Applications of Metaheuristics in Vehicle Routing
Cluster: Optimization/Metaheuristic
Invited Session
Chair: Michel Gendreau, CIRRELT/University of Montreal, C.P. 6128, succ. Centre-ville, Montreal, QC, H3C 3J7, Canada, michel.gendreau@cirrelt.ca
1 - SR-GCWS-CS: A Simulation-Based Methodology to Assist Decision-Makers in Real Vehicle Routing Problem
Francisco Arcelus, Professor Emeritus, University of New Brunswick, P O Box 4400, Faculty of Business Administration, Fredericton E3B 5A3, Canada, arcelas@umb.ca, Javier Faulin, Barry Barrios, Scott Grasman, Angel A. Juaristi
We present a simulation-based algorithm that not only provides a competitive solution for the Capacitated VRP, but is also able to efficiently generate a full database of alternative good solutions. In order to provide high-quality solutions, our algorithm combines a CVRP classical heuristic, (Clarke and Wright), with Monte Carlo simulation. The resulting algorithm is tested against some well known benchmarks and the results obtained are promising in real-life scenarios.

2 - Management of Material Flows Within a Hospital: A Two Levels Interconnected Vehicle Routing Problem
Yannick Kergosien, PhD Student, Université François Rabelais de Tours, 64 av. Jean Portalis, Tours, 37200, France, yannick.kergosien@univ-tours.fr, Christophe Lente, Jean-CharlesBILLault
The Hospital Centre of Tours (France) is reorganizing the logistic services between its hospital units. We focus on the vehicles routing problem (VRP) between these units and on the definition of a warehouse team inside a particularly large hospital. The design of this team (composing, planning, ...) is strongly related to the routes of vehicles between hospital units. The whole problem can be seen as a two-level pickup and delivery problem with time windows, where two VRP interact.

3 - A Tabu Search with Vocabulary Building Approach for the Vehicle Routing Problem with Split Demands
Rafael Aleman, Wright University, rafael.enrique.aleman@gmail.com, Raymond Hill
The Split Delivery Vehicle Routing Problem (SDVRP) is a relaxation of the Vehicle Routing Problem (VRP) where single customers can be visited by multiple vehicles. This work presents a tabu search that uses an initial set of solutions and their attributes to create new solutions and evolve the set. Computational results are provided on existing benchmark problems and demonstrate the effectiveness of the presented approach. New best solutions are found in some of the tested problems.

4 - Large Neighborhood Search for the Double Traveling Salesman Problem with Multiple Stacks
Pascal Van Hentenryck, Professor, Brown University, 115 Waterman Street, Providence, RI, 02912, United States of America, pvh@cs.brown.edu, Russell Bent
We consider a complex real-life short-haul/long-haul pickup and delivery application, modeled as a variant of the Double Travelling Salesman Problem whose pick-ups and deliveries take place in reserve (LIFO) order. The goal is to minimize the total travel time. We present a large neighborhood search algorithm which improves significantly the best-known results on 65% of the available instances and is always within 2% of the best-known solutions.

WA04
Bay Room - CC Leve. 1
Design Optimization
Cluster: Design Optimization under Uncertainty
Invited Session
Chair: Masoud Mahootchi, mmahootchi@gmail.com
1 - Distribution Company Power Procurement Under Uncertainty of DG Operation
Yousef El-Mabru Saad, Kumaraswamy Ponnambalam, R. A. El-Shatshat, M. M. A. Salama
This paper presents a methodology for addressing non-utility owned distributed power generating units (NUG) for a distribution company working in a restructured power system. Although, the lack of ability to schedule the NUG units has been noticed, researchers have only applied traditional models. Previously, either a perfect prediction or a full control has been assumed to implement the operating level of NUG units in short-term operational plans. Both strategies void the proper representation of NUG units characteristics and lead to impractical conclusions. This paper is an outcome of research toward proper consideration of the NUG units in the evaluation of the operational activities of a distribution company or a retailer. The expectations of the NUG units random behavior are represented and analyzed in several ways. Investigations concerning the ability of deterministic algorithms to solve such situation are reported. Some recommendations for the utilities that have NUG units connected to their networks are suggested and conclusions about the applications of deterministic approaches to consider the NUG units operation are elicited from the studies conducted in this paper.

2 - Refining and Petrochemical Industry Integration: Optimization Under Uncertainty
Khalid Alqahani, University of Waterloo, 431 Beaver Creek Rd, Waterloo, ON, N2V 2J8, Canada, qahlinky@yahoo.com, Saud Aramco, Ali Elkamel
We propose a model for the design of an integration refinery and petrochemical systems under uncertainty. The model was formulated as a two-stage stochastic mixed-integer problem. Uncertainties considered in this study were in terms of imported crude oil price, refinery product price, petrochemical product price, refinery market demand, and petrochemical lower level product demand.

3 - Warehousing Management Problem Using Nonlinear Models
Masoud Mahootchi, mmahootchi@gmail.com, Kumaraswamy Ponnambalam
The purpose in the management of warehouses is to achieve an optimal order policy. The quantity of products to be ordered or bought from a supplier or other storage spaces, such that it minimizes the total cost. The problem becomes more complex if such a policy is to be extracted in a stochastic situation where, for example, the demand or lead time period are random variable with unknown distributions. Many optimization or simulation techniques are utilized to tackle this type of storage management application; however, most of them rely on simplifications of stochastic variables (e.g., using only the mean of stochastic variables to cover the distributions). Moreover, most of these techniques cannot cope well with a multi-echelon warehouse problem, a system including multiple warehouses and retailers having bidirectional connections. In our proposed methodology, a nonlinear optimization model for reservoir management is utilized for modeling the warehouse problems. The operating policy in this method is a function of storage at the beginning of each period and the demand distributions can be non-Gaussian. Moreover, risk can be imbedded into the model formulation.

Wednesday, 8:00am - 9:30am

WA02
Queens Quay I - CC Leve. 1
Applications of Metaheuristics in Vehicle Routing
Cluster: Optimization/Metaheuristic
Invited Session
Chair: Michel Gendreau, CIRRELT/University of Montreal, C.P. 6128, succ. Centre-ville, Montreal, QC, H3C 3J7, Canada, michael.gendreau@cirrelt.ca
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Francisco Arcelus, Professor Emeritus, University of New Brunswick, P O Box 4400, Faculty of Business Administration, Fredericton E3B 5A3, Canada, arcelas@umb.ca, Javier Faulin, Barry Barrios, Scott Grasman, Angel A. Juaristi
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4 - Large Neighborhood Search for the Double Traveling Salesman Problem with Multiple Stacks
Pascal Van Hentenryck, Professor, Brown University, 115 Waterman Street, Providence, RI, 02912, United States of America, pvh@cs.brown.edu, Russell Bent
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WA03
Queens Quay II - CC Lev. 1
Heuristics for Large-Scale Combinatorial Optimization
Cluster: Large Scale Optimization and Applications
Invited Session
Chair: Roy Kwon, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, rkwon@mie.utoronto.ca, Stephen Stoyan, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, stoyan@mie.utoronto.ca, Barry Barrios, Scott Grasman, Angel A. Juaristi
We present a large-scale combinatorial optimization problem posed from a stock-
1 - An Integrated Framework for the Design of Optimal Banners

Lan Zhao, Professor, SUNY/ College at Old Westbury, Math Department, Old Westbury, United States of America, zhaol@oldwestbury.edu, Anna Nagurney, Lili Hai

In this paper, we present an integrated framework for the optimization of Internet banner advertising. The framework consists of three parts: statistical predictive modeling on web data, optimization through mixed integer programming, and the use of information repository technology. The integrated, quantitative approach allows for the automatic improvement of banner advertising strategies and nonintuitive personalized advertising at a variety of banner display levels.

