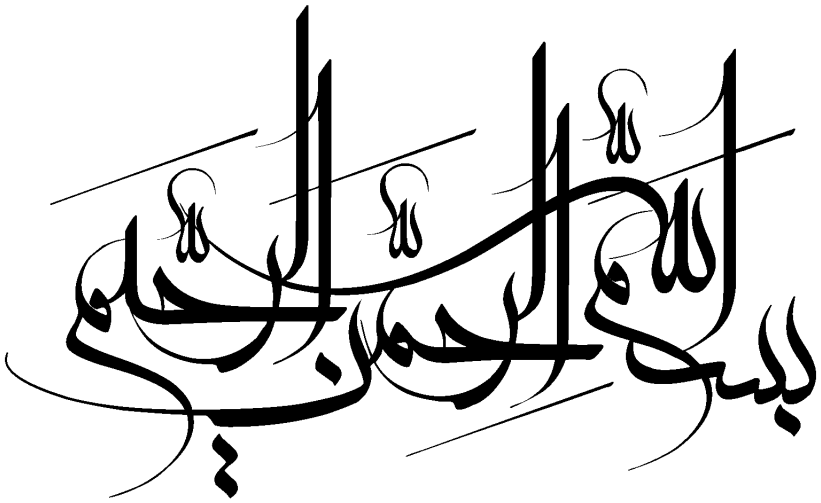

**Book of Abstracts**

**8th International Conference of the Iranian Soceity of**

# Operations Research

**Faculty of Mathematical Sciences**

**Ferdowsi University of Mashhad**

**May 21-22, 2015**

# Contents

## Welcome

We are delighted to welcome you all, participants, students and colleagues to the 8th Conference of the Iranian Operations Research Society. Department of Mathematics at the Ferdowsi University of Mashhad is honored to have been chosen to host this conference, and we hope you have a great time here in Mashhad.

Due to great reception (over 560 registered participants) the scientific committee has decided to widen the scope of the conference by accepting papers in all areas related to OR.

In addition to the 8 plenary speakers, we have 130 oral and 81 poster presentations, which have been chosen from the 318 submitted papers through a systematic review process. Our participants and speakers cover a wide spectrum of universities from across the nation and such countries as China, Australia, Italy, Czech Republic, Sweden, England, and the United States.

A conference such as this one would not be possible to organize without the help of many, but we would like to particularly thank our colleagues Dr.'s Shirin Hejazian, Morteza Gachpazan, Reza Ghanbari, and Ahmad Erfanian for their help. We would also like to express our gratitude to the office of the president of the Ferdowsi University of Mashhad, the Iranian Operations Research Society, and our sponsors for their support.

We hope you enjoy the conference and wish you a memorable stay in Mashhad.

Kazem Khashyarmanesh (Conference Chair)

Hossein Taghizadeh Kakhki (Scientific Committee Chair)

# Author Index

# Technical Sessions, Day 1

# A Diagonalization Based Algorithm for Solving the Generalized Trust Region Subproblem

code: 123
time: 11:30
room: Hall 1

Akram Taati* and Maziar Salahi
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In this paper, we consider the interval bounded generalized trust region (GTRS) subproblem which is the problem of minimizing a general quadratic function subject to an upper and lower bounded general quadratic constraint. Under the assumption that two matrices from the objective and the constraint functions can be simultaneously diagonalizable via congruence, a diagonalization based algorithm is introduced to solve it by showing that GTRS is indeed equivalent to a linearly constrained convex univariate problem. Some numerical experiments are given to show the effectiveness of the proposed method and to compare it with the extended Rendl-Wolkowicz algorithm due to Pong and Wolkowicz.
**Keywords** Generalized trust region subproblem, Global optimization, Diagonalization.

# Network Interdiction Problem with Uncertain Data

Maryam Soleimani-Alyar*
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code: 66
time: 11:30
room: Hall 2

Uncertainty is an intrinsic characteristic of a decision making process. Sometimes there are no samples, and historical data are not enough to estimate an appropriate probability distribution for an uncertain variable. In these situations, uncertainty theory initiated by Liu in 2007 could be a potentially powerful axiomatic framework to manage this sort of uncertainty which is the base of this study. This paper considers the uncertain network interdiction problem that is to minimize the maximum flow through a capacitated network from the source to the sink where the arc capacities are uncertain variables. It is assumed that in the absence of historical data, only the experts' opinion based on his experiences is available to estimate arc capacities.
**Keywords** Network Interdiction; Uncertainty Theory; Bi-Level Programming; Mixed Integer Programming.

# Decentralized Approach in Power Plants Preventive Maintenance Scheduling Problem

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code: 246
time: 11:30
room: Class 1

A decentralized approached is used to solve the power plants preventive maintenance scheduling (PPPMS) problem. Many reasons such as decentralized power system operations, expanding complexity in electricity markets, and an opportunity of solving PPPMS problem faster, support the implemention of this approach in PPPMS problems. The presented method is extends the alternating direction method of multipliers (ADMM) along with several heuristics to mitigate oscillations and traps in local optimality which are the result of non-convexity of PPPMS problem. Due to this distribution, the privacy of commercial data-generating companies is ensured, since it does not require to submit any equipment data to a central agency. Furthermore, subproblems can truly be solved in parallel with minimal need for information exchange in each iteration.
**Keywords** ADMM; decentralized optimization; preventive maintenance; power plant; scheduling.

# Sub Models for Optimal Continuous Cover Multi Species Forestry in Iran

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[2]Faculty of Forest Sciences, Swedish University of Agricultural Sciences, Sweden.
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code: 28
time: 11:30
room: Class 2

Forestry in Iran is based on continuous cover forestry (CCF) management principles. CCF often leads to higher expected present values than rotation forestry (RF) with clear cuts. Furthermore, CCF has environmental advantages of several kinds. Many different species of trees grow together in large parts of these forests in Iran. Mixed species forests give advantages compared to monocultures, such as options to adapt harvesting of different species to changes in market prices, climate, species specific damages etc. In order to optimize multi species CCF in Iran, it is necessary to develop mathematical models for operations research studies that represent the relevant parts of the Iranian forestry planning problem. This presentation includes central components in this modelling process: Forest statistics, growth function estimations and the links to forest harvesting, logistics and the forest industry mills.
**Keywords** Forest statistics; Caspian forest; Dynamic growth models; Optimization; Logistics.

# A Polynomial-Time Algorithm for a Special Class of Complementarity Problems

code: 52
time: 11:50
room: Hall 1

M. Pirhaji*, H. Mansouri and M. Zangiabadi
Department of Applied Mathematics, Faculty of Mathematical Sciences, Shahrekord University, Shahrekord, Iran.
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In this paper, we propose an infeasible interior point algorithm for semidefinite linear complementarity problems (SDLCP). We derive the favorable iteration bound as good as the best obtained complexity bound for this class of problems.
**Keywords** Interior point methods; semidefinite LCP; Complexity analysis.

# Shrinkage Estimation Through Convex Optimization

code: 145
time: 12:10
room: Hall 1

M. Norouzirad*[,1], M. Arashi[1] and A.K.Md.Ehsanes Saleh[2]
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Following least absolute and shrinkage selection operator (LASSO), we define preliminarily, Stein-type shrinkage and its positive part LASSO estimators and propose an algorithm to derive them using the result of [3].
**Keywords** LASSO; Preliminary test LASSO, Stein-type shrinkage LASSO

# Finding and Ranking Efficient Faces in MOLP Problems

code: 355
time: 12:10
room: Class 1

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This paper proposes an approach for finding all efficient faces in MOLP problems. This procedure utilizes the dual of the scalarization weighted sum problem and some mixed integer problems. Then stability of these efficient faces are examined using some parametric MOLP problems. Finally, all efficient faces are ranked using their dimensions and their stability measures.
**Keywords** MOLP; Efficiency; Sensitivity analysis; Ranking; Efficient faces.

