How to Navigate the Technical Sessions

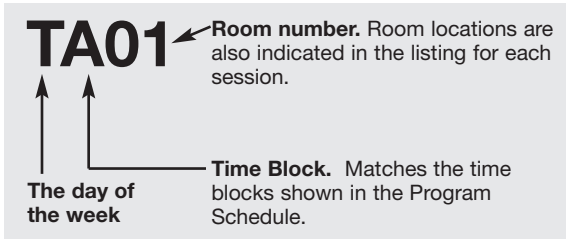
There are four primary resources to help you understand and navigate the Technical Sessions:

- This Technical Session listing, which provides the most detailed information. The listing is presented chronologically by day/time, showing each session and the papers/abstracts/authors within each session.
- The Author and Session indices provide cross-reference assistance (pages 14-17).

Quickest Way to Find Your Own Session

Use the Author Index (page 15) — the session code for your presentation will be shown along with the room location. You can also refer to the full session listing for the room location of your session.

The Session Codes



Time Blocks

Friday

A — 9:00am - 10:30am
B — 11:00am - 12:30pm
C — 1:30pm - 3:00pm
Plenary — 3:10pm — 4:10pm
D — 4:40pm - 6:10pm

Saturday

A — 8:30am - 10:00am
Poster Session A — 10:00am — 10:30am
B — 10:30am - 12:00pm
Plenary — 12:00pm — 1:30pm
C — 1:40pm - 3:10pm
Poster Session B — 3:10pm — 3:40pm
D — 3:40pm - 5:10pm
Plenary — 5:20pm — 6:20pm

Sunday

A — 8:30am - 10:00am
Featured Session — 10:30am — 11:30am
B — 12:30pm - 2:00pm
Featured Session — 2:30pm — 3:30pm
Closing Remarks — 3:30pm - 3:45pm

Friday, 9:00am - 10:30am

■ FA01

Storer Auditorium

Convex Optimization: Theory and Applications

Cluster: Invited Sessions

Invited Session

Chair: Miguel F. Anjos, Ecole Polytechnique de Montreal, C.P. 6079, succ. Centre-ville, Montreal, Canada, anjos@stanfordalumni.org

1 - Conic Representation of Convex Hull of Disjunctions in Integer Second Order Cone Optimization (ISOCO)
Julio Cesar Goez, Lehigh University, Bethlehem, PA, 18015, United States of America, jgoez@lehigh.edu, Pietro Belotti, Imre Pólik, Ted Ralphs, Tamás Terlaky

We consider the intersection of a convex set and linear disjunctions. Under mild assumptions, the convex hull of that intersection can be enclosed in a cone. For ISOCO a closed form representation of that cone is given, which can be used in branch-and-conic-cut algorithms.

2 - Convex Optimization and MINLP Approaches for Decision Problems in Water Distributions Networks
Martin Mevissen, Research Scientist, IBM Research Dublin, Smarter Cities Technology Centre, IBM Technology Campus, Mulhuddart, Dublin, 15, Ireland, Martmevi@ie.ibm.com, Bradley Eck, Susara van den Heever

Decision problems in water distribution networks are challenging due to nonlinearity in the underlying hydraulic models. We propose a novel quadratic MINLP formulation for pressure optimization and optimal valve placement, and combine convex optimization and branch-and-bound methods to solve it.

3 - Factor Models to Log-robust Portfolio Management
Elcin Cetinkaya, Doctoral Student, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States of America, elc209@lehigh.edu, Aurelie Thiele

We investigate robust optimization models addressing uncertainty for asset returns. We use factor model to predict asset returns and treat randomness by a budget of uncertainty.We obtain a tractable robust model to maximize the wealth and gain theoretical insights into the optimal strategies.

■ FA02

Classroom AGB 331

Integer Programming Applications

Cluster: Invited Sessions

Invited Session

Chair: Marcus Poggi, Catholic University of Rio de Janeiro, Rua Marquís de São Vicente, 225 - RDC, 4o. andar, Rio de Janiero, RJ, 22451-900, Brazil, poggi@inf.puc-rio.br

1 - A Column Generation Approach for the Generalized Vehicle Routing Problem (GVRP)
Rafael Martinelli, Catholic University of Rio de Janeiro, Rua Marqués de São Vicente, 225 - RDC, 4o. andar, Rio de Janeiro, 22451-900, Brazil, rmartinelli@inf.puc-rio.br, Marcus Poggi, Diego Pecin

A set partitioning based column generation algorithm is devised for the GVRP. Each column represents an ng-route. Heuristic and exact pricings are developed. Capacity cuts are added through an exact separation. Extensive computational experiments are reported. Open existing instances are solved.