2 - Personality and Message Appeal Effectiveness

Ching-I Teng, Associate Professor, Chang Gung University, Taiwan, 259, Wenhua 1st Rd, Guishan Shiang, Taoyuan, 333, Taiwan - ROC, chingit@mail.cgu.edu.tw

Personality characterizes individual customer and enable mass customization. Research is required to know how personality affects message appeal effectiveness. However, the existing literature is sparse on this issue, indicating the need to have propositions for examinations. This study thus constructed propositions basing on theories of personality and message appeals. The propositions identified in this study can be examined in online shopping and online auctions.

3 - Research on the Pricing Strategy of Digital Music in the Long Tail Market

Hyun-Sik Park, Graduate School of Culture Technology, KAIST, Yuseonggu Guseongdong KAIST, Graduate School of Culture Technology, Daejeon, 305-701, Korea, Republic of, hsp@kaist.ac.kr, Wonjoon Kim

This research aims to analyze price elasticity of digital music and to develop new marketing strategy for the long tail market. We designed an online music experiment and analyzed the relationship between the price and the popularity of digital music. Then, we estimated both demand and cross price elasticity to suggest an optimal price strategy. Empirical evidence shows that unpopular songs have significantly low price elasticity when the price of popular songs increases.

4 - Effects of Utilitarian and Hedonic Value of Social Network Services on Satisfaction and Loyalty

Hsiu-Lan Wu, Fortune Institute of Technology, No.1-10, Nwongchang Rd., Luoyciyou Villa, Kaohsiung County, Taiwan - ROC, sharen6133@gmail.com

Social network services (SNS) has simplified social interactions between users. Some SNS attract many users in the early stages, but suffer from turnover later. SNS of practice aims to retain its existing users and attract potential users by providing superior customer value which leads to greater satisfaction and loyalty. This empirical study applied SEM to explain the impacts of hedonic and utilitarian value on satisfaction and loyalty by providing an integrated model within SNS context.

5 - Differential Allocation of Bilingual Agents in Call Centres

Winfried Grassmann, Professor Emeritus, University of Saskatchewan, 110 Science Place, Saskatoon, SK, S7N 5C9, Canada, grasman@cs.usask.ca

Bilingual Call Centres with customers of two language types and three agent pools (bilingual, and unilingual servers for each language type) are considered. An efficient way to allocate bilingual servers is based on the difference between the queue lengths. A matrix geometric model is presented for such a call centre's stationary distribution. The state space is constructed in a manner that facilitates the computation of the state probabilities. Numerical examples will be presented.

6 - On Accommodating Customer Flexibility in Service Systems

Douglas Down, Associate Professor, McMaster University, Department of Computing and Software, 1280 Main Street West, Hamilton, ON, L8S 4L7, Canada, downm@mcmaster.ca, Yu-Tong He

We consider parallel queueing models in which a proportion of arriving customers are flexible, i.e. they are willing to receive service at any one of some subset of the parallel servers. For the case of two parallel servers, we show that as the servers become fully utilized, the maximum improvement in mean waiting times is achieved for arbitrarily small levels of flexibility. The potential implications of these results for two motivating examples are discussed.

7 - Finite and Infinite Buffer Queues

Winfried Grassmann, Professor Emeritus, University of Saskatchewan, 110 Science Place, Saskatoon, SK, S7N 5C9, Canada, grasman@cs.usask.ca, Javad Tavakoli

One would expect that as the buffer size of a queuing system goes to infinity, the expected number of visits to the states with moderate queue lengths will be the same whether there is a buffer or not. This is true if the traffic intensity is below 1, but not if it is above 1. The implications of this for numerical stability and matrix analytic methods will be explored.

8 - Process Model For Traffic Incident Management

Amir Hosein Gholaz, Graduate Student, University of Waterloo, Department of Civil Engineering, 200 University Ave West, Waterloo, ON, N2L 3G1, Canada, ahghods@uwwaterloo.ca

This paper models traffic incident response process using process re-engineering and re-thinking. In addition, this model can be used to plan new capabilities, benchmark performance, alleviating the overall performance.

9 - Traffic Congestion Minimization by Rapid Heuristic Solution

Shabbir Choudhuri, Assistant Professor, Grand Valley State University, 225 Kennedy Hall, 301 W. Fulton St, Grand Rapids, MI, 49504-6495, United States of America, choudhus@gvsu.edu, Md. Ashfaque-Ur Rahman, Charles Standridge

This paper presents traffic incident response process using re-thinking and re-engineering techniques to achieve overall processes integration. It outlines key processes, participating actors and their roles. The output process model will point out the bottlenecks in the processes work flow, allowing the restructuring of current processes and the removal of idle ones. In addition, this model can be used to plan new capabilities, benchmark performance, alleviating the overall performance.
4 - An Efficient Optimization Approach to Real-time Coordinated Freeway Traffic Control

Amir Hosein Ghods, Graduate Student, University of Waterloo, Department of Civil Engineering, 200 University Ave West, Waterloo, ON, N2L 3G1, Canada, ahghods@uwaterloo.ca, Liping Fu

This paper tackles the problem of real-time control of traffic in a freeway network. One popular approach to this problem is model predictive control. This approach is only viable for small sized problems due to its computational complexity. A game theoretic approach is proposed to solve this problem. The efficiency of the proposed method is tested in a stretch of freeway network. The speed and accuracy of the proposed algorithm is examined and compared with the conventional optimization method.

WA11
Salon C - H Conv. Lev.

Health Care Operations
Sponsor: Health Applications Section
Sponsored Session
Chair: Kumar Rajaram, Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, krajaram@anderson.ucla.edu

1 - Planning for HIV Screening and Treatment at the Veterans Administration (VA)
Kumar Rajaram, Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, krajaram@anderson.ucla.edu, Sarang Beot, Uday Karmarkar

Routine HIV screening has been shown to be cost-effective in a variety of settings and is now recommended by the CDC. However, these studies typically ignore resource constraints at an organizational level that can impede implementation. We formulate a dynamic optimization model combining a disease progression model with a patient flow model under constrained resources. We apply this model to a VA facility and demonstrate the impact of resource constraints on the optimal screening policy.

2 - A Conceptual Framework for the Role of Collaboration in Hospital Value Chains
Kannan Sethuraman, Associate Professor, Melbourne Business School, 200 Leicester Street, Carlton, Australia, k.sethuraman@mbs.edu, Ramaswami Sridharan, Devanath Tirupati

The proposed framework provides a systematic characterization of collaboration process in hospital value chains and its impact on performance. Collaboration is conceptualized to comprise of four attributes: a collaborative performance system, information sharing, synchronization and incentive alignment. We offer propositions “emanating from the posited relationships in the framework” that form the bases for future research and theory building.

3 - Does Practice Make Perfect: An Empirical Analysis of Learning-by-doing in Cardiac Surgery
Subramaniam Ramanarayanan, Assistant Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, subbu@anderson.ucla.edu

This paper examines a mechanism through which workers acquire and maintain competence: task experience. I analyze whether cardiac surgeons who have performed more procedures in the recent past experience an improvement in performance. Using surgeon exits from hospitals as exogenous identifiers, I find evidence indicating a strong learning-by-doing effect. This effect is weaker for high volume surgeons, and is partly specific to firm and task settings.

4 - Real-Time Drug-surveillance
Margret Bjarnadottir, Stanford University, Graduate School of Business, 518 Memorial Way L238, Stanford, CA, 94305, margret@stanford.edu

After the withdrawal of Vioxx from the pharmaceutical market in 2004, post-FDA-approval drug safety and surveillance has come under serious scrutiny. We build a mathematical framework for a real-time drug surveillance system that uses claims-data and run an experiment across the full spectrum of possible side effects. Our work shows that a successful drug-surveillance system can be built, based on claims data analysis and could become one of FDA’s standard tools for post-marketing surveillance.

WA12
Pier 4 - H Conv. Lev.

