large group, first, the distance between preferences is given, then, the conflict function among group members is proposed and large group members' preferences are clustered. After that, the conflict measure models of clusters and group are respectively proposed and applied in the aggregating of large group preferences. Finally, a computing example validates the models.

**3 - Effect of Eager versus Vigilant Judgment Strategies and Project Stage on De-Escalation of Commitment**

Shuja Ul Islam, School of Economics and Management,  
Southwest Jiaotong University, No.111, Erhuanlu Beiyiduan,  
Chengdu, China, shuja.isl@gmail.com, Xi Zhang

Manager's de-escalation of commitment helps to escape from the entrapment of throwing good money after the bad i.e. Escalation of commitment (EOC). EOC can be approached differently by the managers with different regulatory focus orientation i.e. prevention (vigilant strategy) and promotion (eager strategy). This study examines how predilection for eager versus vigilant judgment strategies performs at the three different stages of failing project and which group will quit earlier at which stage.

**4 - Conflict Analysis for Water Resources Allocation**

Haiyan Xu, Professor, Nanjing University of Aeronautics and  
Astronautics, College of Economics and Management,  
Nanjing, 210016, China, xuhaiyan63@hotmail.com, Leilei Ni

It is an important topic about how to allocate and use water resources reasonably and economically to avoid and solve the conflicts effectively among the users of water resources. This paper uses a new conflict analysis model based on rough set theory and the methodology of the graph model for conflict resolution to analyze conflicts arisen from allocation of water resources.

**MD08**

Room 206B

**Procurement and Retail Optimization**

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Thomas Archibald, University of Edinburgh Business School,  
29 Buccleuch Place, Edinburgh, EH8 9JS, United Kingdom,  
tarchibald@ed.ac.uk

**1 - Modeling Proactive Transshipment Decisions in Retail Networks**

Thomas Archibald, University of Edinburgh Business School,  
29 Buccleuch Place, Edinburgh, EH8 9JS, United Kingdom,  
tarchibald@ed.ac.uk

The transshipment of inventory between locations in a retail network can lead to reduced costs and improved service levels. In many settings, the arrival of customers is highly unpredictable and customers require immediate service. Therefore, transshipment decisions have to be taken in anticipation of future demand. A dynamic programming approach is used to develop heuristic policies for proactive transshipment. A numerical study is used to demonstrate the strong performance of the heuristics.

**2 - Optimizing a Multi-item Buyer Procurement Planning Problem**

Jiefeng Xu, Sr. Consultant, Wipro Technologies, 325 Springwell  
Lane, Alpharetta, GA, 30004, United States of America,  
jiefeng.xu1@wipro.com

We describe a procurement planning problem where a buyer purchases multiple items from a seller. Demands of each item are known for a finite number of periods. The seller offers multiple level discounts based on total spending of each purchase. The seller also charges shipping cost based on fixed charge and variable charge. The problem is to optimize the total costs including inventory cost, shipping cost and purchase discount. We formulate the problem and discuss several computational issues.

**3 - Cooperative Game Analysis of Retail Space-Exchange Problems**

Mingming Leng, Associate Professor, Lingnan University, 8 Castle  
Peak Road, Tuen Mun, Hong Kong - PRC, mmleng@ln.edu.hk,  
Mahmut Parlar, Dengfeng Zhang

We analyze retail space-exchange problems where retailers exchange their excess retail spaces. We first investigate a two-retailer exchange problem and use the generalized Nash bargaining scheme to allocate the profit surplus between the two retailers. Next, we consider the space-exchange problem involving three or more retailers, derive the necessary and sufficient conditions assuring the superadditivity of the game, and propose a weighted Shapley value for the allocation of profit surplus.

**4 - Green Retailing Evaluation and its Applications**

Kee-hung Lai, The Hong Kong Polytechnic University, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong - PRC, lgtmlai@polyu.edu.hk, T.C.E. Cheng, A.K.Y. Tang

The emerging trend of greening has led retailers to recognize the importance of integrating environmental management practices into their retail value chain operations. Conceptualized and empirically validated measures of green retailing (GR) are helpful for retailers to implement pertinent environmental management practices for greening success. In this study we investigate the theoretical construct of GR and develop a measurement scale for evaluating the different facets of GR implementation.

**MD09**

Room 208A

**Closed-Loop and Reverse SCM**

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Yang Tan, FedEx, 3640 Hacks Cross Road., Building D 3rd Floor, Memphis, TN, 38125, United States of America, ytan0920@gmail.com

**1 - Optimal Pricing Decisions in Closed-loop Supply Chain**

Yang Tan, FedEx, 3640 Hacks Cross Road., Building D, 3rd Floor, Memphis, TN, 38125, United States of America, ytan0920@gmail.com

This research addresses the problem of integrating the positive supply chain and the reverse supply chain. First we obtain the price models of the manufacturer, the retailer and the third party without exogenous constraint. And then the price-decision models with the maximum profit of the whole Closed-loop supply chain are discussed. The price decision of the manufacturer, the retailer and the third party is analyzed in Game.

**2 - Competing Retailers: How the Substitutability Affects the Closed-loop Supply Chain**

Mengying Cai, Southwestern University of Finance and Economics, 555 Liutai Avenue, Wenjiang, Chengdu, China, caimengying0219@126.com, Shaorui Li

This study investigates the impacts of two kinds of substitutions in a closed-loop supply chain consisting of a manufacturer and two competing retailers in a two-period model. Used products are collected directly by the manufacturer. We show that the more substitutable the retailers' products are, the higher the return rate, sales and total profits will be. Furthermore, the manufacturer's profit can be increased by substituting some margins in the second period for that in the first period.

**3 - Multi-period Closed-loop Supply Chain Network Equilibrium with Product Remanufacturing**

Jiayi Sun, Harbin University of Science and Technology, Mailbox119, 52 Xuefu Road, Nangang District, Harbin, 150080, China, sjy\_sjx@163.com, Zhaobo Chen, Chunxian Teng

In order to overcome the limitations of a single-period model in depicting the process of remanufacturing, we consider a multi-period closed-loop supply chain network consisting of manufacturers and consumer markets. Subsequently, we establish equilibrium conditions of manufacturers, consumer markets and the whole supply chain network by using variational inequality and their economic explanations are presented. Finally, a numerical example is given to show the validity of the model.

**4 - Multistage Stochastic Modeling to Manage Component Commonality in Reverse Supply Chain**

Jack C. P. Su, Assistant Professor, National Tsing Hua University, 101 Sec. 2 Kuang Fu Rd., Hsing Chu, Taiwan - ROC, su@ie.nthu.edu.tw, Yih Long Chang

This paper presents a dynamic stochastic optimization model to jointly determine marketing and operations decisions in a reverse supply chain. In the system, two remanufactured products share a common recycled core component. The main source of the uncertainty is the number of the common recycled core component available in each period. The stationary solutions provide relationships between decision variables and inventory levels. The impact of the uncertainty is also discussed.

**MD10**

Room 208B

**Censored Demand and Incomplete Information**

Sponsor: Manufacturing & Service Operations Management  
Sponsored Session

Chair: Leon Yang Chu, University of Southern California, University Campus Park, Los Angeles, CA, 90089, United States of America, leonyzhu@usc.edu

**1 - Demand Estimation and Optimal Ordering under Censorship: The Benefit of Stockout Timing Information**

Tong Wang, Assistant Professor, National University of Singapore, 15 Kent Ridge Drive, Singapore, 119245, Singapore, tong.wang@nus.edu.sg, Aditya Jain, Nils Rudi

We propose a new Bayesian mechanism for estimating demand distribution when the observation is censored. The mechanism utilizes stockout timing information, which is readily available in any ERP systems. It is analytically tractable and allows for dynamic updating over multiple periods for distribution families such as Normal and Poisson.

**2 - Vendor Selection, Contract Efficiency and Performance Measurement in Service Outsourcing**

Zhijian Cui, Assistant Professor of Operations Management, IE Business School, Calle de Maria de Molina, 12, 5th floor, Madrid, Spain, Zhijian.cui@ie.edu, Sameer Hasija

This study compares the vendor selection and contract efficiency in service outsourcing when the contract terms are decided by the service client and the vendors respectively. This study shows that competitive bidding yields good selection but contract inefficiency; in contrast, the sequential process enables outsourcing firms to achieve perfect efficiency but results in poor vendor selection. This study also highlights the multiple implications of performance measurements in service contract.

**3 - Salesforce Contracting under Demand Censorship: Analysis of Sales-Quota Based Bonuses**

Leon Yang Chu, University of Southern California, University Campus Park, Los Angeles, CA, 90089, United States of America, leonyzhu@usc.edu, Guoming Lai

We study salesforce contracting in a setting where excess demand results in lost sales and the demand information is censored by the inventory level. We aim to explore the optimal contract as well as the impact of demand censorship on incentive design and inventory decision. In our model, a firm contracts a sales agent with limited liability whose effort increases the demand stochastically. The firm designs the incentive contract and invests in inventory and the agent decides his selling effort.

**MD11**

Room 209A

**Supply Chain Management I**

Cluster: Super/Special Sessions

Invited Session

Chair: Shaohui Zheng, Professor, HKUST, Dept. of ISOM, Hong Kong, China, imzheng@ust.hk

**1 - Transparency of Information Acquisition in a Supply Chain**

Hongtao Zhang, Associate Professor, Hong Kong University of Science and Technology, Dept. ISOM, HKUST, Hong Kong - PRC, imhzhang@ust.hk

A manufacturer offers a menu of supply contracts to a retailer who sells it to a market with random demand. The retailer makes an attempt to acquire demand information and becomes privately informed with probability  $t < 1$  or remains uninformed with probability  $1-t$ . We find that disclosing his information status, "informed" or "uninformed" (but not the content of information), benefits the retailer if  $t$  is moderate or low and the market fluctuation is not too large.

**2 - Managing Perishable Goods under Different Customer Preferences**

Qing Li, Associate Professor, HKUST Business School, ISOM Department, HKUST, Hong Kong - PRC, imqli@ust.hk, Zongliang Wen

The shelf lives of perishable goods are influenced by decisions made along the supply chains and on shelves. How should firms coordinate the shelf life decisions and inventory decisions? We show that the answer depends critically on customers' sensitivity to freshness. We consider two classes of customers and measure sensitivity to freshness by the percentage of customers who purchase only new items, and whether the customers who accept both new and aged items retrieve items FIFO or LIFO.

**3 - Consumer Panic Buying and Fixed Quota Policy**

Biying Shou, Assistant Professor, City University of Hong Kong, P7519, Academic 1, City U. of HK, Hong Kong, China, biying.shou@cityu.edu.hk, Huachun Xiong, Max Z. Shen

We study consumer panic buying under supply disruptions and we investigate the retailer's optimal inventory and fixed quota policies. Rational expectation equilibrium framework is used to characterize consumers' behavior and the retailer's decisions. We demonstrate the cost of ignoring strategic consumer behavior and examine the effectiveness of fixed quota.

**4 - Inventory Control with Piece-wise Linear Convex Variable Ordering Cost and Fixed Cost**

Miao Song, Assistant Professor, Hong Kong University, Room 8-6 Haking Wong Building, Hong Kong, China, msong@hku.hk, Ye Lu

We study a periodic-review inventory system whose ordering cost consists of a fixed cost and a variable cost defined by a piece-wise linear convex function. The optimal policy for the single period problem is fully characterized. For the multi-period problem, some interesting properties of the optimal policy have been discovered, which lead to a practical and well-performed heuristic. We also identify certain condition under which the classic (s,S) policy is optimal.

**MD12**

Room 209B

**Innovative Topics in Operations Management**

Cluster: Super/Special Sessions

Invited Session

Chair: Shiming Deng, Professor, Huazhong University of Science & Technology, School of Management, 1037 Luoyu Road, Wuhan, 430074, China, smdeng@mail.hust.edu.cn

**1 - Infrastructure Planning for Electric Vehicles with Battery Swapping**

Ying Rong, Assistant Professor, Shanghai Jiaotong University, China, yrong@sjtu.edu.cn, Ho-Yin Mak, Max Z. Shen

To address the "range anxiety" regarding electric vehicles, i.e., the limited travel range on one full charge, battery swapping has been proposed as a range-extension solution. We consider the problem of deploying battery swapping stations in a freeway network and equipping them with sufficient battery stocks. With adoption levels not precisely known at the planning stage, the major challenge is to develop tractable optimization models that produce robust solutions.

**2 - Competition and Cooperation of Inner River Ports**

Zhijia Tan, Assistant Professor, School of Management, Huazhong University of Science & Technology, Rm. 616, School of Management, 1037 Luoyu Road, Wuhan, 430074, China, zjatan@mail.hust.edu.cn, Zhixue Liu

This paper studies the pricing decisions by two ports with given locations along an inner river. The shippers are assumed to spatially distribute along the river and use the transshipment at a junction port connecting the river and sea. The navigational restriction is heterogeneous along the river. The heterogeneity of navigation restriction and spatial distribution of shippers are considered to examine the competition and cooperation condition between the ports.

**3 - Joint Sourcing and Pricing Decisions under Supply Uncertainty in a Decentralized Supply Chain**

He Xu, Associate Professor, Huazhong University of Science and Technology, 1037 Luoyu Road, Wuhan, 430074, China, xuhe@mail.hust.edu.cn, Xiaolu Zuo, Zhixue Liu

This paper studies one buyer sourcing from a strategic supplier with uncertain yield and a local contingent supplier. The local supplier's capacity is either infinite or random and the buyer has the pricing flexibility to affect the final demand. Under the given wholesale price of strategic supplier, we show that the adoption of hedging tactics is threshold controlled by marginal benefit values. We further examine the hedging tactics adoption when the wholesale price is endogenously set.

**4 - Optimal Strategies for Selling Through Group-buying Sites**

Shiming Deng, Professor, Huazhong University of Science & Technology, School of Management, 1037 Luoyu Road, Wuhan, 430074, China, smdeng@mail.hust.edu.cn, Xuan Jiang

We consider a retailer who can sell products through a group-buying site such as Groupon in addition to her offline channel. The group-buying may specify a minimum threshold for group purchase to be valid. Given this threshold, the retailer decides an online price and an upper bound on the number of coupons that can be sold. We derive the optimal strategies for the retailer and show that she may use the deal sites as just a campaign ground rather than a selling channel.

**MD13**

Room 210A

**Health Care Delivery Service Optimization**

Sponsor: Business Analytics, CPMS-The Practice Section

Sponsored Session

Chair: Raymund Lin, Research Scientist, IBM, 3F, No. 7, SongRen Rd., Xinyi District, Taipei, Taiwan - ROC, raymund@tw.ibm.com

**1 - Patient Compliance Management Empowered by Peer Learning Mechanism Using Keyword-Based Interaction**

Yin-Pin Yang, Principal Researcher, Service Systems Technology Center, ITRI, No.195,Sec.4,Chung Hsing Rd., Hsinchu, Taiwan - ROC, yinpin.yang@itri.org.tw

Per recovery plan, patient compliance can be audited, managed and improved by the presented system featuring the use of live, interactive keyword-bubbles to navigate users to target in-time content and also leverage the collective power – peer learning to encourage patients. Three major components are: an autonomous intelligent keyword-based user behavior collector, a patient similarity analyzer to dynamically cluster peers, and a dispatcher to provide prompt services, activities to users.

**2 - Social Relationship Analytics in Healthcare Management System**

Matthew Chen, Technical Manager, Service Systems Technology Center, ITRI, 195, Sec. 4, Chung Hsing Rd., Chutung, Hsinchu, Taiwan - ROC, matthew@itri.org.tw, Alfred Tzao

In health management domains, social relationships and healthcare compliance play an important role. Both health profile and social information are often presented in very high-dimensional formats. In this paper, we are proposing a novel approach, in which the patient similarity of high-dimensional data is structured as a simplicial complex of Euclidean space. Finally, we cluster the data by the structure of symptoms, which is organized by a social graph on specific healthy living activities.

**3 - Optimizing the Cycle from Health Screening to Social Media Based Interventions in Preventive Care**

Rick Huang, IBM Software, Taipei, Taipei, Taiwan - ROC, tchuang@tw.ibm.com, Raymund Lin

People often neglect adherence issues of health promotion plans after health screening. From the perspective of Preventive Care, it is the adherence that keeps people from getting chronic diseases. Social media based intervention mechanisms were designed to improve the adherence. Now an expert system is built to generate personalized social-media-based interventions right after health screenings, taking feedbacks of previous interventions into consideration.

**4 - An Intervention Recommendation Engine Approach for Chronic Disease Management**

Christina Chung, IBM, 4F., No.7, Song Ren Road, Taipei, Taiwan - ROC, cfchung@tw.ibm.com

Traditional chronic disease management begins when patient approaches medical personnel and ends with treatment plans. However, as preventive care and lifestyle management become important, there is a need for new IT enabled health and wellness service delivery approaches to improve efficiency and effectiveness. The intervention recommendation engine approach proposes an integrated architecture and model to manage whole chronic disease lifecycle with adaptation to personal and clinical needs.

**5 - Seamless Device-System Connection to Improve User Health Management**

Gilbert Liao, IBM, 4 F., No.7, Song Ren Road, Taipei, Taiwan - ROC, gilbert@tw.ibm.com, Ya-Fan Yeh

Health management behavior is difficult to be precisely recorded. The reason is suitable devices for recording those behavior is difficult to find or use. Another reason is customer has no intention or sustainability to record. It is becoming a gap for health service provider to understand their customers' status and to offer a new service by customers' requirement. We develop Personal Health Management System to understand the health behavior of customers. This system can seamlessly and easily connect to a pedometer, weight scale and blood pressure. After three months of tests and found that the appropriate equipment and convenient interface can promote the public record of daily health behavior and results.

## ■ MD14

Room 210B

### Quantitative Methods in Finance

Sponsor: Applied Probability

Sponsored Session

Chair: Yongjin Wang, Professor, School of Business, Nankai University, Weijin Road 94#, Nankai District, Tianjin, 300071, China, yjwang@nankai.edu.cn

#### 1 - Cocos, Bail-In, and Tail Risk

Nan Chen, Chinese University of Hong Kong, Systems Engineering & Engineering Management, Room 609, William M W Mong Engineering, Shatin, N.T, Hong Kong - ROC, nchen@se.cuhk.edu.hk, Paul Glasserman, Behzad Nouri

We develop a capital structure model to analyze the incentives created by contingent convertibles (CoCos) and bail-in debt, two variants of debt that converts to equity as a bank nears or reaches financial distress. Our formulation includes firm-specific and marketwide tail risk in the form of two types of jumps. We investigate how CoCos affect debt overhang, asset substitution, the firm's ability to absorb losses, and the sensitivity of equity holders to various types of risk.

#### 2 - A Two-Dimensional, Two-Sided Laplace Inversion Algorithm with Computable Error Bounds

Ning Cai, Assistant Professor, Hong Kong University of Science & Technology, Industrial Eng. & Logistics Mgmt., Clear Water Bay, Hong Kong - PRC, ningcai@ust.hk, Chao Shi

We develop a two-dimensional, two-sided Laplace inversion algorithm and apply it to the pricing of exotic options, whose prices usually can only be analytically characterized by their double Laplace transforms rather than single transforms. In many cases, this algorithm can lead to computable bounds for both discretization and truncation errors, which decay quickly, and hence is appropriate to provide benchmarks for option pricing.

#### 3 - External Risk Measures and Basel Accords

Xianhua Peng, Assistant Professor, Hong Kong University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong - PRC, maxhpeng@ust.hk, Steven Kou

The Basel II and Basel III Accord use Value-at-Risk (VaR) with scenario analysis as the risk measures for setting capital requirements. We argue a good external risk measure should be robust with respect to model misspecification and small changes in the data. A new class of data-based risk measures called natural risk statistics are proposed to incorporate robustness. Natural risk statistics include the Basel II and III risk measures and a subclass of robust risk measures as special cases.

#### 4 - Stochastic Stability of Affine Jump-diffusion Processes

Xiaowei Zhang, Assistant Professor, Hong Kong University of Science and Technology, HKUST, Hong Kong - PRC, xiaoweiz@ust.hk, Peter Glynn

Affine jump-diffusion (AJD) processes are widely used in finance and econometrics due to their computational tractability and modeling flexibility. We study the long-term behaviors of AJDs. In particular, we provide intuitive sufficient conditions to guarantee the (exponential) ergodicity of AJDs. We will also discuss the applications of such results. One is Gaussian approximations for portfolio default loss distribution; the other is parameter estimation of AJDs.

## ■ MD15

Room 212A

### Market Entry and Industry Dynamics

Sponsor: Marketing Science

Sponsored Session

Chair: Qiaowei Shen, Assistant Professor of Marketing, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 700, Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, qshen@wharton.upenn.edu

#### 1 - McDonald's and KFC in China: Competitors or Companions

Ping Xiao, Assistant Professor of Marketing, National University of Singapore, Mochtar Riady Building, BIZ 1, 8-35, 15 Kent Ridge Drive, Singapore, 119245, bizxp@nus.edu.sg, Qiaowei Shen

This paper examines the entry of McDonald's and KFC in China using a unique dataset that covers the two chains' entire history of expansion. We estimate how local market characteristics and rival's presence affect a chain's decision to enter a new city and open additional outlets. The results are consistent with rival presence having a positive effect on a firm's entry and expansion decision. We further investigate the question of why there may be a positive spillover effect from the rival.

#### 2 - Targeting Strategies in the U.S. DVD Market: A Study of Dynamic Segment-Specific Competition

Anirban Mukherjee, Assistant Professor, Singapore Management University, 50 Stamford Road, #05-02, School of Business, Singapore, 178899, anirbanm@smu.edu.sg, Vrinda Kadiyali

The authors study dynamic competitive targeting strategies in the U.S. DVD market. Consumers have different preferences for DVD freshness (number of weeks between theatrical and DVD release) and DVD price. The authors assess how different studios account for their rivals' targeting strategies as they tailor their own targeting strategies to serve different consumer segments. Estimates of the competitive (dynamic) game are used to create a brand map and a metric of studio competition.

#### 3 - Cyclic Pricing with Oligopoly: An Application in the U.S. Cigarette Market

Jian Ni, Assistant Professor, Johns Hopkins University, 100 International Dr, Baltimore, MD, 21202, United States of America, jni@jhu.edu, Baohong Sun

We develop a dynamic oligopoly model of the cigarette industry to study firms' pricing competition. We solve firms' Markov Perfect equilibrium pricing policies conditional on consumer demand with addiction estimated from individual-level data. Addiction and consumer heterogeneity introduces dynamics to firms' pricing decisions. We find that the proposed dynamic model predicts the price pattern reasonably well and provides the rational why Marlboro initiated the price cut.

#### 4 - Dynamic Learning and Exit in Competitive Markets

Qiaowei Shen, Assistant Professor of Marketing, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 700, Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, qshen@wharton.upenn.edu, Hongju Liu

This paper presents a model of firms making exit decisions in a competitive industry. We model the process as the result of learning and selection in a dynamic game setting. Sales of each time period provide a noisy signal of the capabilities of the competing firms and the firms use the demand signals to update their belief of themselves as well as their competitors in Bayesian fashion. We estimate the model using a data set of China's evolving microwave industry.

## ■ MD16

Room 212B

### Panel: Women in OR

Cluster: Interface between Operations Management and Marketing  
Invited Session

Moderator: Kathryn E. Stecke, Ashbel Smith Professor of OM, University of Texas-Dallas, 800 West Campbell Road, Richardson, TX, United States of America, KStecke@utdallas.edu

Moderator: Grace Lin, Institute for Information Industry, 1F, No. 133, Sec. 4, Minsheng E. Rd., Taipei, TW, 106, Taiwan - ROC, gracelin@iii.org.tw

#### 1 - Women in Operations Research and Management Science (ORMS)

Panelists: Min Huang, Li Luo, Wheyming Song, Qiu-Hong Zhao

In the last sixty years, Operations Research and Management Science (ORMS), including its Big Data and Business Analytics, has come a long way, and has recently become mainstream in business and academia. In this session, we will discuss the progress of women in ORMS. Panelists from the US, China, and Taiwan will share their views about leadership and career development in ORMS from a woman's perspective. They will share both their successes and their challenges as women in the field. Lessons learned will also be discussed. Ample time will be reserved for Q&A and lively discussions.

## ■ MD17

Room 213A

**Joint Session HAS/OR/MS in Medicine:  
Medical Decision Making**

Sponsor: Health Applications & OR/MS in Medicine and Healthcare  
Sponsored Session

Chair: Shengfan Zhang, Assistant Professor, University of Arkansas,  
4207 Bell Engineering Center, Fayetteville, AR, 72701,  
United States of America, shengfan@uark.edu

**1 - Optimal Screening Strategy Design for Chlamydia Infection**

Nan Kong, Purdue University, 206 South Martin Jischke Drive,  
West Lafayette, IN, 47907, United States of America,  
nkong@purdue.edu, Wanzhu Tu, Yu Teng

Chlamydia infection is one of the most common sexually transmitted diseases in the U.S. Since the majority of infected people are asymptomatic and the incidence rate differs by age, age-dependent screening methods may be cost-effective in controlling the disease. We adapt a discrete-time dynamic model to evaluate the total cost and terminal prevalence for each age-dependent screening strategy. We analyze the model to obtain the optimal screening strategy.

**2 - When to Stop Catch-up Vaccination: The Example of  
Hepatitis B in China**

Margaret Brandeau, Stanford University, Stanford, CA,  
United States of America, brandeau@stanford.edu, David Hutton

"Catch-up vaccination" for age groups beyond infancy can be an attractive and effective means of immunizing people who were missed earlier. However, as newborn vaccination rates increase, infection risk decreases, so catch-up vaccination may become less attractive. We present a general framework for determining the optimal time to discontinue a catch-up vaccination program. We illustrate our results with the example of hepatitis B catch-up vaccination in China.

**3 - Optimal Decision Modeling for Breast Cancer Patients in the  
Presence of Disease Regression**

Shengfan Zhang, Assistant Professor, University of Arkansas,  
4207 Bell Engineering Center, Fayetteville, AR, 72701,  
United States of America, shengfan@uark.edu, Julie Ivy

In most screening and treatment decision models, breast cancer is modeled as a progressive disease. However, there have been medical studies that suggest breast cancer may regress without treatment. While this has initiated a lot of debate in the medical community, there have been limited analytical studies on the topic. This research seeks to quantify the impact of breast cancer spontaneous regression on patient outcomes with respect to different mammography screening and treatment policies.

## ■ MD18

Room 213B

**Finance**

Contributed Session

Chair: Kunihiko Iwai, Student, The University of Electro-Communications, 1-5-1 Chofugaoka, Chofu, TO, 182-8585, Japan, kunihiko.iwai.19870403@gmail.com

**1 - AR1 Model and the Mean-reverting Technical Strategy**

Kazuhei Yamagata, Student, The University of Electro-Communications, 1-5-1 Chofugaoka, Chofu, TO, 182-8585, Japan, kazuhei.y@gmail.com, Koichi Miyazaki

Equity price movement is generally thought to be like random walk, in other words, the auto-regression coefficient is one in AR1 type equity model. However, it sometimes looks like mean-reverting and the coefficient is less than one for a short period. We empirically examine the role of the coefficient in the mean-reverting technical strategy.

**2 - Regimes of Financial Market and Real Economy**

Takuya Tokunaga, Student, The University of Electro-Communications, 1-5-1 Chofugaoka, Chofu-shi, TO, 182-8585, Japan, takuya.tokunaga@uec.ac.jp, Koichi Miyazaki

We first discuss how close the regime of financial market is to that of the real economy in Japan using several regime-switching regression models. Secondly, we examine the explanatory power of the estimated regime probability and the derived uncertainty factor to equity excess returns in comparison with the famous SMB and HML factors.

**3 - Applying Game Theory to Credit Guarantee Mechanism on  
Supply Chain Sourcing Model**

Chia-Ping Lin, PhD Student, Department of Business Administration, National Taiwan University, College of Management Floor 9, No.1., Sec. 4, Roosevelt Road, Taipei Taiwan, Taipei, Taiwan - ROC, d95741004@ntu.edu.tw, David Ming-Huan Chiang, Ming-Hsien Yeh

In order to increase the banks' willingness of loaning to Small and Medium Enterprises (SME), this study aims to discuss the Credit Guarantee among large enterprises, SMEs and banks. A leader-follower game is adopted with the upstream suppliers (SEMs) as a follower and downstream suppliers (large enterprises) as a leader.

**4 - Quality or Cost Advantage under Outsource Competition**

Yen-Ting Lin, University of San Diego, 5998 Alcalá Park, San Diego, CA, 92110, United States of America, linyt@sandiego.edu, Ying-Ju Chen

In this paper, we construct a stylized model to examine two competing vendors' selection of contract manufacturers. Each vendor chooses between two manufacturers: One manufacturer is endowed with the key component supplying capability while the other manufacturer provides superior quality. We characterize the equilibrium outsourcing strategies and demonstrate that each vendor may select a different contract manufacturer, even if they are ex ante symmetric.

**5 - Regime-dependent Real Interest Rates in JGB Market**

Kunihiko Iwai, Student, The University of Electro-Communications, 1-5-1 Chofugaoka, Chofu, TO, 182-8585, Japan, kunihiko.iwai.19870403@gmail.com, Koichi Miyazaki

We estimate the 7-year and 10-year real interest rates from the nominal Japanese government bonds using the regime-switching factor model in Ang et al. (2008) and compare them with these implicit in the inflation-linked government bond. The estimation results are pretty dependable on the choice of the short and intermediate maturity bonds.

Tuesday, 8:00am - 9:30am

## ■ TA01

Room 202B

### Airline Economics and Operations II

Sponsor: Aviation Applications

Sponsored Session

Chair: Hai Jiang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, haijiang@tsinghua.edu.cn

#### 1 - The Time-band Approximation Model on Flight Operations Recovery: Considering the Multi-hub-Spoke Airlines in China

Haiwen Xu, Civil Aviation Flight University of China, No.112, Liuzhou Road, Guanghan, China, xuhaiwen\_dream@163.com, Xiaodong Liu, Quan Shao, Songchen Han

Applying new approaches: the simplex group cycles in the multi-hub-spoke airlines in china, the time-band approximation model on flight operations recovery was designed in this paper.

#### 2 - Simulation and Optimal Research of Terminal Passenger Flow Planning

Wei Wu, China Academy of Civil Aviation Science and Technology, No.24A Xibahe Beili, Chaoyang District, Beijing, China, wuw@mail.castc.org.cn

The terminal passenger flow planning determines the level of airport operating effective and service quality. The research on the terminal planning based on computer simulation technique is economic and effective. It is helpful to manager's decision-making. The paper presents the evaluation and optimal research on terminal planning, esp. passenger flow based on theoretically and computer simulation model.

#### 3 - Improving Data Quality in Flight Technical Error Measurement and Uncertainty

Ying Su, Dr., ISTIC, No. 15 Fu Xing Road, Beijing, 100038, China, suy.rspc@istic.ac.cn

This paper presents additional FTE results and improved uncertainty calculations for ILS arrivals at Beijing International Airport (PEK) and Nanjing Lukou International Airport (NKG), as well as comparisons with previous documented FTE results from Hangzhou – Xiaoshan International Airport (HZU).

#### 4 - China International Air Cargo Transport: The Status Quo

Li Zhang, Dr., China Academy of Civil Aviation Science and Technology, Room 508, No.24 Xibahe Beilijia, Chaoyang, Beijing, 100028, China, zhangli@mail.castc.org.cn, Huaqing Hu, Jingjing Yao

In this paper, the situation and development trend of China's international air cargo transport is discussed. A detailed analysis is presented in the paper on the status of the cargo categories and the destinations in China's import and export through air transport. The characteristics and predicament are concluded in the international air cargo market. Some advices are given at the end.

## ■ TA02

Room 202A

### Tutorial: Data Mining in Finance

Sponsor: Data Mining

Sponsored Session

Chair: Chenghu Zhang, Xi'an Jiaotong University, No 28 West Xianning Road, Xi'an, 710049, China, zch@mail.xjtu.edu.cn

#### 1 - Tutorial: Data Mining in Finance

Chenghu Zhang, Xi'an Jiaotong University, No 28 West Xianning Road, Xi'an, 710049, China, zch@mail.xjtu.edu.cn

Topics include: • The application of Data stream mining in suspicious financial transaction • Recognition of Stock Market Manipulation • Recognition of suspicious financial transaction based on data mining • The application of Data mining in CRM of Banking

## ■ TA03

Room 203B

### Service Science - Analytical Models for Performance Improvement

Sponsor: Service Science

Sponsored Session

Chair: Gregory Heim, Associate Professor, Mays Business School at Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, gheim@mays.tamu.edu

#### 1 - A Cargo Security System Applying RFID and GPS Tracker

Ruijian Zhang, Professor of Computer Science, Purdue University Calumet, 2200 169th Street, CLO-372, Hammond, IN, 46323, United States of America, zhang45@purdue.edu

This paper is about developing a centralized, internet based security tool which utilizes RFID and GPS technology to identify drivers and track the load integrity. After the vehicle is loaded, all openings of the tanker are sealed with disposable RFID tag seals. Then a RFID reader and GPS tracker wirelessly connected with the databases will serve as testing grounds for the implementation of security measures that can help prevent future terrorist attacks.

#### 2 - Modeling Medication Adherence using Agent-based Simulation

Wai Kin Victor Chan, Associate Professor, Rensselaer Polytechnic Institute, CII 5015, 110 8th Street, Department of Industrial and Systems Eng, Troy, NY, 12180-3590, United States of America, chanw@rpi.edu, Kee Chan

Adherence to medication regimen is a critical step in many therapeutic treatments, including hepatitis and HIV. Better adherence not only affects treatment results, but also reduces unnecessary clinic visits and saves money. Despite all benefits it brings, adherence remains low. Understanding the impact of nonadherence and designing incentives are important for healthcare and economy. This talk presents an agent-based model for HIV medication adherence and analyzes factors influencing adherence.

#### 3 - Reducing Wait Times and Improving Treatment Planning Process for Radiation Therapy

Mehmet Begen, Assistant Professor, University of Western Ontario, 1151 Richmond St., London, ON, N6A3K7, Canada, mbegen@ivey.uwo.ca, Inge Aivas, Vusal Babashov, Michael Lock, Greg Zanic

Recent statistics show that London Regional Cancer Program (LRCRP) consults 45% and treats 85% of patients within Cancer Care Ontario's (CCO) wait time targets. We develop a simulation model to determine bottlenecks and reduce wait times at LRCRP. The ultimate goal is to perform scenario and sensitivity analysis and recommend alternate policies on process changes and improvements, staffing levels, and schedules of resources that most efficiently achieve COO's target wait times.

#### 4 - Structure Mechanism Design in Healthcare Financing

Zhen Zhu, PhD Student, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47905, United States of America, zzhu@purdue.edu, Nan Kong, Andrew Liu

In healthcare financing, over-utilization and insurance overhead are two major structural costs that do not contribute to well-being. We consider a mechanism design problem to minimize the structure costs. We formulate the problem as a leader-follower game, in which the public insurer is the leader whose objective is to minimize the total structure cost subject to both budgetary and patients' stop-loss constraints, and private insurer is the follower whose objective is to maximize its profit.

## ■ TA04

Room 203A

### Transport, Logistics and Sustainable Development

Cluster: Maritime, Trade and Supply Chain Logistics

Invited Session

Chair: Adolf K.Y. Ng, Assistant Professor, The Hong Kong Polytechnic University, Dept of Logistics and Maritime Studies, The Hong Kong Polytechnic University, Hong Kong - PRC, lgtan@polyu.edu.hk

#### 1 - Incorporating Negative Externalities Into Productivity Assessments of US Airports

Martin Dresner, Professor, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States of America, mdresner@rhsmith.umd.edu, Davide Scotti, Chunyan Yu, Gianmaria Martini

Productivity assessments generally consider only the production of positive outputs from input factors. This paper uses a number of formulations to compare productivity of US airports before and after consideration of negative externalities. Factors contributing to the differences in rankings with and without consideration of the negative externalities are assessed. Finally, managerial and policy implications are drawn from the results.

#### 2 - Sustainable Maritime Transportation and Logistics

Rommert Dekker, Professor, Erasmus University Rotterdam, Rotterdam, Netherlands, rdekker@ese.eur.nl, John Mallidis

In this presentation we consider sustainability issues for intercontinental supply chains, based on maritime transportation. We investigate the choice of port of entry, use of one or multiple ports and way of hinterland transport using mathematical models. We illustrate the methods for a supply chain from China to south-eastern Europe and discuss the effects of choosing different environmental objectives.

#### 3 - Cargo Airships: Sustainable Air Transport for World Trade in the 21st Century

Barry Prentice, Professor, University of Manitoba, 626 Drake Centre, Winnipeg, MB, R3T 5V4, Canada, Barry\_Prentice@UManitoba.ca

This paper explores the revival of airships as an alternative means of air transport. This analysis examines technological developments that are overcoming the prior problems of airships as a sixth mode of transport. A survey of recent developments is provided to assess the state of readiness and opportunities for expansion. The paper concludes with consideration of the impact of airships on world trade and their potential to provide sustainable transport for the 21st century.

#### 4 - Human Reliability Quantification in Maritime Operations

Zaili Yang, Reader in Maritime Transport, Liverpool John Moores University, R229a James Parsons Building, Byrom Street Liverpool, Liverpool, L3 3AF, United Kingdom, Z.Yang@ljmu.ac.uk, Steve Bonsall, Khalifa Abujaafar, Jin Wang

Modern ship system operations, relying on a high degree of automation, contribute to erroneous human actions. A new Cognitive Reliability and Error Analysis Method (CREAM) for quantifying maritime human reliability analysis is developed using Bayesian Network (BN) and Fuzzy Rule Base (FRB). In the model, BN conceptualises CREAM common performance conditions (CPCs) dependency, while FRB formulates the logical relations of influencing nodes through eliciting subjective probabilities by experts.

#### 5 - A Multi-period Planning Model for Liner Shipping's Bunker Management

Xiaoyu Wang, Nanyang Technological University, School of CEE, NTU, 50 Nanyang Avenue, Singapore, 639798, Singapore, WANG0519@e.ntu.edu.sg, Chee-Chong Teo

This paper considers bunker risk management for container shipping lines. A nonlinear finite horizon optimization program is developed to simultaneously optimize liner network planning and bunker hedging. The model captures the uncertainty of bunker price and the associated tolerance for bunker risk exposure. As a rolling-horizon model, it allows the updating of the market information and forecast, such as bunker prices, over the planning horizon.

#### 6 - Port Security Regulations and Policies in Hong Kong

Koi Yu Ng, Assistant Professor, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong - PRC, adolfng@gmail.com

This paper assesses the problems and challenges of existing port security regulations and policies in Hong Kong, as well as the possible solutions in addressing them. We investigate the legal and political framework which confronts Hong Kong port's security risks and challenges, including its evolution, organization and relation to its security structure.

## ■ TA05

Room 205B

### Supply Chain

Cluster: Super/Special Sessions

Invited Session

Chair: Ming Zhao, SAS Institute, 100 SAS Campus, Cary NC, United States of America, Zhao.Ming@sas.com

#### 1 - Robust Seat Allocation and Overbooking with Hybrid Information

Yingjie Lan, Assistant Professor, Peking University, Guanghua School of Management, Beijing University, Beijing, 100871, China, ylan@gsm.pku.edu.cn, Itir Karaesmen, Michael Ball

We study the joint decision of seat allocation and overbooking with hybrid information quality. Information with mixed quality arises as no-show records are accurate and more stable, while demand data is often censored and more volatile. We optimize the worst case performance and solve the problem by competitive analysis. Numerical results are provided to show the practical relevance of our method.

#### 2 - Incentive for Lead Time Reduction

Mingzhou Jin, Associate Professor, University of Tennessee, 405 East Stadium Hall, Knoxville, TN, 37996, United States of America, jin@utk.edu

In the aerospace industry, a big mission or project may involve hundreds of suppliers. How to reduce supply lead times while keep high on-time delivery percentage is critical. This paper studies a premium mechanism to reduce lead times during supplier selection and contracting process. The premium also gives the winning supplier incentive to honor the promised due date. Implications involved in real-world implementation are discussed based on a simulation involving both buyers and suppliers.

#### 3 - Delayed Pricing Schemes of a Newsvendor

Ming Zhao, SAS Institute, 100 SAS Campus, Cary, NC, United States of America, Ming.Zhao@sas.com, Kai Huang, Michael Chen

In this paper, we study a single product multi-period pricing problem. The problem is a nonlinear non-convex optimization problem, for which a local optimal solution is not necessarily a global optimum. We are able to find a global optimal decision structure and to transform the nonlinear non-convex problem to a shortest path problem accordingly.

## ■ TA06

Room 205A

### Revenue Management

Cluster: Supply Chain Management in China

Invited Session

Chair: Yongjian Li, Professor, Business School, Nankai University, 94 Weijin Road, Nankai District, Tianjin, TJ, 300071, China, liyongjian@nankai.edu.cn

#### 1 - Robust Newsvendor Model using S-shaped Utility Function

Hui Yu, Professor, School of Economics and Business Administration, Chongqing University, Chongqing University, Chongqing, China, yuhui@cqu.edu.cn, Jia Zhai, Xuexiang Huang

In this paper, we study the newsvendor problem with partial information about the demand distribution under an S-shaped utility function. We derive the optimal order strategy for a robust newsvendor model, where the newsvendor maximizes his worst-case expected utility. Numerical studies are conducted to illustrate the impact of parameters on the optimal policies. Our approach can be extended to a variety of problems that require a robust but not conservative solution.

#### 2 - An Integrated Short-term Wind & Solar Power Forecasting Solution: The Case in China

Hai Feng Wang, IBM Research - China, Diamond Building, Zhongguancun Software Park, Beijing, China, whf@cn.ibm.com, Rong Fu Sun, Dengfeng Guo, Jun Liu, Tao Zhang, Wen Jun Yin, Jin Dong

We design an integrated wind & solar power forecasting solution to provide forecasting up to 48 hours ahead by combining statistical modeling approaches based on SPSS modeler. The solution is flexible to include many types of wind/solar data. This solution was deployed at a world-largest wind-solar-storage project at Zhangbei, China and is expected to generate extra 80 Million \$ electricity sales and 32 Million \$ environmental revenue from long run.

**3 - A Remedy for Oversold Flights: An Auction Mechanism?**

Sean Zhou, Hong Kong - PRC, zhoux@se.cuhk.edu.hk,  
Zhiheng Zhong

The overbooking practice of airlines might make the affected customers upset and affect the future revenue of the airlines. We propose a call-back auction mechanism, in which the passengers are asked to submit a bid that indicates the compensation they would like to receive for giving up their tickets. This mechanism provides the airline company with information to select passengers with lowest such compensation requirements and also reduces the negative impact on customer relationship.

**4 - Advance Selling by a Newsvendor Retailer with Opportunistic Consumer Returns**

Yongjian Li, Professor, Business School, Nankai University,  
94 Weijin Road, Nankai District, Tianjin, TJ, 300071, China,  
liyongjian@nankai.edu.cn, Jason T.M. Choi, Lei Xu

This paper studies advance selling strategy and failure false return for a newsvendor seller with potential opportunistic returns. We consider the seller's three strategy options: no advance selling allowed (NAP), advance selling with full refund (AFP) and advance selling with partial refund (APP). The seller's optimal pricing and refund policies are derived, and then the results among the three options are compared.

**TA07**

Room 206A

**OR/MS in Industrial Applications**

Contributed Session

Chair: Sara V. Rodriguez, Assistant Professor, Universidad Autonoma de Nuevo Leon, 111-F, Ciudad Universitaria, San Nicolas de los Garza, 66450, Mexico, sara.rodriguezsn@uanl.edu.mx

**1 - An ILS Based Algorithm for the Hot Rolling Production Scheduling Problem with Slab Shuffling Cost**

Ren Zhao, The Logistics Institute, Northeastern University,  
Shenyang, China, rzhao@tli.neu.edu.cn, Lixin Tang

This paper presents HRS problem with slab shuffling cost, which determines the processing sequence of required slabs with considering shuffle number and production scheduling constraints. The objective is to minimize the total production scheduling cost and shuffling cost. The problem is formulated as a linear integer programming model. An ILS based algorithm is developed. Compared with classical HRS problem, the proposed model and ILS algorithm can reduce the total cost by 12.89%.

**2 - New Challenges for OR Researchers to Improve Pork Supply Chain Efficiency**

Sara V. Rodriguez, Assistant Professor, Universidad Autonoma de Nuevo Leon, 111-F, Ciudad Universitaria, San Nicolas de los Garza, 66450, Mexico, sara.rodriguezsn@uanl.edu.mx, Lluís Pla, Javier Faulin

In Europe, the structure of the pork sector is changing from a family-based, small-scale, independent firm to one in which larger firms are more tightly aligned in a Pork supply chain. Our contribution emphasizes then, the importance and complexity of new decision-making tasks and envisions new challenges for OR methods to be successfully applied to increase chain efficiency. Likewise, we identify some existing gaps in the literature that we believe should be addressed in the near future.

**3 - Study of Service Extension in Manufacturing Companies: A Viewpoint of Value Creation**

Yuwei Liu, Xi'an Jiaotong University, No.28, Xianning West Road,  
Xi'an, Xi'an, China, wutaokeda@163.com

Service extension is chosen as the enterprise strategy by more and more companies for intensification of industrial competition in manufacturing, aiming at this trend, the conception of value creation introduced to this paper as the starting point to understand the operation mechanism of service extension. The purpose is to clarify how value is created for both of customer and company, and guide the service extension in practice.

**4 - Development of a Standard R&D Process Model: Comparison of Traditional Process Models**

Kee Eun Lee, Dongguk University-Seoul, E407, 26, Pil-dong 3-ga,  
Chung-gu, Seoul, Seoul, Korea, Republic of, kelee@dongguk.edu,  
Byungun Yoon

This research aims at proposing a standard process model through comparison of traditional process models. Since traditional process models such as CMMI, ISO, EIRMA are hardly applied to R&D activities, a new R&D process model should be derived to evaluate a level of process. To this end, 21 R&D processes and best practices in each process are defined by investigating the aforementioned existing process models. The proposed model will enable a company to find and enhance weak R&D processes.

**TA08**

Room 206B

**Capacity and Production Planning**

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Alex Zhang, Principal Scientist, Hewlett-Packard Company,  
1501 Page Mill Road, Palo Alto, CA, 94304, United States of America,  
alex.zhang@hp.com

**1 - Labor Strategy Optimization for Case-Volume Based Service Businesses**

Alex Zhang, Principal Scientist, Hewlett-Packard Company, 1501  
Page Mill Road, Palo Alto, CA, 94304, United States of America,  
alex.zhang@hp.com, Jerry Shan, Shelen Jain, Tere Gonzalez

We present a tool for planning service capacity and optimizing labor strategies in a multi-tiered IT service provider managing thousands of Customer Engineers and Mission Critical Hardware Specialists. Our tool includes a linear programming model, featuring workforce mix constraints and workforce transformation rules. The optimization model incorporates employee productivity index, attrition, and learning curve. We also describe our software design and its business implementation.

**2 - Capacity Planning with Uncertain Technological Upgrades**

Hongxun Jiang, Associate Professor, School of Information,  
Renmin University of China, No.59, Zhongguancun Street,  
Haidian, Beijing, 100872, China, jianghx@ruc.edu.cn, Lu Qin

Technical breakthroughs (TB) in capacity expansion have been widely studied, while technical upgrades (TU), another type of technical progresses provides incremental expansions of pre-existing capacity, ignored in academia. Uncertainties rose from both TB and from TU are captured, simultaneously, in an optimization model, as well as related capacity replacement decisions. We develop a hybrid heuristics to solve this integer programming model. Preliminary results show that the algorithm works.