2 - Charging Electric Vehicles (EV) in Parking Lots Under Resource Capacity Constraints
Pavankumar Murali, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10532-1596, United States of America, pavanm@us.ibm.com, Ajay Deshpande, Bruno Flach

We present a 2-stage stochastic program to address the problem of scheduling EV charging in commercial locations (malls, offices, etc.). We present methods to determine the price to be charged from consumers and optimal schedules considering uncertain electricity prices.

3 - Experiments with MIP Based Neighborhood Search on the Capacitated Vehicle Routing Problem (CVRP)
Marcus Poggi, Catholic University of Rio de Janeiro, Rua Marquís de São Vicente, 225 - RDC, 4o. andar, Rio de Janiero, RJ, 22451-900, Brazil, poggi@inf.puc-rio.br, Pedro Moura

K-opt neighborhood search implemented by adding constraints to a MIP formulation can be generalized to looking for improving routes that use at most K edges not in a given underlying graph. Further, a limited weighted expression can be used. We report tests of these ideas and devise guidelines.

■ FA03

Classroom AGB 332

Operations/Economics Interface

Contributed Session

Chair: Esra Buyuktahtakin, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu

1 - Analysis of a Carbon Tax Policy Based on the Emission Factor
Samir Elhedhli, University of Waterloo, 200 University West, Waterloo, Canada, elhedhli@uwaterloo.ca, Hossa Almutairi

We study a carbon tax policy based on the emission factor and compare it against other policies such as taxes on total emissions, cap on the emission factor, and cap-and-trade. We use a social welfare mathematical program to model the problem and test it on a case study from the cement industry.

2 - A More Efficient Algorithm for Convex Nonparametric Least Squares
Erick Moreno-Centeno, Assistant Professor, Texas A&M University, 3131 TAMU, College Station, TX, United States of America, e.moreno@tamu.edu, Timo Kuosmanen, Andrew Johnson, Chia-Yen Lee

We propose a generic algorithm to improve the computational performance of Convex Nonparametric Least Squares. We evaluate six variants of the proposed algorithm; the best variant achieves up to a 20-fold improvement in solution time and solves large problems that are currently unattainable.

3 - Adjusted Distance Functions for Outlier Detection in Data Envelopment Analysis
Yi-Chin Chen, Department of Industrial and Systems Engineering, Texas A&M University, 430 Southwest Parkway Apt 2106, College Station, TX, 77840, United States of America, yichin@neo.tamu.edu, Hsiang-chun Chen

Super-efficiency model in DEA is used for screening observations and identifying outliers. Two distance functions of weighted mean and standard deviation of converted output values that make full usage of data are proposed to improve the drawback of outlier detection in super-efficiency model.

4 - A Multi-objective Optimization Model for Invasive Species Control
Esra Buyuktahtakin, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu, Zhuo Feng, Ferenc Szidarovszky

We formulate and analyze a multi-objective dynamic model for controlling invasive species with the application to buffelgrass in the Arizona desert. This model simultaneously optimizes three objectives corresponding to valued and threatened resources including saguaros, buildings and vegetation.

Friday, 11:00am - 12:30pm

■ FB01

Storer Auditorium

Models, Relaxations, and Algorithms for Nonconvex Optimization

Cluster: Invited Sessions

Invited Session

Chair: Jeffrey Linderoth, Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States of America, linderoth@wisc.edu

1 - Relaxations for Production Planning Problems with Increasing By-products
Srikrishna Sridhar, Graduate Student, University of Wisconsin-Madison, 4241, Wisconsin Institutes for Discovery, 330 North Orchard Street, Madison, WI, 53715, United States of America, srikris@cs.wisc.edu, James Luedtke, Jeffrey Linderoth

We consider a planning problem wherein production creates both desirable products and undesirable by-products. Further, the ratio of undesirable by-product to total production increases monotonically. Novel approximations and relaxations are derived and evaluated for this nonconvex problem.

2 - Strong Polyhedral Relaxations of Multilinear Functions
James Luedtke, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, jrluedt1@wisc.edu, Jeffrey Linderoth, Mahdi Namazifar

We introduce an approach for obtaining a polyhedral relaxation of multilinear functions that is based on building the convex hull for selected subsets of variables. We present promising computational results.

3 - Submodular Function Maximization
Jon Lee, University of Michigan, Ann Arbor, MI, United States of America, jonxlee@umich.edu

I will survey math-programming techniques for maximum-entropy sampling. As a submodular-function maximization problem, this is a nice example of a difficult nonlinear discrete optimization problem. Practical interest in this problem comes from reconfiguring a spatial monitoring network.

■ FB02

Classroom AGB 331

Combinatorial Optimization and Applications

Cluster: Invited Sessions

Invited Session

Chair: Cid de Souza, Professor, University of Campinas, Av. Albert Einstein 1251, B. Geraldo, Cidade Universitária, Campinas, 13083-852, Brazil, cid@ic.unicamp.br

1 - MDD Propagation for Disjunctive Scheduling
Andre Cire, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, acire@andrew.cmu.edu, Willem-Jan van Hoeve

We investigate new constraint propagation techniques based on Multivalued Decision Diagrams (MDDs) for disjunctive scheduling problems, in which jobs must run one at a time. We present MDD filtering operations and how they can be efficiently combined with existing propagators, such as edge-finding.