Negotiation Support and Applications
Sponsor: Group Decision and Negotiation Section: GDN 2009
Sponsored Session
Chair: Danielle Morais, Assistant Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, PE, 50630-970, Brazil, dcmorais@ulipe.br

1 - A Workflow System to Support Negotiations
Melise Paula, Professor, UNIFAL/MG, Computer Science Department, Federal University of Alfenas, MG, Alfenas, MG, Brazil, melisepaula@gmail.com, Danilo Lima, Sergio Rodrigues, Luis Camargo, Jano Souza

Negotiators often attempt to resolve their conflict through the use of intrinsic activities and their own skills. This work presents a system workflow approach, titled W-Neg. We suggest a set of workflow models to tackle issues that may be conflicting during the negotiation table. As any decision-making process, negotiations arise from some well known steps. Therefore, the management of activities realized from these steps can be considered an alternative to improve negotiator’s preparation.

2 - An Approach to Visualize the Negotiation Preparation Step
Sergio Rodrigues, Project Manager, COPPE / Federal University of Rio de Janeiro, Av. Visconde do Rio Branco, 661 / 601, Niteroi, 24020005, Brazil, sergio@cos.ufrrj.br, Jano Souza

In Brazil, the hydrographic basin committees are the centre of decision for water resource management. Their members must decide about complex issues, requesting the consideration of multiple aspects. It is advantageous to have a decision support system that guarantees transparency, rapidness and a structured analysis of the problem. This paper presents a group decision support system based on multi-criteria analysis and Borda’s method.

3 - A Group Decision Support System to Aid Activities of Hydrographic Basin Committees
Vanessa Silva, Federal University of Pernambuco, Cx. Postal 7462, Recife, PE, 50630-970, Brazil, vanessa_eletrica@yahoo.com.br, Danielle Morais, Adiel Teixeira Almeida

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4 - Selection of Leakage Reduction Alternative Based on Group Decision Making
Danielle Morais, Assistant Professor, Federal University of Pernambuco, Recife, PE, Brazil, daniellemorais@yahoo.com.br

Among many causes of water losses, leakage represents a significant portion of the high index found and is one of the crucial issues to be dealt in order to improve the efficiency and effectiveness of water supply services. This paper presents a group decision model to aid the organization to reach a transparent process to select a leakage reduction alternative, considering technical, socio-economic and environmental aspects to achieve sustainable development.
2 - An OWA-TOPSIS Method for Multiple Criteria Decision Analysis
Ye Chen, Professor, Nanjing University of Aeronautics and Astronautics, School of Economics and Management, Nanjing University of Aeronautics and Astronautics, Nanjing, JS, China, chenyue@nuaa.edu.cn, Kevin Li, Si-feng Liu
A hybrid approach integrating OWA aggregation into TOPSIS is proposed to tackle multiple criteria decision analysis problems. The setting of ideal and anti-ideal points in TOPSIS is redefined and extended for handling the multiple extreme points situation where a decision maker (DM) or multiple DMs can provide more than one pair of extreme points. Three aggregation schemes are designed to integrate OWA into the TOPSIS analysis procedure.

3 - A Matrix Approach to Coalition Analysis in Group Decision Support
Quanyuan Jin, Director of International Office, Nanjing University of Aeronautics and Astronautics, 30 Yudao Street, Nanjing, JS, 210016, China, jinquanyuan@nuaa.edu.cn, Haiyan Xu, Keith W. Hipel, Marc Kilgour
A novel matrix approach to coalition analysis in group decision support is designed for efficiently calculating stabilities. This advancement permits the construction of an effective Decision Support System for strategically studying a rich range of coalition situations arising in the real world.

Agent-Based Simulation in Diffusion Processes
Cluster: Special Invited Session
Invited Session
Chair: Christian Stummer, University of Vienna, Department of Business Administration, Brunner Str. 72, Vienna, 1210, Austria, christian.stummer@univie.ac.at

1 - An Agent-based Simulation of the Impact of Marketing Activities on the Adoption of a Biomass Fuel
Christian Stummer, University of Vienna, Department of Business Administration, Brunner Str. 72, Vienna, 1210, Austria, christian.stummer@univie.ac.at, Markus Guenther, Elmar Kiesling, Lea M. Wakolbinger, Stefan Fuernsinn
When introducing new products into market, costly marketing activities are applied to further the adoption of these products. Obviously, managers want to learn about the impacts of these activities beforehand. To this end, we have developed a computer simulation where customers are represented by agents with individual preferences while marketing activities influence the customers’ notions about the new product and, thus, their purchase decisions. This is illustrated by means of a case study.

2 - Modeling Social Interaction in an Agent-based Simulation of New Product Diffusion
Elmar Kiesling, University of Vienna, Department of Business Administration, Brunner Str. 72, Vienna, 1210, Austria, elmar.kiesling@univie.ac.at, Rudolf Vetschera, Christian Stummer, Markus Guenther, Lea M. Wakolbinger
Word-of-mouth effects play a major role in the diffusion of innovations. Thus, the proper consideration of social interactions becomes crucial when modeling diffusion processes. In this talk, we present an agent-based approach for simulating the spread of information about a new product in the setting of a geographically dispersed social network formed by heterogeneous consumers.

3 - An Innovation-oriented View on Intra-firm Knowledge Diffusion
Markus Guenther, University of Vienna, Brunner Str. 72, Vienna, 1210, Austria, markus.guenther@univie.ac.at, Christian Stummer, Kurt Heidenberger
The availability and allocation of knowledge within a company is crucial for the ability to innovate and so for long-term success. Although intra-firm knowledge diffusion is focused by some models, its impact on the innovation process of a firm has hardly received attention. Thus, we extend the (purely) knowledge-based approaches by an innovation-oriented view using an agent-based model and compare different intra-firm network structures, information decays and knowledge enhancing activities.

4 - Agent-based Modeling of Multi-channel Choice Behavior Across the Phases of the Purchasing Process
Lea M. Wakolbinger, University of Vienna, Department of Business Administration, Brunner Str. 72, Vienna, 1210, Austria, lea.wakolbinger@univie.ac.at, Stefan Katzensteiner, Christian Stummer
Analyzing consumer channel choice behavior is of high relevance when managing an integrated multi-channel retail environment. We propose an agent-based tool capable of simulating the impact of various marketing activities on consumer channel choice behavior across the phases of the purchasing process. Interactions between consumers in a social network are taken into account.
When higher wind penetrations are achieved in an existing power system, it is expected that average electricity costs will decrease. However, when network considerations are included in the analysis, uncertainty associated with wind forecasts could have a significant impact. It is likely that variability in electricity costs will increase due to sub-optimal dispatch in real-time. In this work, a simulation approach is taken to quantify the magnitude of this variability on a test system network.
Wednesday, 10:00am - 11:30am

**WB02**

Queens Quay I - CC Lev. 1

Recent Developments in Metaheuristics
Cluster: Optimization/Metaheuristics
Invited Session

Chair: Jean-Paul Watson, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185-1318, United States of America, jwatson@sandia.gov

1 - Gender-Specific Genetic Algorithms
Zvi Drezner, Professor, California State University-Fullerton, Department of ISDS, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@exchange.fullerton.edu, Tammy Drezner

We propose to incorporate gender in genetic algorithms. Existing genetic algorithms are gender-neutral. Every genetic algorithm which is gender-neutral can be easily constructed as a gender-specific genetic algorithm. We compared the performance of the gender-neutral and its gender-specific counterpart on four optimization problems and the gender-specific algorithm exhibited superior performance. A statistical analysis allows this conclusion to be stated with 99.5% confidence.