# Solving Uncertain Weighted Set Cover Problem Using Uncertain Programming

Mehdi Djahangiri*,[1] and Shahram Morowati-Shalilvand[2]
[1]Azarbaijan Shahid Madani University, Tabriz, Iran
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code: 300
time: 12:30
room: Hall 1

In this paper, the minimum weighted set cover problem with uncertain weights is considered. Taking advantage of some properties of uncertainty theory, $\alpha$-weighted set cover is proposed which is a deterministic model to find uncertain weighted set cover with confidence level $\alpha$. A numerical example is also presented to show the performance of the $\alpha$-weighted set cover model.
**Keywords** Set cover problem; Uncertainty theory; $\alpha$-weighted set cover; Integer linear programming model.

# A Biojective Generalized Minimum Cost Flow Problem

Donya Heydari*, Mobarake Karimi and Massoud Aman
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code: 265
time: 12:30
room: Class 1

In this paper, we present an algorithm to find all extreme efficient solutions for the biobjective generalized minimum cost flow problem. In the proposed algorithm, the parametric generalized network simplex algorithm is used.
**Keywords** Biobjective generalized minimum cost flow problem; Generalized network simplex; Efficient solution.

# Application of Phase-type Distributions in Operating Theatre Rooms in Hospital

Mohsen Varmazyar*,[1], Raha Akhavan-Tabatabaei[2] and Nasser Salmasi[3]
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code: 304
time: 12:30
room: Class 2

Operating theater rooms are simultaneously the largest cost center and the greatest source of revenue for hospitals. Due to significant uncertainty in surgery durations, scheduling of operating theater rooms can be very challenging. To overcome this issue, a versatile family of distributions called phase-type are introduced and their application in operating theater rooms are presented. The Expectation Maximization algorithm is applied to approximate the surgery duration by phase-type distributions. In order to schedule the operating theater rooms with optimizing some measure of effectiveness, a model of patient flow in hospital is considered and the total length of time that a patient stays in operating theater rooms is modeled by general phase-type distributions.

**Keywords** Operating Theater Rooms; Phase-type Distributions; Stochastic Service Time; Sequencing and Scheduling.

# An Applicable Approach for High Order Generalized Derivatives of Nonsmooth Functions Using Linear Programming

Samaneh Soradi Zeid* and Ali Vahidian Kamyad
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*Faculty Member, Ph.D. student s_ soradi@yahoo.com

code: 12
time: 14:00
room: Hall 1

In this paper, We proposed an Extension Definition to derive, simultaneously, the first, second and high order generalized derivatives (GDs) for non-smooth functions, in which the involved functions are integrable but not necessarily locally Lipschitz. We define a functional optimization problem corresponding to smooth functions where its optimal solutions are the first and second derivatives of these functions in a domain. Then applying these functional optimization problems to nonsmooth functions and using this method, we obtain generalized first derivative (GFD) and generalized second derivative (GSD). We extend this approach to obtain generalized high order derivatives (GHODs) of non-smooth functions, simultineously. Finally, to show the efficiency of our approach some numerical examples have been presented.

**Keywords** Generalized Derivative; Smooth and Nonsmooth Functions; Nonsmooth Optimization Problem; Linear Programming.

# the Inverse Eccentric Problem on Trees Under the Hamming Distance

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Department of Mathematics, Faculty of Mathematical Sciences and Statistics, Birjand University, Birjand, Iran.
*Ph.D. student, javadtayyebi@birjand.ac.ir

code: 134
time: 14:00
room: Hall 2

Given a network $G(V, A, \mathbf{c})$, the eccentric node of a node $v \in V$ is the farthest node from $v$ with respect to the edge length vector **c**. The inverse eccentric problem consists of modifying the edge length vector **c** minimally so that a specific node $t$ becomes the eccentric node of another specific node $s$. The length modifications can be measured by different distances. In this paper, the problem under the weighted sum-type Hamming distance is considered when the network is a tree. It is shown that the problem is NP-hard. Then, a polynomial-time algorithm is presented for a special case of the problem.
**Keywords** Eccentric problem; Inverse problem; Hamming distance; Complexity.

# Some New Solution Concepts in Generalized Fuzzy Multiobjective Optimization Problems

Fatemeh Fayyaz Rouhbakhsh* and Hassan Hassanpour
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code: 218
time: 14:00
room: Class 1

Some new concepts of solutions to a fuzzy type general multiobjective nonlinear programming problem are introduced in this research, and two scalarization techniques are presented to obtain them.
**Keywords** Fuzzy multiobjective; Properly M-Pareto optimal solution; Strictly M-Pareto optimal solution ; Scalarization.

# Solving Linearly Constrained Locally Lipschitz Optimization Problems

Zohreh Akbari*
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code: 121
time: 14:20
room: Hall 1

In this paper, we present a nonsmooth trust region method for linearly constrained optimization problems with a locally Lipschitz objective function. Trust region method is an iterative method. In each iteration, the objective function is approximated by the quadratic model. In the quadratic model, the gradient vector is replaced by an approximation of the steepest descent direction. Then we use a null space technique to handle the constraints. Next, we use the CG-Steihaug method for solving the new quadratic model. Finally, using the BFGS updating formula for the Hessian approximation of the model, we show the convergence of this algorithm. This algorithm is implemented in the MATLAB environment.
**Keywords** Trust region method; Lipschitz functions; Linearly constrained optimization; Quadratic local model.

# a Neural Network Model for Solving a Class of Stochastic Optimization Problems

Alireza Nazemi*
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*nazemi20042003@yahoo.com

code: 214
time: 14:20
room: Class 1

This paper presents a new neural network model to solve chance constrained optimization (CCO) problems. The main idea is to convert the chance constrained problem into an equivalent convex second order cone programming (CSOCP) problem. A neural network model is then constructed for solving the obtained CSOCP problem. It is also shown that the proposed model is stable in the sense of Lyapunov and it is globally convergent to an exact optimal solution of the problem. Simulation results show the effectiveness of the method.
**Keywords** Stochastic linear programming, chance constrained optimization, neural network models, stability, convergence.

# An Improved Infeasible IPM for Symmetric Optimization

S. Asadi*, H. Mansouri and M. Zangiabadi
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code: 308
time: 14:40
room: Hall 1

In this paper, we improve the full Nesterov-Todd (NT)-step infeasible interior-point algorithm for symmetric optimization of Gu et al. In each main iteration of Gu et al.'s algorithm, one feasibility and a few centering steps are needed to get feasible iterates for a pair of perturbed problems, close enough to its central path. In this paper, we perform only one full-NT-step in each main iteration of the algorithm. Despite eliminating the centering steps, the complexity bound of our algorithm matches the best obtained one for symmetric optimization.

**Keywords** Infeasible interior-point method; symmetric optimization; Euclidean Jordan algebra.

# Simplex Method for Multiple Objective Linear Programs with Bounded Variables

code: 82
time: 14:40
room: Class 1

Farnaz Salehi Sadaghiani* and Nezam Mahdavi-Amiri
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We develop a multicriteria simplex method for multiple objective linear programs with bounded variables and compute all nondominated basic feasible solutions (extreme points). The approach is based on the usual multicriteria simplex method and the extended simplex method for single objective linear programs with bounded variables.
**Keywords** multiple objective linear programming; bounded variables; extended simplex algorithm; nondominated basic feasible solutions.

# A New Primal-Dual Interior-Point Algorithm for Semidefinite Optimization Based on a Class of Kernel Functions with Trigonometric Barrier Term

code: 226
time: 15:00
room: Hall 1

Morteza Moslemi*
Faculty of Basic Science, Azarbaijan Shahid Madani University, Tabriz, Iran.
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In this paper, we propose a polynomial-time interior-point algorithm for semidefinite optimization based on a new class of specific kernel functions with trigonometric barrier term. The goal of this paper is to investigate such a class of kernel functions and to show that the primal-dual interior-point method has a favorable complexity result. The iteration bound of large-update interior-point method based on these functions is better than the classical primal-dual one, which is based on the logarithmic barrier method.
**Keywords** Kernel function, Interior-point algorithm, Semidefinite optimization, Polynomial complexity, Primal-dual method

# Finding a $2-(k,l)$-Core Of a Tree

Samane Motevalli Ashkezari*
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code: 115
time: 15:00
room: Hall 2

Let $T=(V,E)$ be a tree, with $\mid v \mid = n$ . A 2-$(k,l)$-core of $T$ is 2 subtrees with at most $k$ leaves and with a diameter of at most $l$ where the sum of the distances from all vertices to these subtrees is minimized. At first, we investigate the unweighted 2-(k,l)-core and prove any of 2 subtrees of 2-(k,l)-core is not a vertex. Also we show that, when the sum of the weights of vertices is negative, 2-$(k,l)$-core of $T$ is obtained, by deleting an edge that is connected to a leaf. Then we propose an algorithm for finding the 2-$(k,l)$-core of a tree with pos/neg weights, which is in fact a modification of the one proposed by Becker et al.
**Keywords** Core; Facility location; Median subtree; Semi-obnoxious.