2 - Branch-and-cut for Complementarity-constrained Optmization
Ismael de Farias, Texas Technical University, Lubbock, TX, 79409, United States of America, ismael.de-farias@ttu.edu, Ernee Kozyreff, Ming Zhao

We give a branch-and-cut algorithm and computational results that prove revealing on formulation and cutting planes for complementarity-constrained optimization. These are among the hardest and most recurring problems in optimization applications.

3 - An Edge-swap Heuristic for the Minimum Branch Vertices Problem

Ricardo Silva, Professor, Federal University of Pernambuco, Av. Jornalista Anibal Fernandes, s/n, Center of Informatic Cidade Universitaria, Recife, PE, 50740560, Brazil, rmas@cin.ufpe.br, Paola Festa, Giorgio De Tomi, Mauricio Resende, Jose Goncalves, Diego M. Silva, Geraldo R. Mateus

This paper presents a new edge-swap heuristic for generating spanning trees with a minimum number of branch vertices, i.e. vertices of degree greater than two. Extensive computational experiments illustrate that this heuristic is both effective and efficient for the minimum branch vertices problem.

4 - On the Minimum Dilation Geometric Spanning Tree Problem

Cid de Souza, Professor, University of Campinas, Av. Albert Einstein 1251, B. Geraldo, Cidade Universit·ria, Campinas, 13083-852, Brazil, cid@ic., unicamp.br, Miguel Gaiowski, Alex Brandt

Let G(P) be the geometric graph associated to a set P of points in the plane. It is NP-hard to find a spanning tree T in G(P) minimizing the greatest ratio, for all pairs in P, between the length of the unique path in T and the euclidean distance. Heuristic and exact algorithms are discussed.

■ FB03

Classroom AGB 332

Financial Engineering Sustainability

Contributed Session

Chair: Álvaro Veiga, Associated Professor, DEE, PUC-Rio, Rua Marqués de São Vicente 225, GÁVEA, Rio de Janeiro, 22453-900, Brazil, alvf@ele.puc-rio.br

1 - On Theoretical and Empirical Aspects of Marginal Distribution Choice Models

Vinit Mishra, NUS Business School, Blk 13, Level 13, Unit 43, 39 Prince George's Park, Singapore, 118431, Singapore, vinitkmishra@gmail.com, Chung-Piaw Teo, Karthik Natarajan, Dhanesh Padmanabhan

The paper discusses theoretical and empirical properties of the Marginal Distribution Choice Models, which are persistency models derived assuming only the marginal distributions of random utilities. The paper shows the power of optimization methods in discrete choice modeling.

2 - Simultaneous Pursuit of Out-of-sample Performance and Sparsity in Index Tracking Portfolios

Jun-ya Gotoh, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo, Japan, jgoto@indsys.chuo-u.ac.jp, Yoshinobu Kawahara, Akiko Takeda, Mahesan Niranjan

In portfolio optimization, a sparse solution and out-of-sample performance often conflict with one another. In this talk, we develop a tracking portfolio model that addresses the trade-off by a combination of L0- and L2-norms. We propose a greedy search method combining with an analytical formula.

3 - An Equilibrium-model-based Option Pricing for Electricity Markets

Eissa Nematollahi, University of Calgary, 2500 University Drive NW, Calgary, Canada, enematol@ucalgary.ca, Janne Kettunen, William Rosehart, Yuriy Zinchenko

Problem of pricing simple financial derivatives in electricity markets is studied. Considering risk averseness of players, we adopt an equilibrium utility-function-based framework for pricing derivatives. We establish bounds on the derivatives price, given some moments of the electricity price.

4 - A Multistage Linear Stochastic Programming Model for Optimal Corporate Bond Issuance

Álvaro Veiga, Associated Professor, DEE, PUC-Rio, Rua Marqués de São Vicente 225, GÁVEA, Rio de Janeiro, 22453-900, Brazil, alvf@ele.puc-rio.br, Davi M. Valladao, Geraldo Veiga

We develop a stochastic programming model for corporate bond issuance with application to an oil company. Investments, bonds and revenues are random, affected by financial, economic and business factors. Our objective function minimizes the cost of inssuance and penalizes leverage and insolvency.