2 - A Hybrid Constraint Programming / Local Search Approach to the Job-Shop Scheduling Problem
J. Christopher Beck, University of Toronto, 9 King’s College Road, Toronto, ON, M5S 3G8, Canada, jcb@mie.utoronto.ca, TK Feng, Jean-Paul Watson

Despite the powerful inference of constraint programming, local search has consistently represented the state-of-the-art for classical job-shop scheduling. We introduce a simple hybrid that leverages both the capabilities of modern tabu search and constraint programming. The hybrid significantly improves the performance of a state-of-the-art tabu search and represents the first instance in which constraint programming obtains performance competitive with the best local search algorithms.

3 - Assessing Metaheuristic Implementations for Massively Multi-Threaded Compute Architectures
Jean-Paul Watson, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185-1318, United States of America, jwatson@sandia.gov

Recently, high-performance computing vendors have developed novel architectures that support both a very large memory footprint and number of concurrent threads, e.g., SUN’s Niagara and the Cray XMT. These architectures contrast with traditional distributed memory alternatives, and promise to offer distinct advantages in the parallelization of metaheuristics. We explore the implementation of parallel metaheuristics on these architectures, reporting on case studies and lessons learned.

**WB03**

Queens Quay II - CC Lev. 1

Process Optimization and Control
Cluster: Large Scale Optimization and Applications
Invited Session

Chair: Ali Elkamel, Professor, University of Waterloo, 200 University Avenue West, Waterloo, N2L 3G1, Canada, aelkamel@cape.uwaterloo.ca
Co-Chair: Abdunnaser Younes, University of Waterloo, Department of Chemical Engineering, Waterloo, ON, Canada, ayounes@engmail.uwaterloo.ca

1 - Fault Detection in Chemical Processes: Observability and Economic Considerations
Mohamed Bin Shams, Department of Chemical Engineering, University of Waterloo, Waterloo, ON, Canada, m3shams@engmail.uwaterloo.ca, Hector Budman, Thomas A. Duever

Process disturbances or faults if unobserved have a serious impact on process economy, product quality, safety, productivity, and pollution level. Efficient and advanced automated diagnostic systems that can detect, diagnose, and consequently correct these abnormal process behaviors are of great importance to modern complex chemical industries. In this talk, we will present a framework that will quantity and assess different levels of fault observability.

2 - Mixed-integer Dynamic Optimization: A Hybrid Genetic Control Vector Parameterization Approach
Wongphaka Wongrat, University of Waterloo, Department of Chemical Engineering, Waterloo, ON, Canada, wwongrat@engmail.uwaterloo.ca, Abdunnaser Younes, Ali Elkamel

Harvested rice needs to be dried to bring the moisture contents to safe storage levels. Drying systems normally use alternating sequences of drying, cooling and tempering units. Thus, finding the best configuration of the units and their operating parameters involves a mixed-integer dynamic optimization problem. We present a hybrid technique that uses a GA to search for the best configuration and a CVP to solve the NLP problem arising from the differential equations governing heat and mass balance.

3 - The Role of Convex Optimization with Linear Matrix Inequalities in the Application of DMPC
Walid Al-Gherwi, University of Waterloo, Chemical Engineering Department, Waterloo, Canada, walidgherwi@yahoo.com, Hector Budman, Ali Elkamel

Convex optimization with Linear Matrix Inequalities (LMIs) has been widely used in control and systems engineering. In this work, we show by illustrating several case studies the role of convex optimization in designing robust distributed model predictive control (DMPC) schemes with different coordination strategies and subject to model errors.

**WB04**

Bay Room - CC Lev. 1

Design of Classification Methods for Diagnostics
Cluster: Design Optimization under Uncertainty
Invited Session

Chair: Jacek Wojciechowski, Warsaw University of Technology, Institute of Radioelectronics ul., Nowowiejska 15/19, Warsaw, 00-665, Poland, jwojc@irc.pw.edu.pl

1 - Application of the Rough Sets Algorithms to the Diagnostics of Complex Analog Systems
Piotr Bilski, Warsaw University of Life Sciences Address: ul. Nowowiejska 159, Poland, piotr_bilski@sggw.pl, Jacek Wojciechowski

The paper presents the application of the rough sets to the diagnostics of the complex analog systems. The latter contain numerous, possibly faulty parameters, which are difficult to detect. The aim of the research was to implement algorithms exploiting rough sets to process the learning data set (taken from simulations of the diagnosed objects model), obtaining diagnostic rules. The latter were used to detect, identify and locate faults in the eighth-order lowpass filter. The experiments determined the diagnostic efficiency and scalability of rough sets, which were successfully used to the diagnostics of smaller systems.

2 - Epileptic Seizure Prediction Using Classification Methods
Kumaraswamy Ponnambalam, University of Waterloo, 200 University Ave, Waterloo ON, Canada, ponnu@uwaterloo.ca, A Doriai

Epilepsy is a serious neurological disorder that is characterized by recurrent unprovoked seizures caused by an imbalance in the central nervous system. With early and accurate detection of seizures, doctors can gain valuable time to administer medications and other such anti-seizure countermeasures to help reduce the damaging effects of this crippling disorder. The time-varying dynamics and high inter-individual variability make the early prediction of the seizure state a very difficult task. Many studies have shown that EEG signals do have valuable information that, if correctly analyzed, could help in the prediction of seizures in epileptic patients before its occurrence. New algorithms and features are presented here to help clarify, monitor, and cross-validate the classification of EEG signals to predict pre-ictal, inter-ictal, and post-ictal states in the brain.

3 - Module of the Data Processing for the Classification of the Geotechnical Layers
P Bilski, S Rabarjoely

The paper presents the automated module for the soil layers classification. It is based on the supervised and unsupervised learning methods (i.e. graph clustering and decision trees). The geotechnical data obtained from the test fields using the probes (such as Dilatometer or Marchetti Test, where the probe is inserted into the ground) are processed to generate decision rules about the soil categories. The rules are then used on the new measurement data to make decision about the soil type. Two methods of rules generation are applied and their results compared.
2 - The Effect of Media Advertising on Brand Consideration and Choice
Aziz Guergachi, Ryerson University, 350 Victoria Street, Toronto, Canada, a2guergi@ryerson.ca, Puyuan Hosseinzadeh, Peng Sheng
The nature of the effect of media advertising on brand choice is investigated in two product categories in analysis that combines household scanner panel data with media exposure information. We find strong support for advertising effects on choice through the route of consideration set formation.

3 - Using Residuals for Market Segmentation
Chaim Ehrman, Marketing Professor, Loyola University, 820 N. Michigan Ave., Chicago IL, 60611, United States of America, Cehrman@luc.edu
Residuals typically indicate an error with a Regression Line. However, a high negative residual can indicate a Marketing Opportunity. The Regression Line predicted a higher value for the dependent variable, and a marketing campaign can bring the response closer to the regression estimated value. This technique will be demonstrated with a Data Set from a Harvard Business Case.

4 - A Birth-Death Model for the Performance of an EMS System with Re-positioning
Ramon Alanis, University of Alberta, School of Business, Edmonton, AB, T6G 2R6, Canada, ramon@ualberta.ca, Bora Kolfal, Arman Ingolfsson
This paper analyzes a Markovian birth-death model for the behavior of an EMS system, and how it can be used to estimate the distribution of the response time. We validate the model with field data and we demonstrate how it can be used to estimate the effects of changes in repositioning policies.

2 - A Simulation Model for Liver Transplantation
Monali Malvankar, PhD Candidate, Ivey School of Business, 1151 Richmond St N, London, ON, N6A3K7, Canada, mmalvankar@ivey.uwo.ca, David Stanford, Greg Zaric
The liver transplantation wait list in London, Ontario, serves a wider region including parts of Northern Ontario, and shares responsibility for Manitoba. We present a simulation model for operation of the wait list, and use it to investigate the delay impact of factors such as blood type and various patient selection rules.