**3 - Where is the Road for Service Supply Chain Research?**

Zhixiang Chen, Professor, Sun Yat-sen University, No.135,  
West Xingang Road, Guangzhou, China, mnszcx@mail.sysu.edu.cn

After two decades of research, researchers find there is little "fish" in the pool of manufacturing supply chain to fish; they want to move to the new pool of service SC. But they find it is not so easy, traditional OR method can't solve the problem of service SC, although many call for research for service SC, still is "heavy thunder with little raining" and why? In this paper I discuss the key problem of service SC and share new thinking and new idea with colleagues of supply chain research.

**TA09**

Room 208A

**Linear and Integer Programming**

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Alexander Engau, Assistant Professor, University of Colorado  
Denver, 1250 14th Street Suite 600, Denver, CO, 80202, United States  
of America, alexander.engau@ucdenver.edu

**1 - Solving the MIP Reformulation of the Product Assortment Optimization Model**

Alvin Lim, President, Quantus Partners, LLC, 22 Birdsall Street,  
Winsted, CT, 06098, United States of America,  
alvin@quantuspartners.com, Jiefeng Xu

The problem selects a set of products to maximize expected sales or profits under certain restrictions such as the total number of items or the total shelf space required. By including some business rules, the problem is usually formulated as a mixed integer nonlinear program. We propose an alternate but equivalent formulation as a mixed integer linear program and provide conditions under which the problem can be solved as a linear program. We further report our computational experience.

**2 - Hiding Sensitive Frequent Itemsets by a Multi-objective Integer Programming Approach**

Yue He, Institute of Systems Engineering, Dalian University of Technology, DUT Faculty of Management and Economics, Dalian, China, heyue1025@163.com, Mingzheng Wang

Sharing of databases either within or across organizations raises the possibility of unintentionally revealing sensitive relationships contained. A multi-objective integer programming is modeled to solve the problem for hiding sensitive frequent itemsets which considers both data accuracy and information loss and a two-phased procedure is proposed to solve it. Finally, we conduct some tests on publicly available real data and further illustrate that our approach is effective and efficient.

**3 - A Review on the Theory and Algorithm for Separated Continuous Linear Programming**

Xiaoqing Wang, Lingnan (University) College, Sun Yat-sen University, 135 Xingangxi Road, Guangzhou, China, wangqx2@mail.sysu.edu.cn

In this paper, we present a review on the theory and algorithm for separated continuous linear programming, which can be served as a useful model for scheduling problems in the multiclass queueing network. Multiclass queueing network is a useful model for many real network, such as job-shop network, input-out economic system, communication network, road network, supply chain network, etc.

**4 - A New Line Search Method**

Wang Zhengyuan, Xi'an Hi-tech Institute, Xi'an, China, nudt\_wzy@tom.com, Si Xiaosheng, Li Yingqi, Qu Na

A new line search method is proposed to tackle the extreme value problem which the curve of the function researched is concave or convex and even the expression of the function is not available even. Five key points is selected and the approximation of the extreme value is worked out by a new point produced. Approximation is worked out by repeated iteration. Experimented results show that the line search method proposed here is more valid than gold section method and interpolation method.

■ **TA10**

Room 208B

**Reliability, Coordination and Performance Evaluation of Supply Chain Services**

Sponsor: Manufacturing & Service Oper Mgmt  
Sponsored Session

Chair: Yugang Yu, School of Management,USTC, JinZhai Road 96, Hefei, PR Chin, Hefei, China, ygyums@gmail.com

**1 - Reference Price Effect, Commitment in Competitive Environments**

Qinglong Gou, Associate Professor, University of Science and Technology of China, Jinzhai Road 96#, Hefei, China, tslg@ustc.edu.cn, Juan Zhang, Liang Liang, Erfeng Zhou

This paper analyzes a differential game of duopolistic rivalry over time in which firms use advertising and pricing as competitive tools considering reference price effect. We propose two alternative strategies that firms can choose: advertising or pricing commitment. A model is developed to study reference price and explicit solutions of optimization problems are derived. The numerical results show that each of the two commitments can be superior to the other one under some certain conditions.

**2 - Carbon Emission Efficiency Evaluation with Performance Standards via Data Envelopment Analysis**

Gongbing Bi, China University of Science and Technology, China, bgbwhl@ustc.edu.cn, Wei Dong

Carbon emission performance gradually gains its concern worldwide. Data Envelopment Analysis (DEA) is the very method to measure the performance. This paper builds carbon emission performance standards innovatively by testing historical data. Based upon the conventional DEA model and the performance standards of carbon emission for all countries, efficiency comparison and potential reductions in carbon emission can be made between original countries and the newly set standard countries.

**3 - Exploratory Study on the Dimensions of E-tailing Service Reliability**

Qianqian Zhao, University of Science and Technology of China, 96 Jinzhai Rd, USTC, Hefei, AH, 230026, China, 111.888.6@gmail.com, Jin Qin, Qi Chen

E-tailing service reliability is a key attribute of service quality. We take two steps to identify the determinants of E-tailing service reliability. First, business process analysis is carried out to capture stages of the E-tailing process and a list of reliability factors is developed. Second, importance of each reliability factor is quantified through factor analysis of data obtained from a survey targeting internet shoppers, and determinants of E-tailing service reliability are identified.

**4 - Inventory Policy for Spare Parts in Parallel Systems with Reliability Requirements**

Ye Shi, Management School, USTC, JinZhai Road 96, Hefei, PR China, Hefei, Anhui, 230026, China, hecralies@gmail.com, Yugang Yu

We consider a finite horizon, single product, periodic review inventory model in which demand follows a Poisson process under reliability requirement. Ordering decisions are made at the beginning of each period and backlogging is not considered. Ordering cost includes a fixed cost. We show the cost function is k-convex. A sufficient condition for unimodality of the cost function is identified. Unimodality is not a special case of k-convexity and helps develop efficient algorithm.

**5 - Dual-channel Coordination Mechanism Based on Product Life Cycle**

Jun Wu, Associate Professor, Beijing University of Posts and Telecommunications, No.10 Xi Tu Cheng Road, Haidian District, Beijing, China, junwu@bupt.edu.cn

In this paper, we study a supply chain system consisting of one manufacturer and one retailer. The product in such a supply chain shows a short life cycle. We focus on the problem that whether an E-channel is beneficial to a supply chain system and how to design a mechanism for channel coordination.

■ **TA11**

Room 209A

**Data Mining and Human Factors in Healthcare Systems**

Cluster: OR/MS in Medicine and Healthcare  
Invited Session

Chair: Art Chaovalitwongse, Associate Professor, University of Washington, Seattle, WA, 98195, United States of America, artchao@u.washington.edu

Co-Chair: Shouyi Wang, Research Scientist, University of Washington, 3311 NE 65th Street, Seattle, WA, 98115, United States of America, shouyi@u.washington.edu

**1 - Supervised Learning Methods for Identifying Subcortical Targets to Treat Parkinson's Disease**

Young Seon Jeong, Post Doctorial Fellow, Khalifa University of Science, Technology and Research, P O Box 127788, Abu Dhabi, United Arab Emirates, young.jeong@kustar.ac.ae, Art Chaovalitwongse, M.K. Jeong, Shabbar F. Danish, Stephen Wong

This talk presents several supervised learning methods to construct pattern recognition models from previously acquired microelectrode recordings (MERs) with labeled subcortical structures. Our approaches are based on statistical feature extraction, time-frequency analysis, and time series classification. The results of our study demonstrate that our approaches can be used for functional localization of subthalamic nucleus (STN) from MER, with close to 90% accuracy.

**2 - Automated Analysis of 3D Glenoid Version**

Kang Li, Assistant Professor, Rutgers University, 96 Frelinghuysen Road, Core Building, Room 228, Piscataway, NJ, 08854, United States of America, kl419@rci.rutgers.edu

Establishment of true glenoid version in the setting of shoulder arthroplasty is of vital importance as improper version of components may lead to abnormal loading of the glenoid component and poor clinical results. This talk presents an automatic method for determining glenoid version and establishing the relationship between extra-articular landmarks and glenoid surface. The method allows a more accurate estimation of glenoid bone loss and normal version for reconstructive purposes.

**3 - Review of Human Error Analysis Techniques in Healthcare**

Tingting Huang, Postdoctoral Researcher, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, htt0905@gmail.com

Human error analysis (HEA) is very useful in preventing and reducing severe accidents in a system and thus it has been paid more attention to. Research on HEA has been well developed in recent years. Many techniques have been built, especially in engineering area like aviation and nuclear industry, and some of them find their applications in healthcare area. This presentation reviews the techniques of HEA in healthcare area including human error identification, analysis and quantification.

#### 4 - Adaptive Learning Approaches for Online Monitoring and Prediction of Epileptic Seizures

Shouyi Wang, Research Scientist, University of Washington, 3311 NE 65th Street, Seattle, WA, 98115, United States of America, shouyi@u.washington.edu, Stephen Wong, Art Chaovalitwongse

This talk presents a novel adaptive learning framework, which combines reinforcement learning, online monitoring, and feedback control theory to make online prediction of epileptic seizures. The proposed adaptive prediction approach can be readily integrated to any clinical EEG system, and achieves personalized seizure prediction through online monitoring of EEG recordings from a patient.

#### ■ TA12

Room 209B

#### Pricing and Financial Issues in Supply Chains

Contributed Session

Chair: Wei Luo, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, wei.luo@duke.edu

##### 1 - Retail Fixed Markup under Price Dependent Demand

Fei Qin, University of Cincinnati, 2925 Campus Green Dr, Carl H. Lindner College of Business, Cincinnati, OH, 45221, United States of America, qinfi@mail.uc.edu, Michael Fry, Yong Liu, Amitabh Raturi

We review both single and multi-period modeling of retail fixed markup (RFM) policies in decentralized supply chains under price-dependent demand. We show that RFM policies can coordinate the supply chain in both single- and multiple-period settings under a variety of scenarios. We then describe behavioral experiments to test empirically if the fixed markup value induces systematic decision biases that will affect supply chain performance in ways not captured in the analytical models.

##### 2 - Value of Reverse Factoring in Multi-stage Supply Chains

Hande Cetinay, Msc, TU Eindhoven, Paviljoen E13, Eindhoven, 5600 MB, Netherlands, h.cetinay@tue.nl, Fehmi Tanrisever, Matthew Reindorp, Jan Fransoo

We consider commercial transactions of a large corporate customer with a small/medium-sized supplier. We show how application of reverse factoring – a popular product within the broad field of supply chain finance – influences the operational and financial decisions of these firms. We determine the individual benefit that each firm can obtain from a given reverse factoring arrangement, and then characterize their participation constraints, and ultimately the total benefits for the supply chain.

##### 3 - Pricing Strategies on the Supply Chain with Selling Products in Other Regions via E-Commerce

Saiang Gao, Guanghua School of Management, Peking University, Guanghua School of Management, Peking University, Beijing, 100871, China, saiang.gao@pku.edu.cn, Lihua Chen, Xiaona Zheng

In China, it is a widely observed phenomenon that wholesaler merchants or retailers sell the goods that they possessed across region border via e-commerce channels. But the manufacturer's regional pricing strategy will be badly hurt, and some distribution system will go chaos. This paper will give a quantitative analysis on the facts including model of how do manufacturers change the dealer's price while taking e-commerce sales into consideration.

##### 4 - Dynamic Inventory Planning Models Considering Supplier Selection and Transportation Costs

Victor Valdebenito, Analytics Manager, Kimberly Clark, Av. del Valle 725, piso 4, Huechuraba, Chile, victorvaldebenitoc@yahoo.com

A multi-period single-product inventory lot-sizing model for a serial supply chain problem is presented. The model determines the optimal inventory policy that coordinates the transfer of materials between consecutive stages while properly placing purchasing orders and satisfying customer demand on time. A general version of the model is formulated as a MINLP, where transportation costs are either represented by piecewise linear functions or approximated by power or quadratic functions.

##### 5 - Integrating Inventory Replenishment and Cash Payment Decisions in Supply Chains

Wei Luo, Duke University, 100 Fuqua Drive, Durham, United States of America, wei.luo@duke.edu, Kevin Shang

We study a two-stage supply chain in which each location procures inventory based on cash available. We consider different payment schemes and derive joint optimal and near-optimal inventory and payment policies. Our study reveals insights on how firms should manage their working capital in order to achieve the supply chain efficiency. We also characterize the conditions under which the value of the flexible payment is most significant.

#### ■ TA13

Room 210A

#### Real Options, Assymmetric Information, and Incentive Design

Contributed Session

Chair: Kyung Min, Iowa State University, 3004 Black, IMSE Department, Ames, United States of America, jomin@iastate.edu

##### 1 - Strategic R&D Timing under Innovative Capabilities Asymmetry: A Real Options Game-theoretic Approach

Jianzu Wu, Dr., Lanzhou University, 222 South Tianshui Road, School of Management, Lanzhou, 730000, China, jzwwu@lzu.edu.cn

This paper investigates the impacts of uncertainty and innovative capabilities asymmetry on the strategic R&D timing of two competitive firms. We show that when both asymmetries are small, the high-capabilities firm preempts the low-capabilities one and invests in R&D firstly. When the innovative capabilities asymmetry becomes sufficiently large, firms invest in R&D sequentially. When innovative capabilities asymmetry is relatively low but uncertainty is high, firms invest in R&D simultaneously.

##### 2 - Impact of Asymmetric Inventory Information on Dynamic Supply Chain Decision Making

Yuyue Song, Associate Professor, Memorial University of Newfoundland, St. John's, NL, A1B3X5, Canada, ysong@mun.ca

We consider a manufacturer-retailer chain over a two-period selling season. The retailer's demand in each period is price sensitive. We assume that the retailer's initial stock level at the beginning of the second period is not available to the manufacturer. Our focus is to investigate the impact of this asymmetric inventory information on the supply chain decision making.

##### 3 - Optimal Retailer's Ordering Policies for Deteriorating Items under Partial Trade Credit Financing

Jianlong Chang, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, Xi'an, 710049, China, chang.jl@stu.xjtu.edu.cn, Tao Jia

The EOQ inventory model for deteriorating item was considered. In a single item distribution channel, the supplier offers the retailer a partially permissible delay in payment, while the retailer in turn provides the trade credit period to his/her customers. Six distinct cases of the system were explored, after analyzing the cost structure of the retailer under every scenario. Upon this, several propositions were developed to efficiently determine the optimal ordering policy for the retailer.

##### 4 - Wind Farm Repowering Decisions: A Real Options Approach

Kyung Min, Iowa State University, 3004 Black, IMSE Department, Ames, IA, United States of America, jomin@iastate.edu, Chenlu Lou

There have been substantial increases in the construction and operation of wind farms across the U.S.A. and the world, which will lead to a significant number of wind farm repowering decisions soon. In this paper, we formulate and analyze mathematical models from a real options perspective with the operation and maintenance cost following the geometric Brownian motion process, and 2) derive managerial insights and economic ramifications with guidelines for relevant government policy makers.

#### ■ TA14

Room 210B

#### Matrix-Analytic Methods and Their Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Qi-ming He, Professor, University of Waterloo, 200 University Avenue West, Department of Management Sciences, Waterloo, ON, N2L 3G1, Canada, q7he@uwaterloo.ca

##### 1 - A Matrix Exponential Solution to the Maximum Number of Individuals Alive in Host-Parasite Models

Martin Lopez Garcia, Complutense University of Madrid, Dept. of Statistics and Operations Research, Faculty of Mathematics, Madrid, 28040, Spain, martin\_lopez@mat.ucm.es, Antonio Gomez-Corral

We characterize the distribution of the maximum number of individuals alive during a fixed time interval in host-parasitoid models, in terms of a matrix exponential form. We present simple conditions on the rates of change of population sizes for the matrix exponential solution to be explicit or algorithmically tractable. Our solution, based on splitting methods, allows us to obtain global error bound, by using bounds based on the spectral norm and the norm induced by the 1-infinity vector norm.

**2 - Optimal Pricing Strategy of a Service Firm with Trial Service**

Zhaotong Lian, Professor, University of Macau, Faculty of Business Administration, Macau SAR, China, lianzt@umac.mo, Wenhui Zhou

In the paper, an priority queuing system is developed for a service firm who provides non-free service to membership customers and provides free trial service to other customers as well. By using the matrix-geometric technique, we obtain the expected waiting time of the membership customers and other performance measures. We then derive the optimal pricing policy for the company. Some managerial insights are given after analyzing the numerical results.

**3 - Information Effects on Performance of Stochastic Service Systems with Customer Choice Behavior**

George Zhe Zhang, Professor, University of Simon Fraser, Burnaby, BC, Canada, gzhang@sfu.ca, Paul Hsing Luh, Chun-min Lin

An important question in a waiting line service system is whether the real-time congestion information affects. We consider a setting with two service options for customer to choose. One channel is the free service and the other is the paid service with a shorter waiting time. Using Matrix Analytical Method and simulations, we evaluate the impact of the information on the system performance.

**4 - Optimal (r, Q) Policy for an Inventory-Production System**

Qi-ming He, Professor, University of Waterloo, 200 University Avenue West, Department of Management Sciences, Waterloo, ON, N2L 3G1, Canada, q7he@uwaterloo.ca, Hanqin Zhang

We consider a system consisting of a warehouse and a production facility. An (r, Q) policy is used for inventory management in the warehouse. A quantity policy is used for shipment consolidation in the production facility. An algorithm is developed for computing the expected system costs. We also explore methods for finding the policy for inventory management in the warehouse and shipment management in the production facility that minimizes the expected system costs.

**TA15**

Room 212A

**Online Marketing**

Sponsor: Marketing Science

Sponsored Session

Chair: Zhanbo Zhao, Associate Professor, Peking University, No. 516, No.1 Guanghua Building, Pku, Beijing, 100871, China, zhaozhanbo@ss.pku.edu.cn

**1 - Effects of Average Rating on Online Review Adoption: An Attribution Perspective**

Jun Pang, Renmin University, No.59 Zhongguancun Street, Beijing, China, pangjun@rbs.org.cn

The present research investigates the effect of average rating on online review adoption and identifies the underlying mechanisms from an attribution perspective. We find that the presence of a conflicting average rating decreases review adoption because it induces non-product-related attributions of the review, and these effects are moderated by review valence and product type. In contrast, the presence of a consistent average rating has little impact on consumers' review adoption.

**2 - Competitors' vs. Focal Keywords: An Empirical Analysis of Sponsored Search Advertising**

Xiaomeng Du, Peking University, China, fanci814@pku.edu.cn, Meng Su, Rui Pan

The purpose of this paper is to examine the strategic difference between competitors' keywords and focal keywords, and to study the influence of other keyword characteristics on the performance of the advertising campaign. We build a nonlinear simultaneous equation model and use the iterated GLS ('IZEF') estimator to identify the parameters. Our results suggest that the optimal advertisement design for focal keywords and competitors' keywords should be differentiated.

**3 - The Persuasion Effects of Online Reviews: A Construal Level Theory Perspective**

Bingyan Hu, Fudan University, China, penguin20061116@gmail.com, Liyin Jin, Yanqun He

Based on the construal fit theory, we suggest that consumers' evaluation of online reviews is a function of the time frame of their intended purchase. When the purchase is for the near(distant) future, recent(past) online reviews have a greater impact on influencing consumers' preference. As the underlying mechanism, we demonstrate that an online review is perceived to be more relevant when there is a construal fit between the recency of a review and the temporal distance of intended purchase.

**4 - Theoretical Model and Empirical Study of Continual Usage Intention of Sina Microblogging**

Qun Cao, Peking University, D302,U1,21 Building, Wan Quan, Xinxin JiaYuan, Beijing, China, caoqun881013@126.com

The objective of the paper is to explore the factors that encourage people to intend to rather than actually use Sina micro blog, the most popular one in China. A conceptual model based on the integrated TPB and TAM is addressed. Set of hypotheses are proposed regarding the effects on continual usage intention through user satisfaction and community norm. An online survey was conducted. Theoretical and practical implications are considered.

**TA16**

Room 212B

**Interdisciplinary Topics between IS and OM**

Cluster: Interface between Operations Management and Marketing  
Invited Session

Chair: Xianjun Geng, UT Dallas, 800 W Campbell Rd, SM 33, Richardson, TX, 75080, United States of America, geng@utdallas.edu

**1 - Price Matching or Simultaneous Negotiation? A Selection Dilemma**

Gangshu Cai, Kansas State University, Department of Management, Manhattan, KS, 66506, United States of America, gcai@k-state.edu, Weixin Shang

This paper investigates two different negotiation mechanisms, price matching negotiation and simultaneous negotiation. We show firms encounter a selection dilemma in choosing a specific negotiation mechanism for the whole industry. Nevertheless, the firms can be coordinated so price matching negotiation mechanism can be mutually beneficial to all firms.

**2 - Outsourcing Competition and Information Sharing with Asymmetrically Informed Suppliers**

Ling Xue, Kania School of Business, University of Scranton, Scranton, PA, United States of America, xuel2@scranton.edu, Xia Zhao, Fuqiang Zhang

We study an outsourcing problem where two service suppliers compete for the service contract from a client. The suppliers face uncertain service cost which is dependent on the client's type. The suppliers receive correlated private signals and compete under asymmetric information. We characterize the equilibrium outcome of the supplier competition and find that the client does not necessarily have incentives to reduce the level of information asymmetry.

**3 - Bundling under Limited Supply**

Qingning Cao, The University of Texas at Dallas, 800 West Campbell Rd, SM30, Richardson, TX, 75080, United States of America, qingning.cao@utdallas.edu, Jun Zhang, Kathryn E. Steckle

This paper examines a retailer's two-product bundling decision when the supply of one product is limited. This paper derives the retailer's optimal prices, stocking levels, and profits under unbundling and bundling. Demonstrating that limited supply can induce the retailer to bundle, this paper highlights a new supply-side rationale for bundling.

**4 - An Economic Analysis of Revenue Model for Online C2C Platforms**

Jianqing Chen, The University of Texas at Dallas, Jindal School of Management, Richardson, TX, 75252, United States of America, chenjq@utdallas.edu, Ming Fan, Mingzhi Li

The two leading online consumer-to-consumer platforms use very different revenue models: eBay.com in the United States uses brokerage model, whereas Taobao.com in China uses advertising model. This paper studies how a platform should choose and design its revenue model. We find that matching probability on a platform plays a critical role in determining which revenue model can generate more revenue for the platform.

## ■ TA17

Room 213A

### Joint Session HAS/ OR/MS in Medicine: Simulation and Optimization in Health Services

Sponsor: Health Applications & OR/MS in Medicine and Healthcare  
Sponsored Session

Chair: Dali Zhang, Analyst, Singapore Health Services Pte. Ltd.,  
Connection One, Jln Bt Merah, Tower3 #06-08, Singapore, 150168,  
Singapore, zhang.dali@singhealth.com.sg

#### 1 - Cost Effectiveness Analysis for Innovative Mental Health Care for Children and Youth

Michael Zhang, Associate Professor, Saint Mary's University,  
903 Robie Street, Halifax, NS, B3H 3C3, Canada,  
michael.zhang@smu.ca

In Canada 15-18% of children have mental health problems. However, only 15-30% receive timely mental health services due to treatment barriers. A telephone-based system has been developed to provide mental health services for children with mild symptoms. Compared with usual care, the new system resulted in significant diagnosis decreases among children with disruptive behavior or anxiety. The study presents a comprehensive economic evaluation of the system.

#### 2 - Dynamic Control of Emergency Medical Services with Patient Transfers and Abandonments

Jingui Xie, Associate Professor, University of Science and  
Technology of China, China, xiej@ustc.edu.cn

Motivated by the time-critical situations in emergency medical services where conditions of patients may deteriorate with time, we study the dynamic control of medical services with patient transfers and abandonments. There are two types of patients: critical and non-critical. While waiting, non-critical patients may become critical and critical patients may leave the system.

#### 3 - Improved Quality of Life for People with Bipolar Disorder Through Personalised Ambient Assessing

Syed Mohiuddin, Research Fellow, University of Manchester,  
Health Economics, Jean McFarlane Building, Oxford Road,  
Manchester, M13 9PL, United Kingdom,  
syed.mohiuddin@manchester.ac.uk, S.C. Brailsford, M. Connock

Bipolar disorder is a mental illness allied with mania and depression which have a major impact on quality of life. To detect the early onset of an acute episode, an intervention called Personalised Ambient Monitoring (PAM) was developed. We linked bipolar health related utilities to a previously developed disease state transition model to determine quality adjusted health gained. PAM can be combined with a suitable pharmacotherapy to help bipolar patients gain more quality adjusted life years.

#### 4 - Robust Inventory Management for Surgery Instruments

Dali Zhang, Analyst, Singapore Health Services Pte Ltd,  
Connection One, Jln Bt Merah, Tower3 #06-08, Singapore,  
150168, Singapore, zhang.dali@singhealth.com.sg, Melvyn Sim,  
Yew Yan Wong, Jin Qi

We propose a robust optimization model for the inventory control of surgery instruments in a multi-period time horizon. In the model, the number of surgeries is ambiguous with limited information on its distribution such as mean, support and some measures of deviations. Compared with the expected cost minimization model, we present the results to show how our model can be used to averse the shortage-risk of instrument resources, and enhance the satisfaction levels at the surgery departments.

## ■ TA18

Room 213B

### Financial Engineering

Contributed Session

Chair: Jiming Peng, University of Illinois, 104 S. Mathews Ave,  
Urbana, IL, United States of America, pengj@illinois.edu

#### 1 - Operational Hedging Strategies and Competitive Exposure to Exchange Rates

Ping Su, Assistant Professor of Operations Management, Hofstra  
University, 134 Hofstra University, Hempstead, NY, United States  
of America, ping.su@hofstra.edu, Lingxiu Dong, Panos Kouvelis

We investigate the impact of operational flexibility on firms' exposure to currency fluctuations in the presence of global competition. We consider a global firm who sells as a monopolist in the domestic market, and sells to a foreign market facing competition. We compare the effects of three operational strategies. We show that natural hedge is not effective for profit maximization, and illustrate the robust profit maximizing and down-side risk control of operational hedging approaches.

#### 2 - Default Swap Games

Kazutoshi Yamazaki, Assistant Professor, Osaka University,  
1-3 Machikaneyama-cho, Center for the Study of Finance and  
Insurance, Toyonaka City, 560-8531, Japan,  
k-yamazaki@sigmath.es.osaka-u.ac.jp, Tim Leung,  
Masahiko Egami

We study game-type credit default swaps that allow the protection buyer and seller to raise or reduce the respective position once prior to default. Under a structural credit risk model based on spectrally negative Levy processes, we apply the principles of smooth and continuous fit to identify the equilibrium exercise strategies for the buyer and the seller. We then rigorously prove the existence of the Nash equilibrium and compute the contract value at equilibrium.

#### 3 - A Real Options Approach to the Valuation of Cross-Training

Mohamed Wahab Mohamed Ismail, Associate Professor, Ryerson  
University, 350 Victoria Street, Toronto, ON, M5B 2K3, Canada,  
wahab@ryerson.ca, Thanasiri Muttulingam, Mohamed Jaber

Learning and forgetting are two important characteristics in manufacturing environments where workers are cross-trained to increase their flexibility of adapting to different tasks. The manufacturing system produces a product and its demand follows a three-regime product life cycle. A real options approach to the valuation of cross-training is proposed. Numerical examples are presented to show the value of cross-training under different scenarios.

#### 4 - Optimal Deleverage Strategies with Linear Price Impact

Jiming Peng, University of Illinois, 104 S. Mathews Ave., Urbana,  
United States of America, pengj@illinois.edu, Jingnan Chen,  
Liming Feng, Yinyu Ye

In this talk, we consider the nonconvex quadratic optimization model for assets liquidation with linear price impact. We characterize the optimal liquidation strategies via the optimality conditions in optimization and discuss how to solve the nonconvex QP under mild assumptions on the price impact.

## ■ TA19

Room 215

### Technology Management and Transition

Contributed Session

Chair: Jian Gang Gong, PhD Candidate, Peking University, Rm579,  
Building 2, Chang Chun Xin Yuan,, Beijing, China, gjg302@sohu.com

#### 1 - Identifying Patent Infringement using a SAO-based Product-Patent Map

Inchae Park, Dongguk University-Seoul, E407, 3-26 Pil-dong,  
Chung-gu, Seoul, Korea, Republic of, inchae.j.park@gmail.com,  
Byungun Yoon

This research aims at proposing a method to identify the possibility of patent infringement by developing a SAO(Subject-Action-Object)-based product-patent map. Semantic patent analysis is conducted through SAO extraction from both patent and product documents. Patent infringement is explored by analyzing a map and various indices based on technological similarity between SAO structures. The suggested method will contribute to applying SAO technique to establishing an effective patent strategy.

#### 2 - New Product Strategy for Competing Innovators in Markets with Network Effects

Wei Wang, Peking University, No.5 Yiheyuan Road,  
Peking University, Beijing, China, wangwei2009@pku.edu.cn,  
Tianxiao Gong, Lihua Chen

We analyze the optimal new-product introduction strategy of two competing firms in a market with network effects and heterogeneous customers. Firms may choose to enter the market earlier to establish an initial user base and enjoy a monopolist situation, or to postpone introduction in order to pursue a more advanced product which increase customers' willingness-to-pay.

#### 3 - Hydrogen Vehicle Diffusion under the Conditions of Technological Progress: An Agent-based Model

Markus Günther, Bielefeld University, Universitaetsstr. 25,  
Bielefeld 33615, Martin Zsifkovits, Kurt Heidenberger

The market introduction of hydrogen vehicles faces a number of challenges arising from technological and market uncertainty. Additionally the availability of the corresponding infrastructure is crucial and faces a "chicken and egg" phenomenon. In order to investigate the diffusion of hydrogen vehicles we introduce an agent based model considering influencing factors like technological enhancements, complementary infrastructure, different public actions and spatial effects.

#### 4 - CIO Transformational Leadership: IT Climate and Information Technology Assimilation

Jian Gang Gong, PhD Candidate, Peking University, Rm. 579, Building 2, Chang Chun Xin Yuan., Beijing, China, gjg302@sohu.com

CIO is the director leader of an organization's IT assimilation. The leadership of a CIO will play an important role to the IT assimilation of an organization. However, the function and importance of this role has not been given enough attention until now, so we know little about it. Based on the theory of transformational leadership, in this paper we study how the transformational leadership of CIO will influence the success of an organization's IT assimilation. The analysis show us that CIO's transformational leadership behavior, including charisma leadership, appealing behavior, intellectual stimulating and individualized consideration, will obviously influence the IT climate of an organization and then this climate will influence the assimilation of the information technology.

### ■ TA20

Room 207

#### Software Tutorials

Cluster: Software Tutorials

Invited Session

##### 1 - Flexsim 3D Process Flow Simulation

Regan Blackett, FlexSim Software Products, Inc., 1577 North Technology Way, Building A, Suite 2300, Orem, UT, 84097, United States of America, regan.blackett@flexsim.com

Flexsim is a 3D process flow simulation software used to model and simulate production and material handling processes for the express purpose of increasing throughput at less cost. 'What if' conditions can be input into a model and their impact simulated and verified before implementing them on the actual system.

##### 2 - Enjoy the Mathematical Modeling Experience with AIMMS

Ming Fang, Senior Operations Research Consultant, Paragon Decision Technology Pte. Ltd., 1739 So. Xizang Rd., 5-403, Huang Pu Dist., Shanghai, 200011, China, ming.fang@aimms.com

The construction of an optimization model is an enjoyable activity. Furthermore, the creation of something useful using state-of-the-art techniques is what we all like to do. In this demo we will show the set of tools in AIMMS that can help you to complete the creation of the model become a fun and enjoyable experience. We will start by presenting an overview of the capability of AIMMS, and follow by a demonstration of creating a model from start to end.

**Tuesday, 11:00am - 12:30pm**

### ■ TB01

Room 202B

#### SCM Disruption and Risk Management

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Fernando Marins, Professor, UNESP, R. Vigário Martiniano, 74, Guaratingueta, SP, 12501-060, Brazil, fmarins@feg.unesp.br

##### 1 - Supply Chain Risk Management in a Brazilian Aerospace Industry

Fernando Marins, Professor, UNESP, R. Vigário Martiniano, 74, Guaratingueta, SP, 12501-060, Brazil, fmarins@feg.unesp.br, Kelly Funo, Valerio Salomon, Ubirajara Ferreira, Jorge Muniz, Jose Montevechi

We present an exploratory research at an important Brazilian aerospace company on supply chain discontinuity. Senior Managers of the Company assessed risk factors as Quality, Productivity, Supply Chain, Business Strategy, Organization, Environmental & Natural Political, Indicators, Product Management, and Information System. To prioritise risks factors, it was applied the AHP. The most relevant risks were: Quality and Productivity.

#### 2 - A Study on Emergency Management of Demand Disruption Based on Supply Chain Competition

Yanshan Zhou, Harbin University of Science and Technology, Mailbox 119, 52 Xuefu Road, Nangang District, Harbin, hl, 150080, China, yszhou76@hrbust.edu.cn, Chunxian Teng, Nan Song

Based on the analyses on SC competition, suppliers are taken as study object; the SC competition model is established by using optimization theory. Then, they analyze some strategies about improving the advantages of supply chain competition under the integrated decision, the impact of demand disruption and build the demand disruption model. According to the extent of the disruption, responsive strategies are made accordingly, the influence of demand disruption on supply chain is reduced.

#### 3 - Coordination and Optimization Analysis with Downside-Risk-Averse Retailer in 3-echelon Supply Chain

Yumei Hou, Professor, Yanshan University, College of Business and Management, Qinhuangdao, China, hym\_1220@163.com, Xin Tian, Lijun Ma, Fangfang Wei

Two kinds of advanced coordination revenue sharing contract for 3-echelon supply chain are proposed. Furthermore, we derive: (1) The two advanced coordination contracts and optimal analysis; (2) Under the coordination contracts we derive the optimal order quantity of a downside-risk-averse retailer in a supply chain with a risk-neutral manufacturer and a vendors and propose an improved contract which coordinates the supply chain.

### ■ TB02

Room 202A

#### Data Analysis and Its Applications in Industries

Sponsor: Data Mining

Sponsored Session

Chair: Jun Wu, Associate Professor, Beijing University of Posts and Telecommunications, No.10 Xi Tu Cheng Road, Haidian District, Beijing, China, junwu@bupt.edu.cn

##### 1 - The Empirical Study of Mobile Data Service Based on Technical Innovation Diffusion Model

Yuan Yuan, Graduate Student, Beijing University of Posts and Telecommunications, No. 10 Xi Tu Cheng Road, Haidian District, Beijing, 100876, China, 369263456@163.com

This paper mainly discusses two problems. The first is about how to determine a mobile data service's performance in the market before its launch, and give some suggestions. The second is to forecast a mobile data service's performance after its launch into the market for some time. The results show that contingent diffusion model gets better effects.

##### 2 - The Simulation of a Dual-channel System Based on the Product Short Life Cycle

Xiangjin Shen, Graduate Student, Beijing University of Posts and Telecommunications, No.10 Xi Tu Cheng Road, Haidian District, Beijing, 100876, China, qqxuewuhun@yahoo.com.cn

This paper aims to test and verify a dual-channel model using the simulation. The simulation consists of two parts. The first is a case of dual-channel in which manufacturers take charge of the e-channel, while the second is another case of dual-channel in which retailers are in charge of the e-channel. Furthermore, this paper compares the profit and the demand between these two cases.

##### 3 - Model Selection in Financial Market Prediction using Fuzzy Soft Sets

Wei Xu, Dr., School of Information, Renmin University of China, No. 59, Zhongguancun Road, Beijing, 100872, China, weixu@ruc.edu.cn

In this paper, a novel model selection method for financial market is proposed based on fuzzy soft sets. In the proposed approach, each of the candidates is firstly constructed by training on financial data. Then, the forecasting accuracy of each candidate is transferred to fuzzy membership function. Finally, the proper forecasting model is selected from those candidates based on fuzzy soft sets. The empirical results show that the proposed method outperforms traditional ones.

## ■ TB03

Room 203B

### Innovation Strategies in a Service-driven Economy

Sponsor: Service Science

Sponsored Session

Chair: Hervé Mathe, ESSEC, Avenue Bernard Hirsch, 75005, Cergy Pontoise, Il, 95021, France, mathe@essec.edu

#### 1 - Business Model Innovation as a Driver of Innovative Mobility Solutions

Hervé Mathe, ESSEC, 1 Avenue Bernard Hirsch, 75005, Cergy Pontoise, Il, 95021, France, mathe@essec.edu

As sustainable transportation solutions become a major preoccupation in today's society, the development of innovative solutions in this domain is of key importance. By exploring a number of innovative business ventures in sustainable transport solutions, we then propose a model to guide the innovation process and aid the discovery of new business models in this field.

#### 2 - The Stakes of Responsible-Innovation: How to Manage 'Responsible-Innovation' in Processes?

Xavier Pavie, Dr, ESSEC Business School, 1 Ave. Bernard Hirsch, Cergy Pontoise, 95021, France, pavie@essec.edu

The outcome of this research reveals that on the one hand the 21st century's innovator must adopt a new behavior that may question his own fundamentals and on the other hand the innovator must not only think in terms of performance but also in terms of responsibility. In consequence, companies, innovators integrate new responsibility-based criteria and take them into account at every step of the long innovation process.

#### 3 - Positive Management as a Driver of Employee Engagement and Quality of Life in Low-cost Service Organizations

Marwyn O'Keefe, ESSEC Business School, Cergt - Pontoise, France, okeefe@essec.edu

This paper analyzes positive management as a driver of employee engagement and quality of life in low-cost service organizations. Low-cost service organizations are often characterized by high levels of turnover, absenteeism, and low levels of employee satisfaction. This is mainly attributed to high levels of productivity, lower staff-client ratios, and greater role multi-functionality. The findings demonstrated that a positive management approach is compatible with the low-cost model.

## ■ TB04

Room 203A

### Transport and Trade Economics and Efficiency

Cluster: Maritime, Trade and Supply Chain Logistics

Invited Session

Chair: Anming Zhang, Professor, Univ. of British Columbia, Sauder School of Business, Vancouver, Canada, anming.zhang@sauder.ubc.ca

#### 1 - The Effect of Open Skies Agreements on Air Travelers' Fares

Jia Yan, Assistant Professor, Washington State University, Pullman, WA, 99164, United States of America, jiy@wsu.edu, Clifford Winston

This paper uses data from international airline markets to assess the effects of Open Skies agreements on air travelers' fares. We develop and estimate a model of airline market demand, supply, market structure, and regulatory regime. The estimated parameters are used to simulate the change in consumer surplus from Open Skies agreements on U.S. international routes and all other international routes.

#### 2 - Effects of High-speed Rail and Air Transport Competition on Prices, Profits and Welfare

Hangjun Yang, Assistant Professor, University of Intl. Business & Economics, School of Intl. Trade & Economics, Beijing, 100029, China, hangjunyang@gmail.com, Anming Zhang

This paper studies competition between air transport and HSR. While airlines are assumed to maximize profit, HSR may maximize a weighted sum of profit and welfare. We show that both airfare and HSR fare fall as the weight on welfare increases, while airfare decreases, and rail fare increases, in airport access time. Welfare is higher under price discrimination when the travel benefit difference is sufficiently larger than the time value difference between business and leisure passengers.

#### 3 - Promoting Electric Automobiles: Supply Chain Analysis under a Government's Subsidy Incentive Scheme

Liping Liang, Assistant Professor, Lingnan University, 8 Castle Peak Road, Tuen Mun, Hong Kong - PRC, lipingliang@ln.edu.hk, Mingming Leng, Jian Huang, Jian Liu

We analyze a fuel automobile supply chain and an electric-and-fuel automobile supply chain in a duopoly setting, under a government's subsidy incentive scheme that is implemented to promote the electric automobile (EA). Benefiting from such a scheme, each EA consumer can enjoy a subsidy from the government. We examine the effectiveness of the scheme in improving the sales of EA and the social welfare.

#### 4 - Container Transshipment and Port Congestion

Loo Hay Lee, NUS, Singapore, Singapore, iselee@nus.edu.sg, Ek Peng Chew, Minju Bae, Anming Zhang

We study duopolistic competition between hub ports for container transshipment. Based on non-linear transshipment demand, we apply a non-cooperative two-stage game. We show that shipping lines may have single or multiple Nash equilibria. The conditions for either outcome are complicated with interaction among demand nonlinearity, port price, transshipment coefficient and capacity. However, the key point can be summarized of the balance between transshipment benefits and congestion cost.

## ■ TB05

Room 205B

### Stochastic Optimization for Energy Industry

Cluster: Super/Special Sessions

Invited Session

Chair: Michael Chen, Assistant Professor, York University, 4700 Keele Street, Toronto, ON, Canada, chensy@mathstat.yorku.ca

#### 1 - Payment Cost Minimization Considering Wind Power Effects

Fangxing Li, Professor, University of Tennessee, MHK523, 1520 Middle Drive, Knoxville, TN, 37996, United States of America, flif@utk.edu

In this paper, the payment cost minimization (PCM) is addressed with the consideration of wind energy uncertainty. With the probabilistic wind generation and MCP, the expected value of the minimum payment cost can be calculated. To avoid the local minima and achieve global optimal PCM, the genetic algorithm is applied to solve PCM in this paper. The numerical results of the examples show that the proposed formulation and the solution can greatly reduce the consumer payments.

#### 2 - A Mathematical Model to Minimize Fuel Consumption in Freight Train Operations

Mingyuan Chen, Professor, Concordia University, 1455 de Maisonneuve West, Montreal, QC, H3G1M8, Canada, mychen@encs.concordia.ca, Sally Kassem, Subhash Rakheja

Fuel consumption is an important criterion in train operations and it depends upon many complex factors. Train speed control is achieved through switching the power notches which sets constant level of fuel supply to the engine in a diesel-electric locomotive. In this study we developed a math model to minimize the total fuel consumption by optimally selecting power notches in freight train operation to complete a journey within given travel time taking into account various track conditions.

#### 3 - Energy Portfolio Management with Entry Decision and Abandonment Option

Zhen Liu, Assistant Professor, Missouri University of Science & Technology, 600 W. 14th Street, Rolla, MO, 65409, United States of America, zliu@mst.edu

We study the optimal time to build a renewable plant to form portfolio, and optimal time to abandon a plant of a firm with a portfolio of plants to maximize the expected profit. We formulate the problems as mixed optimal stopping/control problems, and characterize the optimal strategies through numerical experiments.

#### 4 - A Stochastic Integer Programming Approach to the Optimal Thermal and Wind Generator Scheduling Problem

Michael Chen, Assistant Professor, York University, 4700 Keele Street, Toronto, ON, Canada, chensy@mathstat.yorku.ca, Ming Zhao

In recent years, the increasing capacity of wind energy, together with solar and other renewable energy, brings in a new challenge to the electricity generator scheduling. We will first model the complicated electricity grid, physics of generators, stochastic demand and wind power, and the day-ahead decision process. Based on this stochastic integer model, we develop an effective scenario-crossing deep cut, which accelerates the state-of-art CPLEX solver significantly.

## ■ TB06

Room 205A

### Innovative Supply Chains in China

Cluster: Supply Chain Management in China

Invited Session

Chair: Xiaolin Xu, Nanjing University, 22 Hankou Road, Nanjing, 210093, China, xuxl@nju.edu.cn

#### 1 - Inventory Management for Customers with Alternative Leadtimes in a Dynamic Environment

Lijun Ma, Shenzhen University, Rm.1416, Arts Building,, Shenzhen University, Shenzhen, China, lijun.ma@gmail.com, Songshan Dai

In this paper we consider the inventory management problem for a retailer facing two classes of customers in a dynamic environment. Using dynamic programming framework, we work out the optimal inventory rationing policy and the optimal inventory replenishment policy. We also study the demand induction and demand cannibalization effects under this setting.

#### 2 - Improve Processes or Buy Allowance? A Cost-benefit Analysis under Carbon-regulated Environment

Yanchun Pan, Shenzhen University, Naihai Ave. 3688, Nanshan District, Shenzhen, 518060, China, panyu@szu.edu.cn, Zhimin Chen, Ming Zhou

China is implementing a compulsory carbon-emission reduction program that uses administrative penalty and market trade as main means. In this paper, improve the manufacturing processes to reduce CO2 emission and buy additional emission allowance from the carbon market are considered as two options for enterprise to reach its emission goal. A cost-benefit analysis integrating with simulation is proposed to help enterprise balance between costs for green improvement, allowance and penalty.

#### 3 - Part it off or Sale Whole? Optimal Selling Policy of Dissolvable Product

Xiaolin Xu, Nanjing University, 22 Hankou Road, Nanjing, 210093, China, xuxl@nju.edu.cn

In this paper, we consider a decomposition system where the supplier produces products which would be sold by different components through different channels. We investigate the equilibrium behavior in the decentralized setting and design contractual arrangements between the involved parties.

## ■ TB07

Room 206A

### Sustainability and Green Logistics

Contributed Session

Chair: Elisabeth Gilmore, Assistant Professor, School of Public Policy, University of Maryland, 2101 Van Munching Hall, College Park, MD, 20742, United States of America, gilmore@umd.edu

#### 1 - Decision Making: Ocean Shipping Vessel Speed, Carbon Emission and Shipowner's Profit

Gang Li, Associate Professor, Shanghai Maritime University, 1550 Haigang Dadao, Pudong, Shanghai, China, liliganggang@hotmail.com, Huan Xu, Wei Liu

Memoir shows that shipping industry emits over 12 hundred million tons of CO2 every year, which composes approximately 4% of the total global carbon emission. Therefore reducing the carbon dioxide emissions from the shipping industry is necessary and urgent. This paper established the relations among ocean shipping vessel speed, carbon emission and shipowner's profit, built the relational functions, derived the reasonable speed under minimum carbon emission and optimum shipowner's profit.

#### 2 - Sustainability for Interorganizational R&D Networks: Maximizing Each Member's Value Creation

Ingo Michelfelder, TU Berlin, Strasse des 17. Juni 135, Berlin, Germany, ingo.michelfelder@gmail.com

This research introduces a new scale for measuring the success of multi-institutional R&D networks. The scale is based on a 2  $\Omega$  year field study and measures all major aspects that R&D network participants mentioned as potential areas of value creation, divided in the two subcategories organizational and individual value creation. Following a rational approach, value creation for all network members should be controlled and maximized as a guiding principle for sustainable network management.

#### 3 - Improving Efficiency and Sustainability of Green Supply Chain at the Product Design Stage

Ming-Chuan Chiu, Assistant Professor, National Tsing Hua University, No. 101, Section 2, Kuang-Fu Road, Hsinchu, 300, Taiwan - ROC, mcchiu@ie.nthu.edu.tw, Li-Wei Teng

In addition to technological performance and costs demanded by clients, enterprises nowadays have boarder aspects to consider while producing products. These concerns come from the increasing scarcity of resources and raw materials as well as increasing governmental and environmental regulations. This has pushed enterprises to develop and manufacture a product that can achieve the satisfaction of people, profit, and planet during its life cycle, which is also known as sustainability. In the last two decades, many research efforts have incorporated sustainability into product design. However, most of the studies either provided guideline or compromise solutions. Hence, enterprises who intend to improve sustainability couldn't find appropriate method for their company. There is a need to develop an appropriate methodology for enterprises to integrate product design, supply chain design and sustainability decisions at product design stage. This study will apply multiple objective optimization method to highlight the efficient design concepts using product manufacturability, supply chain network cost, lead-time, carbon footprint and reverse logistics cost as criteria. A case study will be presented to demonstrate the practicality of this methodology.

#### 4 - Cost-effective Reductions in US Residential Carbon Dioxide Emissions

Elisabeth Gilmore, Assistant Professor, School of Public Policy, University of Maryland, 2101 Van Munching Hall, College Park, MD, 20742, United States of America, gilmore@umd.edu, Inis Azevedo, Prithvi Acharya

We develop marginal cost curves for the abatement of carbon dioxide (CO2) emissions that can be optimized for different household CO2 targets in the US. We evaluate more efficient appliances and passenger vehicles. We find that a target slightly lower than the maximum possible emission reductions results in a substantial drop in the marginal cost of abatement. We conduct a sensitivity analysis, including switching from electric to natural gas and two stage abatement policies.