# An Arc-Search Interior-Point Algorithm for Solving the Linear Complementarity Problems

Morteza Moslemi* and Behrouz Kheirfam
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*Ph. D student of Azarbaijan Shahid Madani University, m.moslemi@azaruniv.edu

code: 227
time: 15:20
room: Hall 1

Recently, Yang suggested approximating the central path by using ellipse, and developed an algorithm for linear programming which searches optimizers along the ellipse. In this paper we extend the arc-search interior-point algorithm for solving linear complementarity problems. The algorithm search for optimizers along an ellips to approximate the central path. The algorithm starts from a feasible point in the 2-norm central path neighborhood, close to the central path, uses an arc that passes through the point and approximates the central path. The algorithm searches along the arc to a new point in a larger neighborhood that reduces the duality gap. The process is repeated by finding a better point close enough to the central path in the primary neighborhood. We will show that the algorithm has polynomial complexity bound $O(\sqrt{n}\log(1/\varepsilon))$ which is the best known complexity bound which have been proposed for linear programming and convex quadratic programming.

**Keywords** Arc-search algorithm, Interior-point method, Linear complementarity problems, Polynomial complexity.

# A Genetic Algorithm to Optimize Intermodal Probabilistic Hub Location Allocation Model in Congested Systems

code: 329
time: 15:20
room: Hall 2

Mahdi Rashidi Kahag* , mehdi seif barghi, and Seyed Taghi Akhavan Niaki
*Faculty Member

In this paper, a novel stochastic intermodal P hub median location allocation model is developed in which hub facilities are modeled as M/M/m queuing system. Furthermore, capacity and service time constraints are provided to make to make our proposed problem more realistic. Demand of commodities from origin to destination is random variable. Our proposed model is aimed to maximize probability of not exceeding total costs from its predefined upper bound. Since the proposed model is NP-Hard, a meta-heuristic algorithm called genetic algorithm is proposed to solve it.
**Keywords** intermodal transportation, P-hub median location problem, demand uncertainty, capacity constraint.

# Dynamic Cost Constructiont in Communication Spanning Trees

code: 208
time: 15:40
room: Class 1

Azam Ramezani * and Mehdi Ghiyasvand
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The max + sum spanning tree problem (MSST) is a particular case of the general combined minmax-minsum combinatorial optimization which was solved in $O(mlogn)$. In this paper, the min-max version of MSST is considered. Exact and pseudo-polynomial algorithms are devised to solve the robust subproblems of MSST in general networks under a set of scenarios.
**Keywords** Dynamic network;MSST problem; Min-max critria; Pseudopolynomial;Spanning tree.

# Deterministic Joint Inventory and Pricing Decisions Under the Mixed Bundling Strategy

Salman Jahani* and Mohammad Modarres
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| | |
|---|---|
| code: | 274 |
| time: | 16:30 |
| room: | Hall 2 |

In this paper, a mixed bundling strategy of two products for a retailer who has the monopolistic power in the market is studied. The retailer has to make joint inventory and pricing decisions in order to maximize his profit. Ordering decisions have to be made before the start of selling season. At the start of selling season, the price of each component and a bundle consisting one unit of each individual component has to be defined. In addition, the decision regarding the number of bundles to be offered to the market has to be made. Hence, a mathematical programming model based on the concept of reservation price is proposed in this study. We develop a solution approach based upon the generalized benders decomposition algorithm. In order to accelerate it, a number of integer cuts and valid inequalities are incorporated in the algorithm.

**Keywords** Pricing; Mixed bundling; Mixed-integer non linear programming; Generalized benders decomposition.

# Solution Methods for Scheduling of Heterogeneous Parallel Machines Applied to the Workover Rig Problem

Rahimeh Neamatian Monemi*, Kassem Danach, Shahin Gelareh and Wissam Khalil
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code: 337
time: 16:50
room: Hall 2

We consider a parallel heterogenous machine scheduling problem arising in maintenance planning of heterogeneous wells. This problem particularly arises in the context of workover rig scheduling. The oil wells need regular maintenance to ensure an optimal level of production. After oil production being decreased at some wells, appropriate workover rigs with compatible service capacity are deployed to serve the wells at discrete locations. Every well needs a certain level of maintenance and rehabilitation services that can only be offered by compatible workover rigs. A new mixed integer linear programming model based on the arc-time-indexed formulation is proposed. Then, a heuristic selection type hyper-heuristic algorithm is proposed, which is guided by a learning mechanism resulting in a clever choice of moves in the space of heuristics that are applied to solve the problem. The output is then used to warm start a branch, price and cut algorithm. Our numerical experiments are conducted on instances of a case study of Petrobras, the Brazilian National Petroleum Corporation. The computational experiments prove the efficiency of our hyper-heuristic in searching the right part of the search space using the right alternation among different heuristics and confirm the high quality of solutions obtained by our hyper-heuristic.

**Keywords** workover rig scheduling; arc-time-index formulation; branch, price and cut; hyper-heuristics.

# A Greedy Algorithm for $(d, f)-$ Extended Coloring of Fuzzy Graphs

S. Alipour*, F. Rahbarnia, R. Ghanbari and GH. Abrishami
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code: 241
time: 16:50
room: Class 2

Given a graph $G = (V, E)$, a coloring function is a function $C : E \to N$ such that $C(i, j) \neq C(i, k)$ and $C(i, j) \neq C(l, j)$ for all edges $(i, j), (i, k)$ and $(l, j) \in E$. A $k-$coloring $C^k$ is a coloring function in which no more than $k$ different colors are used. In other words, $C^k : E \to \{1, 2, ..., k\}$. In this paper, we consider $(d, f)-$ extended $k-$ coloring of a fuzzy graph. Analogous to edge coloring given in [V. Ramaswamy and B. Poornima, Edge coloring of a fuzzy graph, AFM, Volume 4, Number 1, 2009, 49 - 58.], we develop an algorithm for determining the $(d, f)-$ extended chromatic number of a fuzzy graph. Our proposed algorithm decreases the number of colors in a $(d, f)-$ extended $k-$ coloring on an example existed in the literature.

**Keywords** Fuzzy optimization, Fuzzy graph, Edge coloring of a fuzzy graph, $(d, f)-$extended coloring of fuzzy graph.

# Technical Sessions, Day 2

# Oil Supply Chain: Planning of a Multi-COMMODITY Oil Transportation Network

Hossein Mostafaei* and Ali Zaghian
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code: 24
time: 8:00
room: Hall 1

Real-life scheduling of large scale oil supply chains appears as a challenging task, which requires efficient supporting tools that can aid the operational decision-making process. This paper looks into the scheduling of a generic oil product transportation system characterized by a multiproduct pipeline that connects several refineries to multiple depots through a mixed integer linear model (MILP). The effectiveness of the MILP model is illustrated by applying it to a real world pipeline system.
**Keywords** Oil supply Chain; Scheduling; Multi-product pipeline; MILP.

# A Multiobjective Invasive Weed Optimization Algorithm to Optimize Multi-Server Intermodal Hub Location Allocation Problems in Congested Systems

| | |
|---|---|
| code: | 324 |
| time: | 8:00 |
| room: | Hall 2 |

Mahdi Rashidi Kahag*, mehdi seif barghi and Seyed Taghi Akhavan Niaki ,
Department of Industrial Engineering, Faculty of Industrial and Mechanical Engineering, Islamic Azad University, Qazvin Branch, Qazvin, Iran.