3 - Scheduling Multi-Priority Patients in the Presence of Patient Preferences
Jonathan Patrick, University of Ottawa, 55 Laurier Ave, Ottawa, ON, K1N 6N5, Canada, Patrick@telfer.uottawa.ca
The allocation of long term care beds is a complex problem due to the non-homogeneity of long term care beds (different facilities and types of bed), the presence of client choice and the need to balance keeping the wait times for community demand short while also controlling the census of patients waiting in the hospital. We present a markov decision model of the scheduling of LTC beds and a simulation model used to compare the MDP policy vs current practice.

Structural Analysis of Systems

Contributed Session

Chair: Ibrahim Mustafa, Mr, University of Waterloo, Chemical Engineering department, DWE, 200 University Avenue West, Waterloo, On, N2L3G1, Canada, ibrahim.mustafa@gmail.com

1 - Structural Analysis of Object-Oriented Designs Using Interpretive Structural Modeling
Sanjay Saini, Dr., Department of Physics and Computer Science, Dayalbagh Educational Institute, Dayalbagh, Agra, UP, 282005, India, sanjay.s.saini@gmail.com, Gursaran Srivastava
Interprettive structural modeling exploits the fact that most complex systems have some form of structure associated with them. In this paper we describe an object-oriented design modeling tool called ISM Analyzer, which provides extensive support in the structuring and analysis of object-oriented designs. The applicability of the tool is described by developing an object-oriented design for a modest application system.

2 - 3D Solids Reconstruction From Measurements Obtained by a Sensor
Miri Weiss-Cohen, Dr., ORT Braude College, Sznuit 78, Karmiel, Israel, miri@braude.ac.il
A comprehensive method for automatically constructing a 3D solid model from orthographic views obtained by a moving sensor is suggested. The views are constructed from sensors in an automatic fashion using estimation techniques. The outcome of the estimation process is a set of explicit contour equations is suitable for creating a 3D model by a graph theoretic approach.

3 - Mathematical Modeling and Bifurcation Analysis of Acetylcholine Neurocycle
Ibrahim Mustafa, Mr, University of Waterloo, Chemical Engineering department, DWE, 200 University Avenue West, Waterloo, On, N2L3G1, Canada, ibrahim.mustafa@gmail.com, Ali Elkamel, Gamal Ibrahim, Said Elnashaie, Pu Chen
The model is proposed to explore the dynamics characteristics of the acetylcholine (ACh) neurocycle. The effects of hydrogen ion, feed concentrations and acetylcholinesterase (AChE) activity on the system performance are studied. It is found that hydrogen ions play an important role, where they create potential differences through the plasma membranes.

When is it actually beneficial to have patients join a queue for health services? We'll examine the "prehabilitation" process for hip/knee arthroplasty. Research shows that if patients are allowed time for functional and medical "optimization" prior to surgery, outcomes may be significantly improved, while some patients often opt to delay surgery for personal reasons. Queuing theory is used to help demonstrate how optimal queue sizes may be determined in these types of situations.

Joint Session Queues/Healthcare: Queues and Congestion in Health Care

Cluster: Queues & Healthcare
Invited Session
Chair: David Stanford, Professor, University of Western Ontario, Department of Statistical & Actuarial Sciences, 1151 Richmond St. N, London, ON, N6A 5B7, Canada, stanford@stats.uwo.ca

1 - Value-Added Waiting: Improving Patient Outcomes with Managed Queues
Sherry Weaver, PhD Student, University of Toronto, 9735 Austin Rd. SE, Calgary, AB, T2J0Z1, Canada, sweaver@ucalgary.ca, Michael Carter
Urban and Regional Transportation Planning

1 - Fareplay: An Examination of Taxicab Drivers’ Response to Dispatch Policy
Mike von Massow, McMaster University, 1280 Main Street West, Hamilton, ON, Canada, vonmassm@mcmaster.ca, Mustafa Canbolat
We explore how individual taxi drivers respond to the specific dispatch policy employed and the implications for customer wait times. We show that there may be equitability dispatch policies that reduce driver wait. We suggest the creation of ‘super zones’ with secondary queues to reduce the incentive to wait at the boundary between zones. This research is, to our knowledge, the first to explicitly address the strategies of drivers in response to a dispatch policy.

2 - Curbside Parking Time Limits
John Rowse, Professor of Economics, University of Calgary, 2500 University Drive NW, Calgary, AL T2N 1N4, Canada, rowse@ucalgary.ca, Richard Arnott
We investigate the economics of curbside parking time limits with a stylized model of downtown parking and traffic congestion exhibiting curbside (onstreet) parking, more expensive offstreet garage parking, and heterogeneity in driver parking duration and driver value of time. We find that imposing a curbside parking time limit subsidizes short-term onstreet parking while eliminating or reducing socially wasteful driver cruising for parking.

3 - A Mixed Integer Programming Model to Help in Decision Making Towards Low Emission Transportation
Amir Hajimiragha, University of Waterloo, 200 University Avenue West, Waterloo, Canada, ahajimir@uwaterloo.ca, Ali Elkamel, Michael Fowler, Claudio Canizares
Plug-in Hybrid Electric Vehicle (PHEV) is an emerging vehicle technology that integrates the electric power and transport sectors. The surplus effective generation capacity of Ontario’s electricity network is suggested to be utilized for charging the batteries in PHEVs. A developed mixed integer linear programming model to find the maximum possible number of PHEVs in Ontario is presented. The model is illustrated through a representative case study.

IT-Governance: A Negotiation Approach
Ana Paula Cabral, Assistant Professor, Federal University of Pernambuco, Cidade Universitaria, Recife, PE, 50910-470, Brasil, apcabral@ufpe.br, Danielle Morais
This paper presents a negotiation model in the context of IT Governance. The proposed negotiation model was applied in one of the phases foreseen in the IT Governance model is the design of IT relational architectures, which is considered as the base for implementing the others. Precisely at this moment that the form of relationship will be established between the IT function and the other functions of the organization.

The VFT Methodology Applied to Environmental Problems in the Buildings Sites
Luciana Alencar, Federal University of Pernambuco, Rua Manoel Bezerra, 197, Madalena, Recife, Brazil, alencarlih@gmail.com, Caroline Moita, Marcelo Alencar
It is each time greater the interest to find solutions that attend the professionals and, at the same time, that decrease the impact in the environment. With the aim to structuring and provide support to environmental problems related to the waste generated by a construction project in a building site, the Value Focus Thinking (VFT) methodology was applied. There were many decision-makers (DMs) involved in the process, being necessary many interactions across the stages of the methodology.

A New Preference Aggregation Technique for Reaching a Consensus Decision in a Water Utility Context
Suzana F Dantas Daher, Federal University of Pernambuco, R. Margina Pontual 147/ 401A, Boa Viagem, Recife, PE, 51021510, Brazil, sfdd@uol.com.br, Adiel Teixeira Almeida
Considering traditional unique synthesis criterion approaches, decision makers have to deal with problems caused by the compensatory effect when their individual preferences are aggregated. Conflicts may emerge in such situations. Using an investment problem for a Water Utility, a new preference aggregation technique is proposed. For that different metrics are introduced: the similarity degree and the magnitude of the projection of one vector onto another using a vector model.
1 - A New Group Decision Approach: The Yonnenkai System Method

Norio Okada, Professor, DPRI, Kyoto University, Research Center for Disaster Reduction S, Uji, Kyoto University, Gokasho, Uji, Kyoto, 611-0011, Japan, okada@drs.dpri.kyoto-u.ac.jp

Jong Il Na, Liping Fang

The Yonnenkai system method is presented as an effective group decision making approach. The Yonnenkai method consists of the following steps: carrying out a SWOT analysis, completing the Yonnenkai chart, debating between groups, and presenting the group action plan. Comparisons with other group decision making methods are discussed.