## ■ TB08

Room 206B

### Social Media and Mathematics

Sponsor: Computational Optimization & Applications (Sponsored by the Computing Society)

Sponsored Session

Chair: Hamid Noori, Professor, Wilfrid Laurier University, 75 University Ave., Waterloo, ON, N2L 3C5, Canada, hnoori@wlu.ca

#### 1 - Social Network Manufacturing (SNM) and Business Continuity Planning (BCP)

Hamid Noori, Professor, Wilfrid Laurier University, 75 University Ave., Waterloo, ON, N2L 3C5, Canada, hnoori@wlu.ca, Adrian Tan

Unexpected disruptions may hit firms' operations because of natural or human-triggered disasters. Essential resources in the SC of a firm may suddenly become unavailable. Firms that engaged in SNM leverage on interfirm relationships to obtain collaborative efforts and resources to achieve specific goals. By integrating the SNM principles of using social networks to efficiently and effectively obtain access to SC resources into its BCP, a firm may mitigate the effects of unexpected disruptions.

#### 2 - Customer Revenue Sharing Program in Online Social Media

Fouad H. Mirzaei, University of Western Ontario, Richard Ivey School of Business, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, fhassanmirzaei.phd@ivey.ca, Fredrik Odegaard, Xinghao Yan

Online social media (OSMs) have become a popular and growing phenomenon on the Internet. Given high competition over the Internet to attract users, a question that arises is whether OSMs should reward their contributing users. We model this competition by a duopoly game where users are either active or passive with respect to each OSM. We show this game has a unique Nash equilibrium in pure strategies and specify how OSMs derive the optimal reward payments.

### 3 - Understanding the Impact of Social Media on Short-Term Stock Performance

Wenjing Duan, Assistant Professor, The George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, wduan@gwu.edu, Yang Yu, Qing Cao

This study aims to investigate the effect of social media and conventional media, their relative importance, and their interrelatedness on short term firm performances. We use a novel and large-scale dataset that features daily media content across various conventional media and social media outlets for 862 public traded firms. Our findings suggest that different types of social media interrelate with conventional media to influence stock movement in various directions and degrees.

### 4 - Basic Social Math – Beyond Statistics, Testing Paradigms and Assumptions Against Empirical Evidence

Jared Lee Hanson, Grenoble Ecole de Management, & Oxford University, P.O. Box 45180, Riyadh, 11512, Saudi Arabia, jared.hanson@oba.co.uk

Neither normative nor descriptive modeling, as currently constituted, can achieve scientific objectivity. Within the statistical paradigm of quantitative & qualitative research, assumptions, values, & beliefs are not rigorously corresponded to empirical systems. Conversions of meaning to numbers and numbers to meaning rely on social constructions, not empirical evidence. This creates subjectivity in computations. Only the linguistic rigor of basic math can re-establish computational legitimacy.

## ■ TB09

Room 208A

### Algorithmic Advances in Optimization

Sponsor: Computational Optimization & Applications (Sponsored by the Computing Society)  
Sponsored Session

Chair: Alexander Engau, Assistant Professor, University of Colorado Denver, 1250 14th Street Suite 600, Denver, CO, 80202, United States of America, alexander.engau@ucdenver.edu

#### 1 - The Watermelon Algorithm for the Bilevel Integer Linear Programming Problem

Lizhi Wang, Iowa State University, 3016 Black Engineering, Iowa State University, Ames, IA, 50011, United States of America, lzwang@iastate.edu, Pan Xu, Yiming Yao

Discrete bilevel optimization problems have been studied for more than two decades, but there are only a handful of algorithms, most of which are heuristic in nature. We present a so-called Watermelon Algorithm for the bilevel integer linear programming problem, which can be proved to terminate finitely to the global optimal solution, if one exists. Computational experiment results will be reported to demonstrate the effectiveness of the algorithm.

#### 2 - New Computational Experiments with Binary Quadratic Optimization Models in Computational Biology

Alexander Engau, Assistant Professor, University of Colorado Denver, 1250 14th Street Suite 600, Denver, CO, 80202, United States of America, alexander.engau@ucdenver.edu, Gary Kochenberger

We present two integer programming models in molecular biology and study practical reformulations to compute solutions to these problems. In extension of several linearization techniques, we formulate corresponding semidefinite relaxations and compare previous results to a new heuristic search methods, that seems to outperforms any currently known method. Our new computational results highlight the possible advantages and remaining challenges of this approach especially on large-scale problems.

#### 3 - A Framework for Solving Mixed-Integer Quadratically-Constrained Quadratic Programs (MIQCQP)

Christodoulos Floudas, Princeton University, Engineering Quadrangle, Princeton, NJ, 08540, United States of America, floudas@titan.princeton.edu, Ruth Misener

We consider a framework for addressing mixed-integer quadratically-constrained quadratic programs (MIQCQP) to epsilon-global optimality. Algorithmic components include: reformulating user input, detecting special structure, generating tight convex relaxations, dynamically generating cuts, partitioning the search space, bounding the variables, and finding feasible solutions. We discuss the Global Mixed-Integer Quadratic Optimizer, GloMIQO, a software implementation integrating these components.

### 4 - Computing Strong Bounds in Combinatorial Optimization

Hans Mittelmann, Arizona State University, Box 871804, Tempe, AZ, 85287, United States of America, mittelmann@asu.edu

We will present three instances where semidefinite (SDP) relaxations of combinatorial optimization problems yield strong bounds: the quadratic assignment problem (QAP) including in dimensions higher than two, the spherical kissing number problem, and general binary codes. In the last two cases higher precision is crucial to solve the SDP problems. The QAPs considered include the optimal index assignment problem from communications.

## ■ TB10

Room 208B

### Topics in Operations Management I

Sponsor: Manufacturing & Service Oper Mgmt  
Sponsored Session

Chair: Chunming Shi, Assistant Professor, Wilfrid Laurier University, School of Business and Economics, 75 University Ave., W. Waterloo, ON, N2L3C5, China, cshi@wlu.ca

#### 1 - Matrix Representation for Coalition Analysis with Uncertain Preference in the Graph Model

Kevin Li, Associate Professor, University of Windsor, Odette School of Business, Windsor, ON, N9B 3P4, Canada, kwli@uwindsor.ca, Takehiro Inohara, Haiyan Xu

An algebraic approach is proposed to calculate coalition stabilities in the graph model for uncertain preference. This matrix representation is based on adjacency matrices, which possess useful algebraic properties for expeditiously carrying out coalition analysis with preference uncertainty and producing improved algorithms for solving generic graph problems.

#### 2 - Coordinating the Agriculture Supply Chain Affected by Survival Ratio and Price

Yong He, Dr, Southeast University, School of Economics and Management, Sipailou 2, Nanjing, 210096, China, hy@seu.edu.cn, Hongfu Huang

Besides the sale price, survival ratio is another important factor to affect the decision of product quantity in agriculture. By increasing the survival ratio, producers can get more finished products. But meanwhile, this will lead to more cost. An optimal strategy to coordinate the agriculture supply chain affected by survival ratio and price is presented in this article.

#### 3 - To Delegate or Not to Delegate: When Acquisition-retention Gap Influences Retention

Junhao Yu, School of Business Administration, Southwestern University of Finance and Economics, 555 Liutai Avenue, Wenjiang District, Chengdu, China, vincent.yu.junhao@gmail.com, Shaorui Li

While the negative effect of customer acquisition on retention has been studied, the influence of the gap between acquisition and retention efforts on retention performance receives little attention. We try to address the void by establishing a model to get the optimal delegation strategy for the acquisition and retention tasks, and the optimal compensation scheme. Furthermore, we seek to extend the study by considering the situation where company faces heterogeneous customers.

## ■ TB11

Room 209A

### Stochastic Modeling for Manufacturing and Service Supply Chains

Cluster: Super/Special Sessions  
Invited Session

Chair: Marc Lambrecht, Professor, KU Leuven, Faculty of Business and Economics, Naamsestraat 69, Leuven, B-3000, Belgium, Marc.Lambrecht@econ.kuleuven.be

#### 1 - Network and Contract Optimization for Maintenance Services with Remanufacturing

Kris Lieckens, KU Leuven, Naamsestraat 69, Leuven, 3000, Belgium, kris.lieckens@econ.kuleuven.be, Pieter Colen, Marc Lambrecht

Long term maintenance contracts often involve remanufacturing of some components removed during a machine overhaul. We optimize simultaneously the price, the overhaul interval, the logistic network and the manpower requirements, while taking into account the effect of price and machine availability on demand.

## 2 - Condition-based Maintenance Optimization for Multi-component Systems with Joint Maintenance Interval

Hao Peng, TU Eindhoven, Den Dolech 2, Paviljoen E.3, Eindhoven, 5612 AZ, Netherlands, H.Peng@tue.nl, Qiushi Zhu, Geert-Jan van Houtum

We propose a new condition-based maintenance policy for multi-component systems with stochastically and continuously deteriorations. To reduce the setup cost of maintenance, we create a joint maintenance interval in the mathematical model. The optimal maintenance control limits of all the degrading components in a system and the optimal joint maintenance interval are determined by minimizing the average long-run cost rate.

## 3 - Using Advanced Demand Information to Manage Order Fluctuations Caused by (s,S) Inventory Policies

Ann Noblesse, KU Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Ann.noblesse@econ.kuleuven.be, Marc Lambrecht, Benny Van Houdt, Robert Bouste

(s,S) inventory policies are often used in manufacturing and service supply chains. We investigate the resulting order pattern and study the impact on lead time. We assume that the demand process can be modeled as a compound Poisson process.

## 4 - Exact Safety Stock Solutions for the Proportional Order-up-to Policy with Stochastic Lead-Times

Xun Wang, Beihang University, School of Economics and Management, 37 Xueyuan Road, Beijing, 100191, China, paul.wong.buaa@gmail.com, Stephen Disney

Motivated by real-world data on global shipping lead-times we obtain exact analytical results describing the impact of stochastic lead-times on safety stocks in a supply chain that is controlled by the so-called Proportional Order-Up-To policy. Interestingly, we show service levels can sometimes be improved by reducing safety stock levels.

## ■ TB12

Room 209B

## Supply Chain Contracts and Coordination

Contributed Session

Chair: Hubert Pun, Assistant Professor, University of Western Ontario, Ivey Business School, London, ON, N6H0A4, Canada, hpun@ivey.ca

### 1 - Consignment Contract vs. Wholesale Price Contract in Competing Supply Chains

Yaner Fang, PhD Student, City University of Hong Kong, p7701, Academic 1, Hong Kong, China, yanefang@cityu.edu.hk, Biying Shou

This paper investigates two competing supply chains, each with a supplier and a retailer. The supplier offers a consignment contract or wholesale price contract to the retailer who decides the stocking level and the retail price. We investigate equilibrium behavior in three scenarios (consignment contract scenario; wholesale price contract scenario; hybrid scenario) and obtain dominant contract strategy according to varied demand price sensitivity and cost share rate.

### 2 - Competitive Channel Selection and Revenue Management in a Supply Chain with a Common Retailer

Tian Lin, PhD, Fudan University, 670 Guoshun Road, Shanghai, 200433, China, 11110690011@fudan.edu.cn, Weixin Shang, Xu Yifan

Why the dual channel(M) structure, where one company has both a direct and a retail presence, becomes so popular now? In this paper, we add competition in and consider the problem with a duopoly common retailer setting: two manufacturers and one common retailer, which the past literature doesn't consider. It is found M is a win-win structure compared with direct channel. However, whether M is better than retailer channel depends on the service level of the retailer, which isn't intuitive.

### 3 - Approximating the Performance of Last Mile Transportation System

Hai Wang, Doctoral Student/ Operations Research Center, Massachusetts Institute of Technology, 77 Massachusetts Ave. Cambridge, MA USA, United States of America, haiwang@mit.edu

The Last Mile Problem refers to the provision of travel service from the public transportation node to a home or office. We study the supply side of this problem in a stochastic setting, with batch demands resulting from the arrival of groups of passengers at rail stations or bus stops who request last-mile service. Closed-form bounds and approximations are derived for the performance of Last Mile Transportation Systems as a function of the fundamental design parameters of such systems.

## 4 - Coordinating Complementary Products and Competing Products

Hubert Pun, Assistant Professor, University of Western Ontario, Ivey Business School, London, ON, N6H0A4, Canada, hpun@ivey.ca

We investigate the channel structure problem when two competing firms are selling in two complementary markets and they are deciding whether to sell their products directly or through their competitors' retail outlets. We find that the market follower would sell the more undifferentiated product through the competitor. The market leader has the largest advantage when the cross-market externalities are strong, or when the products in the two markets are equally differentiated.

## ■ TB13

Room 210A

## Forecasting and Applications

Contributed Session

Chair: Youqin Pan, Salem State University, 352 Lafayette Street, Salem, MA, United States of America, youqinpan@my.unt.edu

### 1 - Robust Multiple Criteria Sorting under Partial Information

Jiapeng Liu, Student, School of Management, Xi'an Jiaotong University, Xi'an, China, Xi'an, 710049, China, liujiapeng\_xjtu@163.com

Abstract not available at this time.

### 2 - Analyzing Technology Spillover by Forecasting the Frequency of Patent Citation: A DEMATEL Approach

Seonkoo Jeong, Dongguk University - Seoul, E407, 3-26 Pil-dong, Chung-gu, Seoul, 100-715, Korea, Republic of, idyurika@naver.com, Yujin Jeong, Byungun Yoon

This research aims to propose a systematic method that investigates technology spillover by forecasting patent citation relationship from a patent database. The frequency of patent citation is estimated to analyze the impact that a technology gives to each technology category, applying a DEMATEL approach that derives a causal relationship and leverage of technologies. The proposed approach will contribute to establishing a technology strategy by finding an influential technology in the future.

### 3 - Imputing Unknown Competitor Activity and Prediction Capacity with Hidden Markov Models

Changan Zhang, PhD Student, Bentley University, 118 Holden Grn. Apt D, Cambridge, MA, 02138, United States of America, zhang\_chan@bentley.edu, Qizhi Wei, Dominique Haughton, John Lin, Danny Jin, Guangying Hua

A hidden Markov model is built to product sales volume in terms of promotion activities over several channels to estimate competitor's activity for the homogeneous product, and to identify a better marketing mix. However, ignoring the capacity of competitor's prediction activity may lead to suboptimal marketing mix decisions. This study introduces hidden Markov models to estimate and compare the estimating competitor's promotion activities and prediction capacity of multi-channel promotions.

### 4 - Cyclical Aspects of Business Cycle Turning Points Based on Empirical Mode Decomposition

Youqin Pan, Salem State University, 352 Lafayette Street, Salem, MA, United States of America, youqinpan@my.unt.edu, Zaiyong Tang, Elizabeth Haran, Saverio Manago

This paper investigates changes in the intensity and duration of US business cycles by analyzing the turning points chronology of US data. Modern business cycles seem to be characterized by the interaction of major and minor cycles. The decomposition of time series data into trend and cycles uncovers the hidden patterns of the time series, which provide insights to investors and policy makers so that they can better plan their activities to gain profits.

## ■ TB14

Room 210B

### Call Centers

Sponsor: Applied Probability

Sponsored Session

Chair: Haipeng Shen, Associate Professor, University of North Carolina at Chapel Hill, Chapel Hill, NC, 27599, United States of America, haipeng@email.unc.edu

Co-Chair: Amy Ward, Professor, University of Southern California, 3670 Trousdale Parkway, Bridge Memorial Hall BRI401H, Los Angeles, CA, 90089-0809, United States of America, amyward@usc.edu

#### 1 - The Speed Quality Dilemma in Large Call Centers with Heterogeneous Servers

Dongyuan Zhan, University of Southern California, Bridge Hall 401, Marshall School of Business, Los Angeles, CA, 90089-0809, United States of America, dongyuan.zhan.2015@marshall.usc.edu, Amy Ward

We consider a call center with heterogeneous agents differentiated by their service speed and quality, where quality is measured by the percentage of callers who call back after service. There is a natural trade-off between minimizing wait time and minimizing call-backs when routing calls. We propose a threshold routing policy based on the diffusion control problem that arises in Halfin-Whitt many-server limit regime. We illustrate our proposed policy outperforms other policies by simulation.

#### 2 - Many-server Heavy-traffic Limit for Queues with Time-varying Parameters

Yunan Liu, Assistant Professor, North Carolina State University, 111 Lampe Dr., Daniels Hall, Room 400, Raleigh, NC, 27695, United States of America, yunan\_liu@ncsu.edu, Ward Whitt

We develop a many-server heavy-traffic FCLT for the  $G_t/M/s_t+GI$  queue, having time-varying arrival and staffing, exponential service times and customer abandonment according to a general distribution. The FCLT provides theoretical support for the approximating deterministic fluid model and a refined Gaussian process approximation, using variance formulas given here.

#### 3 - Staffing and Control for Call Center Outsourcing with Rework

Jiheng Zhang, HKUST, Clear Water Bay, Hong Kong, China, j.zhang@ust.hk, Eser Kikizlar, Jing Fang

We study a system with both in-house and outsourcer call centers. With certain probability, customers need to be rerouted to the in-house call center for further help after receiving service at the outsourcer. The pooling of the two call centers is allowed. Using a fluid approximation in a heavy traffic regime, we jointly determine the optimal control rule and the staffing policy that asymptotically minimize the staffing cost and long run holding cost subject to a service level constraint.

#### 4 - Forecasting and Staffing Call Centers with Multiple Uncertain Demand Streams

Haipeng Shen, Associate Professor, University of North Carolina at Chapel Hill, UNC-CH, Chapel Hill, NC, 27599, United States of America, haipeng@email.unc.edu

We consider call centers with multiple uncertain demand streams, and study the entire planning process of forecasting and staffing. We develop methods to simultaneously forecast multiple stream arrivals by incorporating inter-stream dependence, and obtain corresponding staffing vectors using a chance-constraint staffing algorithm. Numerical studies indicate that the forecasting and operational benefits of incorporating inter-stream dependence vary by type and strength of the dependence.

## ■ TB15

Room 212A

### Consumer Attitudes and Behavior: The Predicting Roles of Personal, Physical, and Social Factors

Sponsor: Marketing Science

Sponsored Session

Chair: Yuhuang Zheng, Associate Professor of Marketing, Tsinghua University, Beijing, China, zhengyh@sem.tsinghua.edu.cn

#### 1 - Tense and Energetic Arousal Routes to Consumer Attitudes

Xiaomeng Fan, Tsinghua University, School of Economics and Management, Beijing, 100084, China, fanxm@sem.tsinghua.edu.cn, Duane Wegener, En-Chung Chang, Yuhuang Zheng

This research aims at validating the existence of two arousal (tense arousal and energetic arousal) routes to consumer attitudes. Results of three studies demonstrate that tense arousal and energetic arousal have independent effects on attitudes, are respectively associated with ergonomic qualities and hedonic qualities of products, and work to different extents according to individual differences in terms of telic (i.e., planning-ahead) or paratelic (i.e., spontaneous) orientations.

#### 2 - "Seeing" the Consumer-brand Relationship

Meng Zhang, Assistant Professor, the Chinese University of Hong Kong, Department of Marketing, CUHK Business, Hong Kong, China, zhangmeng@baf.msmail.cuhk.edu.hk, Xun (Irene) Huang, Xiuping Li

How Relative Physical Position Influences Relationship Perceptions This paper investigates how the physical positioning of brands, relative to the consumer, influences perceptions/evaluations of the consumer-brand relationship. We predict and show that consumers represent different kinds of relationships (brands as leaders, or friends) with different location metaphors (vertical or horizontal).

#### 3 - Does the Distance between Us Matter? Influences of Physical Proximity to Others on Consumer Choice

Jing Xu, Peking University, China, jingx@gsm.pku.edu.cn

Individuals' physical closeness to one another can either increase or decrease their preference for distinctive products. When individuals perceive their proximity to others to be voluntary, they choose options that others consider desirable. When people perceive that their close proximity to others results from circumstances beyond their control, however, they are more likely to choose products that distinguish themselves from others.

#### 4 - Interplay between Shanzhai and Original Products: An Investigation from Consumer Perspective

Liangyan Wang, Associate Professor, Shanghai Jiao Tong University, 535 Fahuazhen Road, Shanghai, China, wly@sjtu.edu.cn

Through two experiments, this paper studied the interplay between Shanzhai and the original. Our study results demonstrated that the presence of Shanzhai would raise consumers' evaluation and purchase intention on the original, as well as their possession happiness of the original. However the presence of the original didn't jeopardize consumers' evaluation and purchase intention on Shanzhai, but it does decrease their possession happiness of Shanzhai.

## ■ TB16

Room 212B

### Marketing Mechanisms for Supply Chain Management

Cluster: Interface between Operations Management and Marketing  
Invited Session

Chair: Qingning Cao, The University of Texas at Dallas, 800 West Campbell Rd., SM30, Richardson, TX, 75080, United States of America, qingning.cao@utdallas.edu

#### 1 - Pricing Extended Warranty in a Supply Chain

Jie Gao, Associate Professor, Xi'an Jiaotong University, Xi'an West Rd. 28, Xi'an, China, gaojie@mail.xjtu.edu.cn

Extended warranty as an add-on of the physical product can be provided by the retailer, the product manufacturer, and/or a third-party repair service provider. In this study, we explored the impact of extended warranty on the wholesale price of the product, and the impact on the profit of both the retailer and the manufacturer when the warranty is provided by the manufacturer. We investigated the case when extended warranty is offered by the retailer or a third-party repair service provider.

**2 - Dual Sales Channel Management**

Ying Cao, Nanjing University of Aeronautics & Astronautics,  
No. 29 Jiangjun Road, Nanjing, 211106, China,  
caoying1008@gmail.com, Xianghui Peng

There has been an increasing number of manufacturers selling their products through dual channels i.e. traditional retail channels and direct online channels. Using multi-stage optimization model and grey game theory, we analyze the impact of retailer's product availability and of manufacturer's delivery lead time with the consideration of whole demand change. The analysis shows that the two factors have significant influence on pricing strategy and profits of manufacturer and retailer.

**3 - Ingredient Branding with Competition in a "Two Suppliers-Single Manufacturer" Supply Chain**

Qinglong Gou, Associate Professor, University of Science and  
Technology of China, Jinzhai Road 96#, Hefei, China,  
tsg@ustc.edu.cn, Ting Zhang, Juan Zhang, Susan Li

This paper constructs a price-setting game between two rival suppliers of components and a final product manufacturer with consideration of Ingredient Branding strategy. According to the assessment of consumers' utility under such strategy, the manufacturer makes competitive retail prices for two products contained different competitive components. We show that the Ingredient Branding of suppliers can not only impact on pricing of goods, but also on the market segmentation.

**4 - Strategic Remanufacturing under Competition**

Zhongwen Ma, PhD Candidate, The University of Texas at Dallas,  
800 West Campbell Rd, SM30, Richardson, TX, 75080, United  
States of America, owenma@utdallas.edu, Ashutosh Prasad

In durable good market, used products usually capture a large market share. More recently, manufacturers begin to promote their remanufactured products as a way to control the used products, and coordinate the new products. In this paper, we investigate the impact of remanufacturing under the competitive environment. In specific, we evaluate the strategy of remanufacturing for manufacturer. We also answer the question how the factors such as degree of competition will influence the policy.

**■ TB17**

Room 213A

**Joint Session HAS/ OR/MS in Medicine:  
Tutorial: Applying Operations Research to Cancer  
Screening and Treatment**

Sponsor: Health Applications & OR/MS in Medicine and Healthcare  
Sponsored Session

Chair: Nan Kong, Purdue University, 206 South Martin Jischke Drive,  
West Lafayette, IN, 47907, United States of America,  
nkong@purdue.edu

**1 - Tutorial: Applying Operations Research to Cancer Screening  
and Treatment**

Nan Kong, Purdue University, 206 South Martin Jischke Drive,  
West Lafayette, IN, 47907, United States of America,  
nkong@purdue.edu, Shengfan Zhang

With the advances in cancer biology and informatics, many forms of cancer can now be cured or at least contained with intelligent preventive and therapeutic interventions. We have witnessed a large quantity of analytics research on cancer screening and treatment. In this tutorial, we survey the academic research from the field of OR with focus on efficiency increase of the cancer care delivery system and outcome improvement of individual patients' outcomes.

**■ TB18**

Room 213B

**Financial Modeling and Analysis**

Contributed Session

Chair: Nabil Nehme, PhD Candidate, American University of Beirut,  
Bliss Street, Beirut, Lebanon, nhn02@aub.edu.lb

**1 - Some Memory-saving Universal Portfolios**

Choon Peng Tan, Associate Professor, Universiti Tunku Abdul  
Rahman, Jalan Genting Kelang, Setapak, Kuala Lumpur, 53300,  
Malaysia, tanp@utar.edu.my, Choon Seng Lim

Cover and Ordentlich (1996) have constructed a universal portfolio using the normalized expected values of Dirichlet random variables over the simplex of portfolio vectors. We generalize this concept by constructing universal portfolios using normalized expected values of independent variables with the objective of memory-saving implementation. The performance of these portfolios on some real data sets is discussed.

**2 - Improving Delinquent Loan Processing Efficiency via Efficient  
Assignments in a Large US Bank**

Aysegul Peker, Operations Research Specialist, SAS,  
SAS Campus Drive, Cary, NC, 27513, United States of America,  
Aysegul.Peker@sas.com, Ivan Oliveira

Due to recent regulation changes in the US, the number and variety of processes Customer Relationship Managers (CRMs) need to perform for delinquent mortgage loans has increased. In this talk, we investigate the assignment problem of a variety of processes to a variety of resources to improve loan processing in a large US bank. We present a model and different approaches to solve this model. We show improvements of this approach compared the traditional manual processes.

**3 - Property Right Type, Debt Characteristics and Firms Investment**

Yan Wang, Dr., Central South University, Changsha,  
Changsha, China, kmust\_wy@sina.com

this paper investigate the relationship among debt characteristics, liquidity risk and firms investment. The result shows that shorten debt maturity can improve firms' investment effectively when the liquidity risk is not considered. However, when liquidity risk is considered we find the relationship between debt maturity and investment become weaker, but lower leverage can improve the investment effectively.

**4 - Political Connections, Ultimate Ownership, and Corporate  
Investment: Evidence from China**

Zhongqin Su, School of Economics and Management, Southwest  
Jiaotong University, No. 111, Erhuanlu Beiyiduan, Chengdu,  
China, su\_zhongqin@126.com

Using a sample of Chinese firms from 2004 to 2010, we investigate the investment behavior, the effects of political connections and ultimate ownership on their investment in a relationship-based economy. The results demonstrate that political connections could help mitigate the underinvestment problem in private firms. Moreover, we contribute to the literature by finding that overinvestment is a more important distortion in politically connected local SOEs.

**5 - Financial Evaluation of an Acquisition between Carriers in the  
Maritime Transport Industry**

Nabil Nehme, PhD Candidate, American University of Beirut,  
Bliss Street, Beirut, Lebanon, nhn02@aub.edu.lb, Jihad Beydoun

This paper considers the acquisition between two major carriers in the maritime transport industry from financial perspective. Techniques used in the assessment are discounted cash flow method and valuation using multiples along with a SWOT analysis. Several managerial insights are drawn in evaluating this acquisition.

**■ TB19**

Room 215

**Marriage of Simulation and Optimization:  
Theories and Examples**

Cluster: Tutorials

Invited Session

Chair: Jeff Hong, Professor, Hong Kong University of Science and  
Technology, Clear Water Bay, Kowloon, Hong Kong - PRC,  
hongL@ust.hk

**1 - Marriage of Simulation and Optimization: Theories and Examples**

Jeff Hong, Professor, Hong Kong University of Science and  
Technology, Clear Water Bay, Kowloon, Hong Kong - PRC,  
hongL@ust.hk

Simulation and optimization are two widely used operation research tools. The marriage of them, often known as optimization via simulation (OvS), provides a unique and powerful combination that may solve many problems that are previously considered difficult. Based on information available on simulation models, we categorize OvS problems into two categories: white-box and black-box OvS. In this tutorial I introduce difficulties and latest theoretical developments of both types of problems, provide examples on problem formulations as well as solution algorithms, show how to translate black-box problems into white-box ones under certain situations, and offer my view on possible future research directions of this exciting area.

## ■ TB20

Room 207

### Software Tutorials

Cluster: Software Tutorials

Invited Session

#### 1 - Fundamentals and Recent Developments of the GAMS System

Toni Lastusilta, GAMS Development Corp., Washington, DC, 20007, United States of America, toni.lastusilta@gmail.com

The open architecture and various interfaces of GAMS make the integration of GAMS applications into a great range of user environments easy. This tutorial will give an overview of the GAMS system and its design principles that make this great flexibility and user friendliness possible. We will also examine how these design principles are important for current developments and take a look at the new enhancements in the modeling capabilities for stochastic optimization problems.

#### 2 - Alternatives for Scripting in the AMPL Modeling Language

Robert Fourer, AMPL Optimization, Albuquerque, NM, United States of America, 4er@ampl.com

Modeling languages are essentially declarative, yet successful optimization languages also offer ways to write interpreted scripts that resemble executable programs. What can scripting in a modeling language offer in comparison to modeling in a general-purpose scripting language? Answers will be suggested through varied examples of problem analyses and iterative schemes.

**Tuesday, 1:30pm - 3:00pm**

## ■ TC01

Room 202B

### Advanced Optimization Models for Airfreight/Airline Operations Planning

Sponsor: Aviation Applications

Sponsored Session

Chair: Heng Chen, Isenberg School of Management, 121 Presidents Drive, University of Massachusetts, Amherst, MA, 01003, United States of America, heng@som.umass.edu

#### 1 - Optimal Runway Planning for Continuous Descent Arrivals with Sustainability Considerations

Heng Chen, Isenberg School of Management, 121 Presidents Drive, University of Massachusetts, Amherst, MA, 01003, United States of America, heng@som.umass.edu, Senay Solak

We develop a dynamic programming framework to identify optimal target spacing policies during continuous descent arrivals. The policies are based on the minimization of fuel burn, as well as related emission and noise costs, while maximizing runway utilization. Some analytical and numerical results are presented.

#### 2 - An Airfreight Forwarder's Aggregate and Disaggregate Resource Planning under Uncertainty

Lawrence Leung, Professor, The Chinese University of Hong Kong, Shatin, Hong Kong, China, lawrence@baf.msmail.cuhk.edu.hk, Yer Van Hui, Gang Chen, Wai Hung Wong

Airfreight forwarders resource planning is a complex problem, requiring decisions to be made in an uncertain environment. Airfreight forwarders acquire airfreight spaces from three major sources: carriers, partners and subcontractors, all of which differ in terms of cost, flexibility, service reliability, and timings of booking. In this research, we formulate this problem as an aggregate planning model. A two-stage newsvendor model is developed, along with several disaggregation techniques.

#### 3 - A SDP Approach To An Airfreight Forwarder's Resource Planning and Revenue Management

Wen He, PhD Student, The Chinese University of Hong Kong, Room 941, Cheng Yu Tung Bldg, CUHK, Hong Kong - PRC, hewen85@gmail.com, Gang Chen, Lawrence Leung, Yer Van Hui

Airfreight forwarders handle more than 80% of international airfreight volume. They plan resources dynamically under highly volatile demand. We formulate this problem as a stochastic dynamic programming model. Here, we optimize the resource portfolio under informational dynamics over time. Several major properties are derived. Relevant issues in resource planning and revenue management decisions are explored.

#### 4 - Research on Constraint Programming for Integral Recovery Problem of Aircraft and Crew

Bo Zhu, Nanjing University of Aeronautics and Astronautics, JiangJun Anueue Campus, Jiangning District, Nanjing, 211100, China, iami-nor@163.com, Jinfu Zhu

To solve the recovery problem of aircraft and crew in airline's daily operation, this paper proposes constraint programming method to model on the integral recovery problem, releases the difficulty by limiting the scale of the problem and designs reasonable and effective search rules based on mix set programming. Finally, instances are tested using step-by-step recovery and integral recovery method respectively, which shows the superiority of integral recovery.

## ■ TC02

Room 202A

### Data Mining in Operations Management

Sponsor: Data Mining

Sponsored Session

Chair: Gang Li, Xi'an Jiaotong University, Xi'an, Sh, China, lee\_rich@163.com

#### 1 - Data Mining in Manufacturing & Service Operations Management

Gang Li, Xi'an Jiaotong University, Xi'an, Sh, China, lee\_rich@163.com

With the prevailing of the integration of manufacturing and service industry in the real world, more and more firms are trying to provide integrated products and services to customers. To get better performance, firms have to pay more attention to the operation of its manufacturing and services. Data mining can be widely used for product and service innovation, customer relationship management and manufacturing process improvement.

#### 2 - SpatioTemporal Event Detection for Network Performance Risk Assessment

Rong Duan, AT&T Labs, 180 Park Avenue, Florham Park, NJ, 07932, United States of America, rongduan@research.att.com

This talk proposes a systematic method to assess the risk at the mobility network driven by the irregular traffic patterns. Markov Modulated Nonhomogeneous Poisson Process (MMNHPP) is employed to estimate the probability with which event happens, when and where the events take place, and assess the spatial and temporal impacts of the events.

#### 3 - A Spatial Scan Statistic for Specific Populations

Xiaobei Shen, Hong Kong University of Science and Technology, Room 205A, Tower B, HKUST, Hong Kong, 999077, Hong Kong - PRC, sxbfay@gmail.com, Fugee Tsung, Wei Jiang

A statistical technique is proposed for detecting geographical clusters with respect to some particular factors, defined as objective factors causing abnormal disease signal. A spatial scan statistic is applied to characterize specific populations chosen for the study (the studied specific populations). A log-normal model is applied to construct the test statistic and geographical detection of abnormal signals caused by the objective factors can then be performed.

#### 4 - An Ordinal Categorical Chart for Detecting Location Shifts

Jian Li, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong - PRC, jianli@ust.hk, Fugee Tsung, Changliang Zou

In multinomial processes, there is usually an order between attribute levels, such as good, marginal, and bad. Traditional control charts for monitoring them consider such levels from a multinomial distribution and therefore neglect this order. We propose an ordinal control chart based on the midrank of each attribute level by integrating the exponentially weighted moving average scheme. Numerical simulations demonstrate its effectiveness in detecting location shifts.

## ■ TC03

Room 203B

### Communities of Practice, Social Responsibility, and Social Networking

Sponsor: Service Science

Sponsored Session

Chair: A.D. Amar, Professor of Management, Stillman School of Business, Seton Hall University, 650 Jubilee Hall, South Orange, NJ, 07079, United States of America, ad.amar@shu.edu

#### 1 - Communities of Practice in Managing Knowledge in Organizations

A.D. Amar, Professor of Management, Stillman School of Business, Seton Hall University, 650 Jubilee Hall, South Orange, NJ, 07079, United States of America, ad.amar@shu.edu, Elayne Coakes, Maria Granados

Based on a comprehensive 104-item global survey of 1034 knowledge managers, executives, and knowledge workers, carried out from year 2007-11, we assess the state of communities of practice (CoPs), and their use and role in managing knowledge in organizations by including data from all forms of business organizations. The findings come from manufacturing, retailing, government, and nonmanufacturing industries. We also give recommendations for designing and operating CoPs for best practice.

#### 2 - Corporate Social Responsibility in the Airlines Industry of Emerging Markets

Wei Yan, Ph.D. Candidate, Department of Business Administration, Universidad Carlos III de Madrid, Calle Madrid 126, Getafe, Madrid, 28093, Spain, wyan@emp.uc3m.es, Maria Jose Alvarez Gil

This paper studies how corporate social responsibility (CSR), environmental initiatives in particular, impacts airline companies' financial performance in emerging markets. Both long and short term analyses are conducted with respect to airline companies' profitability and market value. It is found that in the long run, environmental initiatives can enhance the market value of the airline companies.

#### 3 - Social Networking Services and e-Retailer Performance: An Empirical Analysis

Gregory Heim, Associate Professor, Mays Business School at Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, gheim@mays.tamu.edu, Xiaosong David Peng

Many service businesses today participate in social networking services (e.g., Facebook, MySpace, Twitter, YouTube) to connect with customers and enhance their service offerings. Empirical research examining the value of social networking services to businesses is scant. Using panel data on the top 500 e-retailers in the United States and Canada, this research examines associations between social networking services and e-retailer performance as measured by web sales and traffic.

#### 4 - Auditing in the Twenty First Century - A Stronger, Smarter, Sustainable Paperless Business Process

Robert Troccoli, Founder, Robert Troccoli, LLC - Financial Education of Board Members, Executive Leadership Coaching and Mentoring, 1200 Acoma Street #604, Denver, CO, 80204, United States of America, robert@roberttroccoli.com

In recent years, International Auditing Firms have improved their competitive advantage by changing business processes and adopting electronic tools to improve efficiency, apply analytical procedures, and assess audit risks. The foundation for this talk is a survey of partners and professionals at International Auditing Firms, Internal Audit Departments and Small Auditing Firms. The talk will cover the current status of professional attestation standards related to the subject of sustainability as well as available professional services to guide and assist the transition of governments and companies to a sustainable economy. The focus is on firms and countries with exceptional earth-friendly initiatives and environmental leadership.

## ■ TC04

Room 203A

### Maritime Economics and Finance

Cluster: Maritime, Trade and Supply Chain Logistics

Invited Session

Chair: Hengqing Ye, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong - PRC, lgtvehq@inet.polyu.edu.hk

Co-Chair: Stephen Gong, Dr, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong - PRC, afxhg@inet.polyu.edu.hk

#### 1 - Shipping Investment and Finance post-Financial Crisis

Stephen Gong, Dr, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong - PRC, afxhg@inet.polyu.edu.hk

We examine, through survey questionnaires, the impacts of the recent global financial crisis on shipping investment and finance practices, especially in Hong Kong and China. Changes in the financing choices on the part of shipowners, and on the part of bankers, are compared between the pre-crisis and the post-crisis periods. Challenges to the industry, and research opportunities arising from the financial crisis are highlighted.

#### 2 - 13 Years of MEL and Future Research Directions in Maritime Economics and Logistics

Hercules Haralambides, Professor, Erasmus University Rotterdam, Econometric Institute, Rotterdam, Netherlands, haralambides@ese.eur.nl

Maritime Economics and Logistics was launched in 1999 to meet a gap in the rigorous treatment of the subject area. The journal has published forefront research which has virtually defined/refined the 'conventional wisdom' of maritime economics and logistics; and specifically has been spearheading advances in container terminal and liner network optimisations; port efficiency and productivity studies; finance and investment. This paper review this research and indicate future research directions.

#### 3 - Band Control of Mutual Proportional Reinsurance

John Liu, Centre for Transport, Trade and Financial Studies (CTTFS), Hong Kong City University, Hong Kong - PRC, johnliu@cityu.edu.hk, Jiguang Yuan, Michael Taksar

We investigate the optimization of mutual proportional reinsurance intended for the collective reinsurance needs of homogeneous mutual members, such as P&I Clubs in marine mutual insurance and reserve banks in the U.S. Federal Reserve. We show that a special band-type impulse control defined by a lower and an upper boundary minimize the total maintenance cost. Practical implications are discussed.

#### 4 - Construction of an International Shipping Prosperity Index

Guohua Wan, Professor, Shanghai Jiao Tong University, 535 Fahuazhen Road, Shanghai, 200052, China, ghwan@sjtu.edu.cn

A composite index, called "Shanghai International Shipping Prosperity Index", is constructed to reveal the relationship between supply and demand in international shipping market and to reflect the real value of the global shipping industry. Based on capacity and profitability of the industry, three classes of economic indicators are used to compute the real industrial value using factor analysis and AHP. Data of past five year are used to demonstrate the effectiveness and validity of the index.

## ■ TC05

Room 205B

### Power Generation and the Environment

Contributed Session

Chair: Paul Preckel, Professor, Purdue University, Department of Agricultural Economics, West Lafayette, IN, 47907, United States of America, preckel@purdue.edu

#### 1 - Research on the Unit Commitment Problem in Multiple-energies Distributed Generation

Jin Lang, The Logistics Institute, Northeastern University, Shenyang, China, jlang@tli.neu.edu.cn, Lixin Tang

In this paper we present a mixed integer nonlinear model for the unit commitment in distributed generation system that integrates thermal with wind-battery. The problem is characterized by the batch operating features of wind turbines. In order to reduce the set-up frequency of the battery and improve its use cycle, the start-up cost is considered that includes the charging and discharging cost. We presents a Lagrangian relaxation approach for the problem and reports the computational results.

## 2 - A Hybrid of Variational and Ensemble-based Data Assimilation Methods for Wind Power Forecasting

Jun Liu, North China Grid Company, NCGC Building, Guanganmen Bridge, Beijing, China, hbdwliujun@126.com, Haifeng Wang, Dengfeng Guo, Tao Zhang, Rong Fu Sun, Meng Zhang, Wen Jun Yin

The advantages of hybrid are derived both from the flow-dependent and static background error covariances of the two components, respectively. In this case study, the accuracy of the wind power forecasting, is modeled by an ensemble group for its uncertainty estimation and a deterministic variational analysis for its optimal state estimation.

## 3 - An Empirical Analysis of Environmental Stressor Emissions: Role of Operations Management and Impact

Subrata Chakrabarty, University of Nebraska-Lincoln, CBA 209, P.O. Box 880491, Lincoln, NE, 68588, United States of America, chakrabarty@gmail.com, Liang Wang

This study investigates the role of manufacturing operations regarding the emissions of major types of environmental stressor emissions (e.g., acidification, eco-toxicity, etc). We found: (1) fixed asset intensity and inventory holding periods have a significantly positive impact on the emissions of certain but not all types stressors; (2) certain but not all types of emissions have a significantly negative impact on a firm profitability. This relation is moderated by operation leanness.

## 4 - Modifying Unit Commitment and Economic Dispatch to Manage Wind Generation Uncertainty

Paul Preckel, Professor, Purdue University, Department of Agricultural Economics, West Lafayette, IN, 47907, United States of America, preckel@purdue.edu, Clay Davis, Andrew Liu, Douglas Gotham

The variable intermittent nature of wind poses challenges spanning many areas of electricity markets, especially accurately forecasting this highly variable energy source. The model developed captures a large portion of the benefits of stochastic optimization, while dramatically reducing the problem size and ultimately the computational burden. The size of the full stochastic problem is reduced by focusing on the region of the network that is largely affected by wind generation.

## TC07

Room 205A

## Channel Management – Interaction between Supply Chain, Marketing, and Finance Service

Cluster: Supply Chain Management in China  
Invited Session

Chair: Jun Wu, Associate Professor, Beijing University of Posts and Telecommunications, No.10 Xi Tu Cheng Road, Haidian District, Beijing, China, junwu@bupt.edu.cn

### 1 - Dual Channel Coordination Mechanism Based on Product Life Cycle

Jun Wu, Associate Professor, Beijing University of Posts and Telecommunications, No.10 Xi Tu Cheng Road, Haidian District, Beijing, China, junwu@bupt.edu.cn

In this paper, we study a supply chain system consisting of one manufacturer and one retailer. The product in such a supply chain shows a short life cycle. We focus on the problem that whether an E-channel is beneficial to a supply chain system and how to design a mechanism for channel coordination.

### 2 - Research on the Consignment Contract under Capital Constrains

Quansheng Lei, Associate Professor, Beijing University of Posts and Telecommunications, No.10 Xi Tu Cheng Road, Haidian District, Beijing, 100876, China, leiqshz@163.com

This paper consider a supply chain that composed by a single supplier and a single retailer, we create capital restriction models based on the consignment contract. When the suppliers face fund constraints, they can use financial services from financial institutions to gain the optimal production, and thus supplier and retailer earnings will improve; Finally, we use numerical examples to verified the model results.

### 3 - Analysis of a Sustainable Bioenergy Feedstock Supply Chain Using Rail Transportation

Daniela Gonzales, Graduate Assistant, Mississippi State University, 302 Worley St, Starkville, MS, 39759, United States of America, dsg42@msstate.edu

We developed a mathematical model to optimize the transportation of feedstock from the preprocessing locations, where biomass is densified, to existing coal plants for co-fire. Although there is a cost associated with densifying biomass, we foresee cost advantages further down the supply chain, including potentially reduced transportation costs.

## TC07

Room 206A

## Multi-Criteria Decision Making

Contributed Session

Chair: Xihua Li, Central South University, 932 Southern Lushan Road, Changsha, China, xihuali@126.com

### 1 - Intransitive Judgment Identification Method for Group Decision Making by AHP

Yi Peng, School of management and economics, University of Electronic Science and Technology of China, No.4, Section 2, North Jianshe Road, Chengdu, China, pengyicd@gmail.com, Gang Kou, Yong Shi, Daji Ergu

A block diagonal matrix is introduced to integrate the provided matrices with respect to the same criterion, then a Hadamard product induced bias matrix model (HPIBMM) is proposed to identify the intransitive judgments for all sub-matrices in the block diagonal matrix simultaneously. One numerical example is used to illustrate the proposed method. The result shows that the proposed method can identify the intransitive judgments for several matrices simultaneously in group decision making by AHP.

### 2 - A Hybrid TOPSIS Model on Random Type of Decision Criteria

Gang Kou, Professor, School of Management and Economics, University of Electronic Science and Technology of China, No.4, Section 2, North Jianshe Road, Chengdu, China, kougang@yahoo.com, Kun Chen, Yi Peng, Lei Zhang

The type of decision criteria in TOPSIS is assumed to be dyadic. A hybrid TOPSIS which integrate hierarchical Bayes random effect (HBRE) method is proposed to deal with random type of decision criteria. The preferences of decision criteria by respondents are estimated as distributions of part-worths in HBRE, and the distance to ideal solution and negative solution is redefined. The empirical results indicate that hybrid TOPSIS is a robust procedure by sensitivity analysis.

### 3 - About the Impact of Information Structure in the PROMETHEE II Preference Elicitation Process

Yves De Smet, Professor, Université Libre de Bruxelles, CoDe-SMG, bd du Triomphe CP 210-01, Brussels, 1050, Belgium, yves.de.smet@ulb.ac.be, Stefan Eppe

We focus ourselves on the preference elicitation process in the context of the PROMETHEE II multicriteria method. The DM is asked to provide a set of partial yet rather holistic information about his preferences. This can take different forms and the goal of this work is to investigate what impact both the nature and the quantity of information has on the quality of the elicitation process' results. We adopt an empirical approach to highlight some interesting preliminary conclusions.

### 4 - Group Decision Making Based on Novel Trapezoidal Intuitionistic Fuzzy TOPSIS Method

Xihua Li, Central South University, 932 Southern Lushan Road, Changsha, China, xihuali@126.com, Xiaohong Chen

A novel trapezoidal intuitionistic fuzzy TOPSIS method for group decision making is investigated. The preference values for an alternative on criteria and the weight values of criteria are given using linguistic values of trapezoidal intuitionistic fuzzy numbers and weights of decision makers are unknown. Distance measures, expected values and some weighted averaging operator for trapezoidal intuitionistic fuzzy numbers are used to induce the weight values of criteria and decision makers.

### 5 - IGMBM: a New and Simple Inconsistency Test Model for Reciprocal Pair-wise Comparison Matrix

Wenshuai Wu, PhD, School of Management and Economics, University of Electronic Science and Technology of China, No.4, Sec. 2, Jianshe North Road, Chengdu, China, wenshuai.wu@gmail.com, Gang Kou

This paper is to propose a new and simple inconsistent test model: induced geometric mean bias matrix (IGMBM) model to effectively identify and adjust the pairwise comparison matrix. In IGMBM model, the theorems and the related corollaries are developed. And, the processes of inconsistency test are proposed. Besides, a general adjustment formula of inconsistent element is derived. Finally, the effectiveness and correctness of the proposed model are proved and illustrated by six examples.