Friday, 1:30pm - 3:00pm

■ FC01

Storer Auditorium

Combinatorial Optimization

Contributed Session

Chair: Alexey Sorokin, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, sorokin@ufl.edu

1 - Multi-row Cuts and Integer Lifting

Gerard Cornuejols, Carnegie Mellon University, Pittsburgh, PA, United States of America, gc0v@andrew.cmu.edu, Michele Conforti, Giacomo Zambelli, Manoel Campelo, Amitabh Basu, Matthias Koeppe, Marco Molinaro, Tamas Kis

Recently, it has been shown that minimal inequalities for a continuous relaxation of mixed integer linear programs are associated with maximal lattice-free convex sets. In this talk, we show how to lift these inequalities for integral nonbasic variables. In particular, we identify cases where the lifting is unique.

2 - A Topological Covering Network Flow Model of the LP Dual of Shooting

Sangho Shim, Research Associate, Northwestern University, Industrial Engineering & Mgmt Sciences, 2145 Sheridan Road #C210, Evanston, IL, 60208, United States of America, shim@northwestern.edu, Ellis Johnson

Gomory introduced a shooting experiment involving solving the shooting linear program repeatedly to find important facets. We develop a topological network flow model of the dual problem of the shooting linear program in a reverse procedure from the decomposition of solution vectors into triples.

3 - Identifying Large Robust Network Clusters via New Compact Formulations of Maximum k-club Problems

Vladimir Boginski, Assistant Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, vb@ufl.edu, Alexander Veremyev

We develop a new compact linear 0-1 programming formulation for finding the maximum k-club in a graph that has substantially fewer entities compared to the previously known formulations and is tight despite its compactness. A new related concept of R-robust k-club is also introduced and analyzed.

4 - Risk Management Techniques for Fixed Charge Network Flow Problems with Uncertain Arc Failures

Alexey Sorokin, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, sorokin@ufl.edu, Panos Pardalos, Vladimir Boginski, Artyom Nahapetyan

We consider fixed charge network flow problems with uncertain network topology. CVaR risk measures are used for restricting potential losses of flow. We show that efficient heuristics for finding near-optimal solutions can be utilized, and present computational results for large and dense networks.

■ FC02

Classroom AGB 331

Nonlinear and Convex Optimization

Cluster: Invited Sessions

Invited Session

Chair: Katya Scheinberg, Lehigh University, 200 W. Packer Avenue, Behtlehem, PA, 18015, United States of America, katyas@lehigh.edu

1 - A Sequential Quadratic Optimization Algorithm with Rapid Infeasibility Detection

Hao Wang, Lehigh University, ISE, Bethlehem, PA, 18015, United States of America, haw309@lehigh.edu, James Burke, Frank Curtis

We present a sequential quadratic optimization algorithm for nonlinear constrained optimization. The method attains all of the strong global and fast local convergence for both feasible and infeasible instances. Emphasis is placed on solving infeasible problems. Numerical results are also presented.

2 - Accelerating Level Methods for Large-scale Convex Optimization
Guanghui Lan, University of Florida, 302 Weil Hall, Gainesville, FL, United States of America, glan@ise.ufl.edu

We introduce accelerated level methods optimal for large-scale convex programming problems and smoothing level methods optimal for a class of structured saddle point problems. Promising numerical results for solving certain Semidefinite and stochastic programming problems will be presented.

3 - Sparse Hessian Structure Recovery in Derivative Free Optimization
Katya Scheinberg, Lehigh University, 200 W. Packer Avenue, Behtlehem, PA, 18015, United States of America, katyas@lehigh.edu

We will show how using results from compressed sensing we can construct accurate second order models of black box functions by using relatively few samples. We will apply these ideas within a convergent trust-region based derivative free optimization method.

■ FC03

Classroom AGB 332

Energy and Optimization under Uncertainty

Cluster: Invited Sessions

Invited Session

Chair: Yongpei Guan, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu

1 - A Branch-and-cut Algorithm for the Multi-stage Stochastic Unit Commitment Problem
Ruiwei Jiang, PhD Student, University of Florida, 411 Weil Hall, Gainesville, FL, 32611, United States of America, rwjiang@ufl.edu, Yongpei Guan, Jean-Paul Watson, Ming Zhao

In this talk, we propose a multi-stage stochastic integer programming model to address unit commitment problems under uncertainty, for which we construct several classes of strong inequalities to strengthen the original formulation. Our preliminary computational experiments show encouraging results.

2 - Contingency-constrained Stochastic Unit Commitment Problem
Neng Fan, Sandia National Laboratories, P.O. Box 5800, MS 1326, Albuquerque, NM, 87185, United States of America, nnfan@sandia.gov, Ali Pinar, Richard Chen, Jean-Paul Watson

In this talk, we consider the problem of optimizing generation unit commitment under load uncertainty while ensuring N-k reliability. Several cutting plane algorithms are proposed to solve this large-scale problem.

3 - Two-stage Robust Optimization for Power Grid with Uncertain Demand Response
Chaoyue Zhao, University of Florida, 303 Weil Hall, Gainesville, FL, United States of America, cherryzhao09@ufl.edu, Yongpei Guan

In this talk, we address how to develop a robust optimization model for ISOs to maximize the social welfare under uncertain demand response. We use an uncertain price-elastic demand curve to approximate the response and use Bender's Decomposition to solve the problem.