2 - Collaborative Action Planning for Community Disaster Reduction Using the Yonnenkai System Method

Jong Il Na, Kyoto University, Graduate School of Engineering, Gokasho, Uji, 611-0011, Japan, njworld@drs.dpri.kyoto-u.ac.jp, Norio Okada, Liping Fang

The Yonnenkai system method is presented as an approach for developing collaborative actions for community disaster reduction. The case study carried out in a community in the city of Kyoto demonstrates the method’s usefulness and effectiveness in making a collaborative action plan for a local community’s disaster preparedness and mitigation.

3 - Experimental Study on Negotiation Process in Participatory Decision Making Process in Communities

Hiroyuki Sakakibara, Associate Professor, Yamaguchi University, Ube, Japan, sakak@yamaguchi-u.ac.jp

Participatory decision making process is necessary to solve local problems in a community. On the other hand, participants involved in such process have different concerns, and a conflict between participants can occur. Therefore, it is necessary to coordinate negotiation between participants appropriately. In this paper, game experiment is designed to analyze people’s behaviors in negotiation process. Win-Win situation, Trade-off situation and Unilateral situation are assumed.

4 - Psychological Variables Underlying Cooperative Behavior Toward Local Community

Satoshi Fujii, Professor, Tokyo Institute of Technology, Japan, fujii@plan.cv.ittech.ac.jp, Tsuyoshi Hatori, Tetsushi Suminaga

The problems of local community contain typically a structure of social dilemmas where individuals have to choose between cooperative behavior that promotes collective benefit and defective behavior that promote individual benefit. In this study, we implemented a survey to investigate psychological variables underlying such cooperative behaviors. The data analysis indicated that moral obligation and perceived benefit regarding cooperation were direct important variables underlying the cooperative behavior.

2 - A Combined Procedure for Selecting the Best Simulated System

Mahmoud Alrefaei, Associate Professor, Qatar University, Department of Math and Physics, P.O. Box 2713, Doha, Qatar, malrefaei@qu.edu.qa

We consider the problem of selecting the simulated system with the best performance measure for large scale problems. The idea is to sample the design space and then search for the best. We present a sequential procedure that combines the simulated annealing with constant temperature to sample the design space with ranking and selection procedures to search for the best with a pre-specified confidence level. We also present extensive numerical evaluation for testing the combined procedure.

3 - Introducing A Novel Activation Function For Back Propagation Neural Networks

Hamed Hasheminia, PhD Student, Sauder School of Business (UBC), Box 226-2205 Lower Mall, Vancouver, BC, V6T1Z4, Canada, hamed.hasheminia@sauder.ubc.ca, Hessam Bavala

This paper introduces a novel activation function for BP NNs. The learning speed of this activation function is significantly faster than all well-known ones. To prove learning performance of this activation function a unique statistical experiment is developed. This method not only established a unique tool for measuring and comparing the learning speed of different activation functions but also showed in what order of magnitude it is faster than its well-known and widely accepted rivals.

4 - Optimal Software Testing and Maintenance via Neural Networks

Abdessamad Ben Hamza, Concordia University, 1515 Ste-Catherine Street West, EV7.631, Montreal, QC, H3G 2W1, Canada, hamza@ciise.concordia.ca

We present a novel stochastic discrete-time model to tackle the problem of optimal software release and maintenance times based on fault correction processes, which takes into account not only the environmental factor but also the imperfect software defect removal. In the experimental results, we demonstrate how to reliably estimate the joint optimal testing and maintenance policy using real software data.

2 - Teaching an Undergraduate Management Science Course Using a Mobile Computer Lab

John Wilson, Ivey School of Business, University of Western Ontario, London, Canada, jwilson@ivey.ca

Feedback from employers, faculty, and students indicated that our required third-year B. Comm. management science course was not successful in teaching applied or even basic spreadsheet modeling skills. To improve students’ understanding and retention, we implemented a mobile computer lab in a regular classroom. We discuss the classroom logistics, lab configuration, and the impact on student learning, including examples which allowed students to “discover” management science techniques.

3 - An Integrated Approach to Statistics for MBA’s

John Wilson, Professor, University of Western Ontario, Richard Ivey School of Business, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, jwilson@ivey.uwo.ca

As part of an integrated MS course, we have successfully introduced statistical concepts through cases. The approach has been to present a general management problem, invite discussion before introducing sophisticated techniques, then have the students into seeing why the methodology can be of great use in assisting with management cases. This approach is different to the traditional one where techniques are introduced and then applied and secures “buy-in” even from the weakest students.
1 - A Real Options Approach to Valuing Wind as a Renewable Energy Source
Natasha Kirby, nkirby3@uwyo.ca, Lindsay Anderson, Matt Davison
We value wind as a renewable energy source using a real options approach. Generation companies who provide wind power to the system face risk due to uncertain future wind speed and electricity prices, and there is optionality in making certain operating decisions based on power price, wind speed and storage options. We examine historical data, then bootstrap to make future predictions based on our simple model. We also discuss a PDE approach to solving the optimal control problem.

2 - Long-Term Electricity Market Equilibrium Taking into Account Wind Power Uncertainty
Majid Oloomi, Department of Electrical and Computer Engineering, University of Calgary, Calgary, AB, Canada, moloomi@ucalgary.ca, William Rosehart, Hamidreza Zareipour
This work examines how the intermittency of wind power will affect the long-term market equilibrium. A Load Duration Curve (LDC) and a probability density function (pdf) of wind power are combined to construct the Equivalent LDC. An agent based market model is used to determine market equilibrium for the ELDC. To examine the effect of wind uncertainty on market equilibrium, variance and mean of wind power are changed and the behavior of market equilibrium is observed using a test system.

3 - Optimizing the Amount of Wind Capacity in Competitive Electricity Markets Using Complementarity Programming
Paul Dabrowski, Department of Mechanical and Industrial Engineering, University of Toronto, ON, Canada, paul.dabrowski@utoronto.ca, Scott Rogers
We describe a model for wind capacity expansion in imperfectly competitive electricity markets that uses complementarity programming. WCAPCOMP 1.0 represents a single-price wind capacity market (where gencos can purchase wind capacity) and separate single-price electricity market (where gencos can sell output). All gencos behave strategically, anticipating how other gencos will react to their decisions in each market. We illustrate this approach with an application to an "Ontario-like" system.

DEA Non Profit Applications
Contributed Session
Chair: Walter Garrett, Instructor of Decision Sciences, Saint Louis University, 3674 Lindell Blvd, Suite 417, Saint Louis, MO, 63108, United States of America, wgarrett@slu.edu
1 - The Impact of Competition on Public High School Performance
Julie Harrison, Lecturer, The University of Auckland Business School, Private Bag 92019, Auckland Mail Centre, Auckland, New Zealand, j.harrison@auckland.ac.nz, Paul Rouse
School competition is popularly seen as a way to improve school performance. In the 1990s, with the removal of school zoning, NZ public schools competed with both private schools and each other. A categorical DEA model and regression analysis is used to examine the impact of competition on schools during this period. The results indicate that, longer-term competition could result in the inefficient use of fixed resources, as public school survival is only indirectly related to performance.

2 - Rich and Poor in the Heartland: Performance Characteristics of Public Schools Using a DEA Approach
Walter Garrett, Instructor of Decision Sciences, Saint Louis University, 3674 Lindell Blvd, Suite 417, Saint Louis, MO, 63108, United States of America, wgarrett@slu.edu, N.K. Kwak
Public schools across America are funded using a combination of local direct revenues plus formula-based state and federal funds. There have long been questions about the equity of that approach, and its influence on education quality. This paper uses data envelopment analysis (DEA) to compare efficiencies of the six richest and six poorest school districts in Missouri, using standardized measures of district wealth and performance. The results are related to questions of funding equity.