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a novel multi-objective intermodal hub location allocation problem is presented in this paper in which both origin and destination hub facilities are modeled as M/M/m queuing system. The model is designed to optimize following objectives: 1) Minimizing total costs including transportation and fixed costs and 2) minimizing total system time including waiting, service and idle times in both origin and destination hub nodes. Since the model is strictly NP-Hard, a meta-heuristic algorithm called multi-objective invasive weed optimization (MOIWO) is developed to solve the problem.

**Keywords** Queuing systems, intermodal P-hub median problem, Multi-objective invasive weed optimization.

# Determining the Best Suppliers Using Combinatorial Procurement Auction

Reza Alaei* and Mostafa Setak,
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*Ph.D. student, reza.alaei@yahoo.com

| | |
|---|---|
| code: | 210 |
| time: | 8:20 |
| room: | Hall 1 |

In this paper, a combinatorial procurement auction mechanism is proposed for determining the best suppliers among a set of potential suppliers for a manufacturing company. Through this mechanism, the task of supplying each required item is assigned to only one potential supplier. The corresponding winner determination problem is formulated as a combinatorial optimization problem. However, even finding a feasible solution for the formulated problem is NP-complete. Since exact methods are failed in solving this kind of problems, a problem-specific genetic algorithm is developed to estimate the optimal solution(s) of winner determination problem. The performance of the proposed genetic algorithm is evaluated by solving a set of randomly generated instances of problem. Computational results show that the genetic algorithm performs well in finding feasible solutions and estimating optimal solution(s) of problem instances.

**Keywords** outsourcing; combinatorial procurement auction; winner determination problem; genetic algorithm.

# Scalarization for Properly Efficient Solutions of Fuzzy Multiobjective Programming Problems

code: 195
time: 8:20
room: Hall 2

Fatemeh Soleimani* and Mehrdad Ghaznavi,
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In this paper, we consider fuzzy multi-objective programming (FMOP) problems. We define fuzzy properly efficient solutions of a given FMOP problem. Then, utilizing scalarization techniques, we obtain two sufficient conditions for proper efficient solvtions.
**Keywords** Multi-objective programming; Properly efficient solutions; Convex cone; Fuzzy number.

# Optimal Present Resource Extraction Under the Influence of Future Risk

Peter Lohmander*,
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*Professor Dr, Peter@Lohmander.com

code: 32
time: 8:40
room: Hall 1

The analysis concerns determination of the optimal present extraction of a natural resouce and how this is affected by different kinds of risk in the future. The most general definition of increasing risk, according to Rothschild and Stiglitz, is used. It can be applied to all types of statistical distributions. The approach is much more general than, for instance, increasing variance. The analysis is performed via general function multi dimensional analyical optimization and comparative dynamics analysis in discrete time. It is found that most of the analytical results can be derived via comparative dynamics in a system with three equations in combination with supporting general function analysis. The general analytical results are illustrated via computer solutions to numerically specified special cases.
**Keywords** Optimal stochastic control; Risk; Natural resource management; Forestry; Third order derivatives.

# Interactive Type-2 Fuzzy Multiobjective Linear Programming

code: 149
time: 8:40
room: Hall 2

Hamid Bigdeli* and Hassan Hassanpour,
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An interactive method for solving a type-2 fuzzy multiobjective linear programming problem is presented in this research, which obtains the satisficing Pareto optimal solutions of the problem.
**Keywords** Multiobjective optimization; Type-2 fuzzy set; Fuzzy goal.

# Stackelberg Game Formulation and Eqilibrium of the Interaction Between Shareholders and Employees on Issuing Employee Stock Options

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code: 99
time: 8:40
room: Class 2

This paper models the interaction between the beneficiaries of an employee stock option plan within a Stackelberg game framework. The beneficiaries are shareholders and employees. In the proposed model, shareholders, as the leaders of the Stackelberg game, determine the optimal number of employee stock option grants. In response, employees, the followers of the proposed Stackelberg game, maximize their own profits by determining their own effort level. It is assumed that the stock price follow Geometric Brownian Motion process with a known drift rate and volatility. Also, it is presumed that the drift rate is an ascending function of the employees' chosen effort level. Finally an approach is proposed for finding the Stackelberg Equilibrium' Strategies.
**Keywords** Stackelberg game; Employee stock option; Geometric Brownian motion; Stackelberg equilibrium.

# Scalar Characterizations of Cone-Convex and Cone-Quasiconvex Functions

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code: 21
time: 10:30
room: Hall 1

In this paper we characterize the cone-convex and cone-quasiconvex vector-valued functions in terms of the usual convexity and quasiconvexity of certain real-valued functions, defined by means of some new scalarization functions based on the point-to-set distance.
**Keywords** Cone-convexity; Cone-quasiconvexity; Scalarization functions; Point-to-set distance.

# A New Nonmonotone Truncated Newton Method for the Optimal Control of a Parabolic Distributed System

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code: 16
time: 10:30
room: Hall 2

This paper attempts to present a nonlinear optimization method to find the optimal control of a parabolic distributed parameter system with a quadratic cost functional. This method is based on a discretization of the space and the implicit function theorem to arrive at a finite dimentional problem and then an unconstrained optimization problem. Due the efficiency of the nonmonotone globalization technique for solving nonlinear difficult nonlinear problem, a nonmonotone version of the truncated Newton method is presented to solve the unconstrained optimization problem arised from discretization of the optimal control problem.
**Keywords** Unconstrained optimization;Truncated Newton; Optimal control; Nonmonotone line search.

# Hub and Spoke Network Design Under Uncertainty : a Real Case Study

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code: 6
time: 10:30
room: Class 1

The purpose of a hub location problem is to obtain optimal hub numbers and to allocate non-hub nodes to the hubs. A hub and spoke network design problem is one of the hub location problems. Facility location problems have often vagueness and uncertain properties. In the hub and spoke network design problem, this uncertainty can be in the parameters of demand nods. In this paper, a hub and spoke network design problem under fuzzy random uncertainty is formulated as a fuzzy random hub and spoke network design problem. Then, the proposed problem is converted to deterministic integer programming problems by using fuzzy random chance-constrained programming based on the idea of possibility theory for optimistic and pessimistic decision maker. Finally, a real case study about the air transportation network of Iran is given to clarify described methods. The computational results of study show that these methods can be implemented for the problem with uncertain framework.

**Keywords** Hub and spoke network design; fuzzy random chance-constrained programming; possibility theory.

# Implementation of a Limit-Memory Quasi-Newton Method for Solving Tomographic Imaging

code: 30
time: 10:50
room: Hall 1

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Total Variation (TV) regularization is a powerful technique for image reconstruction tasks such as denoising, in-painting, and deblurring, because of its ability to produce sharp edges in the images. In this paper we discuss the use of TV regularization for tomographic imaging, where we compute a 2D or 3D reconstruction from noisy projections and implement a limit memory $BFGS$ method for solving a TV regularization problem.

**Keywords** Total Variation; Image Reconstruction; Limit Memory $BFGS$; Regularization.

# Optimal Control of a Parabolic Distributed System Via Nonmonotone L-BFGS Method

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code: 17
time: 10:50
room: Hall 2

Optimal control of processes governed by partial differential equations has seen considerable progress in the past decade. The appropriate treatment of such problems requires a fundamental understanding of the subtle interplay between optimization in function spaces and numerical discretization techniques and relies on advanced methodologies from the theory of PDEs and numerical analysis as well as scientific computing. This paper focuses on optimal control problems where the state equation is a diffusion equation and we solve the discretization form of this problem via the nonmonotone L-BFGS method.
**Keywords** Optimal control; Partial differential equations; L-BFGS method.

# A New Approach for Solving Stochastic Interval Programming Problems

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code: 348
time: 10:50
room: Class 1

In many engineering modeling, some of system parameters are not exactly known or can chang under unpredictable influences. Sometimes the ambiguity of parameters can not be described by only random or interval variables. Random interval variables have been introduced to describe the complexity of these variations. To treat the optimization problems that include random interval parameters, stochastic interval programming can be used. In this paper, we present a new approach for stochastic interval linear programming problems (SILP).
**Keywords** Random Interval Parameter, Stochastic Programming, The Expected Value.