Friday, 3:10pm - 4:10pm

Storer Auditorium

Plenary

Cluster: Invited Sessions

Invited Session

Chair: Jerald S. Ault, University of Miami, Miami FL, United States of America, jault@rsmas.miami.edu

1 - Spatial Ecosystem Models to Assess Multispecies Fisheries Risks from Exploitation and Environmental Changes
Jerald S. Ault, University of Miami, Miami FL, United States of America, jault@rsmas.miami.edu

Serious concerns have been raised about global declines of historically productive marine fishery resources. For example, southern Florida coral reefs generated an estimated 101,000 jobs and US$6 billion in economic activity in 2011. These ecosystem goods and services, however, are threatened by increased exploitation and environmental changes from a rapidly growing regional human population. To address these threats, we adopted an ecosystem-based perspective and developed a systems science analysis framework to better assess and improve sustainable multispecies fisheries. Here we describe our progress and provide three example applications. We first built upon traditional catch and effort stock assessment methodologies by collecting spatially-explicit, fishery-independent data covering all reef fishes and reef habitats in the Florida Keys. An optimized sampling strategy and a new length-based assessment framework provided synoptic spatial estimates of species abundance and size structures. Models were developed that encompassed the complex biological dynamics of fish stocks and a broad range of environmental and human impacts, including fisheries, non-target species, predator-prey interactions, species movements, ontogenetic changes in habitat associations, and physical processes. These showed that valuable snapper-grouper resources are overfished relative to established benchmarks for resource sustainability. Next, spatially explicit integer programming and simulation models were integrated to objectively evaluate "no-take" marine reserve boundary options and demonstrated the potential effectiveness of reserve networks to build sustainable fisheries in spatially heterogeneous coastal ocean environments like the Dry Tortugas. Finally, we show the importance of considering physical coupling and regional water quality changes resulting from Everglades restoration. A fishery systems science framework improves understanding of impacts from fishery extraction, ecosystem alterations, and natural oceanographic variability on the dynamics and productivity of exploited fish stocks.

Friday, 4:40pm - 6:10pm

■ FD01

Storer Auditorium

Constraint Programming and Integrated Methods

Cluster: Invited Sessions

Invited Session

Chair: Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, vanhoeve@andrew.cmu.edu

1 - The Multi-inter-distance Constraint
Claude-Guy Quimper, Université Laval, 1065, Avenue de la Médecine, Québec City, QC, G1V 0A6, Canada, Claude-Guy.Quimper@ift.ulaval.ca, Pierre Ouellet, Alejandro López-Ortiz

We introduce the Multi-Inter-Distance constraint that ensures no more than m variables are assigned to values lying in a window of p consecutive values. This constraint is useful for modeling scheduling problems such as runway scheduling problem.

2 - A Branch and Bound Algorithm Based on Approximate Binary Decision Diagrams
David Bergman, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, dbergman@andrew.cmu.edu, Andre Cire, Willem-Jan van Hoeve, J.N. Hooker

In this talk we discuss a branch and bound algorithm based on approximate Binary Decision Diagrams. We apply the ideas to the Maximum Independent Set Problem. Experiments show that the proposed algorithm is competitive with state-of-the-art Integer Programming technology on this problem domain.

3 - Graph Coloring Facets from All-different Systems
John Hooker, Professor, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, jh38@andrew.cmu.edu, David Bergman

We formulate a graph coloring problem using all-different constraints. We analyze the polyhedral structure and map facet-defining inequalities for cyclic structures to valid cuts in a 0-1 model of the problem. These cuts are stronger than any collection of known 0-1 cuts for these structures.

4 - MDD Propagation for Sequencing Constraints
Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, vanhoeve@andrew.cmu.edu

We discuss how Sequencing constraints can be represented and propagated as approximate multi-valued decision diagrams (MDDs) in the context of Constraint Programming. Experimental results demonstrate that propagating MDDs rather than the traditional variable domains can yield substantial speedups.

■ FD02

Classroom AGB 331

Continous Optimization

Contributed Session

Chair: Martine Ceberio, Assistant Professor, University of Texas at El Paso, Computer Science Department, 500 West University, El Paso, TX, 79968, United States of America, mceberio@utep.edu

1 - An Effective Approach for DNN Relaxation Problems for Mixed Binary Nonconvex Quadratic Optimization

Mirai Tanaka, Tokyo Insitute of Technology, 2-12-1-W9-60, Ookayama, Meguro-ku, Tokyo, 152-8552, Japan, tanaka.m.aa@m.titech.ac.jp, Kazuhide Nakata, Hayato Waki

We propose an effective approach to solve DNN relaxation problems for mixed binary nonconvex quadratic optimization. In our approach, we convert a relaxation problem into a smaller one by an incomplete facial reduction algorithm and solve it with an inexact primal-dual interior-point method.