Optimization of Energy Intensive Systems
Cluster: Large Scale Optimization and Applications
Invited Session
Chair: Ali Elkamel, Professor, University of Waterloo, 200 University Avenue West, Waterloo, N2L3G1, Canada, akkamel@cape.uwaterloo.ca
1 - Incorporating Quality Constraints in the Scheduling Problem of Plastics Compounding
Abdunnaser Younes, University of Waterloo, Department of Chemical Engineering, Waterloo, ON, Canada, ayounes@engmail.uwaterloo.ca, Michelle Leung, Ali Elkamel, Costas Tzoganakis
In plastics compounding plants, quality is ensured by applying the final product to quality control testing. However, quality can be controlled by constraining the extruder flow rate. Hence, we propose to ensure quality of the final product a priori by incorporating it as a constraint in the optimization model. The resulting mixed integer nonlinear model is tested on several examples. Experimental results show that incorporating quality constraints produce different optimal solutions for the same problem.
2 - Optimal Load Scheduling of Cryogenic Air Separation Processes Under Uncertainty
Carl Laird, Chemical Engineering Department, Texas A&M University, MS 3122, College Station, TX, 77843, carl.laird@gmail.com, Yu Zhu
Cryogenic air separation is a large-scale complex process, where inevitable load changes are frequently required because of two main factors: the variability of electrical pricing and uncertain multiple product demands. We develop a novel parallel interior-point solution approach to determine optimal decision-making strategies concerning the trade-off between profitability and customer satisfaction levels.

3 - A Carbon Dioxide Efficient Supply Chain Network
Ali Diabat, Assistant Professor, Assistant Professor, Engineering Systems and Management, MASDAR Institute of Science and Technology (MIST), P.O. Box: 54224, Abu Dhabi, UAE, adiabat@mist.ac.ae, David Simchi-Levi
Elevated atmospheric CO2 concentrations have caused warming of the climate system. The increase in global temperature may have many harmful effects on human welfare and the environment. This risk of global warming has led to the development of carbon trading market with the aim of reducing CO2 emission. In this paper, we present a novel mathematical program that deals with the design of carbon dioxide (CO2) efficient supply chain networks.

Dynamic Programming: Theory and Applications

Chair: Oleksandr Shlakhter, PhD Candidate, University of Toronto, 171 Erskine Ave., # PH1, Toronto, ON, M4P 1Y8, Canada, shlakht@mie.utoronto.ca

1 - An Inventory System with Multiple Demand Classes Differentiated by Treatment for Shortages
Yun Zhou, Department of Industrial Engineering, Tsinghua University, Zijing Building 158121b, Tsinghua, Beijing, 100084, China, stevenzhou05@gmail.com, Xiaobo Zhao
We consider an inventory system serving multiple demand classes. Shortages for some classes are treated as lost sales, while those for the others are backlogged. Replenishment and inventory allocation decisions are made in each period, with a setup cost for replenishment. Structural results such as (s, S) replenishing policy and priority-based allocation policy are derived. We also study a special case for two demand classes and zero setup cost, but with different sequence of events.

2 - A Geometric Framework for Partially Observable Markov Decision Processes
Hao Zhang, Assistant Professor, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, 90024, United States of America, zhanghao@usc.edu
We present a novel framework for analyzing partially observable Markov decision processes (POMDPs). The new approach is based on future rewards, vectors and future policies, which is more parsimonious than the traditional approach based on belief vectors. It reveals the connection of the problem with two computational geometry problems: finding the vertices of a convex hull and finding the Minkowski sum of convex polytopes. This new approach can help solve the POMDP problem more efficiently.

3 - Real Time Dynamic Shortest Path Problem Solution Algorithm Using Wavelets
Kaveh Farokhi Sadabadi, Faculty Research Assistant, Civil and Environmental Engineering Department, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, kfarokhi@umd.edu, Ali Haghani
A formulation for the dynamic shortest path problem is given. Wavelet functions are used to approximate time variant travel times. The approximate problem is a static quadratic program. Using the rolling horizon approach, a solution algorithm for the real time (RT) case is proposed. Performance of the proposed algorithm on experimental cases as well as large-scale networks is demonstrated and discussed.

4 - Acceleration Operators in the Modified Policy Iteration Algorithms for Markov Decision Processes
Oleksandr Shlakhter, PhD Candidate, University of Toronto, 171 Erskine Ave., # PH1, Toronto, ON, M4P 1Y8, Canada, shlakht@mie.utoronto.ca, Chi-Guhn Lee
We study the general approach to accelerating the convergence of the policy iteration method for Markov decision processes with the total expected discounted reward. We establish a class of operators that can be used in combination with a contraction mapping operators to reduce the computational efforts required to perform the policy evaluation. We then propose two such operators, which can be easily implemented as part of the policy iteration algorithm and its variants.
4 - The Moments of the Time of Ruin in Markovian Risk Models
Kaiqi Yu, Postdoctoral Fellow, University of Windsor, Windsor, ON, Canada, kyu@uwindsor.ca, David Stanford, Jiandong Ren
In this talk, we present an approach based on matrix-analytic methods for moments of the time of ruin of risk models. This approach is applicable to a class of rather general Markovian risk models. Based on a sample path equivalent fluid flow of the risk model, we established an algorithm to calculate the moments of the time of ruin, and prove that the algorithm is convergent. As examples show that the proposed approach is programmable and computationally stable.

■ WC09
Pier 3 - H Conv. Lev.
E-Commerce
Contributed Session
Chair: Lisha Liu, Beihang University, 2-713B, Beihang University, Beijing, China, Beijing, 100191, China, lisa.buaa@gmail.com
1 - Stock Ordering for a Dual Channel Retailer
Mohamed Mahaboob, McMaster University, 1280 Main St W, Hamilton, ON, Canada, mahaboob@mcmaster.ca, Elkali Hassan
We consider a problem faced by a retailer servicing two channels, a web channel and a traditional store channel, from the stock available at the store. We determine the optimal ordering and allocation of stocks between the two channels in a setting where there are two substitutable products.

Peter Ryan, Research Associate, Ryerson University, 350 Victoria Street, Toronto, ON, M5B 2K3, Canada, prayr@ryerson.ca, Wendy Cukier
The “dot-com” bust early in the new millennium left many investors and corporate operations wondering what lessons could be learned from the volatile transition to an e-commerce marketplace. This paper evaluates the role the media had in fostering what Robert Schiller describes as “irrational exuberance” in the marketplace.

3 - Information Sharing Decision and B2B Market Formation
Zhong Wen, Assistant Professor, Tsinghua University, School of Economics and Management, 438 Weilin, Beijing 100084, China, wenzh@secm.tsinghua.edu.cn
In a buyers-suppliers procurement network, buyers may choose to share their suppliers’ information to find more efficient suppliers, by forming a common procurement platform (B2B market). However, a platform that accommodates all suppliers’ information may fail when the buyer resells products to end customers. In a Cournot competition setting, our model shows that the market equilibrium entails a mix of B2B markets and traditional procurement relationships.

4 - An E-commerce Market Growth Model: An Empirical Research in China
Lisha Liu, Beihang University, 2-713B, Beihang University, Beijing, China, Beijing, 100191, China, lisa.buaa@gmail.com, Siqing Shan
In this article, we explored the impact of the growth of e-commerce market based on the theory of economic growth and studied the difference factors between B2B and B2C in the same environment. The factors we identified are investment in ICTs, network infrastructure, globalization, urbanization and internet users. The data is collected from 2001 to 2007 in China. We got some interesting results through empirical research. And these results have never been raised in the previous study.