■ TC08

Room 206B

**Computational Statistics**

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Chi-Guhn Lee, Associate Professor, University of Toronto,  
5 King's College Road, Toronto, ON, M5S3G8, Canada,  
cglee@mie.utoronto.ca

**1 - Bayesian Process Control with Multiple Assignable Causes**

Chi-Guhn Lee, Associate Professor, University of Toronto,  
5 King's College Road, Toronto, ON, M5S3G8, Canada,  
cglee@mie.utoronto.ca, Jue Wang

We investigate the Bayesian process control in the presence of multiple assignable causes. The problem is formulated as a partially observable Markov decision process to find an optimal stopping time. We show that a conditional control limit policy is optimal. We further derive the analytical lower and upper bounds for the value function and the switching boundary, which leads to a computationally efficient algorithm. We also provide useful insights on the optimal sampling interval.

**2 - Evaluation of Exponentially Weighted Moving Variance Control Chart Subject to Linear Drifts**

Wenpo Huang, Faculty of Business Administration,  
University of Macau, University of Macau, Taipa, Macau,  
wenpohuang@umac.mo, Lianjie Shu, Wei Jiang

An exponential weighted moving variance chart with reflecting barrier (REWMV) is developed for monitoring a linear drift in the process standard deviation when individual observations are used. Piecewise collocation method based on the integral equation approach is presented for calculating the average run length (ARL) of the REWMV chart. Some computational aspects for facilitating computation load are discussed.

**3 - Intelligent Multivariate Sales Forecasting Using Wrapper Approach and Neural Networks**

Z.X. Guo, The Hong Kong Polytechnic University, Institute of Textiles and Clothing, The Hong Kong Polytechnic University, Hunghom, KLN, Hong Kong - PRC, tcguozx@inet.polyu.edu.hk, Min Li, W.K. Wong

This research investigated a retail sales forecasting problem based on early sales. An effective intelligent multivariate model is proposed to handle this problem by integrating a data preprocessing module, a harmony search-wrapper-based variable selection module and a multivariate intelligent forecaster (MIF) module. The MIF module is established based on harmony search algorithm and extreme learning machine. Experimental results have shown that the effectiveness of the proposed model.

**4 - Estimating Planned Sales Call Frequencies with Incomplete Information Using the EM Algorithm**

Lan Nygren, Associate Professor of Management Sciences, Rider University, 2083 Lawrenceville Road, Lawrenceville, NJ, 08648, United States of America, lnygren@rider.edu, Lewis Coopersmith

We consider estimating planned sales call frequencies of a selling company with incomplete information caused by short recording durations in diary surveys. We derive the maximum likelihood estimators of the multinomial cell probabilities for the planned sales call frequencies using the expectation maximization (EM) algorithm. We show that the EM algorithm estimators are asymptotically unbiased and consistent. We then estimate the total sales calls and discuss the properties of the estimators.

■ TC09

Room 208A

**Design and Control of Multilevel Networks**

Sponsor: Computational Optimization & Applications  
(Sponsored by the Computing Society)

Sponsored Session

Chair: Michael Wagner, St. Mary's College of California, 380 Moraga Rd., Moraga, CA, United States of America, mrw2@stmarys-ca.edu

**1 - The Benefit/Detriment of Information in Coordinating Supply Chains**

Michael Wagner, St Mary's College of California, 380 Moraga Rd., Moraga, CA, United States of America, mrw2@stmarys-ca.edu

We study a simple supply chain with one supplier and one retailer, where one firm knows the probabilistic distribution of demand and the other only knows the mean and variance. We show that this informational asymmetry either

reduces or exacerbates the double marginalization effect. We study how the direction of asymmetry, level of uncertainty, economics and game theoretic considerations affect supply chain, as well as individual firm, performance.

**2 - Hierarchical Control Model for Several Stochastic Network Projects**

Aharon Gonik, Professor - Logistics, Sapir College, D.N. Ashkelon, Sdeiot, Israel, aharong@sapir.ac.il

Almost every company is simultaneously handling several projects. The common practice is to supervise each project independently, neglecting levelling company Cash-Flow, optimisation of limited resources and supporting projects that are "Lagging-behind". Hierarchical control model is suggested which at any dynamic control point determines: 1. Optimal budget values reassignment 2. Optimal resource delivery schedules for all the activities. In order to maximize the probability of meeting the due date of the slowest project.

**3 - Stock Reservation in Multi-level Supply Chain Systems**

Chang Liu, NTU, S3, 01B-73, NBS, NTU, Nanyang Avenue, Singapore, 639798, Singapore, CLIU1@e.ntu.edu.sg, Qinan Wang

It is a common practice that the warehouse reserve stocks for the retailers before delivery. We study this phenomenon in a decentralized distribution system using power-of-two policy. Warehouse reserves stock for a retailer when stochastic demand happens at real time. We exactly evaluate the system cost and optimize the delivery schedule and the order-up-to levels. Numerical study shows it has significant efficiency. We suggest a more efficient policy.

**4 - Bilevel Transit Network Design: Hybrid Artificial Bee Colony Algorithm Approach**

Wai Yuen Szeto, Assistant Professor, The University of Hong Kong, Pokfulam Road, Hong Kong - PRC, ceszeto@hku.hk, S.C. Wong, Yu Jiang

This paper proposes a bi-level transit network design model where the route and frequency can be determined simultaneously. A hybrid artificial bee colony algorithm is developed for solving the model. Various experiments are set up to demonstrate the effectiveness of proposed algorithm and illustrate the effects of different parameters in the algorithm.

■ TC10

Room 208B

**Topics in Operations Management II**

Cluster: Manufacturing & Service Oper Mgmt

Invited Session

Chair: Lihua Chen, West Liberty University, Gary E West College of Business, 231 Main Hall, CSC 123, PO Box 295, West Liberty WV 26074, United States of America, lihua.chen@westliberty.edu

**1 - Production, Pricing, and Salesforce Compensation**

Chunming Shi, Assistant Professor, Wilfrid Laurier University, School of Business and Economics, 75 University Ave., W, Waterloo ON N2L3C5, China, cshi@wlu.ca

In salesforce compensation research, how contract design influences both production and pricing decisions of the firm is still under-explored. This paper attempts to fill this research gap and answer questions such as: When market demand is impacted by both salesforce's effort and by the firm's pricing decision, how does the private information possessed by the salesforce affect the firm's production, pricing, and salesforce compensation decisions?

**2 - An Empirical Study of the Bullwhip Effect in China**

Shilei Yang, Southwestern University of Economics and Finance, Guang Hua Chun Street 55, Chengdu, China, shilei.yang@gmail.com

In this study, we investigate the bullwhip effect in China from data on over 1,200 companies listed on the Shanghai and Shenzhen stock exchanges from 2002 to 2009. Specifically, we estimate the ratio of the volatility of production to the volatility of demand as a proxy for the bullwhip effect. The results show that more than 2/3 of the companies exhibit the bullwhip effect.

**3 - Fair Sharing of Profits through Transfer Pricing in Supply Chains with Stochastic Demand**

Lihua Chen, West Liberty University, Gary E. West College of Business, 231 Main Hall, CSC 123, PO Box 295, West Liberty, WV 26074, United States of America, lihua.chen@westliberty.edu

The paper studies how to divide total profits fairly among supply chain members in a stochastic demand market. A value-sharing method based on the Shapley value is proposed to determine the transfer prices among one supplier and two retailers. My goal is to figure out ideal transfer prices for products delivered among supply chain members, which will achieve the suggested profit allocations among the three companies.

## TC11

Room 209A

### Logistic Network Decision/Operation Management

Cluster: Super/Special Sessions

Invited Session

Chair: Sydney Chu, Professor, University of Hong Kong, Department of Mathematics, Hong Kong, Hong Kong - PRC, schu@hku.hk

#### 1 - Optimal Routings in Networks with Multiple Sources and Multiple Sinks

Guangyue Han, Assistant Professor, University of Hong Kong, Department of Mathematics, University of Hong Kong, Hong Kong - PRC, ghan@maths.hku.hk, Li Xu, Weiping Shang

For an acyclic directed network with multiple sources and sinks, we show that through appropriate routings, the number of mergings within the network is upper bounded by a constant, which is independent of the size and the topology of the network. We also compute exact values of and bounds on the tightest such constant for networks with certain special parameters. The obtained results can be applied to transportation and computer networks.

#### 2 - A Location-allocation and Capacity Planning Model with Response Time Service Level

Carrie Lin, Associate Professor, City University of Hong Kong, Department of Management Sciences, Hong Kong - PRC, mslincky@cityu.edu.hk

Response time is crucial in time-sensitive industry like express delivery with uncertain demand and travel time. The relationship between facility location, allocation of demand sites and capacity (number of service units) satisfying the response time service level is examined. A set of efficient solutions is generated by a four-stage heuristic for consideration by decision-maker.

#### 3 - Development of Simulation Model for Non-conveyable Load Handling Processes in Express Cargo Terminal

Vivian Min Zhao, The University of Hong Kong, Industrial and Manufacturing, Systems Engineering, Hong Kong, 999077, Hong Kong - PRC, vivianmzhao@gmail.com, Henry Lau, Bill Chan

The non-conveyable handling processes of DHL Central Asia Hub require revamping to response to demand changes. To facilitate planning, a simulation model is built to help preview the impacts of parameters and new operational methods on system performance. The model also serves as a decision support tool for cost analysis on value substantiation.

#### 4 - Joint Pricing and Inventory Control Problem under an Energy Buy-back Program

Jihong Zhang, Professor, International Business School, Beijing Foreign Studies University, No. 2 North Xisanhuan Avenue, Haidian Du, Beijing, 100089, China, zhangjihong@bfsu.edu.cn

This paper considers a periodic review joint pricing and inventory model under an energy buy-back program by incorporating compensations as well as setup cost over finite T planning horizons. At the beginning of each period, a decision maker has to figure out a joint pricing and production/inventory strategy under an energy buy-back program in order to maximize the expected total profit. It is shown that an (s; S; A; P<sub>S</sub>) policy is optimal for such a problem.

#### 5 - An Evaluation of Routing Policies vs Storage Strategies in a Synchronized-zone Order-picking System

Sydney Chu, Professor, University of Hong Kong, Department of Mathematics, Hong Kong, Hong Kong - PRC, schu@hku.hk, Li Pan

We study picker-to-parts in a synchronized-zone order-picking system via a simulation model of routing policies versus storage effects on throughput time. System performance sensitivity, besides routing/storage, on other factors such as demand pattern is further investigated. Midpoint routing policy with perimeter storage strategy is generally superior to other routing/storage combinations.

## TC12

Room 209B

### Optimization and Competition in Supply Chains

Contributed Session

Chair: Susan Li, Professor, Robert B. Willumstad School of Business, Adelphi University, 1 South Ave, Garden City, NY, 11530, United States of America, li@adelphi.edu

#### 1 - Nash Equilibrium Solution in a Vendor-buyer Supply Chain Model with Permissible Delay in Payments

Maw-Sheng Chern, Professor, National Tsing Hua University, Dept of IEEM, National Tsing Hua Univ., Hsinchu, 30043, Taiwan - ROC, chern@ie.nthu.edu.tw, Jinn-Tsair Teng, Suresh Kumar Goyal

In the supply chain model, vendors often offer their buyers a fixed credit period to settle the account. We incorporate the fact that granting a permissible delay has a positive impact on demand but negative impacts on both costs and default risks to establish vendor-buyer supply chain models. We then derive the necessary and sufficient conditions to obtain the optimal solution for both the vendor and the buyer under non-cooperative Nash equilibrium.

#### 2 - Impact of Providing Trade Credit on Suppliers' Operational Performance

Yuanguang Zhong, South China University of Technology, Wushan Road, Tianhe District, SCUT, Guangzhou, China, hitscut@163.com

The supplier may offer the retailer two types of trade credit contracts: a "one-part" or a "two-part" contract. We specify the conditions under which it is beneficial in improving performance for the supplier to offer the one-part trade credit, and reveal that it is more superior in improving performance for the supplier to offer a two-part credit than to offer a one-part credit. Also, we will show how the supplier should set the two trade credit policies to make them more efficient.

#### 3 - Optimal Power-of-Two Ordering Policies for Two-Level Distribution Systems with Stochastic Demand

Qinan Wang, NTU, S3-B2A-31, NBS, NTU, Nanyang Avenue, Singapore, 639798, Singapore, AQNWANG@ntu.edu.sg

We study an one-warehouse multiple-retailer system. The retailers are non-identical and face independent Poisson demand. The system adopts a power-of-two ordering policy. We provide an approach to evaluate the exact inventory related cost, characterize the structural properties of the inventory control system and develop an exact optimal POT policy to minimize system cost.

#### 4 - Interactive Inventory Models in a Supply Chain System

Susan Li, Professor, Robert B. Willumstad School of Business, Adelphi University, 1 South Ave, Garden City, NY, 11530, United States of America, li@adelphi.edu, Zhimin Huang

This paper explores the impact of quantity discounts on a simple buyer-seller supply chain system where the buyer is in a monopolistic position. The efficiency of transactions is discussed utilizing interactive game theory. An example is provided to illustrate our theoretical findings.

## TC13

Room 210A

### Rolling Horizon, Scheduling and Timetabling

Contributed Session

Chair: Jorne Van den Bergh, PhD Student, HU Brussel, Warmoesberg 26, Brussels, Belgium, jorne.vandenbergh@hubrussel.be

#### 1 - Branch-and-Cut Algorithm for the Crane Scheduling Problem

Zhao Guodong, The Logistics Institute, Northeastern University, Shenyang, China, gdzhao@tli.neu.edu.cn, Lixin Tang

A crane scheduling problem for the hot-rolling slab yard is studied. With the purpose of improving the utilization of crane as well as lifting the efficiency of the whole slab yard minimizing the completion time of all tasks is selected as the objective of the problem. The crane scheduling problem can be seen as a TSP which has been proved to be NP-hard, the Branch-and-Cut algorithm which is a efficiency exact algorithm for solving the integer NP-hard problem is adopted to solve the our problem.

#### 2 - Integrated Scheduling of Loading and Transportation with Tractor and Semitrailer Separated

Feng Li, The Logistics Institute, Northeastern University, Shenyang, China, fli@tli.neu.edu.cn, Lixin Tang

This talk studies an integrated loading-transportation scheduling model. Each vehicle consists of one tractor and one semitrailer. The tractor and semitrailer can be separated. A semitrailer can only be loaded after it is pulled back to the yard by a tractor. We study jobs assignment, semitrailers assignment, and loading scheduling model. We analyze the computational complexity, propose a fast heuristic with the worst case, and also computationally evaluate their performance.

#### 3 - Learning a Rule-Based Prediction Model Using Regularized Random Forests

Yixin Chen, Associate Professor, University of Mississippi, 207 Weir Hall, Computer and Information Science, University, MS, 38677-1848, United States of America, ychen@cs.olemiss.edu

Building a predictive model with good interpretability is important in many applications. We present an efficient learning algorithm using 1-norm regularized random forests. The proposed method simultaneously extracts a small number of rules from random forests and selects important features. The performance of the proposed method is comparable to some state-of-the-art algorithms using a small number of rules.

#### 4 - A Rolling Horizon Heuristic for Optimal Trading in the LNG Spot Market

Ruud Egging, Postdoc, NTNU, Sentralbygg I, Alfred Getz veg 3, Trondheim, 7491, Norway, ruud.egging@iot.ntnu.no, Peter Schütz

We present a multi-stage stochastic optimization model for planning the operations in a liquefied natural gas value chain. The model captures order lead times, capacity constraints and other operational characteristics, combined with uncertainty in LNG and local gas spot prices. To solve the model we propose a novel rolling horizon heuristic, which represents the uncertainty in spot prices but stays numerically tractable for practically relevant problems sizes.

### TC14

Room 210B

#### Multidimensional Reflecting Processes: Stability and Tail Asymptotics

Sponsor: Applied Probability

Sponsored Session

Chair: Toshihisa Ozawa, Komazawa University, 1-23-1, Komazawa, Setagaya-ku, Tokyo, 154-8525, Japan, toshi@komazawa-u.ac.jp

##### 1 - Tail Asymptotics of M/M-JSQ with Non-identical Servers

Masahiro Kobayashi, Tokyo University of Science, 2641, Yamazaki, Noda, Japan, m\_kobayashi@is.noda.tus.ac.jp, Yutaka Sakuma, Masakiyo Miyazawa

We consider a parallel queueing model in which customers arrive according to a Poisson process and join the shortest queue. The number of servers is denoted by  $k$ , which is an arbitrary positive integer. We assume that each server has an exponentially distributed service time, but its mean may be different. We obtain the exact tail asymptotic of the stationary distribution of this queueing model.

##### 2 - Longer-Queue-Serve-First System

Hui Li, Professor, Mount Saint Vincent University, 166 Bedford Highway, Halifax, NS, B3M 2J6, Canada, Hui.Li@msvu.ca, Yiqiang Zhao, Wenzhe Ye

In this talk, we consider the longer-queue-serve-first queueing system with unequal arrival rates. We model such a system into a random walk in the half plane and focus on the exact tail asymptotics of the joint queueing length distributions.

##### 3 - Stability of Constrained Markov Modulated Diffusions

Xin Liu, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN, 55455, United States of America, liuxin@ima.umn.edu, Amarjit Budhiraja

We study a family of Markov modulated constrained diffusions. Constraint set is a polyhedral cone and coefficients of the diffusions are governed by, in addition to the system state, a finite state Markov process that is independent of the driving noise. We give sufficient conditions, which are formulated in terms of the averaged drift (where the average is taken with respect to the stationary distribution of the modulating Markov process), for positive recurrence and geometric ergodicity.

##### 4 - Positive Recurrence of Multidimensional Reflecting Random Walk with a Background Process

Toshihisa Ozawa, Komazawa University, 1-23-1, Komazawa, Setagaya-ku, Tokyo, 154-8525, Japan, toshi@komazawa-u.ac.jp

We deal with a  $d$ -dimensional skip-free reflecting random walk with a finite-state background process, where the transition probabilities are modulated according to the background process. First we obtain a general sufficient condition on which the process is positive recurrent and then apply it to the cases of  $d=2$  and  $d=3$ .

### TC15

Room 212A

#### Competition and Pricing Strategies in China's Industries

Sponsor: Marketing Science

Sponsored Session

Chair: Han LI, Southwestern University of Finance and Economics, Research Institute of Economics and Mana, ChengDu, SiChuan, 610074, China, hli@swufe.edu.cn

##### 1 - Demand Shock and Price Dispersion

Lan Zhang, Associate Professor, Southwestern University of Finance and Economics, Research Institute of Economics and Mana, Chengdu, Sichuan, 610074, China, zhanglan@swufe.edu.cn, Feng Wei, Zaichao Du, Han LI

We study the impact of the opening of the High-Speed train between Beijing and Shanghai on the pricing behavior of airline companies along the railway. We found (1) the price competition is intensified after the introduction of the bullet train; (2) prices became more dispersed after the demand shock. Our results are consistent with the finding of Borenstein and Rose (1994).

##### 2 - Markdown in Chinese Automobile Market

Junji Xiao, Associate Professor, Fudan University, School of Management, Shanghai, 200433, China, junjixiao@fudan.edu.cn, Shanjun Li

Average vehicle prices has been dropping during the past ten years accompanied with arguably improved product quality from year to year. This paper investigates drivers of markdown in Chinese automotive market. Our empirical results show that cost shifters other than learning-by-doing and quality changes, such as labor costs, are the major drivers for markdown. Market structure, learning-by-doing, and quality changes are also factors driving down the auto prices.

##### 3 - Profits versus Message: Objectives of a Chinese Local TV Station

Shihe Fu, Associate Professor, Xiamen University, The Wangyanan Inst. for Studies in Economics, Xiamen, Fujian, 361005, China, fushihe@xmu.edu.cn, V. Brian Viard

Despite the size and influence of China's TV industry, little is known about its objectives. Largely government-controlled, TV stations may have different goals than those fully subject to the market; particularly the willingness to trade off profits and message. We offer empirical evidence using ad and viewership data for a provincial broadcasting group. We use data on three types of ads broadcast by each of the group's stations: paid ads, internal promotions, and unpaid public service ads.

##### 4 - Competition and Price Dispersion in China's Drug Retailing Industry

Han LI, Southwestern University of Finance and Economics, Research Institute of Economics and Management, ChengDu, SiChuan, 610074, China, hli@swufe.edu.cn

We study drug price and price dispersions in both conventional and online market in China. Using data collected from all pharmacies in a geographically isolated area, we find significant price dispersion across 'bricks-and-mortar' sellers. Even after controlling for pharmacy differences, dispersion still persists. Price dispersion in the online market is also considerable, and it is no smaller than dispersion in conventional market.

### TC16

Room 212B

#### Marketing Applications

Contributed Session

Chair: Jane Gu, Assistant Professor of Marketing, The State University of New York, Albany, 1400 Washington Ave. BA336, Albany, NY, 12222, United States of America, zgu@uamail.albany.edu

##### 1 - Limiting Supply of One Recourse Decreases Over-acquisition of Unrelated Resources

Meng Zhu, Assistant Professor of Marketing, The Johns Hopkins Carey Business School, 100 International Dr., Baltimore, MD, 21202, United States of America, mengzhu@jhu.edu, Ajay Kalra

Consumers often over-acquire resources during the course of consumption. Such over-acquisition is only possible when resources are abundant. When a resource is not abundant, people typically acquire less to not deplete the supply. We demonstrate that limiting the supply of one resource can decrease cognitive accessibility of the global notion of abundance, activate a general tendency to conserve and even lead people to acquire less of a different type of resource.

##### 2 - Communicating Sustainability: The Effect of Message Appeal and Construal Level

Sidney Su Han, University of Guelph Canada, 50 Stone Road East, Guelph, Canada, shan@uoguelph.ca

The effectiveness and efficiency of managing sustainability not only depends on structural factors, but also relies on informational factors. Recently, how to effectively communicate sustainability with the public to promote sustainable behaviours is very challenging to public marketers. This study is examining the impact of different message appealing strategies on influencing people's sustainable attitudes and behaviours, as well as investigating the construal condition of the appealing effect.

### 3 - Market Demand Analysis by Using the Market-Data Envelopment Analysis Model

Mehdi Ahmadpanah, Panberes, Beheshti Ave., Tehran, Iran, smapanah@gmail.com, Maryam Ghanizadeh

This paper introduces the market demand analyze model using Market-Data Envelopment Analysis technique. M-DEA is a new approach that initially using AHP technique to extract the main and affecting parameters on different regions' demand and then according to the extracted parameters, assesses market demand in each region. In order to further clarification of this model, analysis of diaper demand in different cities of Iran is presented.

### 4 - Facilitating Fit-Revelation in the Competitive Market

Jane Gu, Assistant Professor of Marketing, The State University of New York, Albany, 1400 Washington Ave. BA336, Albany, NY, 12222, United States of America, zgu@uamail.albany.edu, Ying Xie

This study examines firms' strategic decisions in the competitive market regarding whether to exert effort to assist consumers find the fit between their personal tastes and products' horizontal attributes. We find that the firm offering the high quality product implements fit-revealing activities in a greater intensity than its rival that offers the low quality product, if the quality difference between the two products is small and both products' qualities exceed a threshold.

## TC17

Room 213A

### Joint Session HAS/ OR/MS in Medicine: Home Health Cares

Sponsor: Health Applications & OR/MS in Medicine and Healthcare Sponsored Session

Chair: Xiaolan Xie, Professor, École Nationale Supérieure des Mines de Saint-Étienne, 158, cours Fauriel, Saint Etienne Cedex2, F-42023, France, xie@emse.fr

#### 1 - Mobile Sensor Systems for Measurement of Stress and Activity in Preventive Healthcare Applications

Stefan Hey, Dr, KIT Karlsruhe Institut of Technology, House of Competence - hiper.campus, Fritz-Erler-Str. 1-3, Karlsruhe, 76131, Germany, stefan.hey@kit.edu

The negative health consequences of stress as well as the impact on the health system attracted more and more public's attention. For the diagnosis and therapy of stress related disorders a device for an objective assessment is required. Based on a comprehensive model for the phenomenon 'stress' on psychological, physiological and behavioral level, a system for the measurement of stress is introduced. It consists of a psycho-physiological measurement device and a wireless coupled smartphone.

#### 2 - A Mathematical Programming Model for Multi-service Multi-facility Location Problem of Home Care

Na Geng, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai, China, gengna@sjtu.edu.cn, Xiaolan Xie, Tong Wei

Multi-service multi-facility location problem is to locate a set of new facilities to meet the service demand. This paper proposes a deterministic mathematical programming model with the objective to minimize the total cost in the finite horizon. The location decisions, combining with the decisions of service capacities, are simultaneously determined. Numerical experiments are performed to show the performance of the proposed model.

#### 3 - Assignment and Routing Models for Human Resource Planning in Home Health Care

Andrea Matta, Associate Professor, Politecnico di Milano, Via La Masa 1, Milano, 20156, Italy, andrea.matta@polimi.it, Evren Sahin, Semih Yalcindag

We analyze the problem of assigning patients to nurses in home health care organizations under the constraint of continuity of care. This constraint does not allow that a patient receives the care from different operators, thus aiming at increasing the service quality and at avoiding loss of information between operators. Different assignment and routing models are proposed and evaluated in scenarios with uncertain patient demand. Numerical analysis are based on real data.

### 4 - Healthcare at Home Facility Location-allocation Problem

Xiaolan Xie, Professor, École Nationale Supérieure des Mines de Saint-Étienne, 158, Cours Fauriel, Saint Etienne Cedex2, F-42023, France, xie@emse.fr, Vincent Augusto, Carlos Rodriguez, Thierry Garaix

This article presents a multi-period location-allocation model for healthcare at home (HAH). Several decisions are addressed: location of facilities, assignment of demand to HAH companies, authorization for delivering some specific cares and allocation of resources. This problem is NP-Hard problem but can be solved with standard solvers for instances of medium size. We show by numerical experiments how to adapt a HAH network to face change of demands in time and in geographic distribution.

## TC18

Room 213B

### Risk Management

Contributed Session

Chair: Yanxin Wang, Business College of Beijing Union University, A3, yanjingdongli, Chaoyang Dist. ver, Beijing, 100025, China, yanxin.wang@buu.edu.cn

#### 1 - Risk Management in Performance Based Logistics

Guangyuan Yang, PhD Candidate, Erasmus Universiteit Rotterdam, Burg. Oudlaan 50, Rotterdam, 3062PA, Netherlands, gyang@ese.eur.nl

Motivated by operational practices at an independent performance-based aircraft MRO service provider and its inquiry into risks of extreme repair costs, we develop a risk measure and propose a decision support system to mitigate the risks using a proactive procurement strategy with purchasing limits (both prices and quantities). The tool supports both procurement decisions and repair decisions.

#### 2 - The Play-against-Random-past Strategy for Real Multiple-expert Selection in Sequential Prediction

Mingfei Li, Assistant Professor, Bentley University, 175 Forest Street, Waltham, MA, 02452, United States of America, mli@bentley.edu

If we consider the experts' loss sequences as a repeated game, we can use their history dynamically to decide current stage expert selection. We study a play-again-random-past strategy on decision of such sequential prediction. The effectiveness of this strategy will be measured by Hannan consistency and regret. The origin of this strategy will be introduced and the application of this strategy will be showed by simulation with real world experts in different scenarios from simple to complex.

#### 3 - A Modified Measure of Risk Based on Normalized Expected Utility and Information Entropy

Jiping Yang, Professor, School of Economics and Management, Beihang University, Beijing, 100191, China, yangjp@buaa.edu.cn

Combining normalized expected and Soofi's information index together, we give a modified measure of risk based on the normalized expected utility and information entropy. It has been showed that this measure of risk has some normative properties under certain conditions. Moreover, it can be a proper descriptive model to some extent. Using this model, the certainty effect in prospect theory can be interpreted in a reasonable way.

#### 4 - Research on Risk Control Model of IT Service Outsourcing

Yanxin Wang, Business College of Beijing Union University, A3, yanjingdongli, Chaoyang Dist. ver, Beijing, 100025, China, yanxin.wang@buu.edu.cn, Jianbin Chen, Tong Shi

This paper describes the characteristics of IT service outsourcing (ITSO) in implementation phase, and designs a collection of risk control measures based on the analysis of risk factors in ITSO. A model of multi-objective risk control model is build which consists of risk evaluation, risk cost control and risk loss. And the model is analyzed by multi-objective Pareto-based ant colony algorithm. We get satisfied convergence and diversity of Pareto optimal solutions through numerical example.

■ **TC19**

Room 215

**Challenges in Modern Data Analysis**

Cluster: Tutorials

Invited Session

Chair: Ming Yuan, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, United States of America, myuan@isye.gatech.edu

**1 - Challenges in Modern Data Analysis**

Ming Yuan, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, United States of America, myuan@isye.gatech.edu

The way science is done today is very different from the past, and big data are becoming the new microscope for big science. Immediate access to copious amount of interesting and important data presents unprecedented opportunities, but also creates unique challenges. A distinctive characteristic that often sets these massive data apart from the usual subject of traditional statistical analysis is their high dimensionality, which means that information can be abundant yet at the same time elusive. The difficulty in dealing with high dimensional data stems from the apparent intractability in approximating, integrating, optimizing, and consequently estimating a high dimensional function. Development of statistical theory to understand the nature of such characteristic, and methodology to address the associated issues will advance our intellectual exploration and knowledge, and undoubtedly benefit a multitude of scientific and technological fields. In this tutorial, I will discuss some the recent advances and challenges ahead in tackling these problems, and their potential impact in other areas.

■ **TC20**

Room 207

**Software Tutorials**

Cluster: Software Tutorials

Invited Session

**1 - Edgestone IT - Better Tools for Better Decisions**

Yanfeng Wang, Edgestone Information Technologies Co., Shanghai, Shanghai, China, yanfeng.wang@edgestone-it.com

In this tutorial, we will present an overview of the list of simulation and optimization tools offered by Edgestone Information Technologies for China market. These tools include world-class software like Gurobi, AIMMS, ExtendSim, Demo3D, JOPT, also include in-house developed tools in assembly line balancing and advanced production scheduling.

**2 - IBM ILOG CPLEX Optimization Studio and Advanced Analytics**

John Cui, IBM, New Orchard Road, Armonk NY 10504, United States of America

Come learn about the latest developments in IBM ILOG CPLEX Optimization Studio including how you can combine optimization with the predictive analytics of IBM SPSS, bringing you entirely new capabilities as an operations researcher. Recent and upcoming releases will be discussed. You will see the benefits of leveraging the IBM software portfolio, delivered by the undisputed leader in optimization and advanced analytics.

**Tuesday, 4:30pm - 6:00pm**

■ **TD01**

Room 202B

**Transportation and Logistics Models**

Contributed Session

Chair: Matthias Ehrgott, Professor, The University of Auckland, Department of Engineering Science, Private Bag 92019, Auckland, 1142, New Zealand, m.ehrgott@auckland.ac.nz

**1 - Cargo Routing and Empty Container Repositioning in Multiple Shipping Service Routes**

Jingxin Dong, Lecturer, University of Hull, Business School, University of Hull, Hull, HU6 7RX, United Kingdom, jingxin.dong@hull.ac.uk, Dongping Song

Abstract: Two solution methods are proposed for the problem of joint cargo routing and empty container repositioning at the operational level for multiple liner shipping routes. One is a two-stage exact method, and the other is a two-stage approximate method. The former is preferable for relatively small-scale problems, whereas the latter has advantages in large-scale practical application.

**2 - A Spatially Scalable Model For Global Freight Transportation**

Guoqiang Shen, Professor, University of Oklahoma, 257 Gould Hall, Regional and City Planning, Norman, OK, 73019, United States of America, guoqiangs@ou.edu

This research develops a spatially scalable model using GIS and global end-to-end freight data to study the optimal routing of global shipment of goods with a focus on USA and China. The research provides quick math based on urban transportation modeling - trip generation, distribution, mode split, and flow assignment. The research provides results and spatial visualization of total and commodity specific flows for highway, waterway, railway, and air modes at various spatial scales.

**3 - A Vehicle Routing Model with Stop Nodes**

Leonardo Berbotto, Universidad Carlos III de Madrid, Av. Madrid 126, Getafe, Spain, lberbott@est-econ.uc3m.es, Sergio Garcia, Francisco J. Nogales

The Vehicle Routing Problem (VRP) is one of the most classical combinatorial optimization problems. Here, we study a variant of the VRP that we call VRP with stop nodes where we introduce length leg constraints: no route leg can exceed a given amount (in distance or time) without making a stop at a stop node. Thus, these nodes must be visited in order to avoid the violation of these constraints. We will give a mathematical formulation for this model and we will show a first computational study.

**4 - Dynamic Shortest Path Problem with Arc-Dependent and Travel-Time Dependent Stochastic Disruptions**

Derya Sever, PhD Candidate, Eindhoven University of Technology, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, d.sever@tue.nl, Lei Zhao, Nico Dellaert, Tom van Woensel, Ton de Kok

We consider dynamic shortest path problems with disruptions on certain arcs. We model the problem as a discrete time, finite horizon Markov Decision Process. For large scale networks, the formulation suffers from the curse of dimensionality. We apply Approximate Dynamic Programming with efficient value function approximations to solve large scale networks with high dimensional disruption states. We develop a test bed of networks to evaluate the efficiency of our approximation.

**5 - Multi-objective Network Equilibria, Traffic Assignment and Road Pricing**

Matthias Ehrgott, Professor, The University of Auckland, Department of Engineering Science, Private Bag 92019, Auckland, 1142, New Zealand, m.ehrgott@auckland.ac.nz, Judith Wang

Multi-objective equilibrium models of traffic assignment state that users of road networks travel on routes that are efficient with respect to several objectives, such as travel time and toll. We present the concept of time surplus maximisation as a way of handling user preferences in tolled road networks. We propose to use such models on the lower level of bi-level models for pricing in road networks under multiple upper level objectives such as minimising system travel time and emissions.

■ **TD02**

Room 202A

**Data Mining**

Contributed Session

Chair: Young Seon Jeong, Post Doctorial Fellow, Khalifa University of Science, Technology and Research, P.O. Box 127788, Abu Dhabi, United Arab Emirates, young.jeong@kustar.ac.ae

**1 - News Coverage of US Business in China, 1979-2010: Text Mining and Semantic Network Analysis**

Priscilla Murphy, Professor, Temple University, 220 Weiss Hall, 1701 North 13th Street, Philadelphia, PA, 19122-6085, United States of America, murphy@temple.edu

This study used text mining and network analysis to identify policy frames for US business in the official Chinese media, China Daily and Xinhua News, 1979-2010. Cluster and factor analyses revealed seven distinct periods in Chinese coverage corresponding to political and economic developments. We present the themes and show how the technology offers insights into strategic positioning.

**2 - The Dynamic Economic Dispatch and Risk Management of Large-scale Integration of Wind Power**

Man Hu, Nanjing University, 22 Hankou Road, Nanjing, China, human8932@gmail.com

Large-scale integration of wind power presents some operational difficulties, which are mainly attributed to the intermittent and stochastic nature of wind. The unpredictability of wind power generation makes it an unreliable energy source, which may threaten the stable operation of power grids. To solve the problems in the dispatch of wind power, this paper presents a dynamic economic dispatch model, and the risk management in the process is included in our discussion.

### 3 - Research on High-Quality Wind-Solar Joint Power Forecasting: The Case in China

Tao Zhang, North China Grid Company, NCGC building, Guanganmen Bridge, Beijing, China, zhang.tao@nc.sgcc.com.cn, Rong Fu Sun, Dengfeng Guo, Xiaoguang Rui, Haifeng Wang, Wen Jun Yin, Jun Liu

Accurate power forecasts are beneficial for large scale renewable power integration. In this paper, a high-quality wind-solar joint power forecasting system is proposed and applied at a world-largest wind-solar-storage project at Zhangbei, China. Based on numerical weather prediction for the region, statistical learning methods are applied for the short term and very-short term power predictions of a single wind turbine, a single wind farm, wind farms and a photovoltaic electric power station.

### 4 - Monitoring Scheme for Updating a Decision Tree in Time

Sang-mi Yoon, Dept. of IMSE, Kyung Hee University, 1732 Deogyong-daero, Giheung-gu., Yongin-si, 446-701, Korea, Republic of, yoonssmi@gmail.com, Chang-Ho Chin

Companies build classification models that describe and predict customer characteristics and develop proper marketing strategies based on those models. As time elapses, customer characteristics are changing and existing models cannot describe customer characteristics properly anymore. Therefore, models have to be updated in time to reflect the latest customer characteristics. This study takes advantage of the control chart and statistical hypothesis test for achieving the aforementioned goals.

### 5 - Support Vector Data Description-Based Feature Selection Method

Young Seon Jeong, Post Doctorial Fellow, Khalifa University of Science, Technology and Research, P O Box 127788, Abu Dhabi, United Arab Emirates, young.jeong@kustar.ac.ae, Dongjoon Kong, In-Ho Kang, M.K. Jeong

This talk presents two novel feature selection methods, which integrate support vector data description (SVDD) into radius-recursive feature elimination (RFE), for one-class classification problems as follows: SVDD-RFE method and SVDD-dual objective-RFE method. Evaluation with real-life data sets shows that proposed methods show the improved performance compared to existing SVM-RFE methods even for the classification problems when available observations for the anomaly are few.

## TD03

Room 203B

### Metaheuristics Applications

Contributed Session

Chair: Shuguang Liu, Associate Professor, State University of New York, New Paltz, 1 Hawk Drive, New Paltz, NY, 12561, United States of America, liush@newpaltz.edu

#### 1 - A Simulated Annealing Algorithm for Testing the Collective Consumption Model

Fabrice Talla Nobibon, KU Leuven, Fac. of Bus. and Econ., Naamsestraat 69 - bus 3555, Leuven, Belgium, fabrice.tallanobibon@econ.kuleuven.be, Yves Crama, Thomas Demuyne, Bram De Rock, Frits Spieksma, Laurens Cherchye

This paper proposes an efficient procedure for testing the collective consumption model on large data set. The problem is first formulated as a global optimization problem and a simulated annealing algorithm is derived for solving it. Computational experiments are performed on real-life data.

#### 2 - An Effective Variable Neighborhood Search for the Reliable p-hub Center Location Problem

Ashkan Hassani, University of Nebraska-Lincoln, Nebraska Hall, Lincoln, NE, United States of America, hassani.ashkan@yahoo.com, Maryam Khatami, Pedram Hooshangi Tabrizi, Babak Mousavi

In this paper, a new hub location problem, termed the p-hub maximum reliability location, has been introduced which focuses on locating p hubs in a network and allocating the other nodes (spokes) to them in order to maximize the least value of reliability between any pair of nodes in the network. A mathematical model is developed taking advantage of single-allocation p-hub maximum reliability approach. To tackle the computational complexity of problem in practice, a VNS algorithm is proposed.

### 3 - Research of Sequencing with Chain Constraints Based on Genetic Algorithm

Gao Chenjie, South China University of Technology, College of Automation, South China Unive, Guangzhou, China, gao.chenjie@mail.scut.edu.cn, Zhang Mei

Aiming at improve the biochemical index detective efficiency and degree of automation, this paper presents a scheduling model of tips with chain constraints based on genetic algorithm which can minimize the total working time, because this model considers the constraints of the tips motion, reasonably arranges the working sequence of the tips. The simulation results show that this method can greatly improve the working efficiency of tips and has practical applications.

### 4 - Variable Selection in Classification Using Tabu Search

Minghe Sun, Professor, The University of Texas at San Antonio, College of Business, One UTSA Circle, San Antonio, TX, 78249, United States of America, minghe.sun@utsa.edu

A tabu search procedure is developed to solve an MIP model for variable selection in two-class classification. Recency and frequency based memory structures are used in the procedure. Visited solutions are stored in a primogenitary linked quad tree. Variables frequently selected into trial solutions are used to intensify the search. Datasets publicly accessible online are used to test the performance of the procedure. Very good results are obtained and computational results are reported.

### 5 - A Hybrid Population Heuristic for the Heterogeneous Vehicle Routing Problem

Shuguang Liu, Associate Professor, State University of New York, New Paltz, 1 Hawk Drive, New Paltz, NY, 12561, United States of America, liush@newpaltz.edu

We present a heuristic algorithm for the heterogeneous vehicle routing problem. This is the problem of routing a heterogeneous fleet to serve customers so as to minimize the delivery cost. A population heuristic is implemented where a population of solutions are progressively evolved by a variable neighborhood search. Computational results on a set of eight benchmark test problems confirm that the proposed heuristic produces excellent solutions in short computing times.

## TD04

Room 203A

### Green Supply Chain and Transport Logistics

Cluster: Maritime, Trade and Supply Chain Logistics

Invited Session

Chair: George Q. Huang, Professor, The University of Hong Kong, Pokfulam Road, Pokfulam, Hong Kong - PRC, gquang@hku.hk

#### 1 - Hybrid Flow Shop Scheduling Considering Machine Electricity Consumption

George Q. Huang, Professor, The University of Hong Kong, Pokfulam Road, Pokfulam, Hong Kong - PRC, gquang@hku.hk

This research proposes a new ant colony optimization (MOACO) meta-heuristic considering not only production efficiency but also electricity power consumption (EPC) with the presence of time-of-use (TOU) electricity pricing. The experimental results show that MOACO is slower but it provides better quality non-dominated solutions.

#### 2 - Towards Application of Containers Routing Protocols in Open and Interconnected Logistics Networks

Shenle Pan, Dr, Mines ParisTech, 60, Boulevard Saint-Michel, Paris, 75272, France, shenle.pan@gmail.com, Eric Ballot, Rochdi Sarraj

The interconnection of logistics networks, namely Physical Internet, allows to reconsider dedicated logistics services as containers' routing. The purpose of this pooling framework is to improve transport and handling efficiencies to reach sustainability. Via a case of FMCG in France, various routing protocols and scenarios were tested and encouraging results were measured according to KPI such as CO2 emissions, energy used, cost, etc. The simulation model also suggests several improvements.

#### 3 - Energy Efficiency Analysis for Permutation Flow Shop Problems

Haidong Yang, Professor, China, yanghd@yeah.net, Guo-Sheng Liu

We introduces the mathematical model of the energy-efficient PFS problem. The optimal rule is presented, which provides a simple solution procedure based on Johnson's rule, for two-machine PFS problem; In the regards of m-machine case, an genetic algorithm is developed by utilizing the estimation of energy efficiency; Numerical experiments demonstrates the performance and validation of the proposed method; finally, some remarks and conclusions are given.

## ■ TD05

Room 205B

### Energy: China Studies

Contributed Session

Chair: Huibin Du, Institute of Systems Engineering, School of Management, Tianjin University, 92 Weijin Road, Nankai District, Tianjin, Tianjin, China, duhuibin@tju.edu.cn

#### 1 - Method for Improving Wind Power Forecast: A China Case

Rong Fu Sun, North China Grid Company, NCGC Building, Guanganmen Bridge, Beijing, China, hcxsrf@163.com, Wen Jun Yin, Dengfeng Guo, Jun Liu, Tao Zhang, Hui Du, Haifeng Wang

Wind power forecast is critical to integrate renewable energy to electric power grid. We introduce a hybrid solution, which combines state-of-the-art high resolution NWP model and a statistical model, to perform wind power forecast. To improve the prediction performance, forecasting results from NWP has been tuned and corrected based on the power forecast verification against the wind-turbine-based observations in the past 30 days.

#### 2 - Assessment of China's Regional Energy Efficiency Using SBM-DEA Window Analysis

Huibin Du, Institute of Systems Engineering, School of Management, Tianjin University, 92 Weijin Road, Nankai District, Tianjin, Tianjin, China, duhuibin@tju.edu.cn, Yangyang Wang, Shan Zhou

Under a total-factor framework, this paper uses a slack-based measured data envelopment analysis model (SBM-DEA) with undesirable outputs combined with DEA-window approach to investigate energy efficiencies and maximum potential energy savings of 29 provincial-administrative regions (PARs) and eight areas in China during 1997-2009. For PARs, Fujian, Guangdong, Shanghai performed best in energy use. For areas, the most efficient in using energy are South Coastal Area.

#### 3 - Green Technology: A Case Study of Low-Carbon Project in Penghu Island

Lan Shang Wen, Graduate Institute of Information and Computer Education, National Kaohsiung Normal University, No. 116, Heping 1st Rd., Lingya District, Kaohsiung City 80201, Taiwan (R.O.C.), Kaohsiung, 80201, Taiwan - ROC, flymingblue@gmail.com

Low-Carbon Project in Penghu Island is a pioneered green energy project in Taiwan. The objective of this research is to understand the current progress and further explore the research directions and innovations of green technology in the Information Systems area. We found that the development of green industry must be tailored with local features and resources. The contribution is to empirically study the progress and identify the challenges of a green energy project.

## ■ TD06

Room 205A

### Healthcare I

Contributed Session

Chair: Shan Liu, Stanford University, Huang Engineering Center 212H, 475 Via Ortega, Stanford, CA, 94305, United States of America, shanliu@stanford.edu

#### 1 - Time Stamp Analytics and Data Visualization to Improve Operating Room Scheduling

Sandra Potthoff, Associate Professor, University of Minnesota, 420 Delaware Street SE, Mayo Mail Code 510, Minneapolis, MN, 55455, United States of America, potth001@umn.edu, Diwakar Gupta, Chris Dickerson

Time stamp data in computerized operating room scheduling systems are an underutilized resource in building models to improve scheduling policies. We show the analytics and data visualizations conducted for a metropolitan hospital. Results identified innovative approaches for allocating block to surgeon groups, leaving more open time for urgent demand, and staggering room start times at the beginning of the day to improve staffed room utilization. Drawbacks of time stamp data will be discussed.

#### 2 - An Empirical Study of Inpatient Units Capacity Allocation and its Implication on Service Outcomes

Marcelo Olivares, Associate Professor, Columbia Business School, 3022 Broadway, Uris Hall, New York, NY, 10027, United States of America, mo2338@columbia.edu, Song-Hee Kim, Carri Chan

This paper develops an empirical model to explain how admission to an Intensive Care Unit are affected by patient severity factors and the level of occupancy of

inpatient units, which is estimated using a detailed dataset of 80,000 patients' visit data from a large hospital network. In addition, this routing model is used to identify the effect of routing decisions on patient outcomes using an Instrumental Variable approach.

#### 3 - EDRhythm: Emergency Department Monitoring and Control

Boaz Carmeli, IBM Haifa Research Lab, Haifa University, Mount Carmel, Haifa, 31905, Israel, BOAZC@il.ibm.com, Avishai Mandelbaum

EDRhythm is a prototype implementation of emergency departments monitor, control and decision support. EDRhythm dynamically analyses and optimizes physician's encounter schedule based on clinical and operational performance indicators. In this research we focus on the simulation and fluid model analysis of the question "which patient the physician should treat next?"

#### 4 - Cost-Effectiveness of Risk-Factor Guided and Universal Screening for Chronic Hepatitis C

Shan Liu, Stanford University, Huang Engineering Center 212H, 475 Via Ortega, Stanford, CA, 94305, United States of America, shanliu@stanford.edu, Lauren Cipriano, Mark Holodniy, Jeremy Goldhaber-Fiebert

U.S. guidelines conflict over population screening for chronic hepatitis C. We conduct cost-effectiveness analyses evaluating universal and risk-factor guided screening followed by one of three treatment strategies. Statistical analyses of the National Health and Nutrition Examination Survey estimated sex-, race-, age-specific risk factor prevalence and mortality risks. Universal screening is likely cost-effective.

## ■ TD07

Room 206A

### Recent Developments of Mobile Businesses in China and Korea

Cluster: Comparison of Mobile Businesses in China and Korea  
Invited Session

Chair: HongJoo Lee, The Catholic University of Korea, Jibongro 43, Wonmi, Bucheon, 420743, Korea, Republic of, fastbat@gmail.com

#### 1 - Affecting Factors of Mobile Game Usage Intention: Comparison between China and Korea

Jong Woo Kim, Professor, Hanyang University, 222 Wangsimni-ro, Seongdong-gu, Seoul, 133-791, Korea, Republic of, kjw@hanyang.ac.kr, Jin Yu

In this study, we aim to identify affecting factors of mobile game usage intention. Based on previous studies on mobile services and games, we identify variables which can influence customer attitude on mobile games including perceived enjoyment, perceived attractiveness, and perceived sacrifices as well as perceived device performance. Based on survey from Korea and China, we try to compare differences and similarities of mobile game usage intention between Korean and Chinese.