2 - A Generalization of Directional Derivatives to Set-valued Mappings and Optimality Conditions

Yalcin Kucuk, Professor, Anadolu University, Yunus Emre Campus Faculty of Science, Department of Mathematics, Eskisehir, 26470, Turkey, ykucuk@anadolu.edu.tr, Mustafa Soyertem, Mahide Kucuk

A new definition of directional derivative for set-valued mapping is given by using vectorization constructed in the previous work of authors.Optimality conditions for set-valued optimization problems and calculation rules for some classes of set-valued mappings are given with this derivative.

3 - Vectorization Of Setvalued Maps on Real Separable Hilbert Spaces Using Successive Weighted Sum Method

Mahide Kucuk, Professor, Anadolu University, Yunus Emre Campus Faculty of Sciences, Department of Mathematics, Eskisehir, 26470, Turkey, mkucuk@anadolu.edu.tr, Mustafa Soyertem, Yalcin Kucuk

We expand the characterization of total ordering cones given by authors for n-dimensional Euclidean space to real separable Hilbert spaces. This enabled us to perform vectorization by using Successive Weighted Sum Method for set-valued mappings on real separable Hilbert spaces.

4 - Interval Optimization to Predict Software Quality Assessment Decisions

Martine Ceberio, Assistant Professor, University of Texas at El Paso, Computer Science Department, 500 West University, El Paso, TX, 79968, United States of America, mceberio@utep.edu, Angel Garcia Contreras, Xiaojing Wang, Robert Bixler, Luis Gutierrez

In this work, we are interested in predicting decisions in the context of software quality assessment. To do this, we propose an interval optimization approach to extract a fuzzy measure from sample expert data. Results show improvement in comparison with previous attempts to solving this problem. The work presented here was partially supported by NSF grant CCF0953339 and by NSF grant IIS0852066 through the involvement of our fourth author, who was an NSF REU scholar in Summer 2011.

■ FD03

Classroom AGB 332

Radiation Therapy Treatment Plan Optimization

Cluster: Invited Sessions

Invited Session

Chair: Edwin Romeijn, Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, romeijn@umich.edu

1 - Beam Orientation Optimization for External Beam Radiation Therapy

Troy Long, PhD Student, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, troylong@umich.edu, Edwin Romeijn

In beam orientation optimization, a small number of beam positions must be selected that allow for both a high treatment plan quality and efficient deliverability, creating a large-scale combinatorial optimization problem. We study a new class of column generation based heuristics for this problem.

2 - Optimal Stopping in Radiotherapy

Archis Ghate, Assistant Professor, University of Washington, Industrial and Systems Engineering, Box 352650, Seattle, WA, 98195, United States of America, archis@u.washington.edu, Minsun Kim, Fatemeh Saberian

What is an "optimal" length of a radiotherapy treatment course? This has stumped researchers for a century. No mathematical formulation is currently available. We present a two-variable nonlinear program to model this problem and obtain a closed-form solution. Extensions to IMRT will be discussed.

3 - Dose-reactive Methods in Adaptive Robust Intensity-modulated Radiation Therapy

Tim Chan, University of Toronto, 5 Kings College Road, Toronto, ON, M5S 3G8, Canada, tcychan@mie.utoronto.ca, Velibor Misic

We extend a previous adaptive robust IMRT optimization method to "react", via re-optimization, to the remaining dose-to-go, based on estimates of the dose delivered. Results on a clinical lung case show that while cumulative dose performance may be improved, daily dose distributions are degraded.

Saturday, 8:30am - 10:00am

■ SA01

Storer Auditorium

Computational Methods for Global Optimization and Mixed Integer Nonlinear Programming

Cluster: Invited Sessions

Invited Session

Chair: Jeffrey Linderoth, Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States of America, linderoth@wisc.edu

1 - A Semidefinite Optimization Approach to Space-free Multi-row Facility Layout

Miguel Anjos, Ecole Polytechnique de Montreal, P.O. Box 6079, Station Centre-Ville, Montreal, QC, H3C 3A7, Canada, miguel-f.anjos@polymtl.ca, Philipp Hungerländer

Multi-row facility layout seeks an optimal placement of departments along rows. Large single-row problems have been solved to global optimality using semidefinite optimization. We extend the approach to space-free multi-row layout and show that if provides high-quality bounds in reasonable time.

2 - Low Dimensional Copositive Cuts for Global Optimization

Hongbo Dong, University of Wisconsin-Madison, Madison, WI, United States of America, hdong6@wisc.edu

It is known that many MIQPs can be formulated exactly as conic linear programs over the Completely Positive (CP) cone, whose dual cone is the Copositive cone. We describe separation procedures for low dimensional CP cones, and discuss the potential usage in global optimization.