■ WC10
Salon A - H Conv. Lev.
Routing and Rails
Contributed Session
Chair: Martin Fuchsberger, PhD Student, ETH Zurich, Raemistrasse 101, HG G21.2, Zurich, 8092, Switzerland, martin.fuchsberger@ifor.math.ethz.ch
1 - A Tabu Search for a Deterministic Vendor Managed Inventory Routing Problem
Haihong Xiao, PhD Student, IHEC, School of Management, Paris, 1, Rue de la Libaration, Departement of OM&IT, Jouy en Josas, 78350, France, haihong.xiao@mailhec.net, Laoucine Kerbache, Soumia Ichoua
We propose a tabu search heuristic to solve a deterministic Vendor Managed Inventory Routing Problem. Two methods are applied to find an initial solution: Shortest path (Bertazzi 2002, 2005) and Cluster-First Route-Second. Two types of tabu moves will be evaluated: 1. exchange the sequence of the deliveries between two clients, considering their current roads; 2. exchange two clients between the current roads at the same period.

2 - Solving Reverse Logistics Vehicle Routing Problems
Mingyuan Chen, Professor, Concordia University, Department of Mechanical and Industrial, 1455 de Maisonneuve W, Montreal, H3G 1M8, Canada, mychen@encs.concordia.ca, Sally Kassem
Reverse logistics is a widely acknowledged issue due to increasing public concerns on environment protection and energy conservation. In this work, we address reverse logistics incorporating the model of capacitated vehicle routing with time windows and simultaneous delivery and pick-up. The NP-hard problem was solved using simulated annealing with a heuristic method for generating initial and candidate solutions.

3 - Effective Marshalling at Rail Yards to Mitigate Risk of Derailments Involving Dangerous Goods
Morteza Bagheri, PhD Candidate and Research Assistant, University of Waterloo, Department of Civil Engineering, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, mbeheri@engmail.uwaterloo.ca, Leping Fu, Frank F. Saccamanno
Train derailments involving dangerous goods are important safety concerns. The risk of DG involvement in train derailments can be mitigated through effective placement of DG cars along a train consist. This research proposes a new modeling framework to investigate how the position of DG cars in a train affects its chances of being involved in a derailment. The underlying problem is formulated as a linear integer programming problem and solved using a genetic algorithm based heuristic.

4 - A Vehicle Routing Problem with Pickup, Delivery Time Windows and Coordinated Resources
CKY Lin, Assistant Professor, City University of Hong Kong, Department of Management Sciences, City University of Hong Kong, Kowloon, Hong Kong, China, mslincky@cityu.edu.hk
This study examines a pickup and delivery problem with time windows and two types of delivery resources with possible coordination: a heavy resource may carry both delivery items and one or more units of a lighter resource on its multi-route assignment. The objective criterion is the total cost, comprising the fixed cost and travelling cost of resources. The solution approach is a multi-exchange heuristic based on modifying the shortest path algorithm in a specially designed dynamic network.

5 - Fast Train Scheduling and Dispatching in Main Station Areas
Martin Fuchsberger, PhD Student, ETH Zurich, Raemistrasse 101, HG G21.2, Zurich, 8092, Switzerland, martin.fuchsberger@ifor.math.ethz.ch
We address the problem of generating and maintaining a conflict-free train schedule in main station areas. Our model is based on an integer multi-commodity flow formulation that incorporates the detailed railway topology, dynamics and delays of the trains as well as connection requirements. The resulting integer program is solved with a commercial solver. Tests with data from Berne, Switzerland show that with this model it is possible to find feasible solutions within seconds.

■ WC11
Salon C - H Conv. Lev.
Healthcare Operations Research Applications in the Region of Waterloo
Sponsor: Health Applications Section
Sponsored Session
Chair: Beth Jewkes, Professor, Department of Management Sciences, University of Waterloo, Faculty of Engineering, Waterloo, ON, N2L 3G1, Canada, emjewkes@uwaterloo.ca
1 - A Queueing Model of Ambulance Offload Delays
Eman Almehdawi, PhD Candidate, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, emalmehd@engmail.uwaterloo.ca, Beth Jewkes
Offload delays are common in Ontario, and are a concern to both the public and healthcare providers. The reasons for offload delays are many, most of which are related to downstream congestion in patient care. There are few analytical models available to assist decision-makers with understanding various resource allocation policies. This talk will present a queueing model an EMS-ER system whose results provides insight into how changes in the EMS or hospital system affect offload delays.
Factors affecting the exchange rate of the Chinese currency (RMB) are examined in this paper. In particular, the role of exchange rate determination in the emerging markets is discussed. The paper presents a novel approach to modeling exchange rate movements using multiagent reinforcement learning (MARL). In this approach, the exchange rate is modeled as a dynamic stochastic process, and an RL algorithm is used to optimize the exchange rate over time. The results show that the MARL approach outperforms traditional exchange rate models in terms of accuracy and stability. The paper concludes by discussing potential applications of MARL in international finance and trade.

In addition to the above, the paper also addresses the problem of exchange rate volatility and its impact on international trade and investment. It is shown that exchange rate volatility can significantly affect the attractiveness of foreign investments and the competitiveness of exports. The paper proposes a framework for managing exchange rate risks in the context of global economic integration.

Overall, the paper provides a comprehensive analysis of the factors influencing exchange rate movements, with a focus on the role of MARL in international finance. It is a valuable contribution to the existing literature on exchange rate determination and policy making.
4 - A Modified Apex Game and its Application
Jungsuk Oh, Associate Professor, College of Business Administration, Seoul National University, 599 Gwanangno, Gwanak-gu, Seoul, 151-916, Korea, Republic of, job@snu.ac.kr, Byungwan Koh

There are many markets in which one dominant player possessing essential infrastructure and/or monopoly status and a number of other players providing complementary products and/or services coexist. We formulate such a market as a coalitional-form game. Referring to this as a Modified Apex Game (MAG), we derive its non-cooperative equilibrium outcome configuration and compare it with the outcome predicted by the Shapley value rule.

WC21
Dockside 4 - H Lower Lev.

DEA Applications
Contributed Session
Chair: Mohamed Dia, School of Commerce, Laurentian University, 935 Ramsey Lake Rd, Sudbury, ON, P3C 2C6, Canada, mdia@laurentian.ca

1 - Deployment of DEA for the Effective Measurement and Improvement of Productivity
Kalinga Jagoda, Mount Royal College, Bissett School of Business, Mount Royal College, Calgary, AB, T3E6K6, Canada, kjagoda@mtroyal.ca, Pamini Thangarajah

The rapid changes in oil prices in last five years forced companies to rethink about their manufacturing process. This paper examines application of DEA and revenue management models for measuring and improving of productivity of a Canadian packaging company. The critical success failure factors are also highlighted.

2 - Technical Efficiency of Megaworld Realty Corporation Subsidiaries Measured by a Slack-based DEA
Vicente Reyes, Managing Director, Executive Decisions, 113 Kamuning Road, Quezon City, Metro Manila, 1108, Philippines, vincesreyes@hotmail.com, Noli Hernandez, Babeth Isa Fernando

The research measures technical efficiency scores of 7 Subsidiary Companies of Megaworld Realty Corporation for years 2007-2008. Three input-one output slack-based model DEA is employed to calculate overall performance. Findings show that around forty percent of the companies used inputs efficiently while fifty seven percent got the desired output level.

3 - Super-Efficiency Model for Electricity Efficiency in the Philippines
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This paper analyzes the electricity efficiency in the Philippines. Super-efficiency model of the data envelopment analysis (DEA) is a new approach used to identify the best and worst performing electric cooperatives along the best-practice frontier. Empirical results suggest that out of 118 decision-making units, 28% are found to be super efficient and 76% are inefficient. The results have policy implications for the managerial decision-making of these firms and the electricity sector.

4 - A Portfolio Selection Methodology of Stocks Based on DEA
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This research presents a methodology based on DEA for portfolio selection of stocks. Along the steps of the methodology, stocks efficiency ratios are computed; and then a generation of a portfolio is carried out by optimizing the weighted sum of the stocks efficiency ratios. The methodology is illustrated and compared to the Ben Abdelaziz et al. (2007)’s model. It was capable of reproducing similar results while being easier to apply and to understand for practitioners and decision makers.