# Extrapolation of Relaxed Cutter Operators for Convex Feasibility Problem

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code: 31
time: 11:10
room: Hall 1

The convex feasibility problem is at the core of the modeling of many problems in various areas of science. We present a generalized relaxation of a composition operator which is based on class of strictly relaxed cutter operators on a general Hilbert space for solving convex feasibility problem. This class is important because many commonly used nonlinear operators in convex optimization belong to it. To evaluate the study, we examine a wide class of iterative methods for solving linear equations and use the subgradient projection method for solving nonlinear convex feasibility problems.
**Keywords** convex feasibility problem; relaxed cutter operator; acceleration; convex optimization; subgradient projection

# A Theoretical Measure Technique for Determining 3-D Symmetric Optimal Shapes with a Given Center of Mass

code: 157
time: 11:10
room: Hall 2

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In this paper, a new general approach is proposed for designing the optimal three dimensional symmetric shapes with desired physical center of mass. Herein, the main goal is to find such a shape whose image in $(r, \theta)$- plane is a divided region into a fixed and variable part. Finally, numerical examples are presented and the results are compared to show the advantages of the proposed approach.
**Keywords** Symmetric three dimensional shape; Center of mass; Radon measure; Artificial control.

# Weak and Strong Conditions for Optimality of Multiobjective Programming with Arbitrary Many Constraints

code: 69
time: 11:10
room: Class 1

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This paper deals with a class of multiobjective optimization problems with differentiable data and arbitrary index set of inequality constraints. A suitable constraint qualification and a new extension of invexity are introduced, and the weak and strong Karush-Kuhn-Tucker type necessary and sufficient optimality conditions are investigated.

**Keywords** Optimality conditions; Multiobjective optimization; Constraint qualification; Invex function.

# Computing Symmetric Positive Definite Solutions of Certain Nonlinear Matrix Equations

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code: 48
time: 11:30
room: Hall 1

Symmetric and positive definite solutions to nonlinear matrix equations arise in many practical contexts related to control theory, dynamical programming and finite difference methods for solving some partial differential equations. Here, we propose new iterative algorithms for solving three types of nonlinear matrix equations. Making use of an iterative process for inverse of a matrix, we convert the nonlinear matrix equation to an iterative linear one. In every iteration, we compute a positive definite solution to a linear subproblem and update the unkown matrix using the iterative process. To solve the linear subproblem, we apply our recently proposed error in variables model for computing a positive definite solution to a linear system. We point out our testing results showing that our proposed algorithm converges to a symmetric and positive definite solution in Matlab software environment on a PC, while other methods fail to do so.
**Keywords** Nonlinear matrix equations; symmetric and positive definite solution; inverse matrix approximation; error in variables model.

# Numerical Solution of Fractional Optimal Control Problems with Time Delays

code: 207
time: 11:30
room: Hall 2

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In this paper, a composite Chebyshev finite difference method is introduced and applied for finding the solution of fractional optimal control problems with time delays. The presented method is an extension of the Chebyshev finite difference scheme.
**Keywords** fractional calculus; fractional optimal control; numerical solution.

# the Application of Integrated Models for Finding the Closest Targets with Undesirable Outputs

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code: 257
time: 11:30
room: Class 1

Some inefficient DMUs can't achieve to the best target due to the organizational problems. In recent years, some literatures focused on finding the closest target for an inefficient DMU. Hence, an inefficient DMU need to a less improvement on inputs and outputs. In this paper, we propose an approach to find the closest target for an inefficient unit based on an integrated model that using either minimizing the distance chosen or maximizing the efficiency measure selected will lead to the closest targets. Finally, we test the proposed model on 10 DMUs.
**Keywords** Data envelopment analysis; Efficiency; integrated models; Undesirable outputs.

# Performance Evaluation of the Queueing System at the Emergency Department of Motahari Hospital in Isfahan

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code: 249
time: 11:30
room: Class 2

Emergency Department (ED) is one of the most important wards in every hospital that provides the urgent services to the patients with unstable situation 24 hours a day, 7 days a week. The most serious and largest number of patients of a hospital arrives through ED, therefore, ED performance represents the overall status of the hospital. One of key indicators for ED performance is waiting time to access the care services which can be well analyzed using queueing models. In this paper, Motahari Hospital's ED in Fooladshahr is studied by queueing network model to propose some improvements to its performance.
**Keywords** Emergency Department (ED), Queueing Network, Waiting Time.

# Multi-Part Collection Centers in a Closed-Loop Supply Chain Network Design Under Uncertainty

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code: 130
time: 11:50
room: Hall 2

Supply chain network design is an essential subject to achieve a competitive advantage in today's market. In addition, recycling and recovering of products because of environmental aspects and decreasing of row material consumption is a vital subject. This paper proposes a design of closed-loop supply chain network with considering of multi-part collection centers under uncertainty to obtain minimum environmental damage as well as decreasing total costs. Because of uncertainty nature of related data in the real world, it is essential to use uncertainty approaches in the proposed network. In this regard, we suppose that demand and recovery are defined in stochastic environment. Therefore, we apply a heuristic algorithm of sample average approximation (SAA) to solve the problem. Validity of the proposed model is illustrated through numerical examples. Results show that with consideration of multi-part collection centers, not only recovered products and recycling costs saving are improved but also, customers can receive higher quality products with satisfying of government rules because of environmental damage reduction.
**Keywords** Closed-loop supply chain, Multi-part centers, Stochastic, Sample average approximation.

# Qualifications and Necessary Optimality Conditions for Nonsmooth Semi-Infinite Programming Problems

code: 90
time: 12:10
room: Hall 1

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In this paper, we present several constraint qualifications, and we show that conditions guarantee the nonvacuity of the Karush-Kuhn-Tucker multipliers set for nonsmooth semi-infinite programming problems with mixed constraints. The relationships with various constraint qualifications are investigated. All results are given in terms of the Michel-Penot subdifferential.
**Keywords** Optimality conditions; Semi-infinite optimization; Constraint qualification; Michel-Penot subdifferential.

# A Novel Solution Method for Bilevel Programming Problems with Binary Upper-Level Variables

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code: 84
time: 12:10
room: Class 1

Bilevel programming problems have plenty of practical applications, but are avoided due to lack of efficient solution methods.
In this paper, we exploit the decomposable structure of the problem for designing an efficient algorithm to solve bilevel problems with binary upper-level decision variables. The lower-level variables are assumed to be continuous. The proposed approach is based on Benders' decomposition of the upper-level problem into a master problem and a subproblem which are solved iteratively. If the leader's optimal solution is not considered rational by the follower, a cut is added to the leader's master program that violates the previous solution. The impact of follower's response on the leader's decision is also evaluated by adding another cut, produced by using the follower's optimal objective value, to the leader's subproblem. Some computational results and performance comparisons will be reported.
**Keywords** Bilevel Programming; Benders' Decomposition; Stackelberg Game.

# A Mathematical Model in Production Quota Problem with Convex Cost Function

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code: 176
time: 12:30
room: Hall 1

In this paper, we study a resource allocation and optimization problem arising from some production problems and other investment problems. We apply the incremental solution algorithms in highly restricted form to solve the related mathematical problem. We also apply the algorithms to concrete examples to demonstrate the process and the algorithm complexity.
**Keywords** Production quota; Convex cost function;Optimization; Investment.

# Ranking of DMUs on Interval Data in Two-Stage Processes

code: 283
time: 12:30
room: Class 1

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Data Envelopment Analysis (DEA) aims at assessing the relative efficiency of a number of comparable operating units. In conventional DEA, efficiencies are arranged as a linear order, but in interval DEA, Decision Making Units (DMUs) cannot be easily evaluated and arranged using the calculated efficiency scores. In this paper, we present a method for ranking decision making units (DMUs) with interval data in two-stage processes.
**Keywords** Two-stage; Data Envelopment Analysis; Interval Data; Relative Efficiency.