#### 2 - A Framework of Consumer-oriented Corporate Governance

Bin Xie, School of Economics and Management, Tsinghua University, Beijing, China, xieb@sem.tsinghua.edu.cn

Investor-driven corporate governance system, which has been dominating enterprises, business schools, Wall Street and even the world, can inevitably harm consumers and the world. Based on Taguchi's quality definition of losses to society, a framework of consumer-oriented corporate governance will be discussed.

#### 3 - An Exploration of Virtual Goods in Virtual Market

Andrew Dela Rosa, The Catholic University of Korea, Jibongro 43, Wonmi, Bucheon, Korea, Republic of, drews.delarosa@gmail.com

One of the interesting things brought by the technological advancement with smartphones is the convenience and experience of mobile gift coupons. This research study presents a qualitative approach about the different motivators in the usage of virtual goods in a mobile application platform. Also, to comparatively determine the various situations that suggest the relative advantage of virtual goods than traditional gifts could provide a practical development of virtual market services.

#### 4 - Innovation in the Mobile Business Sector: A Comparative Study of China and Korea

Mingzhi Li, Tsinghua University, School of Economics and Management, Beijing, China, limzh@sem.tsinghua.edu.cn

This paper analyzes the different approaches towards innovation in the mobile business sectors in China and Korea, with particular focus on the roles played by the government. In the Chinese case, the government has taken a leading role in promoting the TDSCDMA 3G standards in order to create a indigenous industry value chain, and in Korea, firms such as Samsung has become world leader in certain areas while following the division of labor in the whole world market.

#### 5 - Engaging the Modern Consumer in Facebook: An Analysis of Strategies of Firms on Corporate Pages

Kristine Luna, The Catholic University of Korea, Jibongro 43, Wonmi, Bucheon, Korea, Republic of, olivialuna\_06@yahoo.com, Hong Joo Lee

Social networks have become an additional marketing channel and online messages from consumers have grown to an astounding amount, evidence of the channel's increasingly essential role as a communications tool. Despite this, firms still do not understand the opportunities they can take advantage of through the social media channel. Insight from this paper aims to enlighten firms on the best practices in getting and maximizing the consumer's thumbs up on Facebook.

#### 6- The Impact of CRM Implementation on Financial Performance: A Comparison between US and China

Jinghua Huang, Tsinghua University, School of Economics and Management, Beijing, China, huangjh@sem.tsinghua.edu.cn, Yangfan Li

There has been insufficient evidence that testifies the business value of CRM, especially in developing countries. This paper selects the listed companies in US and China that implemented CRM in the last 10 years, and analyzes the financial performance impact of the systems. We find that, both the companies in US and China benefit from CRM systems, but the shifting pattern in operational efficiency shows great differences.

### TD08

Room 206B

#### Quantitative Methods into Policymaking

Sponsor: Computational Optimization & Applications (Sponsored by the Computing Society)

Sponsored Session

Chair: Guoliang Yang, Associate Professor, Institute of Policy and Management, Chinese Academy of Sciences, No.15, Zhongguancun Beiyitiao, Haidian District, Beijing, China, Beijing, China, glyang@casipm.ac.cn

#### 1 - Index DEA models with Evidence Enhancement Effect

Guoliang Yang, Associate Professor, Institute of Policy and Management, Chinese Academy of Sciences, No.15, Zhongguancun Beiyitiao, Haidian District, Beijing, China, glyang@casipm.ac.cn, Wenbin Liu

In this paper, we firstly showed the relationship between utility theory and index DEA models, including dual models and some theoretical analysis of index DEA model, etc. Secondly, we proposed generic quadratic and ER index DEA models. Thirdly, we gave illustrative examples to test the features of quadratic and ER index DEA models, and an empirical example of institutes' evaluation practice in Chinese Academy of Sciences (CAS) in 2005.

#### 2 - Genetic Programming Based Combination of Multiple CBRs for Software Effort Estimation

Dengsheng Wu, Institute of Policy and Management Chinese Academy of Sciences, No. 15 Zhongguancun Beiyitiao, Beijing, 100190, China, wds@casipm.ac.cn, Jianping Li

The study puts forward the genetic programming based combination of multiple case-based reasoning to estimate software effort. Based on six widely used CBR methods with optimized weight are constructed, GP combination method is adopted to assemble the result of independent CBR method. The experiments are carried out using Desharnais dataset and Miyazaki dataset. The results show that the GP combination method outperforms the independent methods and other linear combination methods.

#### 3 - Measuring Efficiency in Power Plants with DEA: A Literature Review

Xiangrong Liu, Assistant Professor, Bridgewater State University, 95 Grove Street, Bridgewater, MA, 02324, United States of America, xliu@bridgew.edu, Kelley Donalds

Data Envelopment Analysis (DEA) models have been widely used to measure the efficiency of homogeneous decision making units by relating inputs to outputs. Our literature survey will study how this specific methodology has been applied in the efficiency measurement for power plants. Based on this setting, this study addresses the potential difficulties existing in modeling, implementing and problem solving and discusses the future research directions.

#### 4 - A Study on Efficiency of Taiwanese Banks Using Data Envelopment Analysis

Hsi-Hsing Lee, National Taiwan University of Science and Technology, 43, Sec. 4, Keelung Rd., Taipei, Taiwan - ROC, roxanali@yahoo.com, Cheng-Huang Hung

We use Data envelopment analysis (DEA) to evaluate the efficiency of Taiwanese banks by the data of 32 Taiwanese banks in 2009. Results show there were at least 12 DMU to be efficient in overall, technical, and scale efficiency. Four banks were efficient in technical efficiency, but relatively inefficient in overall efficiency and scale efficiency. Maybe it can explain why these Taiwanese banks are preparing to expand its market from Taiwan to other Mandarin-speaking market these years.

#### 5 - Multi-scale Correlations between Tanker Freight Rate and Oil Price

Xiaolei Sun, Institute of Policy and Management, No. 15, zhongguancun beiyitiao, Beijing, China, xlsun@casipm.ac.cn, Yuying Yang, Ling Tang

Taking time-dependent features into account, this paper focuses on the multi-scale correlations between tanker freight rate and oil price. Multi-scales are extracted from tanker freight rate using Ensemble Empirical Mode Decomposition, and the correlations between multi-scale components and oil price are examined. Empirical results show that major and long-term trends are close correlated to the oil price in opposite dependent structures while the short-term fluctuation is nearly uncorrelated.

### TD09

Room 208A

#### Pricing and Revenue Management

Sponsor: Computational Optimization & Applications (Sponsored by the Computing Society)

Sponsored Session

Chair: Heping Liu, University of Wisconsin at Madison, 3270 ME Building, 1513 University Avenue, Madison, WI, 53706, United States of America, hepingliu@yahoo.com

#### 1 - Opaque Pricing with Capacity Constraints

Xiaoqing Xie, Assistant Professor, Shanghai University of Finance and Economics, Guoding Road 777, Yangpu District, Shanghai, 200433, China, xie.xiaoqing@mail.shufe.edu.cn, Chris Anderson

In opaque pricing certain characteristics of the product or service are hidden from the consumer until after purchase. We model a monopolist selling a product simultaneously via a full information channel, an opaque posted price channel and an opaque bidding channel. We develop a stylized model of consumer choice that illustrates the role of opaque pricing in market segmentation and its impact on optimal revenues. We also study the segmentation and policy changes induced by capacity constraints.

#### 2 - Time Series Forecasting of Short-term Electricity Prices: ARMA-GARCH Approaches

Heping Liu, University of Wisconsin at Madison, 3270 ME Building, 1513 University Avenue, Madison, WI, 53706, United States of America, hepingliu@yahoo.com

Modeling and predicting the mean and volatility of electricity prices can be of great importance to value electricity, bid or hedge against the volatility of electricity prices and manage risk. The current work investigates the applicability of various autoregressive moving average models with generalized autoregressive conditional heteroscedasticity processes, namely ARMA-GARCH models, along with ARMA-GARCH-in-mean (ARMA-GARCH-M), to model and forecast hourly ahead electricity prices.

#### 3 - A Distribution-free Risk-reward Newsvendor Model: Extending Scarf's Min-max Order Formula

Donglei Du, Professor, University of New Brunswick, 7 Macaulay Lane, Fredericton, NB, E3B 9Y2, Canada, ddu@unb.ca, Qiaoming Han, Luis Zuluaga

Scarf's min-max order formula for the distribution-free risk-neutral newsvendor problem is a classical result. The main contribution of this work is to extend Scarf's closed-form order formula to one of the most important risk-reward criteria, namely when the reward is defined by the expected profit, and the risk by the profit's standard deviation.

**4 - Revenue Management as a Strategic Tool**

Ivan Oliveira, Analytical Solutions Manager, SAS,  
SAS Campus Drive, Cary, NC, 27513, United States of America,  
Ivan.Oliveira@sas.com, Maarten Oosten

Revenue Management is often thought of as a tactical and operational tool. However, as is the case with pricing in general, revenue management can also be used as a tool to meet various strategic goals. In fact, it is a relatively nimble tool, compared to changing the production capacity. If the strategic goals change rather abruptly, as we have seen in recent years, revenue management strategies can be adjusted swiftly. In this presentation we will discuss some options.

**TD10**

Room 208B

**Performance Management and Service Optimization in Supply Chain**

Sponsor: Manufacturing &amp; Service Oper Mgmt

Sponsored Session

Chair: Yugang Yu, School of Management,USTC, JinZhai Road 96,  
Hefei, PR Chin, Hefei, China, ygyums@gmail.com

**1 - Turbulence, Integration and Performance: A NKC-Model Simulation**

Jianzu Wu, Dr., Lanzhou University, 222 South Tianshui Road,  
School of Management, Lanzhou, 730000, China,  
jzwu@lzu.edu.cn

In this paper, we examine the impact of environmental turbulence and integration on the organizational performance by a NKC-model simulation. The simulation results show that when organizational environment is stable, the less integration, the more the organizational performance and competitive advantages; when organizational environment is turbulent, the more integration, the more the risks-resisting abilities and competitive advantages.

**2 - Supply Chain Performance Comparison of Typical Information Management Strategies under Disruptions**

Tianjian Yang, Professor, University of Posts and  
Telecommunications, No.10, Road Xitucheng, Haidian District,  
Beijing, 100876, China, frankytj@gmail.com

This paper aims to investigate how to apply control theory to represent and simulate a supply chain under disruptions, with a specific research purpose of comparing the risk-mitigation effects of typical advanced information management strategies. It provides meaningful managerial implications for practitioners to choose appropriate information strategies and control their supply chains influenced by risks.

**3 - A Nash Bargaining Model and its Analytical Algorithm for Cooperative Advertising in a VMI System**

Ning Jiang, University of Science and Technology of China,  
Room 815, School of Management, JinZhai Road 96,  
Hefei, China, noahjn@163.com, Yugang Yu

This paper proposes a Nash bargaining model studying how to improve the profits of individual firms in a VMI (Vendor Management Inventory) system. In the system, a manufacturer vendor determines how to produce and distribute a product to multiple heterogeneous retailers with a VMI policy. We develop a hybrid algorithm that can solve the model quickly. Our numerical results show that our solutions can increase the profits of the firms significantly compared to some non-cooperative cases.

**4 - Performance-based Contracting in the Presence of Initial Acquisition and After-sales Service**

Dong Li, Rotterdam School of Management, Erasmus University,  
P.O.Box 1738, Rotterdam, 3062 PA, Netherlands, dli@rsm.nl,  
Nishant Mishra

We look at service contracting (PBC and TBC) between a customer and a supplier, where equipment downtime impacts the customer's and the supplier's revenues. Both the customer and supplier are profit maximizing agents, and the customer loses revenue if the equipment is not working, and where after-sales maintenance support can be an important revenue stream for the supplier. We compare the equilibria of different cases and find out the partners' decisions under various contracts.

**5 - A Ship Consolidation Plan for Steel Coils to Reduce the Number of Shuffling**

Lixin Tang, The Logistics Institute, #135, Northeastern University,  
Shenyang, China, lixintang@mail.neu.edu.cn, Fei Yang

Consolidation planning problem is to select steel coils with different characteristics (ship capacity, destination) and make an outgoing sequence of these coils. A mixed integer programming model is established considering the total weight of coils loaded on ship, the number of shuffles and the number of splitting bargains. An improved scatter search algorithm is proposed and the numerical experiments show that the proposed scatter search method is effective.

**TD11**

Room 209A

**Monitoring and Control in the Cloud**

Cluster: Super/Special Sessions

Invited Session

Chair: Li Zhang, IBM TJ Watson Research Center, Yorktown Heights,  
NY, United States of America, zhangli@us.ibm.com

**1 - Provisioning for Large Scale Cloud Services via Stochastic Models**

Cathy Xia, Prof, Ohio State University, Columbus, OH, 43210,  
United States of America, xia.52@osu.edu, Yue Tan, Yingdong Lu

Resource provisioning, the task of planning sufficient amounts of resources to meet quality of service targets, has become an important management task in cloud computing services. We present a stochastic modeling framework to guide the resource provisioning task for future service clouds as the demand grows large. We focus on service availability as the key quality of service constraint and provide improved provisioning solutions that are not only easy to compute, but also asymptotically exact.

**2 - Virtual Machines: Resource Monopoly, Monitor and Resource Management**

John C.S. Lui, Professor, Chinese University of Hong Kong,  
Computer Science & Eng. Dept, The Chinese University of Hong  
Kong, Shatin, Hong Kong - PRC, johnslui@gmail.com,  
Patrick P.C. Lee, Qun Huang

Virtual machine is one of the main component in cloud computing. In this talk, we show it is possible to devise techniques to monopolize resource and breaks the QoS guarantees. To overcome this problem, we present software layers to monitor and protect resource. The methodology we propose is general and it opens door for researchers to devise different resource allocation, detection and process migration policies.

**3 - Resource Allocation in Cloud Computing Clusters**

Lei Ying, Prof, Iowa State University, 3219 Coover Hall, Ames, IA,  
50011, United States of America, leiyang@iastate.edu, R. Srikant,  
Siva Theja Maguluri

We consider a stochastic model of a cloud computing cluster, where jobs arrive according to a stochastic process and request virtual machines (VMs), which are specified in terms of resources such as CPU, memory and storage space. Given our model of a cloud, we first define its capacity. Then, we show that the widely-used Best-Fit scheduling algorithm is not throughput-optimal, and present alternatives which achieve any arbitrary fraction of the capacity region of the cloud.

**4 - Performance Analysis of Provisioning Process in Cloud**

Li Zhang, IBM TJ Watson Research Center, Yorktown Heights, NY,  
United States of America, zhangli@us.ibm.com, Hanhua Feng,  
Xiaoqiao Meng, Jian Tan

Cloud computing is becoming the driving force for Information Technology to deliver scalable and economical computing resource. Virtual machine (VM) provisioning is a key component in virtualization-based Cloud offerings. We present experiments on an example Cloud system to illustrate the basic provisioning process. We further construct a queuing network based model to study the performance and capacity implications when the system is under heavy load.

**TD12**

Room 209B

**Consumer Behavior and Revenue Management**

Contributed Session

Chair: Lixian Qian, Department of Business, Economics and  
Management, Xi'an Jiaotong-Liverpool University, 111 Ren Ai Road,  
Suzhou Industrial Park, Suzhou, Room 215, 123, China,  
lixian.qian@xjtlu.edu.cn

**1 - An Agent-Based Simulation for Revenue Management in High-Speed Passenger Railways**

Milan Lovric, Rotterdam School of Management, Erasmus  
University, Burgemeester Oudlaan 50, Rotterdam, 3062PA,  
Netherlands, mlovric@rsm.nl, Peter Vervest, Ting Li, Yun Bao

In this paper we propose an agent-based simulation for revenue management in passenger-dedicated high-speed railway, with applications to Chinese and Dutch transportation systems. We developed our models using demand data obtained from major public transport operators (PTOs). This comparative study suggests that both PTOs can balance railway passenger demand by using time-based pricing strategies, and in such a way improve their financial performance as well as their customer satisfaction level.

## 2 - Digital Media and Consumer Behavior: Exploratory Data Analytics on CATV Viewership Patterns

Rae M. Chang, Research Scientist, LARC, School of Information Systems, Singapore Management University, 80 Stamford Road, Singapore, 178902, Singapore, mrchang@smu.edu.sg,  
Robert J. Kauffman, Insoo Son, Dongwon Lee

This research examines patterns of micro-level viewership behavior based on population-scale return path data collected from cable television (CATV) set-top-boxes. We characterize patterns of consumer channel-surfing behaviors as a basis for making inferences about program and channel bundling and customer relationship management. This research is supported by Singapore National Research Foundation under International Research Centre @ Singapore Funding Initiative administered by IDMPO.

## 3 - A Dynamic Segmentation Approach to Forecast Demand for New Products in Emerging Markets

Lixian Qian, Department of Business, Economics and Management, Xi'an Jiaotong-Liverpool University, 111 Ren Ai Road, Suzhou Industrial Park, Suzhou, Room 215, 123, China, lixian.qian@xjtlu.edu.cn, Didier Soopramanien

Emerging markets (EMs) differ from the developed markets (DMs) in many aspects, so the new product forecasting approaches used in the DMs may not be suitable in the EMs. By focusing on market heterogeneity and market dynamics in the EMs, we propose a dynamic segmentation approach that combines the segmental discrete choice models with segmentation diffusion model. We show how these two factors affect the diffusion forecast of a new product, green cars, in an important emerging market, China.

## TD13

Room 210A

### Inventory Control and Value of Information

Contributed Session

Chair: Anders Thorstenson, Aarhus University, Fuglesangs Allé 4, Aarhus, Denmark, ath@asb.dk

#### 1 - A Closed-loop Supply Chain Equilibrium Model with Random Demands

Qiang Qiang, Assistant Professor, Penn State University, 30 E. Swedesford Road, Malvern, PA, 19355, United States of America, qzq10@psu.edu

A closed-loop supply chain network model is proposed. The model consists of raw material suppliers, manufacturers, retailers, and collection center. The retailers are facing the random demands. The behavior of the different decision-makers is modeled and the governing equilibrium conditions are provided. A special algorithm are used to solve the numerical examples to provide managerial insights.

#### 2 - Optimal Production Control Policy of a Serial/Multi-Echelon Production System

Li Chen, PhD Student, City University of Hong Kong, City University of Hong Kong, Tat Chee Avenue, Kowloon Tong, Hong Kong - PRC, ms.lchen@cityu.edu.hk, Yimin Yu

We analyze the structure of optimal production control policy for a serial/multi-echelon production system. We show that a neighborhood state-dependent echelon base-stock policy is optimal for such a system, i.e., the optimal production policy for a stage only depends on the echelon inventory level(s) of its neighborhood stage(s). We do it by showing the value function is both strongly M-convex and multimodular. Within these results, we break the curse of multi-dimensionality of such a problem.

#### 3 - The Impact of Information Sharing on the Supply Chain Performance

Yungao Ma, Xi'an Jiaotong University, No. 28, Xianning West Road, Xi'an, Shaanx, Xi'an, China, ma.gao@stu.xjtu.edu.cn, Nengmin Wang, Jinpeng Xu

In this paper, we consider a three-level supply chain in which the demand faced by the retailer depends on its price and the price follows an AR (1) process, we derive the analytical expressions of the bullwhip effect with and without information sharing. We focus on a different perspective to explain the impact of demand process characteristics, such as the market demand scale on the value of information sharing.

#### 4 - Optimal Stochastic Inventory Control with Deterioration and Service-Level Constraints

Yang Tan, FedEx, 3640 Hacks Cross Road., Building D, 3rd Floor, Memphis, TN, 38125, United States of America, ytan0920@gmail.com

A finite horizon deteriorating inventory model is studied. The system is under periodic review and there is a positive fixed order cost associated with any placed order. The effect of partial backlogging is neglected by incorporating the service-level constraints so that the explicit order quantities are obtained by formulating the problem as a mixed-integer programming model.

## 5 - Trade-offs in Lead-time Reliability and Evaluation of Their Effects on Inventory

Anders Thorstenson, Aarhus University, Fuglesangs Allé 4, Aarhus, Denmark, ath@asb.dk

Motivated by recent ocean freight transportation policy changes, this paper focuses on inventory effects of varying levels of lead-time reliability. Different methods, both exact and heuristic, for evaluating these effects in a periodic review inventory model are investigated and compared. Results obtained provide guidelines regarding evaluation procedures and trade-off values.

## TD14

Room 210B

### Markov Decision Processes with Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Xianping Guo, Sun Yat-Sen University, Guangzhou, 510275, China, mcsgxp@mail.sysu.edu.cn

#### 1 - Sensitivity-based Optimization for SMDPs with Discounted – and Average – Reward Criteria

Yanjie Li, Harbin Institute of Technology Shenzhen Graduate School, HIT Campus, University Town of Shenzhen, Shenzhen, China, lyj@hitsz.edu.cn

On the basis of the sensitivity-based optimization, we develop an optimization theory for semi-Markov decision processes (SMDPs) with infinite horizon discounted- and average-reward criteria. A simple sensitivity-based approach is proposed to provide a unified formulation for the performance sensitivity analysis of semi-Markov chain and semi-Markov decision problems.

#### 2 - Optimality Property of Service Rates in Closed Jackson Networks

Li Xia, Tsinghua University, Tsinghua University, Beijing, 100084, China, xial@tsinghua.edu.cn

We study the service rate control problem for closed Jackson networks. The problem is modeled as a Markov decision process. The most general results in the literature is that the optimal service rate exists on the boundary (maximal or minimal service rate) when the cost function is linear to that service rate. We extend this condition from linear cost function to strictly convex (concave) cost function for the performance maximization (minimization) problem.

#### 3 - Minimum Risk Probability for Finite Horizon Semi-Markov Decision Processes

Yonghui Huang, Sun Yat-Sen University, Xingang Road West, Haizhu District, Guangzhou, China, hyongh5@mail.sysu.edu.cn, Xianping Guo

This talk is on the risk probability criteria for finite horizon semi-Markov decision processes. The goal is to find an optimal policy with the minimum risk probability that the total reward produced by a system during a finite horizon does not exceed a reward level, where the optimality is over the class of all randomized historic policies which include states, planning horizons and also reward levels. Under mild conditions, the optimality equation and the existence of optimal policies are established, and in addition, an iteration algorithm for solving optimal policies is developed. The main results are applied to a manufacturing system.

## TD15

Room 212A

### Business Analytics

Contributed Session

Chair: Chris Fry, Strategic Management Solutions, P.O. Box 5721, Redwood City, CA, 94063, United States of America, chris@strategicmgmtgroup.com

#### 1 - Hierarchical Forecasting with Bayesian Modeling

Jerry Shan, Hewlett-Packard Company, 1501 Page Mill Road, Palo Alto, CA, 94303, United States of America, jerry.shan@hp.com, Alex Zhang

How many employees at each level of a service enterprise do you need to hire in order to meet your revenue target? In this paper, we present a Bayesian forecasting method that unearths the predictive relationship between different levels in a data hierarchy. The method incorporates what can be derived from the empirical data and what can be solicited from the judgment calls. We will describe the business context of an application of the forecasting method in HP.

## 2 - Fighting Fraud with Advanced Analytics for Life Insurance Company

Sophia Wang, Business Analytics and Optimization Center of Competency, IBM, 9 Jia Feng Road, WaiGaoQiao Free Trade Zone, Shanghai, China, sophiawh@cn.ibm.com

Fraud costs billions of dollars in losses each year for life insurance companies, who are under great pressure to process and pay claims quickly, yet often find themselves overburdened with case loads and ill equipped with resources and technology to catch fraud. We will share our experience in helping a local insurance company adopt advanced analytics, primarily outlier detection and classification methods, to quickly identify suspicious activities and emerging trends for fraud detection.

## 3 - Closing the Gap Between Analytics and Action

Chris Fry, Strategic Management Solutions, P.O. Box 5721, Redwood City, CA, 94063, United States of America, chris@strategicmgmtgroup.com

While many analytics efforts have great impact, too many ideas never reach their potential. We discuss 3 strategies to help ensure impact from analytical work: 1) start with process changes first, adding analytical sophistication over time, 2) lift up the hood, using graphics and interactivity to make models transparent, and 3) highlight the 'so what's' that enable users to take action. I will illustrate these principles through examples from our work in pricing and supply chain analytics.

## TD16

Room 212B

### Marketing: E-commerce Applications

Contributed Session

Chair: Qi Wang, Associate Professor of Marketing, State University of New York at Binghamton, Binghamton, NY, United States of America, qiwang@binghamton.edu

#### 1 - Trial and Recommendation in Adoption of Mobile Application

Jungmin Son, Yonsei University, Yonsei-Ro 50, Seoul, Korea, Republic of, sonjm81@gmail.com, Donghoon Kim

We study how trial promotion and recommendation within a mobile application store affect the adoption of paid mobile applications. Using actual purchase/download data from an app store, we model and analyze the impact of customer ratings and firm promotions and how they are moderated by customer expectations.

#### 2 - Consumer Learning and the Informational Value from Online Reviews: An Empirical Study of Dianping

Hai Che, Marshall School of Business, University of Southern California, Los Angeles, CA, United States of America, haiche.email@gmail.com, Tat Chan, Chunhua Wu

How consumers use online reviews to obtain product information has received wide attention. We empirically study the mechanisms of consumer learning of the overall quality and cost of visiting restaurants from reviews. Our models have the following features: (1) Consumers update not only the mean but also the variance of reviews; (2) consumers may differentiate reviews in terms of the informational value; and (3) we account for the subjectivity of reviews.

#### 3 - Spilling Over Through Semantic Networks: Selecting Effective Keywords in Paid Bidding Search

Shuai Yang, University of Connecticut, Marketing Department, School of Business, 2100 Hillside Road Unit 1041, Storrs, CT, United States of America, syang2@business.uconn.edu, Shan Lin

Our study employs a Bayesian dynamic model to capture potential spillover effects of a focal keyword on its all related keywords, and empirically verifies the effects on a 3-year dataset from google.cn. To further explain the variation of spillover effects, we conduct a follow-up analysis on a semantic network of search keywords. The results show that the centrality of a focal keyword in the network can affect when and how it will spill over to influence the corresponding keyword searches.

#### 4 - Keyword Search Advertising and First-Page Bid Estimates: A Strategic Analysis

Woochoel Shin, Assistant Professor, University of Florida, P.O. Box 117155, Gainesville, FL, 32611, United States of America, wshin@ufl.edu, Preyas Desai, Wilfred Amaldoss

In a recent keyword search auction innovation, Google provides advertisers "First Page Bid Estimates"—bid estimates for their advertising links to feature in the first page of search results. Our theoretical analysis explains why and when FPBE mechanism yields higher profits for the search engine compared to ASMB mechanism or classic generalized second-price (GSP) auction. We further examine implications of FPBE for the equilibrium outcome of the keyword search auction.

## 5 - Multiple-Winner Award Rules in Online Reverse Auctions

Qi Wang, Associate Professor of Marketing, State University of New York at Binghamton, Binghamton, NY, United States of America, qiwang@binghamton.edu, Xuping Jiang, Jinhong Xie, Juan Feng

We investigate a novel mechanism in online reverse auctions, multiple-winner award rules, which specifies the number of winning candidates, the number of final winners, and the proportion of contract volume allocated to each winner. Using a unique data set of online reverse auctions across a variety of product categories, we find that while all three award rules significantly impact the suppliers' participation decision, they induce opposite effects in experienced and inexperienced suppliers.

## TD17

Room 213A

### Joint Session OR/MS in Medicine/HAS: Pandemic Modeling and Planning

Cluster: OR/MS in Medicine and Healthcare & Health Applications  
Invited Session

Chair: Dionne Aleman, University of Toronto, Toronto ON, Canada, aleman@mie.utoronto.ca

#### 1 - Models for Managing the Impact of an Epidemic

Ana Cecilia Zenteno, Columbia University, 313 S. W. Mudd Bldg., 500 W. 120th Street, New York NY 10027, United States of America, acz2103@columbia.edu, Daniel Bienstock

We analyze strategies for managing the impact of a severe influenza epidemic on the operations continuity of critical infrastructure. We consider deploying additional resources in response to a robust model of the evolution of the epidemic. We describe algorithms analogous to generalized Benders' decomposition that proves fast and numerically accurate. Our goal is to bring insights on the structure of optimal robust contingency plans that can be implemented during the epidemic.

#### 2 - Performance Assessment of Mass Immunization Clinic via Simulation

Dionne Aleman, University of Toronto, Toronto ON, Canada, aleman@mie.utoronto.ca, Michael Beeler, Michael Carter

We employ a discrete-event simulation to estimate the cost-effectiveness of mass immunization clinics (MICs) for pandemic influenza, as well as the expected number of infections occurring within the facility due to asymptomatic infectious patients. The impact of patient spacing, infection rates, and staff levels on MIC cost-effectiveness and infections is determined through a designed experiment. The methodology can be adapted to estimate infection risks in other venues during a pandemic.

#### 3 - Strategies for Vaccine Prioritization

Eva Lee, Professor and Director, Georgia Institute of Technology, Ctr. for Operations Research in Medicine, Atlanta, United States of America, evakylee@isye.gatech.edu, Fan Yuan

This work is joint with CDC Strategic National Stockpile. When limited vaccines are available, prioritized vaccination should be used. We couple a vaccine dispensing queuing model and a vaccination optimization module within a disease propagation model that aims to determine the optimal switch time in a mixed vaccination strategy that minimizes the infection and mortality severity throughout the course of the pandemic. Results will be analyzed for a city with a population of 8.8 million.

## TD18

Room 213B

### Linear Optimization Algorithms

Contributed Session

Chair: Siming Huang, Professor, Chinese Academy of Science, 1st Avenue Zhongguancun, Beijing, China, simhua@casipm.ac.cn

#### 1 - A New Algorithm for Linear Programming

Jianming Shi, Professor, Muroran Institute of Technology, 27-1 Mizumoto, Muroran, Japan, shi@mmm.muroran-it.ac.jp

We discuss a new algorithm for linear programming that does not directly use the information of extreme points of a feasible region. We also report some numerical experiments with this new algorithm.

**2 - An Algorithm for Solving the Sum of Linear Ratio Problem**

Yongwen Hu, Muroran Institute of Technology,  
27-1 Mizumoto-cho, Muroran 050-8585, Japan,  
huyongwennew@163.com, Jianming Shi

In this talk, we propose an algorithm for solving the sum of linear ratio problem (SOLRP) by using semidefinite programming (SDP). We discuss how to transform the SOLRP into SDP. We also report some primary numerical experiments with the proposed algorithm.

**3 - A New Algorithm to Find the Cycle on the Transportation Tableau**

Han Weiyi, Members of the Operations Research Society of China,  
Box1218, No 13 Fayuan Street, Harbin, Harbin, 150001, China

In the paper, a new algorithm is obtained to present the cycle in the transportation tableau. Experimental result shows that it runs faster than the removing isolated cells method about five times, and back tracking method about two times on the average.

**4 - A Block Pivot Scheme for the Fixed Charge Transportation Problem**

In-Chan Choi, Professor, Korea University, 1, 5Ka Anamdong,  
Seongbookku, Seoul, Korea, Republic of, ichoi@korea.ac.kr,  
Moo-Sung Sohn

We present a block pivot scheme for the fixed charge transportation problem. In the scheme, two entering arcs are simultaneously considered to determine a new basis. This approach, which utilizes a newly derived modified reduced cost, makes it possible to search broader neighborhood compared to the existing single pivot approach. Preliminary computational results on the OR-LIB show that the proposed scheme is highly competitive compared with the existing heuristic algorithms.

**5 - Expected Iteration Complexity of Interior-point Algorithms for Linear Programming**

Siming Huang, Professor, Chinese Academy of Science,  
1st Avenue Zhongguancun, Beijing, China, simhua@casipm.ac.cn

We study the average performance of interior-point algorithms for solving random linear programming (LP) problems. We show that, on average, the number of iterations of these algorithms is bounded above by  $O(n^{1.5})$ . The random LP model is Borgwardt's probabilistic model with the stable distribution.

**TD19**

Room 215

**The Recent Financial Crisis and Related Financial Engineering Research Problems**

Cluster: Tutorials

Invited Session

Chair: Xuedong He, Assistant Professor, Columbia University,  
316 S. W. Mudd Building, 500 W. 120th Street, New York, NY, 10027,  
United States of America, xh2140@columbia.edu

Co-Chair: Xianhua Peng, Assistant Professor, Hong Kong University of  
Science & Technology, Clear Water Bay, Kowloon, Hong Kong - PRC,  
maxhpeng@ust.hk

**1 - The Recent Financial Crisis and Two Related Financial Engineering Research Problems**

Xuedong He, Assistant Professor, Columbia University, 316 S. W.  
Mudd Building, 500 W. 120th Street, New York, NY, 10027,  
United States of America, xh2140@columbia.edu,  
Steven Kou, Xianhua Peng

Some main causes of the recent financial crisis are excessive risk taking due to the limited liability of fund managers and corporations, which means profits are shared, but not losses, and the inability of valuing housing market fairly, which partly leads to the housing bubble. In this tutorial we will present some broad research questions in financial engineering related to these. In particular we will discuss how to design better hedge fund performance fee scheme to improve the satisfaction of regulators, fund managers, and fund investors simultaneously, and how to model housing prices. No finance background is assumed in this tutorial.

**TD20**

Room 207

**Software Tutorials**

Cluster: Software Tutorials

Invited Session

**1 - Optimization and Discrete-Event Simulation with SAS**

Manoj Chari, Senior R&D Director, SAS Institute Inc.,  
100 SAS Campus Drive, Cary, NC, United States of America,  
manoj.chari@sas.com, Yan Xu

SAS provides a broad spectrum of analytic capabilities, including operations research (optimization, simulation, scheduling). We explore OPTMODEL, which provides a unified environment for building and solving optimization models including LP, MILP, QP and NLP with support for standard and custom solution methods. We also survey SAS Simulation Studio, which provides a graphical interface for discrete-event simulation.

**2 - AnyLogic - Simulation Modeling of the Supply Chain**

Andrei Borshchev, CEO, XJ Technologies/AnyLogic,  
49 Nepokorennyykh pr., St. Petersburg, 195220,  
Russian Federation, andrei@xjtek.com

Transportation design challenges? Logistics optimization? Supply chain problems? These problems have always been diverse and complex. A challenge. Simulation software AnyLogic takes you to a whole new level of power and speed in simulating and solving these problems. Whether you're a traffic engineer, supply-chain expert, consultant or researcher you will appreciate how quickly you can develop complex models with AnyLogic. Because of AnyLogic's flexibility and power these have always been among our clients most common application areas. We will share how some of our clients have used AnyLogic for these types of problems. We will provide an overview of the basic tool as well as new features. We will stay late and answer any specific questions or make suggestions about your simulation applications. See you there!

**Wednesday, 8:00am - 9:30am****■ WA01**

Room 202B

**Sustainable Developments in Transportation**

Contributed Session

Chair: Shujuan Cui, Master, Beijing Jiaotong University, Beijing, Haidian, Jiaoda Dong Road, 18, Beijing, China, cuishujuanforever@163.com

**1 - Option of Operating Speed for Vessels under Low-carbon Economy**

Huan Xu, Shanghai Maritime University, 1550 Haigang Dadao, Pudong, Shanghai, China, lovely\_xuhuan@163.com, Gang Li, Wei Liu

Article studies ships' optimum operating speed under low-carbon economy. It analyzed the relations between ship's carbon emission and the operating speed, get the optimum speed under minimum carbon emission, established the relations between the shipowner's profit and the speed, and derived maximum profit from the speed under which the entire fleet minimum carbon emission. At last proposed policy which the government can make for the shipping under low-carbon economy are given.

**2 - The Impact of Travel Demand Uncertainty on Plug-in Electric Vehicle Energy Consumption**

Melissa Duell, PhD Research Student, The University of New South Wales, School of Civil & Environmental Eng., UNSW, Sydney, 2052, Australia, m.duell@student.unsw.edu.au

Plug-in electric vehicles (PEVs) represent an unprecedented interaction between the road network and electricity grid. PEVs replace petrol with electricity, thereby increasing the demand for electric power in a region. We employ transport modelling tools to quantify the relationship between individual users' travel patterns and PEV energy consumption rates, with focus on how long-term demand uncertainty impacts system level energy consumption variability, a vital issue for energy providers.

**3 - Smart Card Data Enabled Agent-Based Simulation of Multimodal Public Transportation**

Paul Bouman, Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, PBouman@rsm.nl, Milan Lovric, Ting Li, Peter Vervest

We use a unique smart card dataset to extract demand patterns of travelers in the Dutch urban transportation. To the best of our knowledge, this is the first study that employs smart card data to develop agent-based simulation in a multimodal setting. This simulation testbed allows public transport operators to experiment with various pricing and revenue management strategies to even out demand concentration and achieve higher customer satisfaction and financial performance.

**4 - Road Network Vulnerability Assessment Considering Interdependencies of Susceptible Factors**

Cheng-Min Feng, Professor, Institute of Traffic and Transportation, National Chiao Tung University, 4F, 118, Sec. 1, Chunghsiao W. Rd., Taipei City, 10044, Taiwan - ROC, cmfeng@mail.nctu.edu.tw, Cheng-Hsien Hsieh

Transport vulnerability significantly impacts the quality of life including daily trips and logistics. However, road network vulnerability analysis considering susceptible factor interdependency is absent from previous literature. This study employs systematic simulation to explore spatial-functional vulnerability considering relationships among road network vulnerable factors, and to assist in critical infrastructure protection.

**5 - The Research on Evaluation Index About Land-use Around the Rail Station in the TOD Mode**

Shujuan Cui, Master, Beijing Jiaotong University, Beijing, Haidian, Jiaoda Dong Road, 18, Beijing, China, cuishujuanforever@163.com, Yanping Liang, Xue Hou

With the theory of green and sustainable urban space pattern development, this paper establishes the system of quantitative evaluation index of land-use based on the characteristics of the land-use around URT in the TOD mode. The system evaluates the land-use around URT from three aspects: TOD regional integrity, TOD regional service level and regional accessibility. Through the establishment of evaluation index system, China's URT site surrounding land-use can get an objective evaluation.

**■ WA02**

Room 202A

**Information Systems I**

Contributed Session

Chair: Jian Lau, Nanjing University of Aeronautics & Astronautics; Pennsylvania State University, 103 Seymore Ave., State College, PA, United States of America, jlau@ist.psu.edu

**1 - Software Platform Competition with Heterogeneous Technologies**

Yifan Dou, Tsinghua University, Room 447, Tsinghua SEM, Beijing, China, douyf.03@sem.tsinghua.edu.cn, Yongbo Xiao

Software platform like Apple AppStore is playing a critical role in the digital goods market. We employ an analytical model to study the pricing game between platforms with heterogeneous technologies. Our results suggest that multi-sidedness lead to severe price war and inferior platform invest in exclusive software offerings.

**2 - Experimental Evaluation of Sequential Bias in User Reviews**

Enes Eryarsoy, Assistant Professor, Sabanci University, School of Management, Orhanli, Tuzla, Istanbul, 34956, Turkey, enes@sabanciuniv.edu, Selwyn Piramuthu

Many Internet websites feature user review sections where users share their experiences and rate products/services. Recent research suggests that users may be biased during this process. We consider a specific type of bias known as sequential bias, which occurs due to the user's non-neutral predisposition toward the reviewed entity as well as existing non-neutral reviews on that entity. We attempt to experimentally evaluate its existence and the extent of its effects.

**3 - Data Security in Public Cloud Computing: Risks & Challenges**

Zafor Ahmed, Senior Analyst, Bank of Canada, 234 Wellington Street, Ottawa, ON, K1A 0G9, Canada, zahmed@bank-banque-canada.ca, Shaobo Ji

This paper discusses the security risks associated with cloud computing from the perspective of data security in the context of public cloud computing. Potential risk issues are reviewed and examined according to cloud's deployment and service delivery models. Detailed discussion is focused on the states of data and their associated potential security risks in the public cloud computing domain. Challenges and potential solutions to address data security risk are reviewed and presented.

**4 - The Value of Competitor Information**

Ting Li, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, Netherlands, tli@rsm.nl, Clint Pennings, Otto Koppius, Niels Agatz

We examine the impact of competitor's prices on product sales and demonstrate how the effect is softened by non-price competitions, using data collected from an e-retailer and price comparison sites. The results show that the price rank of a seller is an important determinant of the seller's demand and the delivery time reduces price competition effect, and the effect varies between standard products and niche products.

**5 - Per-branch Aware Prediction Based on Adjacency Matrix Process Mining**

Jian Lau, Nanjing University of Aeronautics & Astronautics; Pennsylvania State University, 103 Seymore Ave., State College, PA, United States of America, jlau@ist.psu.edu, Peng Liu, Si-feng Liu, Jin-jin Li

we use adjacency matrix to extract 3 types of annotations information (i.e., frequencies, remaining times, activities) and use them to construct new process models from the event logs. These new process models can be used to predict what will actually happen, how possible to reach the next activity, and how soon for the ongoing process instances to finish. The process models can be used to optimize the handover business process via prediction.

## ■ WA03

Room 203B

### Auctions, Bidding, and Games

Contributed Session

Chair: Abhijit Deshmukh, James J. Solberg Head of Industrial Engineering, Purdue University, Grissom Hall, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, abhi@purdue.edu

#### 1 - Game-theoretic Analysis of RFID Technology in Three-level Supply Chain with Lead-time Reduction

Wei Xu, University of Macao, RoomB412, Block One, University of Macao, Macao, China, jerryxu@w.cn, Zhaotong Lian, Xin Li

Motivated by radio-frequency identification (RFID), it has been heralded as a major breakthrough to enhance the efficiency of a supply chain. RFID will make the real world visible with EPC data stored in the RFID tags and the combination of the sensor networks. This paper aims to explore the effect of RFID on controlling the lead-time in a three-level supply chain. Who take the initiative to invest the RFID technology that will have a great influence on the coordination of the whole supply chain.

#### 2 - Late and Multiple Bidding in Online Auctions: A Comparative Study of the United States and China

Jianwei Hou, Associate Professor of Marketing, Minnesota State University, Mankato, 150 Morris Hall, Mankato, MN, 56001, United States of America, jianwei.hou@mnsu.edu

While late (submit one's bid as late as possible) and multiple bidding (submit multiple bids in one auction) has been widely studied in the U.S. online auction market, it is not clear how well these studies and associated theories translate to other cultural contexts. This study compares online bidding behavior between the China and U.S. consumers, examine the behavioral differences, and provide explanations.

#### 3 - An Integer Programming Model for an Energy Supply Game

Jeroen Belien, HU Brussel, Warmoesberg 26, Brussels, Belgium, jeroen.belien@hubrussel.be, Jan Colpaert, Johan Eyckmans, Liesje De Boeck, Wouter Leirens

This paper presents an Integer Programming (IP) model for solving an online energy supply game. Instead of a traditional approach in which students are given a problem statement and asked to develop an IP model, both the problem and data are hidden in the game. A classroom experiment proves that the game component, together with the use of a current topic such as energy supply, motivates students more to build IP models when compared to classical approaches.

#### 4 - Preference Elicitation in Multi-attribute E-procurement Auctions: A Web Service for the Auctioneers

Na Yang, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, Xi'an, China, yang.na616@stu.xjtu.edu.cn, Xiu-wu Liao, Fu-ling Cai

It is difficult to explicitly elicit the auctioneers' scoring functions in real-world multi-attribute e-procurement auctions. In the paper, a new preference elicitation process based on reference actions is proposed for inferring a preference model compatible with the declared information. This framework is implemented by an intelligent buyer agent which is embedded in the e-intermediary as a decision support module.

#### 5 - On Assessing Impact of Coordination and Structure on Network Equilibria

Abhijit Deshmukh, James J. Solberg Head of Industrial Engineering, Purdue University, Grissom Hall, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, abhi@purdue.edu, Brandon Pope

This presentation examines the impact of different network topologies and coordination mechanisms on the speed and quality of the equilibria reached in a network of interacting agents. Specifically, we study networks that are hybrids of Poisson random graphs and scale-free networks. Two coordination mechanisms are investigated in this work, bargaining and diffusion. We study the impact of each paradigm on the speed, total welfare, and equity of equilibria reached on networks.

## ■ WA04

Room 203A

### Quality Control and Management

Contributed Session

Chair: Jie Ding, Associate Professor, Rider University, 2083 Lawrenceville Road, Lawrenceville, NJ, 08648, United States of America, Ding@rider.edu

#### 1 - An Interactive Model for a Repetitive Testing Process

Jie Ding, Associate Professor, Rider University, 2083 Lawrenceville Road, Lawrenceville, NJ, 08648, United States of America, Ding@rider.edu, Linguo Gong

We study an interactive repetitive testing process with testing equipment accuracy may shift randomly over time. We develop a quantitative model to study the decisions on initial testing batch size, equipment setup, and testing repetition stopping criterion. The model formulation will capture the effects of testing equipment random shift, type I&II testing errors, various costs on performing testing operations, and opportunity cost of defectives that are wrongly accepted by the testing process.

#### 2 - A Xbar-based Monitoring Scheme for The Various Magnitudes of Mean Shifts

Taek-jin Jeong, Ph.D. Candidate, Dept. of IMSE, Kyung Hee University, 1732 Deogyong-daero Giheung-gu, Yongin-si, 446-701, Korea, Republic of, genius.jtj@gmail.com, Chang-Ho Chin

The EWMA control chart is more sensitive to small mean shifts in the mean of a process than to large shifts as opposed to the Shewhart control chart. The right selection of control charts is directly linked with the successful detection of mean shifts because the type of mean shift is not practically known. In this article, we propose a Xbar-based scheme to apply a right control chart to the process over time. Simulation results show the proposed scheme outperforms others.

#### 3 - An Optimization Method for QFD Planning with Consideration of Heterogeneous Customer Requirements

Xingang Luo, Professor, Northeastern University, No.11, Lane 3, WenHua Road, HePing Distr., Shenyang, China, xgluo@mail.neu.edu.cn

In traditional QFD planning process, a set of weights of importance of customer requirements is used in the house of quality. However, nowadays customer demands are increasingly diversified, they may have various purchasing behaviour or preferences towards a new product. This research considers the heterogeneity of customer requirements in QFD planning process, and proposes an systematic optimization approach for determining the optimal levels of engineering characteristics in QFD.

#### 4 - ISO 9000 Quality Standards: Impact on American Auto Industry

Ahmad Karim, Indiana - Purdue University Fort Wayne, 2101 E. Coliseum Blvd., Fort Wayne, IN, United States of America, karim@ipfw.edu

This study examines the impact of implementing ISO 9000 Quality Standards in the automotive industry of USA. The results show that most companies do obtain certification despite the high costs. It also illustrates that the overall impact to the companies is beneficial.

#### 5 - Allocation of Maintenance Resources in Mixed Model Assembly Systems

Weihong Guo, Ph.D Pre-Candidate, University of Michigan, Dept. of Industrial & Operations Eng., 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, graceguo@umich.edu, Judy Jin, S. Jack Hu

Mixed-model assembly systems (MMASs) have been well recognized for their ability to handle increased variety for mass customization. With multiple products to produce, the prioritization of maintenance work-order becomes more crucial and challenging. This paper developed a quantitative method to systematically determine maintenance work-order priorities in a MMAS using on-line production information. The impact of product mix ratio on maintenance decisions is studied in detail.