3 - Convex Quadratic Programming with Variable Bounds

Hyemin Jeon, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States of America, jeon5@wisc.edu, Andrew Miller, Jeffrey Linderoth

We aim to obtain a good approximation of the convex hull of a mixed binary set constrained by convex nonseparable quadratic functions. The set is first transformed using Cholesky factorization, and several valid inequalities are derived. Computational results on different formulations are compared.

4 - MINOTAUR: A Toolkit for Mixed-integer Nonlinear Optimization

Sven Leyffer, Argonne National Lab, 9700 South Cass Avenue, Argonne, IL, 60439, United States of America, leyffer@mcs.anl.gov, Ashutosh Mahajan

MINOTAUR is a flexible toolkit for solving MINLPs. The modular code enables developers to combine the knowledge of problem structure with algorithmic insights. We present the underlying ideas of MINOTAUR, focusing on the integration of nonlinear solvers into the branch-and-cut framework.

■ SA02

Classroom AGB 331

Convex Optimization

Contributed Session

Chair: Peter Richtarik, Assistant Professor, University of Edinburgh, 6317 JCMB, Kings Buildings, Mayfield Road, Edinburgh, EH93JZ, United Kingdom, peter.richtarik@ed.ac.uk

1 - Shrink-wrapping Trajectories for Linear Programming
Yuriy Zinchenko, Assistant Professor, University of Calgary, 2500 University Dr Nw, Math and Stat MS 446, Calgary, AB, T2N1N4, Canada, yzinchen@ucalgary.ca

Hyperbolic Programming (HP) is a class of convex optimization problems that contains Linear Programming (LP). Moreover, LP can be relaxed into a sequence of HP, giving rise to a new approach for LP due to Renegar. We examine how the resulting trajectories compare to a well-known central path.

2 - Semidefinite Relaxation for the Clustering and Biclustering Problems
Brendan Ames, Postdoctoral Fellow, Institute for Mathematics and its Applications, 2529 Cole Avenue Southeast, Minneapolis, MN, 55414, United States of America, bpames@gmail.com

Identifying clusters of similar objects in data plays a significant role in many applications. We present new semidefinite relaxations for the clustering and biclustering problems and establish guarantees for recovery of the correct clustering from the optimal solution to this relaxation.

3 - A Modified Potential Reduction Method for Monotone Complementarity and Convex Programming Problems
Sanjay Mehrotra, Professor, IEMS, Northwestern University, 2145 Sheridan Rd, Room C210, Evanston, IL, 60208, United States of America, mehrotra@northwestern.edu, Kuo-Ling Huang

A modified potential reduction homogeneous algorithm is developed and implemented in package iOptimize for convex programming problems. iOptimize takes fewer iterations than Mosek, a mature interior solver. Moreover, iOptimize solves several problems successfully where Mosek fails.

4 - Parallel Block Coordinate Descent Methods for Minimizing Semi-separable Convex Functions
Peter Richtarik, Assistant Professor, University of Edinburgh, 6317 JCMB, Kings Buildings, Mayfield Road, Edinburgh, EH93JZ, United Kingdom, peter.richtarik@ed.ac.uk, Martin Takac

We show that randomized BCD methods can be accelerated by parallelization when applied to the problem of minimizing a semi-separable convex function. The speedup is equal to the product of the number of processors and a natural and easily computable measure of separability of the objective function.

■ SA03

Classroom AGB 332

Network Applications

Cluster: Invited Sessions

Invited Session

Chair: Subramanian Raghavan, Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States of America, raghavan@umd.edu

1 - An Integer-programming-based Approach to the Close-enough Traveling Salesman Problem
Behnam Behdani, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, behdani@ufl.edu, J. Cole Smith

We address the Close-Enough Traveling Salesman Problem (CETSP), where the traveler visits a node if it enters a compact vicinity of that node. Our approach prescribes a method of computing a series of lower bounds on the optimal CETSP tour length that converge to an optimal solution of the problem.

2 - Minimum Spanning Trees with Generalized Degree Constraints in the Design of Wireless Networks
Luis Gouveia, University of Lisbon, Centro de Investigacao Operacional, Bloco C6 - Piso 4- Campo Grande, Lisboa, 1749-016, Portugal, legouveia@fc.ul.pt, Amaro Sousa, Pedro Moura

To build a wireless network we use a spanning tree where a maximum degree is imposed on every node different types of links may be installed and between two nodes depending on the distance between the nodes and the degrees of the nodes. We introduce and relate two models in terms of LP relaxation.

3 - The Maximum K-club Problem in Graphs
Baski Balasundaram, Assistant Professor, Oklahoma State University, 322 Engineering North, Industrial Engineering & Management, Stillwater, OK, 74078, United States of America, baski@okstate.edu, Foad Mahdavi Pajouh, Illya Hicks

A k-club is an induced subgraph of diameter at most k, used to model low-diameter clusters in social and biological networks. We discuss some recent complexity and polyhedral results concerning 2-clubs, preliminary numerical results, and modeling extensions.