# Evaluation of VaR Models: DEA Approach

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code: 76
time: 14:00
room: Hall 1

Value at Risk (VaR) models are important part of financial risk management and as a such concerns especially banks and insurance companies. While improper amount of capital would have negative impact on entity performance and might even lead to bankruptcy, application of an improper model could have the same implications. It is therefore natural that there have been many studies. The authors of the paper in their previous research have tested various type of models using standard approaches. By contrast here, we adopt an alternative approach to examine the efficiency of available models, the data envelopment analysis. The results shows some interesting findings and relations among particular models.
**Keywords** Market risk; Value at Risk; Model quality; Data Envelopment Analysis

# Fuzzy Classification Using Linear Programming

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code: 248
time: 14:00
room: Class 1

Among various statistical and data mining discriminant analysis proposed so far for group classification, linear programming discriminant analysis have recently attracted the researchers' interest. This study introduces fuzzy multi-group discriminant linear programming ( fuzzy MDLP) for classification problems. MDLP is less complex compared to other methods and does not suffer from local optima, and fuzzy MDLP overcomes the uncertainty inherently exists during collecting data. The model determines fuzzy boundaries for the groups and finds fuzzy membership grades for the customers, which outperforms the conventional classification methods.
**Keywords** Customer Classification; Multi-group Linear Programming; Fuzzy Linear Programming.

# A New Network Data Envelopment Analysis Model by Balanced Scorecard Approach for Projects Efficiency Evaluation

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code: 291
time: 14:20
room: Class 1

Purpose of this paper is to provide a framework for evaluating the overall performance of decision-making units by means of a data envelopment analysis (DEA) model with balanced scorecard approach. Many papers have regressed nonparametric estimate of efficiency in the four stages DEA procedure. All of these studies have several problems in the benchmark or projection unit and present the DMU with relative efficiency. Most of these papers do not present an efficient benchmark unit and cannot evaluate the relative efficiency unit. In this paper, we review these studies and then create a four-stage model (based on BSC) that does not have these problems. Our model presents the efficient benchmark unit and also, presents DMU with relative efficiency. In the next step we apply our four stage model in Civil projects promoted by the Omran institute in IRAN.
**Keywords** Network DEA; BSC; Efficiency Evaluation.

# A New Super-Efficiency Model in the Presence of Negative Data

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code: 147
time: 14:20
room: Class 2

In a recent paper by Vencheh and Esmaeilzadeh, a super-efficiency model based on RDM model is formulated where some input and output data are negative. However, we show that the formulation in the paper is not always feasible or bounded for its purpose and cannot produce the numerical results claimed. Moreover, we demonstrate that the super-efficiency model based on RDM model is unable to provide a super-efficiency measure in some cases. To deal with this drawback we propose a new model, which is always feasible, to rank the DMUs in the presence of negative data.
**Keywords** DEA; Super-efficiency; Negative data; RDM model

# A Modified SBM-NDEA Approach for the Efficiency Improvement in Bank Branches

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code: 369
time: 14:40
room: Hall 2

In this study an envelopment form of NDEA model is used for efficiency measurement of bank branches. So, a slack based NDEA model introduced by Tone and Tsutsui (SBM-NDEA) is nominated for its mathematical model. But according to the new categorization of the efficiency measurement factors introduced in this paper and also regarding some previous reviews on SBM-NDEA model, the model will be modified to include desired properties.
**Keywords** Data envelopment analysis; network DEA; SBM-NDEA model; bank branches.

# Measuring the Overall Efficiency of Units with Adaptable Factors via Data Envelopment Analysis

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code: 59
time: 14:40
room: Class 1

In conventional data envelopment analysis (DEA) models, the role of each variable (i.e. input/output) is certain. Nevertheless, in real world, there are situations that a measure can play both input and output roles. In this paper, these measures are defined as adaptable measures. At first, the efficiencies of decision making units (DMUs) from two viewpoints, optimistic and pessimistic, are evaluated where adaptable variables present. Then, the efficiencies are integrated by using the geometric average. A numerical example is used to illustrate the approach.

**Keywords** DEA; efficiency; adaptable factor; input/output.

# A Complete Ranking of DMUs Based on $\alpha-$Efficiency in DEA with Imprecise Data

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code: 152
time: 14:40
room: Class 2

The Imprecise inputs and outputs in Data Envelopment Analysis (IDEA) is a topic that has attracted attention of many researchers. Our view of the ambiguity in the data focus on fuzzy relation. We introduce a fuzzy monotonicity assumption and construct a fuzzy production possibility set (FPPS) with varying degrees of feasibility. Using the tolerance approach a nonsymmetric fuzzy linear programming model and subsequently a parametric DEA model are constructed. By applying this model, it will be seen that, for a specific and small tolerance of constraints, the efficiency scores are made more various. Hence, we have a complete ranking of DMUs only based on the $\alpha-$efficiency scores.

**Keywords** Imprecise data envelopment analysis; Fuzzy relation; Production possibility set; Ranking

# A Novel Feedback Neural Network for Solving DEA Problems

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code: 91
time: 15:00
room: Hall 1

Data Envelopment Analysis (DEA) is one of the non-parametric approaches for evaluating efficiency. This paper presents a feedback neural network model for solving DEA models. By applying a suitable Lyapunov function, it is shown that the proposed neural network is Lyapunov stable and convergent to an exact optimal solution of DEA models. A numerical example is provided to show the applicability of the proposed method.
**Keywords** Data envelopment analysis; Neural network; Linear programming; Lagrangian function.

# Efficiency Using Neural Networks and DEA-R

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code: 293
time: 15:00
room: Hall 2

The DEA based on an analysis of fraction (DEA-R) we are looking for DMU (Decision Making Units) efficiency, also considering the prices of inputs (costs), efficiency of costs are calculated. Estimates of production function in the DAE-R, have some weak points. The neural networks in this regard, with repetition, training and use of multilayer networks are useful. In this article, using DEA-R models and neural networks, scale efficiency and performance cost are calculated on the Stock Exchange 250.
**Keywords** DEA-R; Neural network.

# Data Envelopment Analysis Models in the Presence of Ratio Data and Non-Discretionary Factors

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code: 174
time: 15:00
room: Class 2

The traditional data envelopment analysis(DEA) models for the observations containing ratio data as input and/or output may result incorrect efficiency scores. To overcome this shortcoming, a set of modified DEA models has been presented in the literature taking into account the correct convexity of decision making units (DMUs) when a ratio variable is included in the assessment model. The objective of the present paper is to propose a novel set of generalized DEA models for measurement of relative efficiencies of DMUs in the presence of ratio data and non-discretionary factors. The generalized models integrate the previous approaches for dealing with
**Keywords** Data envelopment analysis; Efficiency; Non-discretionary factors; Ratio data; Convexity.

# Efficiency Analysis in Two-Stage Network DEA: A Slack-Based Measure

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code: 120
time: 15:20
room: Hall 2

Data Envelopment Analysis evaluates the efficiency of decision making units via a mathematical programming model, while considering the production process of the units as a black box. However, considering the internal structure of the units, network DEA models have been proposed. In this paper, we present a network DEA model for efficiency analysis in a two-stage production process which is based on collaboration between the two sub-units. The proposed model can also be applied for benchmarking.
**Keywords** DEA; efficiency; improved unit.

# An Application of Three Level Taguchi Orthogonal Arrays for Solving the No–Wait Flow Shop Scheduling Problem

code: 53
time: 15:40
room: Hall 1

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A genetic algorithm (GA) is introduced for the no-wait flow shop scheduling problem (NWFSP) by Tseng et. al [**?**]. In their algorithm, Taguchi method is introduced as a crossover operator. In fact, in this paper, we compare the performance of $L_8(2^7)$ that is common and used their algorithm and $L_9(3^4)$ as a crossover approach with six and three cut points. Comparison of the results shows that the new method for crossover operators are effective and it is efficient and competitive method for solving no-wait flow shop problem.