## ■ WA05

Room 205B

### Decision Making Based on DEA Approaches

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Feng Yang, Associate Professor, School of Management, University of Science and Technology of China, 96 Jinzhai Road, Hefei, China, fengyang@ustc.edu.cn

#### 1 - Self-appraisal, Peer Appraisal and Nash Equilibrium: A Multiple-Constituency Framework

Jie Wu, USTC, #96, Jinzhai Road, Hefei, China, jacky012@mail.ustc.edu.cn, Liang Liang

In this paper, we consider a decision problem where an individual or a decision maker (DM) evaluates multiple attribute (or criteria) alternatives. The mathematical models are proposed to represent the self-appraisal and peer appraisal in multiple criteria decision making (MCDM) problem, respectively. Based upon this assumption, we propose a game model which can combine game theory with typical MCDM problem in the multiple-constituency framework.

#### 2 - Centralized Resource Allocation Model Considering Managerial Effort Based on DEA

Gongbing Bi, China University of Science and Technology, China, bgbwhl@ustc.edu.cn, Jingjing Ding

Methodology based on data envelopment analysis (DEA) for resource allocation has been studied before. In the previous works, managerial effort as an important input has not been explicitly modeled. This paper presents a model to incorporate managerial effort in the form of equality constraints. The proposed model is used in a centralized decision setting to generate an efficient resource allocation plan, and balance the efforts needed by the local managers to achieve the output target as well.

#### 3 - Allocating Fixed Costs Using Data Envelopment Analysis under Loss Aversion

Feng Yang, Associate Professor, School of Management, University of Science and Technology of China, 96 Jinzhai Road, Hefei, China, fengyang@ustc.edu.cn, Sheng Ang, Qiong Xia

The current paper integrates loss aversion effect in DEA efficiency analysis in cost allocation among peer subunits. Two reference points (the worst efficient subunit and the best one) are involved. For a given subunit, its gain in utility is realized by comparing with the worst efficient subunit, and its loss by comparing with the best one. Individual utility function is defined according to loss aversion effect, and overall utility maximization leads to a fair cost allocating plan.

#### 4 - Over-rationality Dilemma: Efficiency Biases between DEA Measurement and Intuitive Judgment

Huaqing Wu, Associate Professor, Hefei University of Technology, Tunxi Road No.193 Hefei, Anhui, China 230, Hefei, China, wu.huaqing@gmail.com, Liang Liang, Shaofu Du

DEA, an objective method for efficiency measurement, chooses optimal weight sets for each DMU, while intuitive judgment can subjectively integrate an array of factors weighing on a changing situation. With Chinese banking industry data, this paper evaluates two types of efficiency, respectively. The efficiency biases are identified with related sources analyzed. Research shows DEA measurement relies too much on single decision-makers' preference, inevitably leading to over-rationality dilemma.

## ■ WA06

Room 205A

### Service Operations

Contributed Session

Chair: Emanuel Melachrinoudis, Northeastern University, 360 Huntington Avenue, Boston, MA 02115, United States of America, emelas@coe.neu.edu

#### 1 - Diagnosing Versioning for Innovation of Mobile Application: Customer Review Based Conjoint Analysis

Woosuk Jang, Seoul National University, Rm. 319, Bldg. 39, 1 Gwanak-ro, Gwanak-gu., Seoul, Korea, Republic of, woosuk0219@snu.ac.kr, Jieun Kim, Yongtae Park

Versioning is important to maximize customer satisfaction in the innovation of mobile application, which must be established from the customers' opinions. However, past research mainly depending on survey based conjoint analysis for predefined attributes cannot reflect real customer's needs. In response, this study diagnoses versioning by customer review based conjoint analysis. Utility map for comparing utilities between versions contributes to identifying the detailed improvement directions.

#### 2 - Effect of Major Transportation Project on the Changes of Service Sector – An Empirical Study in Taiwan

Chih-Hsien Chen, Associate Professor, Fo Guang University, Department of Management, No.160, Linwei Rd., Jiaosi Shiang, Yilan, Taiwan - ROC, jimmychen1968@gmail.com

This study aims to analyze the industrial transition of 12 service categories by collecting relevant data 5 years before and after the operation of Taipei-Yilan Highway to traffic. The purposes of this study include: (1) Testing the significance of the overall commercial scale, the population employed, and the revenue structure; and (2) analyzing the changes and trends of the 12 service industries and productivities.

#### 3 - Customer Preferences and Opaque Intermediaries

Xiaoqing Xie, Assistant Professor, Shanghai University of Finance and Economics, Guoding Road 777, Yangpu District, Shanghai, 200433, China, xie.xiaoqing@mail.shufe.edu.cn, Chris Anderson

we develop an online choice experiment to understand consumer preferences among multiple online distribution channels including regular full information sales channels (e.g. Expedia) and opaque sales channels where some attributes of the product or service are disguised until after purchase (e.g. Hotwire, Priceline). A Multinomial Logit model is employed to analyze the experimental data and measure the consumer tradeoffs between price and other attributes of the product.

#### 4 - Scheduling Price Markdowns to Phase-out Items in Retail Stores

Emanuel Melachrinoudis, Northeastern University, 360 Huntington Avenue, Boston, MA 02115, United States of America, emelas@coe.neu.edu, Nizar Zaarour, Marius Solomon

Items in retail stores are being periodically phased-out due to the introduction of replacement items. In order to sell out these items within a certain time horizon, price markdown schedules have to be developed. To determine the optimal markdown schedule, multi-period non-linear programming models based on price elasticity are developed to maximize revenue from the discontinued items. Efficient algorithms are developed and tested with real data provided by a retailer.

## ■ WA07

Room 206A

### Decision Analysis II

Contributed Session

Chair: Wolfgang Garn, Lecturer, University of Surrey, Surrey Business School, Guildford, GU2 7XH, United Kingdom, w.garn@surrey.ac.uk

#### 1 - Likelihood-based Bayesian Method for Assessing Process Risk in Real Time

Chang-Ho Chin, Assistant Professor, Dept. of IMSE, Kyung Hee University, 1732 Deogyong-daero Giheung-gu, Yongin-si, 446-701, Korea, Republic of, chin@khu.ac.kr, Aida Mercado Hernandez

A process is a sequence of interdependent and linked activities to accomplish a predetermined goal. The early detection of process instances terminated without reaching the goal reduces the loss of resources. We propose a likelihood-based Bayesian method to estimate the abnormal termination probability of process instances in real time. The estimated probability could be used as a precaution for the worst or a basis for go/no-go decision.

#### 2 - Potential Optimality Analysis and Robust Optimality Analysis: A Comparative Study

Jiamin Wang, Associate Professor, Long Island University, Roth Hall 202, 720 Northern Blvd, Brookville, NY, 11548, United States of America, jiamin.wang@liu.edu, Guiwu Wei

This study extends robust optimality (RO) analysis for MADM problems with imprecise information by introducing two RO measures and developing a three-level RO classification scheme. It is shown that potential optimality (PO) analysis and RO analysis together provide a comprehensive picture of an alternative's variable payoff. A computational experiment compares these two approaches in terms of their discrimination power and the average quality of the alternatives they deem optimal.

### 3 - Comparing Methods for Structuring Bayesian Belief Network Models for Supply Chain Risk

Kanogkan Leerojanaprapa, PhD Student, Department of Management Science, University of Strathclyde, Graham Hills Building, 40 George Street, Glasgow, G1 1QE, United Kingdom, kanogkan.leerojanaprapa@strath.ac.uk, Robert van der Meer, Lesley Walls

In principle, Bayesian Belief Network (BBN) models can represent systemic risks in a supply chain. However it can be challenging to effectively and efficiently structure a BBN for supply chain risk. We describe a comparative study to examine three alternative methods for building a BBN model for a complex supply chain. We explain the study design and the implications of our findings for modelling supply chain risk.

### 4 - Applying Cognitive Work Analysis to Develop Medical Decision Support System

Shang-Hwa Hsu, Professor, Department of Industrial Engineering and Management, National Chiao Tung University, 1001 University Road, Hsinchu, 30010, Taiwan - ROC, shhsu@cc.nctu.edu.tw, Shih-Han Lin, Jen-Wei Chang

Nowadays decision problems are getting more complicated and uncertain, developing decision support systems for applications is challenging. This study proposed a cognitive approach to develop medical decision support system and an example of intensive care unit is used to illustrate the feasibility of proposed approach. Result showed the proposed medical decision support system is capable of providing the decision-supporting information to improve the efficiency and quality of decision making.

### 5 - Predictive Power Decisions with Generated Conditional Probabilities

Wolfgang Garn, Lecturer, University of Surrey, Surrey Business School, Guildford, GU2 7XH, United Kingdom, w.garn@surrey.ac.uk

Decision making is often based on conditional probability tables (CPTs). Three new methods to generate CPTs are proposed. The first two map conditional expectations to the probability space. The third is a column extraction method, which obtains CPTs from nonlinear functions. Case studies on military effects and forest desertification have demonstrated that so derived CPTs have highly reliable predictive power.

## WA08

Room 206B

### Integer/Combinatorial Optimization Models and Algorithms

Contributed Session

Chair: Yu Guo, PhD, The Logistics Institute, Northeastern University, The Logistics Institute, 135#, Shenyang, 110819, China, yguo@tli.neu.edu.cn

#### 1 - Two-agent Scheduling with a Special Structure on a Single Machine

Zhao Xiaoli, The Logistics Institute, Northeastern University, Shenyang, China, xlzhao@tli.neu.edu.cn, Lixin Tang

We consider a two-agent scheduling with a special structure on a single machine. We show by example that the WSPT rule is not optimal for the weighted sum of completion time and we use the WSPT rule as heuristic for this problem and analyze his worst-case error bound.

#### 2 - The Knapsack Problem with a Minimum Filling Constraint

Zhou Xu, Assistant Professor, The Hong Kong Polytechnic University, Dept. LMS, The Hong Kong, Polytechnic University, Hong Kong, Hong Kong - PRC, lgtzx@polyu.edu.hk, Xiaofan Lai

We study a knapsack problem with an additional minimum filling constraint, so that the total weight of selected items cannot be less than a given positive threshold. We have developed an approximation scheme for this problem that can return a feasible solution with a total profit not less than  $(1-\epsilon)$  times the total profit of an optimal solution for any  $\epsilon > 0$ , and it achieves a polynomial time complexity when the ratio of the threshold to the capacity is a constant independent of the input size.

### 3 - Solving the Multi-dimensional 0-1 Knapsack Problem Using Depth-k Canonical Cuts

Aysegul Peker, Operations Research Specialist, SAS, SAS Campus Drive, Cary, NC, 27513, United States of America, Aysegul.Peker@sas.com

Many decision problems can be formulated as a Multi-dimensional 0-1 Knapsack Problem (MKP). We study the effectiveness of canonical cuts over 0-1 MKP problems. We introduce the depth concept for canonical cuts and depth-k canonical cut. We propose three different implementations of canonical cut to increase their practicality. We integrate depth-1 and depth-2 canonical cuts within the SAS/OR MILP solver and evaluate performance improvement over OR Library test problems. Overall, new implementations of canonical cuts are shown to be very effective over these test suites.

### 4 - A 3/2 Approximation Algorithm for Three Depots Hamiltonian Path Problem

Kheffache Rezika, Miss, Mouloud Mammeri University, Department of Mathematiques, Tizi Ouzou, Tizi Ouzou, 15500, Algeria, kheffache.rezika@yahoo.fr, Ouafi Rachid

In this paper, we propose an approximation algorithm for solving the three depots Hamiltonian path problem. The problem studied can be viewed as a variant of the well-known Hamiltonian path problem with multiple depots. For the 3DHPP, we show the existence of a 3/2 -approximation algorithm. The aforementioned result is established for a variant of the three-depot problem; that is, when costs are symmetric and satisfies the triangle inequality.

### 5 - Optimal Unit Commitment Scheduling by Generalized Benders Decomposition

Yu Guo, PhD, The Logistics Institute, Northeastern University, The Logistics Institute, 135#, Shenyang, 110819, China, yguo@tli.neu.edu.cn, Lixin Tang

This paper discusses the application of Generalized Benders Decomposition in the unit commitment scheduling. We modify the model to meet the property which is needed by the GBD. For accelerating the convergence of the algorithm, we add valid inequalities into the master problem and constitute pareto cuts.

## WA09

Room 208A

### Optimization Theory and Algorithms

Contributed Session

Chair: Qingwei Jin, Assistant Professor, Zhejiang University, Department of MS&E, School of Management, Zhejiang University, 866 Yuhangtang Road, Hangzhou, 310058, China, qingweijin@gmail.com

#### 1 - Alternating Direction Method for Latent Variable Gaussian Graphical Model Selection

Shiqian Ma, Postdoctoral Associate, University of Minnesota, 400 Lind Hall, 207 Church Street SE, Minneapolis, MN, 55455, United States of America, sm2756@gmail.com

We propose an alternating direction method for solving latent variable Gaussian graphical model selection, which is a convex optimization problem that aims to estimate an inverse covariance matrix that can be decomposed into a sparse matrix plus a low-rank matrix from sample data. Global convergence result is established for our proposed method. Numerical results are shown.

#### 2 - A Canonical Dual Approach for Solving Linearly Constrained Quadratic Programs

Ziteng Wang, NC State University, 1613 Gorman Street, Ste. 301, Raleigh, NC, 27606, United States of America, zwang23@ncsu.edu, Wenxun Xing, Shu-Cherng Fang, Ruey-Lin Sheu

We provide a canonical dual approach for minimizing a general quadratic function over a set of linear constraints. We first perturb the feasible domain by a quadratic constraint, and then solve a "restricted" canonical dual program at each iteration to generate a sequence of feasible solutions of the original problem. The sequence is proven to be convergent to a KKT point with a strictly decreasing objective value. Some numerical results are provided to illustrate the proposed approach.

#### 3 - Signal Recovery Using Relaxation Techniques

Cong Cheng, The Logistics Institute 135#, Northeastern University, Shenyang, China, ccheng@tli.neu.edu.cn, Lixin Tang

Suppose we wish to recover a sparse signal  $f$  reliably from highly incomplete measurements. The problem is formulated as a nonconvex optimization problem that is utterly intractable to compute. Relaxation is employed by means of Lagrange duality, and a second-order cone programming (SOCP) formulation is used, which can be applied by using standard state-of-the-art SOCP solvers such as SeDuMi. It is proved that under suitable conditions,  $f$  can be recovered exactly. Beside, a smoothing method is proposed to approximate the original problem. The relations between the smoothing problem and the original problem are given.

#### 4 - On the Optimality Condition of the Conic Quadratically Constrained Quadratic Optimizations

Qingwei Jin, Assistant Professor, Zhejiang University, Department of MS&E, School of Management, Zhejiang University, 866 Yuhangtang Road, Hangzhou, 310058, China, qingweijin@gmail.com, Cheng Lu, Shu-Cherng Fang, Wenxun Xing, Zhenbo Wang

The conic quadratically constrained quadratic optimization is a generalization of quadratically constrained quadratic optimization. Using the concept of cone of nonnegative quadratic functions, a new sufficient condition is provided to certify a KKT point being a global optimal solution. We also use conic duality theory to study the properties of the corresponding optimal Lagrangian multipliers. The results lead to a computational scheme that could provide an optimal solution or a lower bound.

### ■ WA10

Room 208B

#### Capacity Flexibility, Planning and Control

Contributed Session

Chair: Wenjin Lin, Ph.D. Candidate, Shanghai Jiao Tong University, 800 Dongchuan Road, Minhang, Shanghai, 200240, China, wjlin2012@gmail.com

##### 1 - United We Stand? Risk Pooling and Capacity Ownership in Joint Ventures

Ying Wei, Associate Professor, Jinan University, School of Management, Huiquan Building, Huangpu Dadao Xi, 601#, Tianhe District, Guangzhou, 510632, China, yingwei@jnu.edu.cn, Philippe Chevalier, Guillaume Roels

In this paper we study how to structure a joint venture between manufacturing firms that pool their resources in order to reduce their overall demand risk. In particular, we study whether capacity should be owned jointly or separately so as to ensure the joint venture's long-term viability. We find that both ownership structures can coordinate the firms' capacity investments and production decisions while ensuring their participation in the joint venture through a stable negotiation process.

##### 2 - Capacity Flexibility with Multiple Market Periods under Demand Uncertainty

Liu Yang, Assistant Professor, University of International Business and Economics, No 10 Hui Xin Dong Jie, Beijing, 100029, China, amyangliu@gmail.com, Liang Xu, Daniel Ng

We establish a flexible capacity strategy model with multiple market periods under demand uncertainty. A firm makes its capacity decision at the beginning of the planning horizon which embraces  $n$  market periods. In each market period, the firm goes through three decision-making stages: the safety production stage, the additional production stage and the optimal sales stage. We solve the optimal operational decisions. We also make sensitivity analyses of the key factors.

##### 3 - Service Scheduling with Capacity Acquisition, Lead Time Quotation and Competition

Hongyan Li, Northeastern University, Post Box 329, Shenyang, China, hongyanli2006@hotmail.co.uk

Capacity planning and lead time quotation are important decisions in service companies which affect the service performance directly. We investigate a joint capacity acquisition and lead time quotation decision problem in a service company, and extend the model to consider the resource competition case. We formulate the single firm problem as a non-linear mathematical programming model, and solve the model to optimality. Furthermore, the resource competition situation is analyzed.

##### 4 - Capacity Management of Car Rental Company with Customer Strategic Behavior and Downward Substitution

Xiaojuan Zhang, School of Management, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, China, xiaojuanzh@stu.xjtu.edu.cn, Sheng Hao Zhang, Lin Yan Sun

In this paper, we compare optimal capacity and revenue in three scenarios. Customers strategic behavior method with given capacity is presented by pretending proportion. The way how car rental company responses to customers' strategic behavior with capacity adjusting is explored. And then, final numerical study results reveal that downward substitution as well as concerning strategic behavior is necessary to prevent profit loss.

##### 5 - Capacity Strategy for Heterogeneity Customer Demand in Service-oriented Manufacturing Supply Chain

Wenjin Lin, PhD Candidate, Shanghai Jiao Tong University, 800 Dongchuan Road, Minhang, Shanghai, 200240, China, wjlin2012@gmail.com, Zhibin Jiang

Although customer behavior and supply chain instability have interaction through service availability, existing research has not analysed it yet. While customer's response to variable service level represents an important concern in service-oriented manufacturing industry. In this study, we investigate the feedback between demand variability and supply chain performance in a system dynamics model grounded in a first-hand study of the service-oriented manufacturing supply chain.

### ■ WA11

Room 209A

#### Information, Coordination, and Design in Supply Chains

Contributed Session

Chair: Jooyol Maeng, Assistant Professor, Pacific Lutheran University, 12180 Park Ave. S., Tacoma, WA, 98447, United States of America, maengjy@plu.edu

##### 1 - Design of Traceability Systems for Product Recall

Hongyan Dai, Assistant Professor, Central university of finance and economics, No 39, Xueyuan Nanlu, Haidian District, Beijing, China, daihy@ust.hk, Mitchell Tseng, Paul Zipkin

A product recall is very expensive and implementing a recall can be a very difficult task in a long and complex supply chain. This paper therefore focuses on traceability system design to support recall management to control total recall liability and motivate the supply chain to improve traceability. The goal is to provide a cost-effective framework to design the traceability system with consideration of technologies, recall liabilities, and incentives.

##### 2 - Strategic Information Sharing in Competing Supply Chains

Tian Li, Postdoctoral Fellow, Hong Kong University of Science and Technology, Dept. ISOM, HKUST, Hong Kong - PRC, litian@ust.hk, Liang Guo, Hongtao Zhang

This study investigates strategic information sharing in two competing supply chains where each retailer can ex post decide whether to share private demand information with his upstream manufacturer after the content of information becomes known. We find that a retailer should share less information when the retail market becomes more competitive but should disclose more information when his capability to acquire information improves.

##### 3 - How Supply Chain Partners in Emerging Markets Influence Process Innovation in Multinational Firms

Xin Zhai, Peking University, Guanghua School of Management, Peking University, Beijing, China, xinzhai@gsm.pku.edu.cn, Yi Han, Rui Wang

We investigate how characteristics of vertical supply chain partners affect the process innovation performance of multinational corporations (MNCs). Our findings show that when faced with the problem of choosing either an upstream or downstream supply chain partner, the MNC should (i) choose a supply chain partner with a different type of ownership structure and (ii) reduce the degree of concentration with its supply chain partners.

##### 4 - Multi-Task Principal-Agent Analysis of Logistics Service Supply Chain

Zhijun Gao, Shanghai Maritime University, 1550 Haigang Ave., Pudong, Shanghai, China, zhijun159159@163.com, Wei Liu, Weiping Zhu

In order to study the multi-task principal-agent model of Logistics Service Supply Chain, the difference between observation degree of logistics task and that of quality tasks is analyzed, and substitution relationship of effort costs caused the weakened incentive performance of logistics integrator is studied. The principle-agent model with integrators' supervision is introduced, integrator could effectively bestir suppliers to put more in both tasks meanwhile, and integrators' revenue is increased.

##### 5 - Benefit of Demand Forecasting vs. Risk-Pooling Strategy

Jooyol Maeng, Assistant Professor, Pacific Lutheran University, 12180 Park Ave S., Tacoma, WA, 98447, United States of America, maengjy@plu.edu

A multi-product single-period newsvendor can either use sales orders to forecast demand or a risk-pooling strategy to reduce demand variability. This paper examines the dynamics between two strategies when a sales order can reflect a poor quality of demand and the products can have a benefit from demand risk-pooling.

## ■ WA12

Room 209B

### Seasonality, Variability and Coordination in Supply Chains

Contributed Session

Chair: Linguo Gong, Associate Professor, Rider University, 2083 Lawrenceville Road, Lawrenceville, NJ, 08648, United States of America, Lgong@rider.edu

#### 1 - Effect of Variability on Lead Time in Flexible Supply Chains

Seratum Jannat, Ph.D. Student, Mississippi State University, Dept. of Ind. & Sys. Engr., Mississippi State, MS, 39762, United States of America, sj659@msstate.edu, Allen Greenwood

This paper extends the work on flexible supply chains with uncertain demand to include stochastic processing times. Discrete-event simulation is used to analyze the behavior of order lead time and total cost based on such factors as level of supplier flexibility, efficiency of alternative suppliers, information systems automation, priority levels, and process-time variability. Results from the simulation are used to tradeoff benefits and investments to determine the optimal level of all factors.

#### 2 - Dual-channel Supply Chain Coordination Model Based on Seasonal Compensation

Qi Xu, Vice Dean, Professor, 1882 Yanan West Road, Shanghai, China, xuqi@dhu.edu.cn

Paper presents a dual-channel supply chain coordination model based on seasonal compensation. When out of stock in direct channel, excess inventory of traditional retailers will be transhipped to direct channel based on coordination policy. The seasonal compensation model was discussed to analyze optimal amount of transshipment. The results shows under coordinated, the profit of cooperative dual-channel supply chain is greater than non-cooperative's while the rate of out of stock decreases

#### 3 - Viewpoint of Supply Chain Management: Why Prices of Perishable Seasonal Products Fluctuate Wildly?

Jing-An Li, Academy of Mathematics and Systems Science, CAS, No. 55, Zhongguancun East Road, Haidian, Beijing, 100190, China, ajli@amss.ac.cn

In recent years, Chinese farmers have often suffered from the severe price turbulence that has affected crops such as ginger and garlic. Since ginger and garlic belong to perishable seasonal products, this paper will study price fluctuations of such products based on supply chain management.

#### 4 - Ordering Strategy with Asymmetric Buy-Back Rate Information

Jianheng Zhou, Dong Hua University, 1882 West Yan-An Road, Glorious Sun School of Business and Mgmt., Shanghai, 200051, China, janeryzhou@163.com, Vidyananya Gargeya, Dan-qing Ding

This article investigates the decisions to be made by the retailer characterized by buy-back contracts. We examine the retailer's ordering strategy under the risk of a fluctuating buy-back rate. We discuss profits for retailers considering the risk fluctuations under three different situations depending on the symmetry and feedback information. If the retailer adjusts the ordering strategies based on the risk, then the profit of the retailer will be shifted to the supplier.

#### 5 - Comparison of a Distribution System under Different Levels of Coordinations

Linguo Gong, Associate Professor, Rider University, 2083 Lawrenceville Road, Lawrenceville, NJ, 08648, United States of America, Lgong@rider.edu

This research studies collaboration and information sharing issues of a distribution system. We use quantitative and simulation models to examine the effects of different levels of information sharing on performance and decisions of the system. Three different levels of collaborations between supplier-customers will be discussed. Issues relating SC information system design, planning and scheduling, inventory procurement decisions will be discussed.

## ■ WA13

Room 210A

### Reverse Logistics and Sustainability

Contributed Session

Chair: Kunpeng Li, Sam Houston State University, College of Business Administration, Box 2056, Huntsville, United States of America, kli@shsu.edu

#### 1 - Don't Forget Your Supplier When Remanufacturing

Yu Xiong, Senior Lecturer/Associate Professor, University of East Anglia, University Research Park, Norwich, United Kingdom, y.xiong@qub.ac.uk, Gendao Li, Yu Zhou

We model a closed-loop supply chain in which the manufacturer can remanufacture used products. The interaction with the supplier significantly impacts the performance of remanufacturing. The remanufacturing opportunity can form a prisoner's dilemma, making the players' profits shrunk. The manufacturer may be worse off with a lower remanufacturing cost or a larger return rate. Remanufacturing may be detrimental to the environment.

#### 2 - Product Return Policy with Dishonest Consumer

Guang-Zhi Shang, PhD Student in Operations Management, University of South Carolina, 1705 College St., Columbia, SC, 29201, United States of America, guangzhi.shang@grad.moore.sc.edu, Michael Galbreth, Bikram Ghosh

Customers value the ability to return a defect-free item when there is some probability that, after a trial period, they will find that it does not fit their needs. Dishonest customers might act as 'returns abusers,' using the trial to extract value rather than assess fit. Retailers can use restocking fees to deter dishonest customers, but these will also impact the purchase decisions of honest customers. We provide insights into the pricing and restocking fees of retailers in this context.

#### 3 - Transition Management as a Model for Sustainable Energy Transition in China

Yixi Xue, Tongji University, No.4800 Cao'an Road, Shanghai, China, nkxueyixi@yahoo.com.cn

We present a model of transition management for transforming Chinese energy system into a more sustainable one. It is based on visions of sustainable energy, strategic experiments and programmes for system innovation, to complement energy policies. Then we outline some possible transition pathways and proposes a coevolutionary framework for analysing Chinese current transition practices, within a multi-level micro-meso-macro perspective. At last policy implication is discussed.

#### 4 - Pricing and Ordering Strategies with Customer Returns in e-Marketplaces

Zhong Yao, Professor, BeiHang University, 37#, Xueyuan Rd. Haidian District., Beijing, 100191, China, iszhayao@buaa.edu.cn, Linlin Zhang

We build a business model that on-line firms face the customer returns with price-dependent demand to decide pricing and ordering policies simultaneously and firms operations are assumed to be in single-period ordering conditions with certainty and stochastic demand market, respectively. The study shows with stochastic demand, pricing, ordering and profits of online firms are negative correlation with price-elasticity; but the pricing is positive correlation with the return rate of customers.

#### 5 - Remanufacturing under Extended Producer Responsibility

Kunpeng Li, Sam Houston State University, College of Business Administration, Box 2056, Huntsville, AL, United States of America, kli@shsu.edu, Shaorui Li

In a supply chain setting, we study how remanufacturing and the reverse channel are influenced by Extended Producer Responsibility (EPR) policy. An EPR policy specifies a minimum percentage of remanufactured products in a production process.

## ■ WA14

Room 210B

### Stochastic Models in Reliability

Sponsor: Applied Probability

Sponsored Session

Chair: Lirong Cui, Professor, Beijing Institute of Technology, South Zhongguancun No.5, Haidian District, Beijing, China, lirongcui@bit.edu.cn

#### 1 - A Study on Sojourn Time-based Two-part Partition of Aggregated Stochastic Processes

Lirong Cui, Professor, Beijing Institute of Technology, South Zhongguancun No.5, Haidian District, Beijing, China, lirongcui@bit.edu.cn, Donglei Du

Aggregated stochastic processes have been developed more in the system reliability recently, some phenomena and backgrounds related to sojourn time-based two-part partition for the state space of stochastic processes can now be found in reliability field and other areas such as in the financial market. Some situations of two-part partition for the state space of stochastic processes have been discussed already in the Ion channel modelling for example Colquhoun and Hawkes (1982) and in reliability Zheng et al. (2006) and Cui and Li (2007). However, all these partitions for the state space are based on the classification of states without considering sojourn time. In this paper, we take the sojourn time into consideration for partitions of the state space. The researches for this problem are more details as follows. Given a homogeneous continuous-time Markov Chain  $\{X(t), T > 0\}$  with finite state space  $S=W+F$  ( $W \cup F = S$ ), we define a new stochastic process based on  $\{X(t), t > 0\}$  as follows, where the critical value  $W$  is the probability for some events related to the stochastic process  $\{Y(t), t > 0\}$ ? What are the distributions for some durations related to the stochastic process  $\{Y(t), t > 0\}$ ? Some of these interesting questions are discussed in the paper.

#### 2 - Hierarchical Modeling and Mission Reliability Evaluation of TT&C System Using Stochastic Petri Net

Xiao-Song Yang, College of Information System and Management, National University of Defense Technology, Changsha, 410073, China, yangxiaosong1211@gmail.com, Qi Liu, Xiaoyue Wu

From the analysis of space tracking, telemetry and command (TT&C) system characteristics and mission process, it can be viewed as a complex phased-mission system (PMS) with multitasks. PMS means that the system will go throughout several time-continuous, length-fixed and non-overlapped operational phases (such as launch, orbiting and return of spacecraft), during which the system configurations and logics may differ from one another. A general methodology for the reliability modeling of TT&C system using stochastic Petri nets (SPNs) is introduced since the traditional modeling method is difficult to solve this complex problem. In order to construct the overall model of TT&C system, a modeling framework for hierarchical and modular representation of TT&C system is proposed. Firstly, different levels or subsystems of SPN models are built independently using top-down decomposition techniques through a gradually detailed process, for example, phase level SPN models the division and transitions of different phases, system logic level SPN expresses the system failure logic in each phase in terms of component failures, and component level SPN describes the dependences of different components and the basic events of component failure or repair. Then by introducing a new kind of Petri net place, named the replaceable place, the low level Petri net can be packed modularly as a place and added to upper level Petri net according to the actual system construction and operational process. Finally, the SPN model of each level is implemented and the overall TT&C system mission reliability model is constructed by using bottom-up synthesis techniques. The obtained combinational model provides a graphical and clear representation of TT&C system structure and mission process. To consider complexities such as non-exponential distribution of timed transitions and state space explosion which leading to the difficulties of analytical solution, the Monte-Carlo simulation method is used to obtain the results. Meanwhile, the hierarchical and modular modeling method provides a favorable reusability of these models for different scenarios.

#### 3 - Analysis of Censored Data with Partial Information

Renyan Jiang, Changsha University of Science and Technology, Faculty of Automotive and Mechanical Eng. Changsha, Hunan, China, Jiang@csust.edu.cn

Some censored data are generated due to partial condition information. An example of such data is preventive maintenance or replacement data, which are generated due to the fact that an inspection shows that the item can fail soon. Such data are neither failure observations nor randomly censored observations since it contains the information of the real status of the item though such information is not quantitatively reflected in the records. We call such data quasi-censored data. It is an issue how to use them in reliability modeling. This paper examines this issue and presents two approaches to analyze such data. The approaches are illustrated using two examples and give almost the same results.

#### 4 - Bayesian Sequential Test Design Based on Posterior Probability for Exponential Distributed System

Qi Liu, College of Informational Systems and Management, National University of Defense Technology, Changsha, China, liuqigfkd@hotmail.com, Xiaoyue Wu, Nan Wang

Testing the system's reliability is often a costly and difficult undertaking. Currently used Sequential Posterior Odd Test (SPOT) or Sequential Posterior Ratio Test (SPRT) reliability test design methods are based on the risks of Type I and Type II error, do not take the 'principle of small-probability event' and the posterior probability of accepting or rejecting the null hypothesis into consideration. For exponential distributed system, the assumptions of accepting null hypothesis and alternative hypotheses are given, and based on the assumptions, a Bayesian Sequential Test Design Model (BSDM) based on posterior probability is proposed, where posterior probability of accepting or rejecting the null hypothesis is taken into consideration. According to 'principle of small-probability event' and posterior probability, the test and judgment criteria of sequential test are carried out, and the posterior risks of type I and type II are proven to be smaller or equal than given posterior probability. One case example is used to demonstrate the proposed BSDM methodologies, and a test design plan is carried out to give prior distribution, small-probability of accepting null hypothesis or alternative hypothesis. The results indicate that by using BSDM, system reliability test design plan can be decided effectively and economically.

## ■ WA15

Room 212A

### Marketing and the Internet

Contributed Session

Chair: Qin Zhang, Assistant Professor of Marketing, University of Iowa, Tippie College of Business, Iowa City, IA, 52242, United States of America, qin-zhang@uiowa.edu

#### 1 - Choice-based Recommender Systems

Hai Jiang, Associate Professor, Tsinghua University, Dept. of Industrial Engineering, Beijing, 100084, China, haijiang@mail.tsinghua.edu.cn, He Sun

Recommender systems are widely used by online stores to suggest items of interest to users. A key concern with existing approaches is over-specialization, which results in returning items that are too similar to each other. We propose to use choice probability to measure the overall quality of recommendation lists, which unifies the desire to achieve both relevancy and diversity in recommendation. Optimal solution algorithms are developed and tested using data from a major travel website.

#### 2 - Optimize the Marketing Communication Strategy by Mining Online Review

Lei Zhang, School of Management and Economics, University of Electronic Science and Technology of China, No.4, Section 2, North Jianshe Road, Chengdu, China, moulim@uestc.edu.cn, Kou Gang, Kun Chen

This paper wanted to optimize marketing communication strategy. We first found the consumer's attitude to specific product by review mining. Then, we took questionnaire and analyzed how four marketing communication worked well to ameliorate consumer's attitude. Then, we formatted a model to analyze how one enterprise should choose communication strategy in order when it has different communication objects. At last, we choose one company's communication decision-making to test our proposal.

#### 3 - Viral Marketing on Micro-blogging Platforms: Incentives and Diffusion Patterns

Chunhua Wu, Sauder School of Business, University of British Columbia, Vancouver, Canada, chunhuawu@wustl.edu, Liyin Jin

We investigate how the macro-level diffusion patterns are related with the incentives firms provide in micro-blogging viral marketing campaigns. Specifically, we look at three measurements for diffusion patterns and model how the incentives firms provide lead to three individual participation behaviors, by tracking the entire lifetime of 200 firm initiated viral marketing campaigns on Weibo.

#### 4 - Understanding User Behavior and Motivation in Online Gaming

Baojun Jiang, Assistant Professor of Marketing, Olin Business School, Washington University in St. Louis, One Brookings Dr., St. Louis, MO, 63130, United States of America, baojunjiang@wustl.edu, Li Wang, Ying Xie

We use a large panel dataset from a popular, massively, multiplayer online game to investigate user motivations when consuming state- and status-based entertainment online. We find that the time and money users spent on the game exhibit a pattern suggesting that users have several sub-goals in achieving the highest level of the gameplay.

### 5 - Identifying High Value Customers in a Network: Individual Characteristics Versus Social Influence

Qin Zhang, Assistant Professor of Marketing, University of Iowa, Tippie College of Business, Iowa City, IA, 52242, United States of America, qin-zhang@uiowa.edu, Sang Uk Jung, Gary Russell

We propose a spatial autocorrelation model to measure customer values in a social network that accounts for both individual and network effects. We apply our model to a user-level dataset on online gaming in Korea. Our model outperforms benchmark models in predicting revenues from gamers. We quantify the relative impact of individual and network effects on revenues and show that the most influential individuals in a network sense may not be the individuals with the highest customer values.

### ■ WA16

Room 212B

### Marketing: New Product Development

Contributed Session

Chair: Angela Xia Liu, Assistant Professor, Tsinghua University, School of Economics and Management, Tsinghua University, Beijing, China, liux@sem.tsinghua.edu.cn

#### 1 - The Complementarity between Marketing and Technological Knowledge on Innovation Development

Fang Wu, Clinical Professor, University of Texas at Dallas, School of Management, Richardson, TX, 75083, United States of America, fangwu@utdallas.edu, Shichun Xu, Anna Cui

This study examines how incumbents manage its innovation process through synthesizing different knowledge sources. Past research has suggested the complementarity between marketing and technological knowledge on innovation. We argue that depending on the technological breadth and depth, the complementarity of marketing and technological knowledge can differ for radical and incremental innovation development. In addition, external knowledge source can also play a role in the above relationships.

#### 2 - Modeling Dynamic Diffusion of Information Technology

Hirokazu Takada, Baruch College/CUNY, One Bernard Baruch Way, New York, NY, 10010, United States of America, hirokazu.takada@baruch.cuny.edu, Kaichi Saito, Masataka Yamada, Nobuhiko Terui

Latest IT products performing multiple functions provide ubiquitous access to the Internet. Bass model utilizing the simultaneous equations was developed to analyze the co-diffusion processes. We conjecture different segments according to the specific adoption processes. Segment potentials can be identifiable through empirical analysis. The empirical analysis of PC and digital cellular phone subscriptions in the U.S. and Japan can capture the interactive effect, and provide accurate forecast.

#### 3 - Assessing Different Diffusion Patterns and the Role of Determinant Predictors

Xi Chen, Assistant Professor, China University of Political Science and Law, #27, Fuxue Rd., Changping District, Beijing, China, chelseatsinghua@gmail.com

Using passenger vehicle registration data ranging from January 2008 to June 2011 across 31 provinces, I pin down the diffusion pattern of Chinese passenger vehicles across the country with a growth curve modeling approach. For the first phase, I investigate the diffusion with four widely applied innovation diffusion models. I then compare their performance in explaining power. In the second phase, I quantify the impact of a series of demographic variables of each province in China

#### 4 - A Spatiotemporal Analysis on the Diffusion of Mobile Digital Content Product

Angela Xia Liu, Assistant Professor, Tsinghua University, School of Economics and Management, Tsinghua University, Beijing, China, liux@sem.tsinghua.edu.cn, Xuping Jiang, Xiaosong Dong

The thriving of mobile content product makes it urgent for both scholars and managers to understand its diffusion pattern and other relevant determinants. Using spatial panel model, we combined the sales data on one type of mobile content product with consumer online searching data at provincial level, and examine the spatial pattern of its Internet sale process. We further discuss the managerial implications and point out directions for future research.

### ■ WA17

Room 213A

### Health Care Marketing and Quality Assessment

Sponsor: Health Applications

Sponsored Session

Chair: Liam O'Neill, Associate Professor, UNT-HSC/ SPH, UNT-HSC/SPH, 3500 Camp Bowie Blvd, Fort Worth, TX, 76107, United States of America, Liam.ONeill@unthsc.edu

#### 1 - De-Juking the Stats: How to Improve Hospital Quality Rankings While Holding Quality Constant

Liam O'Neill, Associate Professor, UNT-HSC/ SPH, UNT-HSC/SPH, 3500 Camp Bowie Blvd, Fort Worth, TX, 76107, United States of America, Liam.ONeill@unthsc.edu

Information asymmetry between doctors and patients can lead to a two-tiered market for health care. Data on more than 100,000 pacemaker implantations were used to measure quality and access. Fixed effects logistic regression was used to predict admission to cardiac hospitals. We demonstrate that physician-hospital ownership introduces moral hazard in which physicians can arbitrage knowledge of their patient's health status in order to maximize financial return and quality rankings.

#### 2 - Enhancement of Patient and Staff Experience at Outpatient Pharmacy Via Optimization of Drug-Shelf Research

Hong Choon Oh, Manager, Centre for Health Service Research, Sing Health, 168 Jalan Bukit Merah #06-08 Tower 3, Singapore, oh.hong.choon@singhealth.com.sg, Jane Ai Wong, Mui Chai Tan

The drug-shelf allocation planning problem of a pharmacy entails assignment of drugs to shelves. A good drug-shelf allocation plan is critical to a pharmacy due to its impact on experience of patients and pharmacy staff. This paper aims to introduce a new three-stage solution framework to solve the drug-shelf allocation planning problem where the latter is decomposed into three sub-problems.

#### 3 - A Stochastic MOPCC Model for Healthcare Resource Allocation

Yan-Chao Liang, PhD Student, Dalian University of Technology, School of Mathematical Sciences, DaLian, China, liangyanchao83@163.com, Dali Zhang, Gui-Hua Lin

We proposed a two-stage model for a healthcare resource allocation problem. At the first stage, the distribution of patient volume at each hospital is characterized by stochastic user equilibrium, and at the second stage, the healthcare resources are allocated according to the patient volumes. The model also captured the multi-objective feature in healthcare problem, and a set of optimality conditions has been proposed to solve the allocation problem in the Pareto sense.

### ■ WA18

Room 213B

### Recent Advances in Radiation Treatment Planning Optimization

Cluster: OR/MS in Medicine and Healthcare

Invited Session

Chair: Gino Lim, University of Houston, E206, Engr. Bldg 2, 4008, Houston, TX, United States of America, ginolim@uh.edu

#### 1 - mdaccAutoPlan: A System to Automate Treatment Planning for Intensity Modulated Radiation Therapy

Xiaodong Zhang, MD Anderson, 1515 Holcombe Blvd., Houston, TX, United States of America, xizhang@mdanderson.org

We describe the methodology and results of mdaccAutoPlan system: for every new patient, the system automatically generates intensity modulated photon and proton plans (the autoplans) that meet or exceed the dose-volume constraints by one button click in treatment planning system (TPS). We compared autoplans with clinical plans created by the experienced dosimetrists. The autoplans were consistently better, or no worse, than clinical plans in terms of tumor coverage and normal tissue sparing.

## 2 - Optimization Methods for Fractionated Radiotherapy Treatment Planning Using Gamma Knife™ Perfection

Dionne Aleman, University of Toronto, Toronto, ON, Canada, aleman@mie.utoronto.ca, Kimia Ghobadi, Hamid Ghaffari, David Jaffray, Mark Ruschin

Gamma Knife™ (Elekta, Stockholm, Sweden) radiation treatment units are commonly only used for radiosurgery, wherein a high but conformal radiation dose is delivered to target structures; allowable doses are up to twice the prescribed dose. Conversely, radiotherapy emphasizes dose homogeneity over conformity, and treatment quality is far more sensitive to couch positioning. We present isocenter selection and sector duration optimization models to address the added challenge of homogeneity.

## 3 - Spot Intensity Optimization for Intensity Modulated Proton Therapy Treatment Planning

Gino Lim, University of Houston, E206, Engr. Bldg. 2, 4008, Houston, TX, United States of America, ginolim@uh.edu, Wenhua Cao, Xiaodong Zhang

Intensity modulated proton therapy (IMPT) has emerged as an advanced type of radiation therapy for cancer patients. However, optimization models and solution algorithms for determining delivery variables have not been well addressed. In this talk, we focus on optimizing spot intensities for IMPT and compare LP-based and QP-based optimization models in terms of plan quality and delivery efficiency. We also present our initial study results on several prostate cancer patients using LP and QP.

## 4 - A Hybrid Image Segmentation Algorithm with Supervised Iterative Learning for Radiotherapy

Yin Zhou, MD Anderson, 1515 Holcombe Blvd, Houston, TX, United States of America, cascade\_2006@163.com, Xiaodong Zhang, Joe Chang

In this paper, we propose a novel hybrid image segmentation algorithm with supervised iterative learning to tackle the problem of sensitivity to noise and local minimum for regions with low image contrast and large shape variation. We apply the algorithm to the image segmentation in the radiotherapy of lung cancer and show that it has the potential of allowing for whole image segmentation and promises to fully automate the image segmentation process for radiotherapy.

## ■ WA19

Room 215

### Business Analytics and Optimization

Sponsor: Business Analytics, CPMS-The Practice Section

Sponsored Session

Chair: Roger R. Gung, Sr. Manager of Business Analytics & Optimization, University of Phoenix, 4025 S. Riverpoint Pkwy., Phoenix, AZ, 85251, United States of America, roger.gung@phoenix.edu

#### 1 - Business Analytics Overview in Higher Education Industry

Roger R. Gung, Sr. Manager of Business Analytics & Optimization, University of Phoenix, 4025 S. Riverpoint Pkwy., Phoenix, AZ, 85251, United States of America, roger.gung@phoenix.edu, Tao Kang

We present several analytical projects where we applied advanced statistical methods and optimization techniques to gain insights and create solutions for business problems in Higher Education Industry. These include bad debt reserve modeling, bad debt expense forecasting, scholarship grant for revenue optimization, and early delinquent student persistence scoring. We also present research on nonlinear logistic regression and categorical variable binning that were applied in these projects.

#### 2 - Generalized Reduced Trust-region Search and Applications to Statistical Multi-Objective Optimization

Argon Chen, Professor, National Taiwan University, Taipei, Taiwan - ROC, achen@ntu.edu.tw, Yang-Ting Chen

In this research, we propose a straightforward formulation for statistical optimization problems with multiple responses. The formulation turns the problem into a quartic nonlinear programming (NLP) problem. We develop a 'Generalized Reduced Trust Region' (GRT) search method with a convergence proof. The method is shown to overcome the zigzagging problem, often incurred by conventional gradient search methods.

#### 3 - Market Basket Analysis and its application in Bioinformatics

Shu-Chuan Chen, Assistant Professor, Arizona State University, Tempe, AZ, United States of America, schen29@asu.edu

For any association rule to be meaningful, it is critical to have sufficient high values of support and confidence. In this talk, we propose a statistical way to determine the minimum support and minimum confidence. In addition, we propose an algorithm, dynamic support and confidence association rules analysis, for gene expression data analysis with the intent to find descriptive and predictive biological processes.

## Wednesday, 10:00am - 11:30am

### ■ WB01

Room 202B

#### Vehicle Routing

Contributed Session

Chair: Shu-Chu Liu, National Pingtung University of Science and Technology, 1 Huesh Fu Rd., Nei Pu, Pingtung, Taiwan - ROC, shliu@mail.npust.edu.tw

#### 1 - School Bus Routing - A Column Generation Approach

Joris Kinable, KU Leuven, Naamsestraat 69, Leuven, Belgium, joris.kinable@econ.kuleuven.be, Greet Vanden Bergh, Frits Spieksma

The School Bus Routing Problem (SBRP), a generalization of the well-known Vehicle Routing Problem, comprises the routing, planning and scheduling of public school bus transportation. The core problem can be decomposed into several subproblems, including bus stop selection, assigning students to buses, and determining the bus routes. This work presents an exact branch-and-price framework for the SBRP, with a strong emphasis on efficiency issues inherently related to column generation.

#### 2 - Vehicle Management of AMHS in Semiconductor Manufacturing

Kuo-Hao Chang, Assistant Professor, National Tsing Hua University, No. 101, Section 2, Kuang-Fu Road, Hsinchu, 30013, Taiwan - ROC, birdhow@gmail.com, Yu-Hsuan Huang

In semiconductor manufacturing, AMHS plays a key role in enhancing production efficiency. In this talk, we propose a new formulation for the vehicle management in AMHS, and develop a new method to determine the optimal number of vehicles for each interbay and intrabay of the AMHS. The goal is to meet the transportation requirement, while achieving minimal vehicle cost. An empirical study shows that the proposed method works well in real settings.

#### 3 - A Heuristic Method for the Fleet Size and Mix Vehicle Routing Problem

Shu-Chu Liu, National Pingtung University of Science and Technology, 1 Huesh Fu Rd., Nei Pu, Pingtung, Taiwan - ROC, shliu@mail.npust.edu.tw, Hsu-Ju Lu

Numerous heuristic methods have been proposed for the fleet size and mix vehicle routing problem (FSMVRP) since the FSMVRP is an NP-hard problem. In this paper, a heuristic method, incorporating the vehicle type information into variable neighborhood search, is proposed. The experimental results indicate that the proposed method is better than other reported methods in terms of total cost and average percentage deviation.