**Keywords** Scheduling; Flow shop; No-wait flow shop; Taguchi orthogonal arrays.

# Central Resource Allocation in DEA$_R$ Models

code: 315
time: 15:40
room: Class 1

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In this paper the central resource allocation models based on DEA fraction analysis are suggested. DEA_R resource allocation models are proposed in radial and non-radial modes and results of DEA models are compared. In case of multiple inputs and one output and vice versa the solutions of DEA_R are equal with DEA models. And in case of multiple inputs, multiple outputs in the input oriented DEA_R are efficiently greater than or equal to similar models in DEA.

**Keywords** DEA, DEA_R.

# Supply Chain Coordination with Buyback Contract in Uncertain Environment

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code: 54
time: 15:40
room: Class 2

Some products have remarkable short life cycles and experience considerable price drops afterward. Due to this phenomenon in this type of commodities, incentive contracts are usual exercises, especially in the high-tech industries. Increasing innovation in such industries in addition to the uncertain characteristics of market demand may prevent the retailers to order not too much of a product to satisfy the market demand. In this paper, the effect of buyback contract in supply chain coordination is considered using the uncertainty theory introduced by Liu in 2007. This contract is intended to potentially counterbalance the negative impact of double marginalization outcome.
**Keywords** Supply Chain Coordination; Buyback Contract; Uncertainty Theory.

# Ant Colony Algorithm for the Job Shop Scheduling Problem

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code: 162
time: 16:30
room: Hall 2

This paper presents an ant colony algorithm for solving the well-known job shop scheduling problem which is a typical NP-hard problem. In order to initialize the pheromone trails, a novel mechanism is employed based on an initial sequence. Moreover, the pheromone trail intensities are limited between lower and upper bounds dynamically modified. An artificial ant constructs a complete solution by iteratively applying a pseudo-stochastic rule based on the pheromone trails. A local search is then performed to improve the performance quality of the solution. The computer simulations were made on a set of benchmark problems and the results demonstrated the effectiveness of the proposed algorithm.
**Keywords** Job shop; scheduling; Ant colony optimization.

# A Migrating Birds Algorithm for the Travelling Salesperson Problem with Hotel Selection (TSPHS)

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code: 237
time: 17:10
room: Hall 1

In this paper a new metaheuristic solution is designed to solve the travelling salesperson problem with hotel selection (TSPHS). The applied solution approach is based on the V flight formation of migrating birds. Different numerical analysis confirms that it is efficient enough for solving the problem in a reasonable computational time. To check the efficiency and suitability of the solution algorithm, results of exact solution method solved by commercial software for small instances are compared with results of the applied metaheuristic algorithm. The comparisons confirm that the developed algorithm is capable to find near optimal solutions for the TSPHS. By doing more numerical analysis we concluded the trip duration will decrease by increasing of available hotels. It also decreases if there is permission for over time working by travelers.
**Keywords** TSPHS; hotel selection; migrating birds algorithm; new metaheuristic.

# The Pick up and Dlivery Poblem with Cross Docking Considering Customer Preference Time Window (PDCDPTW)

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time: 17:10
room: Class 1

Cross docking is a distribution policy that enables the consolidation of freight from origins to destinations. In a cross dock, freights are unloaded from inbounded trucks and directly reloaded to out-bounded trucks without long storage in it. In this paper we introduce a pickup and delivery problem with cross docking and customer preference time window (PDCDPTW) that considers a preference time window (PTW) inside of a hard time window (HTW). The preference time window is the time window in which customers incline to receive their demands. Deviation from preference time window are allowed but these deviations are accounted for in the objective function. We propose a mixed integer programming model for this problem to minimize transportation cost with maximum customer satisfaction. Real instances of data sets are used to check performance of the proposed model. The results confirm better customer servicing.
**Keywords** Cross docking; Vehicle routing; Preference time window; Pickup and delivery.

# Poster Presentation, Day 1

# A Multi Objective Linear Programming Approach for Sustainable Plantation

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code: 25
time: 11:30
room: Hall B

Multi objective linear programming or goal programming technique was used in order to determine the optimal forest plantation in north of Iran. The objective was maximizing net present value, number of labor and carbon sequestration. Required data including growth, stumpage price, carbon sequestration and number of labor was collected. Regression analysis was used to derive growth models. Expected mean price was estimated using wood price and variable harvesting costs. LINGO software was used for analysis. Results indicated that the optimal plantation for oak, ash and loblolly pine are 149.37, 136.72 and 206.20 ha, respectively.
**Keywords** Multi objective linear programming; sustainable forest plantation; carbon sequestration.

# Economic-Statistical Design of VSSI-MEWMA-DWLControl Chart with Multiple Assignable Causes Using Genetic Algorithm

code: 45
time: 11:30
room: Hall B

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Desirable properties of the multivariate exponentially weighted moving average (MEWMA) control chart such as the ability to detect small shifts in the process parameters have been caused that the MEWMA has been received significant attention from researchers in recent years. This paper proposes an economic-statistical design (ESD) model of the variable sample size and sampling interval (VSSI) MEWMA control chart by using double warning lines (DWL) by considering multiple assignable causes based on Lorenzen and Vance cost function and multivariate Taguchi loss approach. Due to the complexity of the model a genetic algorithm is designed as an optimization technique. A numerical example is provided to illustrate the performance of the model and the solution approach.
**Keywords** MEWMA control chart; VSSI; DWL; ESD; Genetic algorithm.

# Solving MADM Problems in Intutionistic Fuzzy Environments Based on Combining Choquet Integral and TOPSIS Methods

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code: 55
time: 11:30
room: Hall B

In some Multi Attribute Decision Making (*MADM*) problems, *TOPSIS* and Choquet Integral (*CI*) methods , are used to rank or choose the best alternative, individually. In this paper, to gain the advantages of these methods, we combine them and propose a new hybrid method for aggregation of intuitionistic fuzzy-valued information in *MADM* problems. First, some definitions and preliminaries are defined. Then, we'll define a new method for aggregation of Intuitionistic Fuzzy Numbers (*IFNs*) based on *TOPSIS* and *CI* which is called *TOPSIS-CI*. It is caused to interdependent or interactive characteristics among the decision maker's preference criteria are considered. Finally, this method is illustrated by numerical example.
**Keywords** Choquet Integral, Distance Functions, Intuitionistic Fuzzy Numbers, Fuzzy measure.

# Bee Algorithm for Solving an Inverse Parabolic System

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code: 153
time: 14:30
room: Hall B

In this paper a numerical approach combining the least squares method and bee algorithm is proposed for the determination of the source term in an inverse parabolic system (IPS). A numerical experiment confirm the utility of this algorithm as the results are in good agreement with the exact data. Results show that a reasonable estimation can be obtained by the bee colony algorithm within a Intel(R) core(TM) i3 cpu with 2.20 GHz.
**Keywords** Bee algorithm, The least squares method, Inverse parablic system.

# An Optimal Model of Inventory Positioning for Multi-Echelon Supply Chain Networks

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code: 275
time: 14:30
room: Hall B

One of the important key of the supply chain performance is its service level which is directly can be affected by variable demands, lead times, traveling times and production times. For this reason, we need to stock the inventory in order to meet costumers demand at the particular time. The focus of this paper is on inventory positioning based on the given configuration of the supply chain, especially for multi-echelon networks, to minimize the holding costs. Inventory positioning policy allows the supply chain to be responsive to uncertainty and variability. Therefore, the main challenge in the inventory positioning field of study is about the question of where and how much inventories should we stock in the supply chain stages to face the uncertainty. The structure of this work is that we first address the problem and the existing approaches which are known as stochastic-service and guaranteed-service models, and then introduce the assumptions and notations of the proposed optimization model as well as the constraints in order to find the best positions of inventory to be stocked at the minimum holding costs.
**Keywords** supply chain network; inventory positioning; stochastic-service model; guaranteed-service model; base-stock inventory.