### ■ WB02

Room 202A

#### Information Systems II

Contributed Session

Chair: Te-Min Chang, Associate Professor, National Sun Yat-sen University, 70, Lien-hai Rd, Kaohsiung, 804, Taiwan - ROC, temin@mail.nsysu.edu.tw

#### 1 - The Impact of Hardware/Software Investments on Profitability: Empirical Evidence From China

Chuan Shi, Peking University, RM422, Building 2, Changchunxinyuan, Beijing, China, shichuan@gsm.pku.edu.cn, Dong Li

Many researchers in IS area argue that IT investments can improve firm performance, but until now, at the profitability, no consistent conclusion has been reached. There are only a few empirical researches focus on this problem by comparative analysis between the performance of software and hardware investments. Therefore we try to explore the relationship between IT investments and firm profitability from this perspective.

#### 2 - How to Make Friends in Professional SNSs: Concentrative or Continuous Participation

Guoxin Li, Associate Professor, Harbin Institute of Technology, 13 Fayuan St., Nangang Dist., Harbin, 150006, China, lisappleheart@gmail.com, Yanxue Wang

Professional users intend to be involved in online SNSs to expand social circles and make business friends. But how can benefit users to make more friends by specific participation behavior in professional SNSs? With the data recorded five months from 2400 samples, the paper found that concentrative participation has an inverted U curve and continuous participation a positive linear effect on users' increasing networks. Work position has negative moderating role on the above effects.

### 3 - Sustainable Revenue Management: Agent-Based Modeling Approach For the Public Transportation Industry

Milan Lovric, Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, 3062PA, Netherlands, mlovric@rsm.nl, Ting Li, Peter Vervest

Public transportation operators (PTOs) function in an increasingly competitive and socially sensitive context that demands new approaches to revenue management. We propose a new perspective of sustainable revenue management that considers individual customers' needs in addition to the financial viability. We evaluate this perspective using agent-based simulation and smart card data. By taking a customer-centric view, PTOs can find revenue management strategies that lead to a sustainable win-win.

### 4 - Do Inter-organizational Networks Increase Effect of IT Investment on Firm Performance

Li Jixue, Peking University, No.5 Yiheyuan Road Haidian District, Beijing, China, lijixue@pku.edu.cn, Gao Zhaojun

This study discusses and empirically tests the moderating effects of inter-organizational networks on the impact of IT investment on firm performance. The study sample consists of top 500 listed China corporations in 2009. The present study extends that work to yield a framework that shows the relationship between IT investments and firm performance.

### 5 - Personalized Document Recommendation by Latent Dirichlet Allocation

Te-Min Chang, Associate Professor, National Sun Yat-sen University, 70, Lien-hai Rd, Kaohsiung, 804, Taiwan - ROC, temin@mail.nsysu.edu.tw, Li-Zen Chen

This work focuses on building personalized document recommender systems using the latent Dirichlet allocation (LDA) approach. LDA can uncover latent topics hidden in documents, and through the common topic inference, we can get each active user's preference of topics to assist the recommendation process. Several experiments are conducted to examine the performance and the feasibility of the proposed approach.

## WB03

Room 203B

### Knowledge Management

Contributed Session

Chair: Sean Eom, Professor, Southeast Missouri State University, 1 University Plaza, Cape Girardeau, MO, 63701, United States of America, sbeom@semo.edu

#### 1 - Evaluation of Knowledge Management Tools

Gulfem Isiklar Alptekin, Galatasaray University, Ciragan Cad. No: 36 Ortakoy, Istanbul, 34357, Turkey, gisiklar@gsu.edu.tr, S. Emre Alptekin, Y. Esra Albayrak

Since organizations operate in different business contexts and drivers of knowledge management are often unique for each company, knowledge management decision making problems are often associated with evaluation of alternative knowledge management tools. In this research, we compare different knowledge management tools and find most effective one for our scenario.

#### 2 - A Hybrid Methodology for Marketing Decisions Based on Design of Experiment

S. Emre Alptekin, Galatasaray University, Ciragan Cad. No: 36 Ortakoy, Istanbul, 34357, Turkey, ealptekin@gsu.edu.tr, BurAin Yakan

In private pension and life insurance systems, companies make investments on their marketing activities to manage customers and determine new prospective customers. In this study, we propose a methodology that is based on design of experiment and case-based reasoning in order to determine the most-profitable customer profile.

#### 3 - Knowledge Leaks: The Role of Repatriate Experts on Tech Knowledge Transfer & Firm Absorptive Capacity

Abraham Lee, Handong Guest House, IE Business School, HandongRo 558, Pohang, 791-708, Korea, Republic of, safeguide@gmail.com

This studies the mediating role of repatriated experts in the acquisition of knowledge and the development of absorptive capacity in the home organizations they are recruited by. We find returning experts mediate firms' ability to overcome knowledge and network isolation effects and serve as vehicles for knowledge transfer, catalyzing knowledge assimilation for organizations that are located in highly competitive and rapidly developing economies.

### 4 - Building User Models in E-learning Environment

Qiyang Chen, Montclair State University, Montclair, NJ, United States of America, chenq@mail.montclair.edu

The traditional methods of designing web page/site for teaching Information Technology (IT) fail to concentrate on integration of various modes of learning within the stages of the technological process. Most of tutorial websites or web-based instructional environment, fail to adapt human cognitive progress. The nature of complex human cognitive models in web based instructions is not clearly discussed in literature, especially in the area of teaching information technology. This paper presents a conceptual framework of designing a user stereotype based instructional model that facilitates critical thinking and cognitive progress. This framework provides a set of criteria, assumptions, goals, the structure and issues for the implementation. It is focusing on the interactive and individualized teaching-learning process. In particular, this framework incorporates the following aspects to enhance students' learning experiences: • Activity-based interactions that lead to individual learning and teaching, thus promoting active learning and thinking applicable for students. • Explicit teaching of the sub-processes of critical thinking which correspond to the needs of students during stages of the technological process that influence students' responsibility and understanding in problem solving. • Monitoring mechanism for individual progress that allows the teacher to adapt to the different paces of students' learning experiences and personalize the instructions. • A balance between instructional strategies contributes to dynamic individual and collaborative activities, which stimulate the attainment of design skills and creativity during technological process. This provides a rich array of social interactions and different modes of learning. • Utilizing power of peer tutoring to enhance students' domain knowledge and to stimulate a wide range of skills, including cognitive, social and communication. The teacher becomes a coordinator of the learning process and facilitates the cognitive aspects of students' learning experiences.

### 5 - Testing the Delone-McLean Model of Information System Success in an E-Learning Context

Sean Eom, Professor, Southeast Missouri State University, 1 University Plaza, Cape Girardeau, MO, 63701, United States of America, sbeom@semo.edu

Evaluating DSS involves examining multi-dimensional attributes associated with the value of DSS. In the early 1990s, DeLone and McLean presented the IS success model as a framework and model for conceptualizing and operationalizing IS (including DSS) success. This paper empirically tests the validity of the DM model in an e-learning environment.

## WB04

Room 203A

### Ethical, Team and Social Issues

Contributed Session

Chair: Edward Baker, Professor, University of Miami, School of Business, 412 Kosar Epstein, Coral Gables, FL, 33143, United States of America, ebaker@miami.edu

#### 1 - When Can "Wrong" Predictions Tell Us to Do the Right Things?

Rong Chen, Associate Professor, Tsinghua University, Room 357, Weilun Building, Beijing, 100084, China, chenr@sem.tsinghua.edu.cn, Wenyu Dou, Song Su

Statistically, consumers can make perfectly correct predictions by utilizing information sources that always make wrong predictions. However, we show by experiments that consumers tend to follow the information source with a high accuracy rate. This tendency shifts as experience accumulates or after having previous learning. In addition, informativeness bias can be moderated by the normativeness of the information source (supported by NSF072057, 71172011).

#### 2 - The Effect of Social Identity and Public Service Motivation on the Collective Goods: Experimental Evidence from China

Chengwei Xu, Xi'an Jiaotong University, No.28 Xianning Road, Xi'an, China, xuchengwei1985@163.com

This study focuses on the effects of Social Identity (SI) and Public Service Motivation (PSM) on the Collective Goods (CG), and tries to explain the functional mechanism of SI and PSM on CG. Through the lab-experiment, we found that the designated levels of SI can enhance the subjects' willingness to contribute to CG in the same level, and the effects are diversified between subjects with different PSM.

**3 - Hawks Will Not Pick Hawks' Eyes Out**

Xi Zhang, School of Economics and Management, Southwest Jiaotong University, No.111, Erhuanlu Beiyiduan, Chengdu, 610031, China, zhangx-hill@163.com, Shuja Ul Islam, Zhankui Dong

Previous studies suggest that the relationship between director and CEO would have effects on the corporate governance. We design a computer experiment to see if the ties (especially the social ties) between director and CEO would influence CEO compensation level and incentive structure. Our results show that CEO who has social ties with the board members will receive a higher compensation and lower pay performance sensitivity.

**4 - Team Structure and Innovation in Open Source Development Networks**

Mu Xia, Santa Clara University, 500 El Camino Real, Santa Clara, CA, 95053, United States of America, mxia@scu.edu, Ali Tafti, Ramanath Subramanyam

Innovations are increasingly originating from open collaborative environments such as open source communities. We examine how the structure of the adjacent collaboration knowledge network of software designers in the development community affects the ability of the focal group to innovate, using cross-sectional and panel data on several hundred open source projects to test our hypothesized relationships.

**5 - Is It Profitable to Be Ethical?**

Edward Baker, Professor, University of Miami, School of Business, 412 Kosar Epstein, Coral Gables, FL, 33143, United States of America, ebaker@miami.edu, Trevor Fiorentino

The debate on the ethical behavior of companies often offers up a number of points of view as to what the cost of being ethical, or perceived as being ethical, entails. Using current and publically available data we test claims that ethical behavior leads to higher profits on a number of metrics across sectors, industry groups, and industries. The data reveal somewhat less optimistic results than one may have been initially led to believe.

**WB05**

Room 205B

**Production Planning and Control**

Contributed Session

Chair: Rong Yuan, Massachusetts Institute of Technology, 4084b, 235 Albany St., Cambridge, MA, 02139, United States of America, rongyuan@mit.edu

**1 - Implementation of LP Models for a Production Planning Problem in the LED Array Process**

Jaewoo Chung, Assistant Professor, Kyungpook National University-Daegu, South Korea, 1370 Sankyuk-dong Buk-gu, Daegu, Korea, Republic of, chung@knu.ac.kr

This research introduces a practical scheduling application based on multiple LP models for the LED array process that is a part of the liquid crystal display (LCD) manufacturing. The new method proposed in this research centers on reducing the inventory level of LED chips and packages. Maintaining low inventory levels is especially critical in this industry because the higher inventory causes a higher scrap rate of LED parts when product models are frequently changed by customers.

**2 - A Volatility Safety Stock Model for Kanban Controlled Manufacturing System**

Yan Feng, Wuhan University of Technology, 122 LuoShi Road, Wuchang, Wuhan, China, 13fengyan13@163.com, Shaojun Wang

In the dual-kanban pull production system, safety stock is not a minimum stock which is theoretically calculated by considering the batch size, cycle time of each station, and the takt time only. In the circumstances of the emergent production, the material handling system broken unexpectedly, or unreasonable high defect rate, the additional safety stock will be needed. In this paper, a volatility model is established to adjust safety stock dynamically with considering these uncertain factors.

**3 - Setting Optimal Production Lot Sizes and Planned Lead Times in a Job-shop Manufacturing System**

Rong Yuan, Massachusetts Institute of Technology, 4084b, 235 Albany St., Cambridge, MA, 02139, United States of America, rongyuan@mit.edu, Stephen Graves

We model a job shop that produces a set of discrete parts. The intent of the research is to develop a planning model to determine the optimal operating tactics that minimize the relevant manufacturing costs subject to workload variability and capacity limits. The operating tactics are setting the production lot size for each part and the planned lead time for each work station. We have tested our model on the large-scale actual factory data which consists of 109 parts and 59 work stations.

**WB06**

Room 205A

**Novel Topics and Methods in Innovation Management**

Cluster: Super/Special Sessions

Invited Session

Chair: Zhijian Cui, Assistant Professor of Operations Management, IE Business School, Calle de Maria de Molina, 12, 5th floor, Madrid, Spain, Zhijian.cui@ie.edu

**1 - Ambidexterity in Product Development. The Role of Information Technology**

Elena Revilla, Professor of Operations Management, IE Business School, Calle de Maria de Molina 12, Madrid, 28006, Spain, Elena.Revilla@ie.edu, Daisy Escobar

Building on the knowledge-based view literature, the study presents evidence that ambidexterity mediates the relationship between the information technology that encourages exploration and exploitation and subsequent performance in product development.

**2 - Emergence and Decline of Design Gurus**

Haibo Liu, PhD Candidate, INSEAD, Singapore, haibo.liu@insead.edu, Jurgen Mihm, Manuel Sosa

This study examines the creative output of individual designers over time and disentangles knowledge and social factors that predict both the emergence and decline of design gurus. We define design gurus as top ranked designers based on the citations received by their design patents. We test our hypotheses by using Event History Analysis on the design patents filed in United States Patent and Trademark Office (USPTO). Practical and theoretical implications for design management are discussed.

**3 - Firm Investment, Growth Opportunity and Stock Returns: Evidence from China**

Zhiguo Li, Associate Professor of Management, Fudan University, R 313 Siyuan Building, 670 Guoshun Road, Shanghai, 200433, China, lizg@fudan.edu.cn, Jiangang Xu, Kun Yu, Xiaorong Zhang

A negative relation is documented between abnormal investment and subsequent benchmark adjusted stock returns of the firms. However, further examination fails to establish a uniform free cash flow hypothesis. Empirical results show that the negative investment-return relation is due to the market concerns about the incentives of overinvestment induced by free cash flow problems in the firms with low investment opportunity.

**4 - A Model of Product Specification Bargaining and Project Failure**

Zhijian Cui, Assistant Professor of Operations Management, IE Business School, Calle de Maria de Molina, 12, 5th floor, Madrid, Spain, Zhijian.cui@ie.edu, Christoph Loch

This chapter models the bargaining between two organizational parties on a one-dimensional feature design decision for a new product. We examine three managerial levers to reduce the bargaining failure risk including signaling of fallback utility, adding incentives and managing concern of social status.

**WB07**

Room 206A

**Decision Analysis Applications**

Contributed Session

Chair: Gloria I. Rodriguez Lozano, National University of Colombia, Universidad Nacional de Colombia, Bogota, Colombia, girodriguez@unal.edu.co

**1 - Incentive Regulation in the Brazilian Electricity Distribution Industry**

Ana Lucia Lopes, Professor, CEPEAD, Federal University of Minas Gerais, Brazil, Rua Rio de Janeiro, 2754 ap. 601, Av. Antonio Carlos, 6627/UFMG - Pampulha, Belo Horizonte, MG, 30160042, Brazil, analopes.ufmg@gmail.com, Rajiv Banker

We address the empirical question of maintaining a returns to scale assumption when using DEA models in incentive regulation. Although the complete specification of a production relationship between all inputs and outputs may exhibit NDRS or CRS for a local monopoly, we prove that the estimated production function will necessarily exhibit VRS in the simpler empirical abstraction. Data from 28 Brazilian electricity distribution companies also statistically rejects the NDRS assumption.

**2 - GRASP and Path Relinking for the Bi-objective VRP**

Arne Løkketangen, Professor, Molde University College,  
Britveien 2, Molde, 6411, Norway, arne.lokketangen@himolde.no,  
Jorge Oyola

We suggest applying GRASP and Path Relinking to the Bi-Objective VRP, with the objectives being minimizing route cost and minimizing route balance. First a tabu search heuristic is used to find the solutions that optimize each of the objectives independently. The pareto front is then approximated either through an iterative process that combines path-relinking and local search or a GRASP-based ruin-and-recreate algorithm. Computational results will be presented.

**3 - Evaluating Software Quality with Choquet Integral**

Tuncay Gürbüz, Dr., Galatasaray University Industrial Engineering  
Dept., Ciragan cad. No. 36 Ortakoy, Istanbul, 34357, Turkey,  
tuncaygurbuz09@gmail.com, S. Emre Alptekin,  
Gulfem Isiklar Alptekin

Software quality (SQ) is the satisfaction degree of consumer demands and it can be measured as the degree to which a software program conforms to those demands. As the consumers may have different types of requirements, this can be regarded as a multicriteria decision making (MCDM) problem. In this study, Choquet Integral method, which helps analyzing the conjunctive and disjunctive interactions among criteria, was used based on the model developed by the international ISO norm (ISO 9126-1).

**4 - Comparison between the Relative Efficiency of Entrepreneurship Business Units of Bogota Using DEA**

Gloria I. Rodriguez Lozano, National University of Colombia,  
Universidad Nacional de Colombia, Bogota, Colombia,  
giorodriguezl@unal.edu.co, Orlando Trazona

This research presents a comparison of the relative efficiency of a group of Corporate Venture Units of Bogota (Colombia), using Data Envelopment Analysis (DEA) in order to approximate those practices that make efficient and around others are not. The units down forming the Efficient Frontier in each of the models and a comparative analysis by which some of the actions identified tentatively could displace inefficient to the efficient frontier.

**WB08**

Room 206B

**Optimization/Game Theory Models in Operations Management**

Contributed Session

Chair: Jinwen Ou, Associate Professor, Jinan University,  
601 Huangpu West Rd, Guangzhou, China, toujinwen@jnu.edu.cn

**1 - Coordinating Contracts for Fresh Product Outsourcing Logistics Channel**

Qing Wu, University of Electronic Science and Technology of  
China, No.4, Section 2, North Jianshe Road, Chengdu, 610054,  
China, wuq@uestc.edu.cn, Yi Feng

This paper focuses on how a distributor designs effective contracts to induce a third party logistics service provider to improve logistics service quality which can enhance the demand for the distributor's product and reduce the product supply losses during logistics process. Based on the analysis of a traditional unit pricing contract and a service menu contract, coordinating contracts are designed by considering the impact of power structure on them.

**2 - Modeling for Efficient Distribution of the Inspection Effort**

Yong Wu, Ph.D, School of Management, Xi'an Jiaotong  
University, No.28, Xianning West Road, Xi'an, Shaanxi, Xi'an,  
710048, China, xajh199@163.com, Qiaozhuan Liang

This paper analyzes a non-zero-sum inspection game with three players. Inspectors, dispatched by the authority to detect and minimize violation, make decisions from the standpoint of their own interests while the authority distributes staff to supervise inspectors to prevent corruption. We propose a method to find an optimal strategy for the game, which can help the authority make an effective plan about how to assign inspectors and supervisors to supervise the inspectors.

**3 - Eco-efficiency Analysis of Steel Recycling in Korea**

Seung Min Hong, Department of Information & Industrial  
Engineering, Yonsei University, Sinchon-dong, Seodaemun-gu,  
Seoul, Korea, Republic of, smnj1@naver.com, Bong Ju Jeong

Since steel is one of the most recycled materials in Korean industries, steel recycling largely affects nationwide eco-friendly environment. This study analyzes environmental and economic effects of steel recycling in Korean industries. Relevant mathematical models and scenario analysis are introduced to find efficient steel recycling strategies.

**4 - Dynamic Lot Sizing with All-Units Discount and Resales**

Jinwen Ou, Associate Professor, Jinan University, 601 Huangpu  
West Rd, Guangzhou, China, toujinwen@jnu.edu.cn

We consider a single-product dynamic lot sizing model with an all-units quantity discount pricing scheme available to the buyer, where the discount price breakpoints are stationary. To capture the real life behavior of a typical buyer who often takes advantage of quantity discounts through purchasing in excess of the anticipated demand, our model allows the buyer to resell or dispose of any leftover inventory that she does not need.

**WB09**

Room 208A

**Optimization Models under Uncertainty**

Contributed Session

Chair: Jin Xin Cao, Vice Department Head, Inner Mongolia University,  
No. 24 Zhaojun Road, Yuquan District, Hohhot, China,  
caojinxin@gmail.com

**1 - A Novel Robust Optimization Algorithm Combined with Differential Evolution**

Yinzi Zhou, State Key Laboratory of Digital Manufacturing  
Equipment & Technology, Huazhong Univ. of Sci. and Tech.,  
Wuhan, China, leitezhou@gmail.com, Xinyu Li, Liang Gao

Robust optimization with implementation error, the phenomena that parameters of design may never be set as best value, can be defined as a min-max problem. In this paper, we introduce a novel robust optimization algorithm. We simplify the worst-case cost part as an integral problem of the uncertainty domain, and use the differential evolution algorithm to minimize the worst-case scenario. The computation result shows that the proposed algorithm can find global optimum with robustness.

**2 - Differential Evolution and SQP for Optimization with Interval Uncertainty**

Mian Li, Associate Professor, Shanghai Jiao Tong University,  
800 Dong Chuan Road, UM-SJTU Joint Institute, Shanghai,  
China, mianli@sjtu.edu.cn, Shuo Cheng, Jianhua Zhou

Two novel approaches, Sequential Quadratic Programming and Differential Evolution for Robust Optimization, with their combination are proposed to solve optimization problems with interval uncertainty. The algorithms are first tested on numerous numerical examples, then further applied to the design of electric vehicles, in order to maximize the EV's energy economy under various driving uncertainties. Results show that our algorithms are efficient compared to their deterministic counterparts.

**3 - Online Optimization for Freight Locomotive Planning with Stochastic Train Plan Disturbance**

Wenting Mo, Research Staff Member, IBM Research, Diamond A,  
Zhongguancun Software Park #19, Haidian District, Beijing,  
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In freight transportation, train plan fluctuates a lot due to a lot of reasons. It causes the locomotive plan usually is only useful within the first 3-6 hours, but unusable afterwards. To generate more realistic plans, we proposed an online planning approach. A stochastic model for train plan disturbances is introduced, which are generated by simulation in experiments. The results show the proposed approach could generate whole-day usable and effective locomotive plans with minimized fuel cost.

**4 - Discrete Network Design Problem under Stochastic Costs**

Jin Xin Cao, Vice Department Head, Inner Mongolia University,  
No. 24 Zhaojun Road, Yuquan District, Hohhot, China,  
caojinxin@gmail.com

This paper proposes a discrete network design problem, in which the cost of each potential link addition follows a certain stochastic distribution. A solution algorithm is designed to solve the model in an efficient way. A comprehensive computational experiment is conducted to illustrate correctness and efficiency of the model and the algorithm proposed in this paper.

■ **WB10**

Room 208B

**Dynamic Pricing**

Contributed Session

Chair: Yang Wang, PhD Student, Rice University, 4100 Southwest Fwy, #573, Houston, TX, 77027, United States of America, yang.wang@rice.edu

**1 - Group-buying Mechanism Design in Uncertainty Market**

Weina Wang, School of Management, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, China, qingniao.1004@stu.xjtu.edu.cn, Sheng Hao Zhang, Lin Yan Sun

We consider a retailer sells homogeneous products to heterogeneous consumers in an uncertainty market. Retailer chooses whether to set group-buying channel or not; how many products (threshold), should be sold in group-buying; and what is the optimal price in two channels. We show that group-buying can be used as response to uncertainty market and bring retailer more expected profit. We also presents that the threshold can help retailer prevent potential losses from consumers's strategic move.

**2 - Optimal Markdown Pricing of Perishable Product Considering Quantity Discount**

Linghong Zhang, Tongji University, Cao'an Road No.4800, Shanghai, China, zhanglinghong2005@126.com, Jianxin You, Yixi Xue

This paper proposes a model of a seller who sells a product over a finite selling season by using quantity discount and dynamic pricing. Consumers enter the market who purchase one or more products, seller employ quantity discount to attract consumers to buy more. Combining the two-period dynamic pricing, we study how the seller employs the two strategies to improve profit. The result shows that the profit increases effectively by combining quantity discount and dynamic pricing.

**3 - Durable Goods Pricing with Reference Price Effect**

Zhang Jie, University of Science and Technology of China, 166 Ren'ai Road, Industrial Park, Suzhou, China, zjhlqy@mail.ustc.edu.cn, Wei-yu Kevin Chiang

A price benchmark shaped by customers based on their perception of past prices is known as a reference price. While the existence of reference price effect is evident for a variety of consumable and durable products, such an effect has been overlooked in the durable goods pricing literature. This study incorporates the reference price effect into a dynamic pricing model, wherein the saturation effect associated with selling a durable good is present.

**4 - Dynamic Pricing with the Counter-conformity, Conformity and Non-conformity of Consumer Behavior**

Chen Xiaohong, Central South University, Business School, Changsha, China, 353925505@qq.com, Chen Sha

The customer population is heterogeneous along two dimensions: they may have an inclination towards the obedience of the public and different degrees of patience. After introducing the price deviation variables, we demonstrate that heterogeneity in both inclination and patience is important because they jointly determine the structure of optimal pricing policies.

**5 - Dynamic Pricing in Las Vegas**

Yang Wang, PhD Student, Rice University, 4100 Southwest Fwy, #573, Houston, TX, 77027, United States of America, yang.wang@rice.edu

Models with a priori demand assumptions have dominated dynamic pricing (DP) research. I take a nonparametric approach to estimating demand for a single room type at a Las Vegas resort. Using the estimation results, I optimize the DP problem. I find that managers can yield higher revenues by charging higher prices early in the booking window. Furthermore, I show significant revenue gains when considering competitive rates and small revenue losses when constraining rate change frequency.

■ **WB11**

Room 209A

**Pricing and Channel Section in Supply Chains**

Contributed Session

Chair: Xiangling Hu, Grand Valley State University, 376C DeVos Center 401 Fulton Street West, Grand Rapids, United States of America, hux@gvsu.edu

**1 - Loss-Averse Newsvendors with Supplying Options**

Xi Li, HKUST, 3208 HKUST Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, xitheory@gmail.com, Chung-Yee Lee

We consider a loss-averse newsvendor that could reserve options before her stochastic demand is known, and decide how many options to execute after the demand is revealed. The newsvendor therefore faces the problem of deciding how many of each options to reserve. We characterize the structure of the newsvendor's optimal reserving strategy and propose an algorithm to compute it in polynomial time in the general case with  $n$  options.

**2 - Compare and Combine Time and Target Strategies under Stochastic Purchasing Prices Environment**

Xiangling Hu, Grand Valley State University, 376C DeVos Center 401 Fulton Street West, Grand Rapids, MI, United States of America, hux@gvsu.edu

we analyze and compare purchasing on a certain Time strategy and purchasing on a certain Target Strategy and then combine these methods into an approximately optimal algorithm to facilitate the purchasing decision in a more efficient way, as indicated by the simulation results. We then extend the solution procedure to an environment of selecting among multiple suppliers with potentially different price processes and further provide downside risk analysis for the selection of suppliers.

**3 - The Provision and Impact of Trade Credit in Supply Chains with Imbalanced Bargaining Power**

Jianer Zhou, Assistant Professor, Boston College, Fulton Hall 454C, 140 Commonwealth Ave., Chestnut Hill, MA, 02467, United States of America, jianer.zhou@bc.edu, Hsiao-Hui Lee

This paper empirically investigates the provision and impact of trade credit in supply chains. Our results show that suppliers offer trade credit as both a collaborative and a competitive tool. Trade credit decreases with a supplier's market share (horizontal competition) but increases with its bargaining power to its customers (vertical competition). Although suppliers benefit from a higher gross margin by offering trade credit, they incur more costs and experience a lower inventory turnover.

**4 - Channel Selection and Pricing for New-product under Dual-channel: Consider Free-riding Behavior**

Yongmei Liu, Professor, Central South University, Business School, Changsha, HN, 410083, China, liuyongmei@yaho.com.cn, Chunjie Ding

Free-riding that consumers learn in a channel but buy in another occurs in dual-channel (online and offline channels). Especially for new products, consumers have cognitive deficits about its value, thus free-riding based on experience or information services significantly exists. Under different product-types and dual-channel structures, this study analyzes the impact of free-riding on channel selection and pricing decisions for new-product, providing recommendations for new-product promotion.

**5 - Pricing Games of Mixed Conventional and E-commerce Distribution Channels**

Qihui Lu, Dr., Zhejiang University, School of Management, Zhejiang University, Hangzhou, ZJ, China, qihuilu@zju.edu.cn, Nan Liu

This paper studies a distribution system with one supplier, one physical retailer and e-tailers. We examine two Stackelberg and one Nash games. We find that channel acceptance plays a critical role in the system. When the customer acceptance of one channel exceeds a certain threshold, this channel will cannibalize all retail sales. The supplier benefits by adopting differential pricing strategy. Numerical analysis indicates that both the supplier and the retailer are worse off in the Nash game.

## ■ WB12

Room 209B

### Supply Chain Competition and Risk Management

Contributed Session

Chair: Jingqi Wang, Northwestern University, 860 N. DeWitt Pl., Apt. 2002, Chicago, IL, 60611, United States of America, jingqi-wang@kellogg.northwestern.edu

#### 1 - The Uncertainty Evaluation Method of Emergency Supply Chain Risk

Xu Zhenyu, Xi'an Jiaotong University the School of Management, No.28, Xianning West Road, Xi'an, Xi'an, China, xuzhenyuxjtu@126.com, Yuan Zhiping

Emergency supply chain risk assessment has crucial significance to build an emergency reliable supply chain for responding to disasters. The goal of this project is to scientifically evaluate supply chain risk. After analyzing the influence of various factors upon emergency supply chain risk, intervals, linguistic assessment information, and triangular fuzzy numbers are used to measure these factors. Gray correlation degrees are applied to calculate an aggregate score for each alternative.

#### 2 - Supply Chain Competition Model with Customer Preference

Jie Guo, Management School, Min zu, University of China, Beijing, China, guojiegogo@yahoo.com.cn

This paper proposes a mathematical model for supply model with stochastic demands, described the competition chain versus supply chain competition with customer preference. behavior among supply chains based on the maximization profit. The model is based on stochastic user equilibrium and spatial price criteria.

#### 3 - Competition and Efficiency of Express Service Providers in Online Shopping Industry

Yihong Hu, lecturer, Tongji University, No 1239 Road, Siping, Shanghai, China, fox2002cn@gmail.com

We studies the competition and efficiency of the express service providers in dramatically growing online shopping industry in China. We construct the supply chain network and describe the customers' behavior. The existence of Nash equilibrium in express service providers competition is proved. Our analysis disclose that the competition bring insufficient investment and not fully realized customer demand. Then we analyzed the bound of efficiency loss. Finally a numerical example is provided.

#### 4 - Markdown Optimization in Retail Industry

Kun Huang, Optimization Specialist, Macy's, 151 West 34th Street, New York, NY, 10001, United States of America, kun.huang@macys.com

Markdown is one of the most important topics in retail business to achieve high liquidating speed and profit. Sparse data and broad variety of merchandise are the major obstacles for fashion business. Macy's, as the largest department store in United States, cooperates with SAS retail solution, groups its business into subsets and prioritizes markdowns satisfying the requirements from business to maximize various objectives.

#### 5 - Impact of Downstream Competition on Innovation in a Supply Chain

Jingqi Wang, Northwestern University, 860 N. DeWitt Pl., Apt. 2002, Chicago, IL, 60611, United States of America, jingqi-wang@kellogg.northwestern.edu, Hyoduk Shin

We explore the impact of downstream competition on upstream innovation in a supply chain. We show that this impact depends on the contract form used in the industry. We also demonstrate that all firms within a supply chain can be better off by giving the supplier more channel power. Our findings have implications related to First Solar's recent challenge on how to encourage component manufacturer(s) to invest more on innovation.

## ■ WB13

Room 210A

### Business Analytics and Consumer Behavior

Contributed Session

Chair: Tingting Jiang, Northwestern University, 2145 Sheridan Road Room C217, Evanston, IL, 60202, United States of America, tingting-jiang@northwestern.edu

#### 1 - Intellectual Property Licensing in a Production Outsourcing Environment

Tingting Jiang, Northwestern University, 2145 Sheridan Road Room C217, Evanston, IL, 60202, United States of America, tingting-jiang@northwestern.edu

This paper studies the optimal licensing strategies of an Intellectual Property vendor that generates profit from licensing innovation to a production sourcing market: the buyers that design the product and the suppliers that manufacture

the product. We show that the optimal licensing contract depends on market expectation. In pessimistic expectation we show the 'free IP model' can be the only profitable strategy. We also show in a sequential adopting case, commitment strategy can be harmful.

#### 2 - Enhancing Marginal Productivity of Effort in Compensation Plans

Changrong Deng, The Fuqua School of Business, Duke University, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, changrong.deng@duke.edu

In the moral hazard problem on effort, e.g., a manufacturer and its managers and a firm and its salespeople, we consider the interaction between effort and its effectiveness (marginal productivity) and the potential improvement on effort effectiveness. In a two-stage (repeated) game, where the second stage is a standard principal-agent setting and the first stage includes vertical or horizontal effectiveness enhancement, we provide conditions for this enhancement and explore its welfare effects.

#### 3 - Daily Deal Sites Like Groupon and Living Social: Signaling Effects and Consumers' Perceptions

Ming Zhao, Hong Kong Polytechnic University, M628, Li Ka Shing Tower, Hong Kong, China, 10900716r@connect.polyu.hk, Xianghua Gan

Daily deal sites have been growing at an impressive rate. On a daily deal site, merchants offer large discounts that would appeal to locals; the daily deal site sells discount vouchers to its subscribers and takes a portion of the revenue. We show that if a merchant offers a deep discount in a daily deal promotion and if the regular price is observable, then rational and informed consumers will perceive the product to be of high quality, and respond positively to the promotion.

#### 4 - Journey of "Resource Management" in Advanced Services, Cisco

Malathi Latha Morthala, Manager, Advanced Services, Cisco Systems India Pvt. Ltd., Sarjapur Marathalli Outer Ring Road, Bangalore, 560103, India, malatm@cisco.com, Anand Srinivasan, Rahul Saxena

Problems Dive n Catch staffing of the projects. Multiple Resource Pools in the org working in Silos. High lead times in staffing projects. Challenges include fear of losing control, Insufficient processes, systems and tools, Multiple stakeholders in each region. Change through arduous individual buy-in from multiple points of contact at each stage, Data mining and analysis, Build confidence through example. We can report lessons learned and expect to provide results, if we execute successfully.

#### 5 - Credit Card Program Value Maximization with Promotion Density for Product Discounts in Shopping Mall

Kwansoo Kim, Research Assistant, Singapore Management University and Seoul National University, School of Information Systems, 80 Stamford Road, Singapore 178902, Singapore, Singapore, kskim@smu.edu.sg, Robert J. Kauffman, Rae M. Chang

We model value maximization of credit card programs for shopping malls, when card customers can obtain product discounts of different percentages in the presence of promotion density and competition. Our results suggest strategies for quantitatively evaluating the trade-offs in value outcomes when consumer sensitivity to product discounting varies. This research is supported by Singapore National Research Foundation under Intl Research Centre @ Singapore Funding Initiative administered by IDMPO.

## ■ WB14

Room 210B

### Queueing Systems

Contributed Session

Chair: Quan-Lin Li, Professor, Yanshan University, Yanshan University, Qinhuangdao, HB, 066004, China, liquanlin@tsinghua.edu.cn

#### 1 - Discrete-time Batch-service Geom/Geom/1/(N-1)+a Queue with Multiple Working Vacations

Jiang Cheng, Lecture, 1. Sichuan Normal University, 2. Southwest University for Nationalities, Chengdu, 610066, China, cheng\_05swue@126.com, Miaomiao Yu, Yinghui Tang

This paper considers a discrete-time bulk-service Geom/Geom/1 early arrival queueing system with finite buffer space and multiple working vacations. According to a bulk-service rule, that is, at least one customer is needed to start a service with a maximum serving capacity 'a'. The queue length and the waiting time at arbitrary epochs are obtained. Key words: Discrete time; Bulk-service; working vacation; queue.

**2 - Supermarket Models with Server Vacations**

Quan-Lin Li, Professor, Yanshan University, Yanshan University, Qinhuangdao, HB, 066004, China, liql22@yahoo.ca, John C.S. Lui, Yang Wang

We analyze three supermarket models of  $N$  identical servers with server (either multiple, single or working) vacations. Using the operator semigroup, we provide a mean-field approximation for the sequence of Markov processes describing the vacation supermarket models. Furthermore, we provide a unified algorithmic framework to compute the fixed point, and obtain the mean of stationary queue length in any server and the expected sojourn time of any arriving customer spending in this system.

**3 - Loss Queues with Advance Resource Reservation**

Maartje van de Vrugt, PhD Student, University of Twente, Drienerlolaan 5, Enschede, 7500 AE, Netherlands, n.m.vandevrugt@utwente.nl, Nelly Litvak, Richard J. Boucherie

We consider  $M/G/c/c$  models with advance resource reservation. This type of models can for example be used for modeling telecommunication systems in which system resources can be reserved a random time in advance. We compare the blocking probability of the reservation model with the ordinary  $M/G/c/c$  queue and show advance reservation can both in- and decrease the blocking probability. The consequences appear to be highly sensitive to the system parameters. We illustrate this by several examples.

**4 - Analysis of Ticket Queues with Reneging Customers**

Ding Ding, Assistant Professor, University of International Business and Economics, No10, Huixin Dongjie, Chaoyang District, Beijing, China, dingd.cn@hotmail.com, James Ang, Jihong Ou

We analyze queues in which customer waiting positions are represented by ticket numbers. The customers at any time can observe the number being served and may leave the queue without obtaining the service (reneging). Assuming the customers' tendency to renege depends dynamically on the difference between their ticket number and the number being served, we develop an approximation procedure in order to calculate the percentage of reneging customers.

**WB15**

Room 212A

**Marketing/OM Interface**

Contributed Session

Chair: Xiaojing Dong, Santa Clara University, Lucas Hall, 500 El Camino Real, Santa Clara, CA, 94087, United States of America, xdong1@scu.edu

**1 - Strategic Timing of Product Introduction for Managing Inventories of Substitutable Products**

Qian Chen, STC-CityU Joint Advanced Research Center, Suzhou, China, lilichou2248@162.com, Wei-yu Chiang

We consider a retailer selling two substitutable products with a short life-cycle. The retailer must decide the order quantity for each product under demand uncertainty. Customers differ in product preference. When their preferred product is unavailable, some customers may buy the other one as a substitute. We compare the inventory-related costs under simultaneous versus sequential product introductions and generate implications on optimal ordering strategies for selling substitutable products.

**2 - Retailer Brand: Share it or Keep it Private**

Yunchuan Liu, University of Illinois at Urbana-Champaign, 1206 S. Sixth Street, RM 350, Champaign, IL, United States of America, liuf@illinois.edu, Liwen Chen, Steve Gilbert

Private labels or store brands are brands offered by retailers who may also sell national brands from manufacturers. Private labels often substitute national brands and allow retailers to segment the consumers who visit the retailer. Interestingly, some retailers sell their store brands through competing retailers. In this paper, we explore the benefits for retailers to supply their private labels through competing retailers.

**3 - Revenue Sharing and Bargaining with a Dominant Retailer in Channel Selection**

Yuelin Shen, Shanghai University of Finance and Economics, Guoding Road 777, Shanghai, China, shen.yuelin@mail.shufe.edu.cn, Yue Dai

Motivated by the electronics appliance market in China, we study a manufacturer's channel selection problem with two retailers, one of which dominates the market. The manufacturer is demanded to pay a slotting fee and share the revenue. We found that a lower slotting fee will result in a larger revenue share for the dominant retailer, but the dominant retailer prefers a higher slotting fee.

**4 - Quantifying Satisfaction Spillovers Across Categories**

Xiaojing Dong, Santa Clara University, Lucas Hall, 500 El Camino Real, Santa Clara, CA, 94087, United States of America, xdong1@scu.edu, Pradeep Chintagunta

Using service satisfaction survey data of seven companies providing both banking and credit card services, we quantify the spillover effects of customer satisfaction in one category on purchase intent in other categories. A Multivariate Ordered Probit model is estimated using Hierarchical Bayesian methods. A key methodological challenge we face is that consumers select into whether they have single vs. multiple providers across categories so we need to account for this selection in estimation.

**WB16**

Room 212B

**Marketing and Economic Modeling**

Contributed Session

Chair: Syed Shahabuddin, Central Michigan University, Smith 203c, Mt Pleasant, MI, 48858, United States of America, shaha1s@cmich.edu

**1 - Market Orientation and Innovation Performance: The Perspective of Ownership Structure**

Jing Song, Assistant Professor, Southwest Jiaotong University, 111#, Erhuanlu, Jinniu District, Chengdu, China, jsong@home.swjtu.edu.cn, Guoqun Fu, Rui Wang

Taking an agency perspective, this study attempts to reconcile the mixed findings on the market orientation-innovation performance link by developing a fine-tuned understanding. Using a merged dataset including 242 Chinese listed companies, empirical test shows that market orientation and firm ownership structure generate synergies to enhance innovation performance. Theoretical and managerial implications and suggestions for future research are discussed.

**2 - Impacts of Earthquake Perceived Risk on Consumer's Decision-Making**

Chunmei Fan, Southwest Jiaotong University, No.111 North Section One, Erhuan Road, Chengdu, SC, 610031, China, hqlx@163.com, Chunmei Fan, Jianmin Jia

A theoretical model of the impacts of earthquake perceived risk on consumer's decision-making process from psychological perspective was developed in this study. It was found that earthquake perceived risk did play a crucial role in consumer's value evaluation and purchase behavior in real estate market after the earthquake.

**3 - Own and Cross Effects of Price Promotions of Vice and Virtue Products**

Enar Ruiz, Lecturer, University of Alicante, P.O. Box 99, Alicante, 03080, Spain, eruiz@ua.es, Josefa Parrao, Aurora Calderon, Francisco Mas

We propose models which estimate the own effect of price promotions of virtue and vice products on their sales, as well as the cross effects within a category, among categories and among time periods. The analysis in a supermarket shows a higher own effect of price promotion on vice products compared to on virtue products. However, the complementarity effect among categories for virtue products allows a greater expansion in the category of virtue products than in that of vice products.

**4 - Economic Future of China**

Syed Shahabuddin, Central Michigan University, Smith 203c, Mt. Pleasant, MI, 48858, United States of America, shaha1s@cmich.edu

China's economy has been growing at a very high rate. This has been possible due to its exploding export. However, many economies are in recession unable to spend money. Therefore, Chinese is prone to slow down due to its declining export. Unless China expand its own domestic consumption, it is vulnerable to lose its economic growth. My paper shows what China needs to do to protect its economic growth.

## ■ WB17

Room 213A

### Evidence Based Operations Research

Sponsor: Health Applications

Sponsored Session

Chair: Joris van de Klundert, chair, Erasmus University Rotterdam, J 06 -039, Postbus 1738, Rotterdam, 3000 DR, Netherlands, vandeklundert@bmg.eur.nl

#### 1 - Using Master Surgery Schedules

Jeroen Van Oostrum, Assistant Professor, Erasmus University Rotterdam, Burg. Oudlaan, Rotterdam, Netherlands, vanoostrum@bmg.eur.nl

Optimizing the surgery schedule on a weekly basis is laborious and leads to different schedules every week. We propose a surgery scheduling approach that exploits the property that many surgery types are recurring. This led to a so-called Master Surgery Schedule (MSS), which is a repetitively executed schedule of surgery types, and which is optimized regarding resource utilization and leveled ward occupations. We demonstrate the benefits of using a MSS compared to a standard planning approach.

#### 2 - Models, Evidence and Theory in Health Service Operations – A Literature Review

Joris van de Klundert, Chair, Erasmus University Rotterdam, J 06 -039, Postbus 1738, Rotterdam, 3000 DR, Netherlands, vandeklundert@bmg.eur.nl

We explore if and how the many articles in health services operations which use operational models have resulted in accumulation of knowledge and generally applicable theory. Our systematic review considered over 4000 papers of which 116 papers are included. The majority are cases studies which have not been implemented and have little external validity. Although knowledge accumulation still is limited, our findings suggest an operational modeling framework to guide further research.

#### 3 - Quantifying the Value of Information for Inferring Contagion Patterns in Social Activity Graphs

Lauren Gardner, Lecturer, University of New South Wales, Sydney, Australia, laurengardner84@gmail.com, David Fajardo

The model presented seeks to predict the infection pattern which depicts the current state of the network for an ongoing outbreak of a communicable disease. This is accomplished by inferring the most likely path of infection through a contact network under the assumption of partially available infection data. The problem is formulated as a bi-linear integer program, and heuristic solution methods are developed based on iteration of two sub-problems which can be solved much more efficiently.

## ■ WB18

Room 213B

### Healthcare Analytics

Sponsor: Business Analytics, CPMS-The Practice Section

Sponsored Session

Chair: Ci-Wei Lan, Institute for Information Industry, 1F, No. 133, Section 4, Minsheng E. Rd., Taipei, Taiwan - ROC, cwlan@iii.org.tw

#### 1 - Glaucoma Detection Using Linear-combinations of Neuro Inference Systems (LINIS)

Wheyming Song, Professor, National Tsing Hua University, Taiwan, Hsinchu, Taiwan - ROC, wheyming@ie.nthu.edu.tw, La Ing-Chou, Michael Chuang, Ray Lo

Motivated by the increasing number of glaucoma patients and the difficulty of early glaucoma detection, we propose to investigate strategies for constructing an efficient classifier to differentiate between normal and glaucomatous eyes and further propose early glaucoma detection strategies. The proposed classifier is based on linear-combinations of neuro inference systems (LINIS). The results show that the proposed LINIS has improved the sensitivity and specificity for data from the quantitative assessment of summary data reports of the Stratus optical coherence tomography (OCT) in Taiwan Chinese population.

#### 2 - Multi-scale Modeling and Analytics of Biomedical Systems for Clinical Diagnostics

Yo-Cheng Chang, Advanced Research Institute, Institute for Information Industry, 1F, No. 133, Section 4, Minsheng E. Road, Taipei, Taiwan - ROC, markchang@iii.org.tw

Biomedical researches now heavily rely on the ability of effectively utilizing mass information from biomedical systems at genetic, cellular, and organic levels. Here we introduce how mathematical methods can help to tackle various practical problems in biomedical research, and a particular example for clinical diagnostics of cardiac disease.

#### 3 - Individual Privacy Protection within Healthcare Application

Ci-Wei Lan, Institute for Information Industry, 1F, No. 133, Section 4, Minsheng E. Rd., Taipei, Taiwan - ROC, cwlan@iii.org.tw

It is common to leverage data mining techniques in healthcare applications. However, health-related data are sensitive to be disclosed. We proposed a decision-tree based approach to group individuals together so that they are with identical attribute values. The approach allows the flexibility to well trade-off data integrity and individual privacy in terms of data masking preferences.

## ■ WB19

Room 215

### Supply Chain Analytics

Sponsor: Business Analytics, CPMS-The Practice Section

Sponsored Session

Chair: Wheyming Song, Professor, National Tsing Hua University, 101, Sec. 2, Kuang-Fu Road, Hsinchu, 30013, Taiwan - ROC, wheyming\_song@yahoo.com

#### 1 - A Stochastic Optimization Algorithm for Selecting the Carrier that Maximizes the Logistics Network Reliability

Wheyming Song, Professor, National Tsing Hua University, 101, Sec. 2, Kuang-Fu Road, Hsinchu, 30013, Taiwan - ROC, wheyming\_song@yahoo.com, Chen-Lin Kuo

Selecting carriers to provide logistics services is one of the most important issues facing global enterprises. The algorithm presented in this paper provides a method for selecting the carrier that maximizes the logistics network reliability; i.e., the probability that some pre-determined number of units of a specific commodity are successfully transmitted to the proper customers no later than a pre-determined time and at a cost not exceeding a pre-determined value. Further, to properly include the effects of uncertainty in both the carrier's capacity to transmit the commodities of interest as well as the uncertainty in the carriers' transmission time, both of these entities are treated as random variables. To demonstrate the practicality of this algorithm, a real-world example will be presented.

#### 2 - Service Failures Analysis and Recovery Planning for Telecommunication Service

Yahui Chan, Senior Engineer, Institute for Information Industry, Taipei, Taiwan - ROC, yhchan@iii.org.tw, Shu-Ping Lin, Chen-Lung Yang

In this paper, we propose a systematic methodology to help firms identify service failures for recovery program planning. Thus the non-linear gap analysis and impact analysis are adopted for extracting recovery opportunities. Then the Decision-Making Trial and Evaluation Laboratory method is applied to analyze the interdependence among recovery solutions as well as the relationship between service failures and recovery solutions in order to better prioritize recovery solutions operations.

#### 3 - Providing Predictive Maintenance and After Sales Innovation Based on Data from Connected Equipment

Changrui Ren, IBM Research - China, rencr@cn.ibm.com, Jinfeng Li, Miao He, Fei Liu, Jin Dong

A tremendous amount of equipment become connected in asset intensive industries. By analyzing data exposed from connected equipment, manufacturers have chance to gain a deep understanding of equipment and customers. This presentation will introduce how IBM uses advanced analytics and optimization techniques in driving predictive maintenance and after sales innovation.

**Wednesday, 11:45am - 1:15pm****■ WC01**

Room 202B

**Global Supply Chain Competition and Alliance**

Contributed Session

Chair: Xiaona Zheng, Peking University, Guanghua School of Management, Beijing, 100871, China, xzheng@gsm.pku.edu.cn

**1 - Supply Chains Competition with Vertical and Horizontal Information Sharing**

Zhaobo Chen, Taiyuan University of Science and Technology, Mailbox 226, 66 Waliu Road, Wanbolin District, Taiyuan, 030024, China, chenzb1983@hrbust.edu.cn, Yao Fengmin, Chunxian Teng, Miao Shidi

This paper studies the incentive for vertical and horizontal information sharing in two supply chains with uncertain demand. We investigate the equilibrium decisions in the competitive supply chains and discuss how horizontal information sharing impacts the payoffs of the supply chains. We show that no vertical information sharing in both supply chains is the unique equilibrium to this problem. And, horizontal information sharing will increase the supply chain profits under some situation.

**2 - A Reverse Logistics Network Model in Korean Auto Industry**

Ye Ji Lim, Department of Information & Industrial Engineering, Yonsei University, Sinchon-dong, Seodaemun-gu, Seoul, Korea, Republic of, izzy253@gmail.com, Bong Ju Jeong

Although the millions of auto parts are reused in Korean auto industry, the efficiency of auto recycling logistics is doubtful. This study identifies the current Korean auto reverse logistics network and develops its relevant model to find desirable recycling policies in terms of eco-friendly and economic efficiency.

**3 - The Effect of Global Supply Chain on U.S. Manufacturing: A Switching Cost View**

Xin James He, Professor, Fairfield University, 1073 North Benson Road, Fairfield, CT, 06824, United States of America, xhe@fairfield.edu

We have witnessed U.S. manufacturing industry's dramatic declining both in percentage of the GDP and in percentage of the labor force over the past decade as a result of global supply chain and offshoring. This research tries to investigate the impact of global supply chain on U.S. manufacturing from a switching cost view, which explains why it is so difficult for such firms as Apple to bring jobs back to the U.S. and what policy changes are necessary to revitalize U.S. manufacturing sector.

**4 - Double Chains of Price Competition Vertical Structure Choose Research under Stackelberg Game**

Qingtian Tong, Student, School of Management Harbin University of Science and Technology, Mailbox 119, 52 Xuefu Road, Nangang District, Harbin, 150080, China, tq0419@163.com, Chunxian Teng

The paper constructs two layer supply chain price competition model with a linear demand function. Under the Stackelberg game we analyze the supply chain competition results in three scenarios: centralized scenario, hybrid scenario, decentralized scenario. We show that when competition level is low, centralized scenario is Nash equilibrium of supply chain structure choice; When competition level is high, decentralized scenario is Nash equilibrium. There exist prisoners' dilemma phenomenon.

**5 - The Formation and Stability of Purchase Alliance**

Xiaona Zheng, Peking University, Guanghua School of Management, Beijing, 100871, China, xzheng@gsm.pku.edu.cn, Mingxi Zhang

We study a supply chain with one manufacturer and  $n$  retailers, in which retailers may form a purchasing alliance. We examine how profits of the retailers inside/outside an alliance change with the alliance size, and identify the conditions that lead the alliance to reach a stable state. Specially, we find that a larger alliance does not necessarily benefit the alliance members, and there exists a threshold value for a stable alliance. We also extend the basic model in three different settings.

**■ WC02**

Room 202A

**Supply Chain Operations**

Contributed Session

Chair: Ge Peixin, The Logistics Institute, Northeastern University, Shenyang, China, pxge@tli.neu.edu.cn

**1 - A Study on the Operational Characteristics of Container Feeder Vessels (Based on Far East)**

Dalwon Kang, Korea Maritime University, Dongsam-dong, Youngdo-gu, Busan, Korea, Republic of, kangdw@hhu.ac.kr, youngmo An, Ki-Chan Nam, Kyu-Seok Kwak

This study aims at analysing the characteristics of feeder container shipping and deriving some implications for the development of the shipping sector. For this a feeder shipping company was chosen as a case for the data such as operation costs, revenue, port charge and handling charge. Based on the analysis some implication for the development of the feeder shipping industry were derived.

**2 - Carton Dimension Design with Bin Packing and Container Loading**

Gang Chen, Associate Professor, Sun Yat-sen University, Xingang-xi Road 135#, Lingnan College, Guangzhou, 510275, China, linscheng@mail.sysu.edu.cn, Sung-Chi Chu, Waiman Cheung

Nowadays it is common that a US-based retailer procures many products of various types from China, and ships them to the states. The shipping process consists of two important operations: packing product items into a carton and loading cartons into a container. This study proposes a mixed 0-1 model for designing the dimensions of cartons with bin packing and container loading.

**3 - Benders Decomposition Approach for a Multi-period Distribution Systems Design**

Defeng Sun, The Logistics Institute, Northeastern University, Shenyang, China, dfsun@tli.neu.edu.cn, Lixin Tang

We investigate a multi-period distribution systems design problem with the consideration of two different distribution structures. Given a set of potential distribution centers and customers with seasonal demands, our goal is to determine the configuration of the systems with lowest sum costs. We develop a MIP model and an improved Benders decomposition approach methodology.

**4 - SDP Relaxations of the Optimal Turned-out Slab Pile Problem**

Ge Peixin, The Logistics Institute, Northeastern University, Shenyang, China, pxge@tli.neu.edu.cn

The optimal turned-out slab pile (TOSP) problem in the slab yard of iron & steel industry is formulated as a quadratic programming model. This paper investigates two SDP relaxations of the TOSP problem. A semidefinite relaxation of the quadratically constrained quadratic -1/1 optimization problem is applied to TOSP problem. And a tight semidefinite relaxation which provides a sharp lower bound is achieved by defining the operator  $hsvcc$ .

**■ WC03**

Room 203B

**Financial and Economic Modeling**

Contributed Session

Chair: Hao Fu, Vassar College, Box 2555, Vassar College, 124 Raymond Avenue, Poughkeepsie, NY, 12604, United States of America, markfu1022@gmail.com

**1 - Influential Factors of Local Government Fiscal Deficit**

Zhiguo Wang, School of Management Xi'an Jiaotong University, No. 28, Xianning West Road, Shaanxi, Xi'an, China, wangzhiguo66@gmail.com, Li Herui

We conducted an empirical analysis the deficit of a Chinese western province which employed the least squares dummy variable method and generalized least squares estimation. Consequently, we found that random effects can't pass through the Hausman test and the Breusch-Pagan test, so we selected the fixed effects model. The results showed that age of political leaders, per capita income, economic growth, carbon emissions, etc all have a significant effect to the local government budget deficits.

**2 - Capacity Investment Dynamics of Start-ups and Established Firms in a Vertically Differentiated Market**

Gang Wang, University of North Carolina at Chapel Hill, 352 Cobblestone Ct., Chapel Hill, NC, 27514, United States of America, gang\_wang@unc.edu, Laurenxiaoyuan Lu

We analyze the capacity investment dynamics of start-ups and established firms in a vertically differentiated market with uncertain demand. We find that a monopolistic start-up is more likely to invest early than an established firm, but tends to invest late for its high quality product than for its low quality product. In the duopoly setting capacity investment dynamics critically depends on quality differentiation.

**3 - Network Theoretic Characterization of Corporate Structures**

Hao Fu, Vassar College, Box 2555, Vassar College, 124 Raymond Avenue, Poughkeepsie, NY, 12604, United States of America, markfu1022@gmail.com

It is unclear whether traditionally hierarchical corporate structure meets today's demand for innovation. This research provided a framework for comparing different corporate structures using network theoretic characterizations. Some prevalent social networks were examined and compared to hierarchical structure both analytically and numerically. The result showed structures resembling social networks had more advantage in innovation. A general algorithm was provided to design desirable structures.

**WC04**

Room 203A

**Quality and Business Decisions**

Contributed Session

Chair: Xiaohuan Wang, Lecturer, Northeastern University, 11-3, Wenhua Road, Shenyang, China, Shenyang, China, xhwang@mail.neu.edu.cn

**1 - The Effect of Market Value to the Supply Chain with Asymmetric Quality Information**

Jun Yang, Associate Professor, School of Management, Huazhong University of Science & Technology, Wuhan Luoyu Road 1037, Wuhan, 430074, China, jun\_yang@mail.hust.edu.cn, Wei Lu

We study a supply chain with a supplier and a buyer. The supplier who knows private quality cost information and has an incentive to influence his market value. The buyer offers a menu of contracts to screen out quality cost information and capital market estimates supplier's value with contract choice. We show buyer's screening cost and distorted quantity is mitigated by supplier's interest of market value. It is beneficial to buyer to order products from supplier cares more about market value.

**2 - Should Semiconductor Manufacturer Scrap or Not?**

Rong Li, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, 178899, Singapore, rongli@smu.edu.sg, Zhengping Wu

In the semiconductor industry, the fall-outs of a production, or the yield loss, are no longer doomed to be scrapped, but are now sold to a value conscious market. While the manufacturers are thrilled by this creative idea, we show that, when the production yield rate is either low or high, the manufacturers should consider switching back to the old practice: scrapping at a cost.

**3 - Multiple Attribute Control Charts with False Discovery Rate Control**

Yanting Li, Assistant Professor, Shanghai Jiao Tong University, Room 628, Mechanical Building, Shanghai Jiao Tong University, Shanghai, China, ytli@sjtu.edu.cn

In this article, we propose multiple Binomial and Poisson CUSUM charts incorporating False Discovery Rate (FDR) control. The procedures for establishing the new control schemes are presented and the performance of the new methods is evaluated via Monte Carlo simulation. The approximation methods for obtaining the p-values of the CUSUM statistics for conducting the new control schemes are also provided and evaluated. The new methods are also illustrated with a real example.

**4 - A Reinforcement Learning Model for Multi-source Knowledge Fusion in Complex Decision-making Problems**

Xiaohuan Wang, Lecturer, Northeastern University, 11-3, Wenhua Road, Shenyang, China, xhwang@mail.neu.edu.cn, Zhiping Fan

When the decision-making environment is unaware or uncertain, it is not easy to acquire multi-source relevant decision knowledge. In this paper, a reinforcement learning model is proposed, including a reward and punishment rule for agents' exploration towards the decision-making environment, and a state transition rule for agents' adjustment about their actions. Here, one agent represents the solutions from one single decision knowledge source towards the complex decision-making problems.

**WC05**

Room 205B

**Project Management**

Contributed Session

Chair: Henry Jen, Assistant Professor, Yuan Ze University, 135 Yuan-Tung Road, Zhongli, 32003, Taiwan - ROC, henyi@saturn.yzu.edu.tw

**1 - Two-interface Module for Project Schedule Reuse**

Bibo Yang, Assistant Professor, The Hong Kong Polytechnic University, LMS, Hong Kong - PRC, lgtybb@polyu.edu.hk

To facilitate project schedule reuse, a two-interface module is defined, which has only two interfaces with other modules in a project network. A survey on the schedule reuse is conducted. We theoretically compare the applications of a two-interface module and an ordinary module in project schedule reuse. The two-interface module is proved to be easier to reuse and reduce the time and effort needed in project planning.

**2 - Influence of Behavioral Decision Making on Project Scheduling**

Min Yang, BeiHang University, XueYuan Road No.37, Haidian District, Beijing, China, yangminxp@buaa.edu.cn, Shourong Li

Considering the procrastination during project execution, CCM halves estimated activity durations and sets up buffers to decrease the consequences, but its role is still controversial. This paper verifies the influence of procrastinated behaviors in projects by Monte Carlo simulation, and thus contrasts the performance of CPM/PERT and CCM. Based on analysis of the results, several suggestions are provided to accurately predict and guide the behavioral decisions for project performers.

**3 - Can Burgess and Killebrew Help to Solve the Stochastic RCPSP?**

Patricio Lamas, PhD Student, KU Leuven, Naamsestraat 69, 04.109, Leuven, 3000, Belgium, Patricio.LamasVilches@econ.kuleuven.be, Erik Demeulemeester

In this presentation, we consider the stochastic RCPSP where the stochasticity is incurred because the resource availabilities are considered to be uncertain. We want to schedule the activities of a project such that the risk of not being able to execute the project within the resulting resource availabilities is minimized. Based on a computational experiment, we show that the Burgess and Killebrew procedure for resource leveling can be helpful in this respect.

**4 - Managing Volunteers in Humanitarian Operations: Issues and Solutions**

Shenghan Xu, Assistant Professor of Operations Management, University of Idaho, P.O. Box 443161, Moscow, ID, 83844, United States of America, shenghan@uidaho.edu

Most humanitarian efforts use volunteers to support their missions. We examine the operational challenges of heavily relying on volunteerism. In addition to the managerial strategies, we also propose mixed-integer programming based approaches that improve the operation efficiency as well as the satisfaction of the volunteers.

**5 - Combining OCBA with PSO to Solve Project Time-Cost Trade off Problems**

Henry Jen, Assistant Professor, Yuan Ze University, 135 Yuan-Tung Road, Zhongli, 32003, Taiwan - ROC, henyi@saturn.yzu.edu.tw

Heuristics needs to control their parameters to have good solution quality. They depend on random numbers for the execution and there are constraints of finite resources. Optimal Computing Budget Allocation can help find better parameters and solution with significant confidence. OCBA combines with Particle Swarm Optimization (PSO) is studied and project time-cost trade-off problem are used to test the effectiveness.

**WC06**

Room 205A

**Control and Optimization Applications**

Contributed Session

Chair: Dinesh Kumar Unni Krishnan, Professor, Indian Institute of Management Bangalore, IIM, Bannerghatta Road, Bangalore 560076, Bangalore, Ka, 560076, India, dineshk@iimb.ernet.in

**1 - A Feedback Control Model for A Dynamic Decision Making Environment**

Yawei Liang, Professor, Royal Military College of Canada, Dept. of Math & CS, Kingston, ON, K7K 7B4, Canada, liang-y@rmc.ca

In this paper we present the composition of a general dynamic scenario, the relations of its components and a dynamic making algorithm called ECA (Evaluation and Correction Algorithm). The paper proposes three relations, namely, stable relation, controllable relation and uncontrollable relation. Numerical results are given by some simple dynamic scenarios.

## 2 - Analysis on Decision Bias in the Competitive Newsvendor Problem with Product Substitution

Qiu-Hong Zhao, Professor, Industrial Engineering, Beihang University, Xueyuan road #37., Haidian District, Beijing, 100191, China, qhzhao@buaa.edu.cn

Decision bias due to psychological losses in the single-product newsvendor problem has been observed in the previous studies, and the 'pull to center' phenomenon was confirmed. In this paper, theoretical studies and experiments confirm the existence of the 'pull to center' phenomenon with multiple newsvendors facing product substitution, however, it is shown by numerical studies that such phenomenon is alleviated contrasting to the situation without product substitution.

## 3 - Optimal Allocation of Local Exclusivity Rights

Sasa Pekec, Duke University, Duke University's Fuqua School of Business, 100 Fuqua Drive, Durham, NC, 27708-0120, United States of America, pekec@duke.edu, Changrong Deng

Multiple identical items are being sold to unit-demand buyers in a network. Buyers are willing to pay a premium if they obtain the item exclusively in their neighborhood. We solve the revenue maximizing mechanism design problem for locally linear exclusivity valuations. We discuss the complexity of the problem and the non-monotonicity of the optimal seller revenues in buyers' valuations. We also present an ascending auction implementation of the optimal mechanism for the clique.

## 4 - A Bilevel Optimization Model for Hazmat Transportation Network Design

GeLeTu Qing, Student, School of Economics and Management, Beijing University of Chemical Technology, 15 Beisanhuan East Road, Chaoyang District, Beijing, China, qinggetu1231@yahoo.cn, ChunLin Xin

We assume there are regional and local government authorities that want to regulate the hazmat transportations by imposing restrictions on the amount of hazmat traffic over the network links. The regional authority aims to minimize the total transport risk induced over the entire region in which the transportation network is embedded, while local authorities want the risk over their local jurisdictions to be the lowest possible, forcing the regional authority to assure also risk equity.

## 5 - Supply Chain Optimization under Availability Contracting and Performance Based Logistics

Dinesh Kumar Unni Krishnan, Professor, Indian Institute of Management Bangalore, IIM, Bannerghatta Road, Bangalore 560076, Bangalore, Ka, 560076, India, dineshk@iimb.ernet.in, Pradipta Patra

Availability contracting and performance based logistics are emerging as preferred supply chain strategies among defence industry. This paper uses stochastic models to estimate operational availability under multiple maintenance scenarios, optimize fleet size and maintenance planning using dynamic allocation indices (Bandit Models). The models developed in the paper are validated using data obtained from a defence aircraft manufacturing company.

## WC08

Room 206B

### Algorithms for Integer Programming Problems

Contributed Session

Chair: Lijie Su, The Logistics Institute, Northeastern University, Shenyang, China, ljsu@tli.neu.edu.cn

#### 1 - A Cut-and-Branch Approach for the Synchronization Bus Timetabling Problem

Omar Jorge Ibarra-Rojas, Universidad Autonoma de Nuevo Leon, Garcia Marquez 825, Santa Cecilia., Apodaca, Nuevo Leon, Mexico, hokua.ojir@gmail.com, Yasmin Agueda Rios-Solis

We present a NP-hard synchronization bus timetabling problem with the objective of maximize passenger transfers and avoid bus bunching in common nodes of different lines with almost homogeneous headway times. Our contributions are the MILP formulation and the development of different families of valid inequalities which are used to define a Cut-and-Branch approach that allows to obtain high quality solutions (less than 1% of deviation from the optimal solution) in minutes for large instances.

#### 2 - A Branch and Price Algorithm for Two-stage Cutting Stock Problem

Ying Meng, The Logistics Institute, Northeastern University, Shenyang, China, ymeng@tli.neu.edu.cn, Lixin Tang

A one-dimensional two-stage cutting stock problem in steel plant is investigated. The objective of the problem is to minimize the trim loss and reduce the number of intermediate tubs. A branch-and-price algorithm is proposed to solve the problem, and some improvement strategies are introduced to make the algorithm more effective.

## 3 - A Branch-and-cut Algorithm for Quay Crane Scheduling Problem in Container Terminals

Xu Cheng, The Logistics Institute, Northeastern University, Shenyang, China, xcheng@tli.neu.edu.cn, Lixin Tang

Unloading or loadings movements are performed by quay cranes in container terminals. Quay crane scheduling problem is to assign such movements to cranes and determine the movement sequence, minimizing berthing time of vessels. An integer model is formulated and small scale instances can be solved by CPLEX. For large scale problems, several families of valid inequalities are incorporated in a branch-and-cut algorithm, such as odd cycles constraints, subtour elimination constraints and so on.

## 4 - Lagrangian Heuristics for the Two-stage Capacitated Facility Location Problem

Edith Lucero Ozuna Espinosa, Universidad Autónoma de Nuevo León, Plan de Iguala 200, U. H. Independencia, Apodaca, NL, 66634, Mexico, luceroozuna@gmail.com, Igor Litvinchev

Two different mixed integer formulations are considered for the two-stage capacitated facility location problem. Several Lagrangian relaxations are analyzed and compared, Lagrangian heuristics producing feasible solutions are presented. Results of a computational study demonstrate that near optimal solutions of the Lagrangian dual typically produce better feasible solutions than those corresponding to optimal Lagrange multipliers.

## 5 - Improved Outer Approximation Algorithm for Mixed-Integer Nonlinear Programming

Lijie Su, The Logistics Institute, Northeastern University, Shenyang, China, ljsu@tli.neu.edu.cn, Lixin Tang

MINLP optimization provides a powerful framework for mathematically formulating many optimization problems. Outer approximation(OA) was usually applied for solving convex MINLP. For the complexities and difficulties of MINLP, OA has not yet reached the stage of maturity and reliability. Our work would focus on the improved parallel strategies of OA and its application in Ethylene production scheduling. Data experiments demonstrate the efficiency of the developed methodology.

## WC10

Room 208B

### Revenue Management

Contributed Session

Chair: Bi Wenjie, Associate Professor, Business School of Central South University, Changsha, China, beenjoy@126.com

#### 1 - Pricing and Rationing Strategy for Innovating Firms in the Presence of Strategic Customers

Tianxiao Gong, Ph.D. Candidate, Peking University, No.5 Yiheyuan Road, Peking University, Beijing, China, gongtx@pku.edu.cn, Wei Wang, Lihua Chen, Yingjie Lan

Innovating firms in hi-tech industries face challenges that the strategic customers may postpone their purchasing when taking both the future launch of the new generations and the price drop of the current version into consideration. In a two-period game model we analyze pricing and rationing strategy for innovating Firms. We derive the possible purchase patterns for customers in equilibriums as well as the optimal strategy for the firm.

#### 2 - Dynamic Reserve Price in Sponsored Search Advertising

Wei Yang, Associate Professor, Management Department / LIU Post, 720 Northern Blvd, Brookville, NY, 11548, United States of America, wei.yang@liu.edu, Youyi Feng, Baichun Xiao

We study how the search engine should adjust the reserve price in a generalized second-price auction with entry and exit of advertisers bidding for sponsored links. Initial study shows that when all ad positions are sold in the first page, the new reserve price should be at least as high as the original with a new entrant; otherwise, it is a function of the number of positions sold and the characteristics of the new advertiser's willingness to pay.

#### 3 - Dynamic Nonuniform Pricing for Perishable Asset

Yan Liu, Nanyang Technological University, PhD Office, S3-B1C-125, NBS, Singapore, Singapore, liuy0057@e.ntu.edu.sg, Michael Li

This paper considers a dynamic pricing model for selling a given initial inventory of a perishable product over a finite time horizon where individual's purchase quantity is endogenous. The strategy for the decision maker readily specializes into the schemes of dynamic nonuniform pricing (DNP) and dynamic uniform pricing (DUP). The structural properties for both DNP and DUP schemes are examined.

#### 4 - Dynamic Pricing with Reference Price Updating Strategies and Customers' Memory Window Effects

Bi Wenjie, Associate Professor, Business School of Central South University, Changsha, China, beenjoy@126.com,  
Desheng Dash Wu

We consider a dynamic pricing model with reference-dependent consumer, whose reference price is a function of past prices within a memory window. We analysis the cases when parameters of past prices are linear and nonlinear, show that the optimal pricing policies always monotonically converges to their steady states. With the consideration of memory window, our model is more flexible to make pricing strategy.

#### WC12

Room 209B

#### Fuzzy Sets and Systems

Contributed Session

Chair: Yejun Xu, Hohai University, Business School, Hohai University, Nanjing, China, xuyejohn@163.com

##### 1 - Interval-valued Intuitionistic Fuzzy Decision Making Based on Entropy and Correlation Coefficient

Chen Xiaohong, Central South University, Business School, Changsha, China, chenshareading@163.com, Dai Zijing

First, construct interval-valued intuitionistic fuzzy entropy is proposed. Next, a formula of correlation coefficient with attribute weights is defined. Then, introduce decision-making steps with unknown attribute where individual decision-making steps with unknown attribute where individual assessments are provided as interval-valued intuitionistic fuzzy numbers based on above principle. Finally, the example to verify the simplicity and effectiveness of the developed approach.

##### 2 - A Variation Coefficient Similarity Measure for Intuitionistic Fuzzy Sets and its Application

Liyuan Zhang, School of Business, Central South University, School of Business, Central South University, Changsha, China, cuihuazly@163.com, Shenghai Zhou, Minsai Wang

In this paper, considering the defect of some existing similarity measures between intuitionistic fuzzy set (IFS), we propose a variation coefficient similarity measure (VCSM) and weighted VCSM. Then, we use several examples to compare the VCSM with the existing similarity measures between IFSs, numerical results show that the VCSM is much effective than the existing methods, some properties of them are also proved. Finally, the VCSM is applied to pattern recognition and medical diagnosis.

##### 3 - Fuzzy Multiattribute Group Decision-making Method Based on Binary-relation

Liyuan Zhang, School of Business, Central South University, School of Business, Central South University, Changsha, China, zhangliyuan@163.com, Yue Xia, Haoying Wu

In this paper, we propose a new method for large group fuzzy multiattribute decision-making problems based on binary-relation. Firstly, a similarity measure of expected vector is used to aggregate preference in the form of intuitionistic trapezoidal fuzzy numbers. Then, exact formulas are proposed to determine the vector of the clustering set and group set. According to the weighted expected values of group set, it is easy to rank alternatives and select the most desirable alternative.

##### 4 - Multi-criteria Decision-making Method based on Similarity of Interval Type-2 Fuzzy Number

Junhua Hu, Associate Professor, Central South University, Zuo Jialong Road, Yuelu District, Changsha, 410083, China, hujunhua@yahoo.com.cn, Yan Zhang

A new method to deal with MCDM based on the similarity of interval type-2 fuzzy number is proposed. First the overall value of all alternatives is calculated by type2 aggregation operators. Then both positive and negative ideal points are determined. Moreover obtain the similarity coefficients from the alternatives to those ideal points separately, thus getting the ranking of all alternatives. Finally a numerical example is employed to show the efficiency and feasibility of the developed method.

##### 5 - Prioritized Aggregation for Non-homogeneous Group Decision Making in Water Resource Management

Yejun Xu, Hohai University, Business School, Hohai University, Nanjing, China, xuyejohn@163.com, Huimin Wang

This paper deals with non-homogeneous group decision making problems in water resource management. The group decision makers are partitioned into three sets: the officials from government, the experts in water resource management, the users of water resources. In order to aggregate a collective preference based on prioritized group decision makers' preferences, a so-called prioritized weighted aggregation operator (PWAO) is utilized to aggregate the preference values.

#### WC13

Room 210A

#### e-business Modeling and Applications

Contributed Session

Chair: Wenqi Zhou, Ph.D. Candidate, George Washington University, 2201 G St., Fungler Hall, Suite 515H, Washington, DC, 20052, United States of America, wenqi@gwu.edu

##### 1 - The Research of IFPDM-Rec recommender Model for E-Business System

Fudong Wang, School of Management, DongHua University, 1882 West Yan'an Road, Shanghai, China, wfd@dhu.edu.cn, Fengtao Liu

Because there are so many products in E-Business system. Recommender system is very important for the customer to quickly find what they want. In this paper, the influencing factor of purchase decision-making will be combined in technology of collaborative filter. We call it 'the model IFPDM-Rec recommender Model'. Finally, the result of experimental analysis tell us that the recommender quality of the IFPDM-Rec recommender model is better than the classical collaborative filter model.

##### 2 - The Effects of User Generated Online Reviews on Strategic Interactions within E-Channels

Yu Qian, University of Electronic Science and Technology of China, No. 4, Sec. 2, North Jianshe Road, Chengdu, 610054, China, qiany@uestc.edu.cn

This paper studies an e-channel in which a supplier sells a product through a portal. The product has accumulated online reviews. The relative strength between positive and negative reviews determines the probability of demand increasing or decreasing. The portal makes the ordering decision based on online reviews and sales data, while the supplier makes the wholesale price based on the former. This paper intends to investigate the effects of online reviews on performance of supplier and portal.

##### 3 - The Cost of Clicking Twice: Identifying Return Costs in Online Markets

Zemin (Zachary) Zhong, Peking University - HSBC Business School, 09 Class 1, HSBC B-School, PKU, Xili Uni, Nanshan District, Shenzhen, 518055, China, zachary.z.zhong@gmail.com, David Ong

We extend the standard search model to incorporate the cost of visit and return in price ranking setting. We characterize how the search behavior of consumers, in anticipation of such cost, can possibly result in price dispersion. We apply this model to the field experimental data of Ong and Zhong (2011) to show how the anticipation of return cost could not drive price dispersion in a fairly wide parameter range, indicating that consumers are using price as a signal of quality.

##### 4 - The Impact of the Distribution of Online Word-of-Mouth over Multiple Websites on Online Sales

Wenqi Zhou, Ph.D. Candidate, George Washington University, 2201 G St., Fungler Hall, Suite 515H, Washington, DC, 20052, United States of America, wenqi@gwu.edu, Wenjing Duan

This study investigates the impact of the distribution of online Word-of-Mouth (WOM) information over different websites on online retail sales in software market. We find that a more evenly distributed WOM across retailing websites and third-party websites has a positive sales impact. Have a majority of WOM hosted by retailing websites is an even a more favorable scenario. In addition, a consistent consumer evaluation on a product across websites boosts its sales.

#### WC14

Room 210B

#### Reliability, Inspection and Maintenance

Sponsor: Applied Probability

Sponsored Session

Chair: Xiaoyue Wu, College of Informational Systems and Management, National University of Defense Technology, Changsha, China, xiaoyuewucn@yahoo.com.cn

##### 1 - Availability of a Periodically Inspected System with Random Inspection and Maintenance Times

Jinting Wang, Beijing Jiaotong University, #3 Shang Yuan Cun, Haidian District, Beijing, China, jtwang@bjtu.edu.cn, Nan Zhang

Numerous models have been developed for inspection and maintenance optimization of repairable systems. In this work, the availability of a periodically inspected system with random inspection and repair or replacement times is studied. Assuming that the inspection times are non-negligible, we extend the work by Cui and Xie (J. Statist. Plann. Inference 131 (2005) 89) in which two periodic inspection models with different repair policies were investigated. Our

model includes several existed models as special cases and provides some general results on the instantaneous availability and the steady-state availability for the two models under the assumption of random inspection and repair time.

## 2 - Mission Reliability Analysis of Missile Defense System of Systems Based on Multi-agent Models

Xiaoyue Wu, College of Informational Systems and Management, National University of Defense Technology, Changsha, China, xiaoyuewucn@yahoo.com.cn, Bin Liu, Qi Liu

It is illustrated that analytic models for mission reliability have the problems of lacking ability of description and solving and simulating models is hard to transforming and lacking of standardization after analysis most of reliability modeling methods for System of Systems (SoS). The definition of Multi-agent reliability models is given. The standard syntax and semantics for Multi-agent models and the formalize definition of SoS reliability are also given. The mission reliability models for missile defense SoS and fire unit are built based on Agent formalization models after analysis the composition and operation flow of SoS. At last, we simulate on AnyLogic simulating platform and analyze the simulating results. The Multi-agent models are verified by comparing to the analytic models for the fire unit; the adaptability of Multi-agent models is verified by modeling the interaction factor of missile defense SoS.

## ■ WC15

Room 212A

### Marketing and Business/Finance

Contributed Session

Chair: Sascha Raithel, Assistant Professor, Ludwig-Maximilians-Universitaet in Munich, Kaulbachstr. 45 / I, Munich, 80539, Germany, raithel@bwl.lmu.de

#### 1 - CSR and Market Value in Emerging Markets: An Event Study of Inclusion in China's SRI

Peng Zou, Associate Professor, Harbin Institute of Technology, No.13 Fayuan St., Harbin, 150001, China, zoupeng@hit.edu.cn, Qi Wang, Jinhong Xie

We investigate whether being newly included in the stock market index of the most socially responsible firms causes a firm's stock price to rise. Our event study of firms newly added to China's Social Responsibility Index (of 100 firms) shows that inclusion in the SRI does indeed create greater-than-expected returns. The magnitude of these benefits is found to differ across industries and depends on a firm's marketing, innovation, and global expansion strategy

#### 2 - Does Before-Recall Advertising Affect Abnormal Stock Returns of a Product Recall?

Haibing Gao, University of Florida, 319 University Village, Apt 8, Gainesville, FL, 32603, United States of America, gao1229@ufl.edu, Qi Wang, Kenneth Wilbur, Jinhong Xie

A product recall can have a significant negative effect on a firm's stock price. We investigate whether the size of this effect can be influenced by firm-level or product-level advertising before the recall announcement. Using data from the auto industry, we find that ads do ease recall effects, with firm-level ads being more effective than product-level ads. These findings have implications for advertising strategy when untoward product incidents make a recall imminent.

#### 3 - Do Brands Really Work? Dynamics and Heterogeneity of Brand Performance

Sascha Raithel, Assistant Professor, Ludwig-Maximilians-Universitaet in Munich, Kaulbachstr. 45 / I, Munich, 80539, Germany, raithel@bwl.lmu.de, Marko Sarstedt, Xueming Luo

Researchers often investigate the "mean" effect but neglect the "variance" effect of brand performance. This study uses a large-scale dataset (daily level, >1,400 brands, three countries, >three years) covering multiple dimensions of consumer perceptions of brand performance and applies a time-series model to evaluate the long-term dispersion/heterogeneity effect on financial performance. We also show what brand-level factors moderate the dynamics and heterogeneity of brand performance.

#### 4 - Role of Music on Perceived Price in Retail Store

Rajesh Srivastava, Director General and Professor, Sterling, University of Mumbai, 2/9/12, Bluemoon, Bhawaninagar, Marol, Mumbai, 400059, India, srivastava@vsnl.net

The purpose of this paper is to examine the influence of music in the context of retailing. Interesting findings were on how music could influence the repeat visit of consumer and enhances the perceived value of quality and price. Music do create better shopping experience due to better ambience, comfort and consumer spends more time leading to more purchases in retail stores Type of Paper: Research paper

## 5 - Cumulative Advantage of Research Productivity: How Large is it and Who has it?

Junhong Chu, Assistant Professor, NUS Business School, 15 Kent Ridge Drive, Singapore, 119245, Singapore, bizcj@nus.edu.sg

We quantify marketing researcher's cumulative advantage (CA) of publishing, compute publishing capacity and study determinants and implications. CA exists for everyone with diminishing returns. Researchers whose productivity grows faster initially also have faster decline later. The publishing capacity is far from being realized. There exists substantial heterogeneity, and research area, gender, PhD training and COO are main determinants. CA does not lead to growing inequality in publications.

## ■ WC17

Room 213A

### Healthcare II

Contributed Session

Chair: Shengyong Wang, Assistant Professor, University of Akron, ASEC 101, Dept of Mechanical Engineering, University of Akron, Akron, OH, 44325-3903, United States of America, wangs@uakron.edu

#### 1 - Appointment Management of CT Scanner Capacity Among Two Patient Types

Qin Chun rong, Si chuan University, Service Management Institute 517, Cheng du, China, jianghu525@126.com, Li Luo

Suppose there is only one CT scanner in the radiology department, we present a method to allocate the capacity of a CT to different patient types. For inpatients, we prove that the optimal policy is a threshold-type policy. For outpatients, we partially characterize the structure of the optimal policy.

#### 2 - Study on Influences to the Capacity of Operation Room Based on Using Preoperative Preparing Room

Rongmei Li, West China Hospital, N0.37 of Guoxue Road, Chengdu, Sichuan, Chengdu, China, 493360304@qq.com, Li Luo, Nan Li

This paper aimed at verifying the influence of using preoperative preparing room in West China hospital. Two consecutive surgery groups are selected randomly. One is before using preoperative preparing room, the other is after. Statistical test is put to use. The method reduces common surgical durations about 15min in a certain significance level. Using preoperative preparing room shortens pre-operation and recovery time, which would extend the time of occupying operation room before.

#### 3 - Optimization Algorithm and Software for Kidney Paired Donation Program

Yanhua Chen, University of Michigan, 1415 Washington Heights, Ann Arbor, MI, United States of America, chenyanh@umich.edu, Peter Song

Kidney paired donation (KPD) program provides an important platform for incompatible donor-recipient pairs to exchange donor organs to achieve mutual benefit. With the participation of altruistic donors (ADs), the donation mechanism will increase the number of transplants. We propose a graph-based algorithm and software to optimize the overall expected utility of exchanges in a KPD program with both incompatible pairs and ADs.

#### 4 - Modeling-based Approaches to Continuous Process Improvement in Healthcare Delivery

Shengyong Wang, Assistant Professor, University of Akron, ASEC 101, Dept of Mechanical Engineering, University of Akron, Akron, OH, 44325-3903, United States of America, wangs@uakron.edu

Hospitals are facing tremendous challenges to make the healthcare delivery systems safe, effective, patient-centered, timely, efficient, and equitable. The strategic use of operations management tools can be readily used to measure, characterize, and optimize performance in a healthcare system. This talk presents three case studies (1) Deployment of 'lean' in hospital design, (2) Hospital inpatient bed capacity planning, and (3) Hospital pharmacy staffing model, to demonstrate such efforts.

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 Li, Xiuping TB15  
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Nie, Xiaofeng SC11  
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Nogales, Francisco J. TD01  
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Otieno, Wilkistar MD07  
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Tseng, Mitchell WA11  
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## Monday, 8:00am – 9:30am

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MA02	Risk Management
MA03	Behavior Informatics
MA04	Simulation in Financial Engineering
MA05	Optimization Models and Applications in Energy Systems
MA06	Supply Chain Modeling and Applications
MA07	OR/MS and Social Science Applications
MA08	Decision Support for Design Optimization
MA09	Scheduling Models and Algorithms
MA10	Operations Economics
MA11	Optimization Models in Logistics Management and Supply Chain Management I
MA12	Pricing and Customer Service
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MA15	Practices of Interactive Marketing in the Digital World
MA16	Integrated Pricing and Inventory Models
MA17	Joint Session HAS/OR/MS in Medicine: Panel Discussion: Healthcare OR Around the World: Past, Present and Future
MA18	Financial Engineering: Modeling and Computation
MA19	Stochastics

## Monday, 11:00am – 12:30pm

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MB02	Mining Data for Quality and Reliability Improvement
MB03	Search Engine Marketing
MB04	Contemporary Advances in Simulation and Optimization
MB05	Sustainable Biofuel System Planning and Management
MB06	Sustainable Transport Planning and Scheduling
MB07	Risk Perception and Social Impact
MB08	Computational Finance
MB09	Facility Layout and Location
MB10	Emergency Management of Pharmaceutical Supply Chains
MB11	Optimization Models in Logistics Management and Supply Chain Management II
MB12	Dynamic Control of Inventory and Supply Chains
MB13	Scheduling II
MB14	Performance Analysis for Queueing Models
MB15	Marketing Science is a Work in Progress
MB16	Demand Information and Uncertain Consumer Valuation
MB17	Hospital Resource Planning and Scheduling
MB18	Financial Modeling and Risk Management
MB19	Recent Linear Programming Developments for Operations Research and Management Science

## Monday, 1:30pm – 3:00pm

MC01	Safety Risk Management and Emergency Management
MC02	Data Mining for High-Dimensional Data
MC03	Top Open Research Questions: Service Science Panel
MC04	Applications of Simulations
MC05	Energy Performance Simulation and Optimization
MC06	Risk Management in Supply Chain
MC07	Weights in Multi-attribute Decision Making
MC08	Risk Management in Energy Systems
MC09	Optimal Design in Health Care
MC10	Advanced Quality Control Methods for Manufacturing and Service Operations
MC11	Optimization Models in Logistics Management and Supply Chain Management III
MC12	Supply Chain and Inventory Analysis
MC13	Scheduling III
MC14	Queueing Systems: Performance Analysis and Control
MC15	Brand and IP Management
MC16	Competitive Channel and Supply Chain Management
MC17	Joint Session HAS/OR/MS in Medicine: Treatment Planning in Radiation Therapy
MC18	Financial Optimization
MC19	Optimization Software: Algorithms, Computation and Applications

## Monday, 4:30pm – 6:00pm

MD01	Airline Economics and Operations I
MD02	Modeling in Analytics
MD03	Service Science - Improving Complex Service Systems
MD04	Simulation
MD05	Impact of Customer Behavior on Service Systems
MD06	Scheduling and its Applications
MD07	Decision Analysis I
MD08	Procurement and Retail Optimization
MD09	Closed-Loop and Reverse SCM
MD10	Censored Demand and Incomplete Information
MD11	Supply Chain Management I
MD12	Innovative Topics in Operations Management
MD13	Health Care Delivery Service Optimization
MD14	Quantitative Methods in Finance
MD15	Market Entry and Industry Dynamics
MD16	Panel: Women in OR
MD17	Joint Session HAS/OR/MS in Medicine: Medical Decision Making
MD18	Finance

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## Sunday, 9:00am – 10:30am

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- SA02 Data Mining Techniques in Multiple Areas
- SA03 AI in Social and Economic Modeling
- SA04 Simulation Optimization I
- SA05 Emerging Topics in Energy Systems
- SA06 Healthcare Operation Management
- SA07 Set Covering and Partitioning
- SA08 Optimization Software
- SA09 Joint Session ICS/MAS: Military and Defense Applications and Infrastructure Security
- SA10 Panel: The Challenges of Practicing “Scientific Decision-Making” in Chinese Organizations
- SA11 Competition Models in Supply Chain Management
- SA12 Sustainable Development and Green Supply Chain
- SA13 IAC Invited Panel Discussion: Recent Development of Industrial Engineering in Asia
- SA14 Large-scale Service Systems
- SA15 Bayesian Estimation in Marketing
- SA16 Retail Innovations and Supply Chain Performance
- SA17 Planning and Scheduling in Health Care I
- SA18 Advances in Traffic Signal Control and Optimization
- SA19 Queuing Theory and Applications

## Sunday, 11:00am – 12:30pm

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- SB03 AI in Healthcare
- SB04 Monte Carlo Simulation in Financial Engineering
- SB05 Bioenergy Supply Chain and Market Models
- SB06 Dynamic Models in Operations Management
- SB07 Air, Rail, and Vessel Operations
- SB08 Optimization and Complementarity Problems with Economics Applications
- SB09 Assignment and Scheduling
- SB10 Scheduling Applications
- SB11 Multi-echelon Systems
- SB12 Global Supply Chains
- SB13 INFORMS IAC/Board: Overview of INFORMS and Analytics Initiatives
- SB14 Asymptotics and Optimization of Stochastic Networks
- SB15 Behavioral Economics Models in Marketing
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- SB17 Planning and Scheduling in Health Care II
- SB18 Financial Markets
- SB19 Model Uncertainty, Robust Optimization and Learning

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- SC02 Humanitarian Logistics Management
- SC03 Joint Session AI/Data: Data Mining in Social Computing
- SC04 Simulation Applications
- SC05 International Energy Trading
- SC06 Theoretical and Empirical Research Stemming from Practice in China
- SC07 Replenishment and Pricing
- SC08 Integer Programming
- SC09 Sustainability in Waste and Water
- SC10 Quality Management and Lean Six Sigma I
- SC11 Supply Chain and Risk Management
- SC12 Electronic Commerce I
- SC13 Analytics in Sustainability
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- SC15 Cause Marketing, Green Marketing, and Corporate Social Responsibility
- SC16 Pricing Strategies and Supply Chain Management
- SC17 Modeling Sustainable Energy
- SC18 Analysis of Systemic Risk
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## Sunday, 4:00pm – 5:30pm

- SD01 Transportation and Logistics System Planning under Uncertainty
- SD02 Supply Disruption Management
- SD03 Social Network
- SD04 Simulation Optimization II
- SD05 Operations Research in Sustainability
- SD06 Supply Chain Management with Behavior Issues
- SD07 Smart System Service Enabled Business Transformation
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- SD09 Computational Problems on Graphs
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- SD18 Data Envelopment Analysis in the Financial Services Sector
- SD19 Unlocking the Hidden Value in Your Data with SAS Analytics

## Tuesday, 8:00am – 9:30am

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TA05	Supply Chain
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TA11	Data Mining and Human Factors in Healthcare Systems
TA12	Pricing and Financial Issues in Supply Chains
TA13	Real Options, Assymetric Information, and Incentive Design
TA14	Matrix-Analytic Methods and their Applications
TA15	Online Marketing
TA16	Interdisciplinary Topics between IS and OM
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TB18	Financial Modeling and Analysis
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## Tuesday, 1:30pm – 3:00pm

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TC02	Data Mining in Operations Management
TC03	Communities of Practice, Social Responsibility, and Social Networking
TC04	Maritime Economics and Finance
TC05	Power Generation and the Environment
TC06	Channel Management—Interaction between Supply Chain, Marketing, and Finance Service
TC07	Multi-Criteria Decision Making
TC08	Computational Statistics
TC09	Design and Control of Multilevel Networks
TC10	Topics in Operations Management II
TC11	Logistic Network Decision/Operation Management
TC12	Optimization and Competition in Supply Chains
TC13	Rolling Horizon, Scheduling and Timetabling
TC14	Multidimensional Reflecting Processes: Stability and Tail Asymptotics
TC15	Competition and Pricing Strategies in China's Industries
TC16	Marketing Applications
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TC18	Risk Management
TC19	Challenges in Modern Data Analysis
TC20	Software Tutorials

## Tuesday, 4:30pm – 6:00pm

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TD04	Green Supply Chain and Transport Logistics
TD05	Energy: China Studies
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TD07	Recent Developments of Mobile Businesses in China and Korea
TD08	Quantitative Methods into Policymaking
TD09	Pricing and Revenue Management
TD10	Performance Management and Service Optimization in Supply Chain
TD11	Monitoring and Control in the Cloud
TD12	Consumer Behavior and Revenue Management
TD13	Inventory Control and Value of Information
TD14	Markov Decision Processes with Applications
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TD20	Software Tutorials

### **Wednesday, 8:00am – 9:30am**

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WA04 Quality Control and Management  
WA05 Decision Making Based on DEA Approaches  
WA06 Service Operations  
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WA10 Capacity Flexibility, Planning and Control  
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WA15 Marketing and the Internet  
WA16 Marketing: New Product Development  
WA17 Health Care Marketing and Quality Assessment  
WA18 Recent Advances in Radiation Treatment  
Planning Optimization  
WA19 Business Analytics and Optimization

### **Wednesday, 11:45am – 1:15pm**

WC01 Global Supply Chain Competition and Alliance  
WC02 Supply Chain Operations  
WC03 Financial and Economic Modeling  
WC04 Quality and Business Decisions  
WC05 Project Management  
WC06 Control and Optimization Applications  
WC08 Algorithms for Integer Programming Problems  
WC10 Revenue Management  
WC12 Fuzzy Sets and Systems  
WC13 e-business Modeling and Applications  
WC14 Reliability, Inspection and Maintenance  
WC15 Marketing and Business/Finance  
WC17 Healthcare II

### **Wednesday, 10:00am – 11:30am**

WB01 Vehicle Routing  
WB02 Information Systems II  
WB03 Knowledge Management  
WB04 Ethical, Team and Social Issues  
WB05 Production Planning and Control  
WB06 Novel Topics and Methods in Innovation Management  
WB07 Decision Analysis Applications  
WB08 Optimization/Game Theory Models in Operations Management  
WB09 Optimization Models under Uncertainty  
WB10 Dynamic Pricing  
WB11 Pricing and Channel Section in Supply Chains  
WB12 Supply Chain Competition and Risk Management  
WB13 Business Analytics and Consumer Behavior  
WB14 Queueing Systems  
WB15 Marketing/OM Interface  
WB16 Marketing and Economic Modeling  
WB17 Evidence Based Operations Research  
WB18 Healthcare Analytics  
WB19 Supply Chain Analytics

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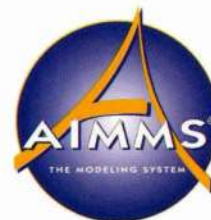
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