# Solving the Problem of Gate Assignment to the Flights Using a Modified Shuffled Frog Leaping Algorithm

code: 118
time: 14:30
room: Hall B

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Gate is one of the most important sources in an airport. Gate assignments to the flights have influence on passengers' satisfaction, air traffic, increasing agencies performance; flights delay time and airport expenses. Something that complicates assignment problem is those unexpected changes in which the best gate reassignment should be done as soon as possible. Most of studies on gate assignment are based on mathematical models and since assignment of $M$ gates to $N$ flights has $M^N$ possible cases, it is included in an NP-hard problem. It means in order to solve problem, meta-heuristics should be applied.
**Keywords** Gate assignment; Meta-heuristics; Frog Leaping algorithm.

# Solving Inverse Heat Conduction Problem by Nelder-Mead Simplex Search Method

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code: 124
time: 14:30
room: Hall B

In this paper Nelder-Mead(NM) simplex search method combines with least squares method for the determination of temperature in an inverse heat conduction problem (IHP). The performance of NM is established with an examples of IHP.
Numerical results are obtained by implementation NM on 2.20GHz clock speed CPU.
**Keywords** Nelder-Mead simplex search method, The least squares method, inverse heat conduction problem.

# A Numerical Study on Optimization of PMEDM Process Parameters for Ti-Co Alloy Using Genetic Algorithm

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code: 366
time: 14:30
room: Hall B

Nowadays, electrical discharge machining (EDM) has become one of the most extensively used non-traditional material removal process. In the present work, a study has been made to model and optimize the process parameters of powder mixed electrical discharge machining (PMEDM). Metal removal rate (MRR) and electrode wear rate (EWR) have been considered, as the process characteristics, to plan and analyze the experiments. Grain size of the aluminum powder (S), concentration of the powder (C), discharge current (I) and pulse on time (T) are chosen as control variables to study the process performance. The experimental results are used to develop the regression models based on second order polynomial equations for the different process characteristics. Then, a genetic algorithm (GA) has been employed to determine optimal process parameters for any desired out put values MRR and EWR.
**Keywords**

# Poster Presentation, Day 2

# Robust DEA Under Discrete Uncertain Data: An Application for Iranian Hospital Emergency Departments

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| code: | 198 |
| time: | 11:30 |
| room: | Hall B |

This paper presents a Data Envelopment Analysis (DEA) model with uncertain data for performance evaluation of the emergency department in Hospitals. The application of mathematical programming models in the important case study such as considering efficiency of emergency departmentis main contribution to this study.The paper used model basis of DEA with 4 scenarios for calculating the efficiency of 6 hospitals in Tehran.The result from the model indicates that 2nd DMU (hospital number 2) has better performance compared with other hospitals' ED.

**Keywords** Robust DEA (RDEA); Discrete uncertain data; Healthcare; Emergency department (ED).

# Qualitative and Quantitative Evaluation of R&D Projects Applying a Hybrid Grey BSC–DEA Approach

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room: Hall B

Prioritization of research and development (R&D) projects is of paramount importance due to their outstanding role in the durability of businesses. It is necessary for a thriving business to define its R&D activities in concordance with its strategic tendencies and objectives. Hence, it is necessary for R&D projects to be evaluated and prioritized according to the business strategies. Balanced scorecard (BSC) is a potent tool to define the evaluation criteria based on strategic preferences. Thereafter, the evaluation process could proceed with data envelopment analysis (DEA) method to evaluate the candidate R&D projects according to the BSC-defined criteria. Based on this, the present research is designed to evaluate the R&D projects in a banking system utilizing BSC–DEA approach. In addition to the approach ability to accord with strategic preferences, it is empowered to cope with three more technical complexities, i.e. the DEA model is capable of: embedding ordinal and interval data as nondeterministic subjective viewpoints as well as cardinal data into the model; weighing different significance levels of BSC perspectives; possessing enough discriminatory power in the presence of abundant criteria. The four features mentioned in the preceding statement are the main contributions of this research.

**Keywords** Balanced scorecard; Research and development; Efficiency; Data envelopment analysis; Grey theory.

# Efficiency Measure by Generalized Fuzzy Data Envelopment Analysis Model

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code: 205
time: 11:30
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Data envelopment analysis (DEA) is a non-parametric technique to measure the efficiencies of a set of decision making units (DMUs) with common crisp inputs and outputs. In real-world problems, however, inputs and outputs typically have some levels of fuzziness. To analyze a DMU with fuzzy input/output data, previous studies provided the fuzzy DEA (FDEA) model and proposed an associated evaluating approach. Nonetheless, numerous deficiencies must be improved in mentioned models. Therefore, the present paper proposes a generalized FDEA model for evaluating efficiency which can evaluate SDMU and the traditional FDEA model.
**Keywords** Data envelopment analysis, Efficiency, Fuzzy linear programming problem, Sample DMU.

# Finding Non-Zero Multiplier Solutions in Data Envelopment Analysis

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code: 231
time: 11:30
room: Hall B

While evaluating decision making units via multiplier $DEA$ models, there exists the possibility of finding multiple optima specially for the $DMUs$ in the relative interior of a face of production possibility set which is not full dimension. With respect to the importance of marginal rates and obtained weights of multiplier models in analyzing sensitivity and robustness of under assessment $DMUs$; we are looking for non-zero solutions in multiplier models. In other words, the more positive the solution components of multiplier models are, the more robust the under assessment $DMUs$ will be. This signifies that by small variations in input and output data of efficient $DMUs$ it still remains efficient.
**Keywords** Data envelopment analysis; non-zero weights; multiplier models.

# Equitable Efficiency in Multiobjective Programming

code: 247
time: 11:30
room: Hall B

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A problem that sometimes occurs in multiobjective optimization is the existence of a large set of efficient solutions. Hence the decision making based on selecting a unique preferred solution is difficult. Considering models with equitable efficiency relieves some of the burden from the decision maker by shrinking the solution set. This paper focuses on solving multiobjective optimization problems by introducing the concept of equitable efficiency.
**Keywords** Pareto; Nondominated; Equitability; Multiobjective programming.

# Performance Evaluation with Data Envelopment Analysis and Balanced Scorecard Approach

code: 338
time: 14:30
room: Hall B

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Purpose of this paper is to provide a framework for evaluating the overall performance of decision-making units by means of a data envelopment analysis (DEA) model with balanced scorecard approach. This paper presents the development of a conceptual framework, which aims to evaluate performance of Saipa Malleable Company. The proposed conceptual framework has two main contributions. Firstly, it determines causal relationship and mutual influence between four perspectives of the balance scorecard (BSC) with the DEMATEL technique. Secondly, it combines two well-known managerial tools, balance scorecard (BSC) as a comprehensive framework for determining Saipa Malleable Company criteria, and data envelopment analysis (DEA) for measuring efficiency.
**Keywords** DEA; BSC; DEMATEL.

# A Bi-Level Programming Formulation and a Hybrid $K$-Means Algorithm for Identifying the Optimal Customer Satisfaction Scheme Under Attack

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code: 276
time: 14:30
room: Hall B

Developing a responsive service system play a crucial role in developing a long-term reputation in the marketplace. Nowadays, some terrorists are planning acts of sabotage to destabilize the economy and some facilities are more vulnerable to imminent attack. In this paper, for choosing the best scheme of establishing new facilities and identifying the most cost-effective way of demand satisfaction, a bi-level model is proposed. This model can be regarded as a static Stackelberg game between a malicious interdictor as the leader and a system defender as the follower. In the upper level problem (ULP), the most destructive interdiction strategy in the presence of limitation on the maximum available interdiction budget is detected. In the lower level problem (LLP), the system defender, firstly, locates a specified number of facilities in the most sensible candidate sites. Subsequently, she tries to identify the least cost allocation pattern of customers to the facilities. In this paper, a comprehensive enumeration is used to identify all feasible interdiction strategies. The LLP can be considered as a capacitated clustering problem; therefore, the K-means clustering algorithm is applied to solve the LLP for each interdiction strategy.
**Keywords** interdiction problem; bi-level programming; location and allocation problem; $K$-means clustering algorithm.

# Multiobjective Semidefinite Programming

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code: 352
time: 14:30
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In this paper we recall multi-objective programming and semidefinite programming problems, then we introduce multi-objective semidefinite programming problem and prove some theorems about it.
**Keywords** Multi-objective; Semidefinite programming; Efficency.