4 - The Least Cost Influence Problem (LCIP) on a Social Network
Subramanian Raghavan, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, raghavan@umd.edu, Dilek Gunnec

We analyze a product diffusion problem on a social network where the desire is to minimize the incentives paid out while ensuring that all nodes adopt the product. We show that on a tree network when the neighbors equally influence an individual the problem is polynomially solvable.

Saturday, 10:00am - 10:30am

Store Auditorium Lobby

Poster Session A

Cluster: Posters

1 - A Deflected Parameter for the Spectral Projected Subgradient Method
Kimoy Williams, Florida Memorial University, 15800 NW 42nd Avenue, Miami Gardens, Fl, 33054, United States of America, kwil1202@fmuniv.edu, Milagros Loreto

In this work, we present and discuss numerical results for the set covering problems using the spectral projected subgradient (SPS) method .We identify and diminish the presence of zigzagging kind I. The deflected parameter is chosen using deflection strategies and the results are encouraging.

2 - Methodology for the Imputation of Data Missing in the Meteorology
Jorge Andrés Urrutia Mosquera, Msc. Investigación de Operaciones y Estadóstica, Universidad Tecnológica de Pereira, Vereda la Julita, Pereira, Crr 4 No. 34 - 34, Pereira, Colombia, jurrutia@utp.edu.co, Leonel Arias Montoya, Jorge Hernan Restrepo Correa

The procedure consists on making use of partial correlations, regression models, adjustments of the data by means of the method of double mass and verification of the tendency through the the test of Kendal. You could evaluate that for missing of data of 20% this methodology is appropriate.

3 - An Interior Point Method with a Primal-dual Merit Function for Nonlinear Semidefinite Programming
Atsushi Kato, Student, Tokyo University of Science, 1-3, Kagurazaka, Shinjuku-ku, Tokyo, Japan, j1410702@ed.kagu.tus.ac.jp, Hiroshi Yabe, Hiroshi Yamashita

In this talk, we consider an interior point method for nonlinear semidefinite programming. We propose a differentiable primal-dual merit function within the framework of the line search strategy and prove the global convergence property of our method.

4 - Linear Model Applied to the Allocation of Land Uses in Relation to the Carrying Capacity of Land
Jorge Hernan Restrepo Correa, Msc. Investigación de Operaciones y Estadística, Universidad Tecnológica de Pereira, Vereda la Julita, Pereira, Santa Rosa de Cabal, Pereira, Colombia, jhrestrepoco@utp.edu.co

The work provides feasible alternatives in the process of land allocation for different applications supporting the processes of territorial management and planning in the municipality of Marseille - Risaralda - Colombia.

Saturday, 10:30am - 12:00pm

■ SB01

Storer Auditorium

Software for Optimization Modeling

Cluster: Invited Sessions

Invited Session

Chair: Robert Fourer, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, 4er@northwestern.edu

1 - The Aimms Interface to Constraint Programming

Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, vanhoeve@andrew.cmu.edu, Chris Kuip, Marcel Hunting

We present an extension of the modeling system Aimms to handle constraint programming problems. We discuss the available functionality, various design choices, and example constraint programming models in Aimms.

2 - Leveraging Structure in Pyomo Models

William Hart, Sandia National Laboratories, Albuquerque, NM, United States of America, wehart@sandia.gov, Carl Laird, John Siirola, Jean-Paul Watson, David Woodruff

The Pyomo modeling library can model structure in optimization applications that is not typically captured in modeling systems. We describe how Coopr optimization solvers exploit model structure in a generic fashion for stochastic programming and disjunctive programming models.

3 - Alternatives for Scripting in the AMPL Modeling Language

Robert Fourer, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, 4er@northwestern.edu

Modeling languages are essentially declarative, yet successful optimization languages also offer ways to write scripts or programs. What can scripting in a modeling language do in comparison to modeling in a general-purpose scripting language? Some answers will be suggested through varied examples.

■ SB02

Classroom AGB 331

Robust Optimization

Contributed Session

Chair: Dan Iancu, Assistant Professor, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, daniancu@stanford.edu

1 - A Decomposition Algorithm for a Two-stage Moment Robust Optimization Model

He Zhang, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, hezhang2012@u.northwestern.edu, Sanjay Mehrotra

In this paper we study a two-stage stochastic convex programming model using distribution moments to define the probability ambiguity set for cost coefficients in both stages. A decomposition based algorithm is given, and we show that this model can be solved to any precision in polynomial time.

2 - An Exact Algorithm for Two-stage Robust Optimization with Mixed Integer Recourse Problems

Bo Zeng, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, FL, 33620, United States of America, bzeng@usf.edu, Long Zhao

To solve a linear two-stage robust optimization model with a MIP recourse problem, we present a nested column-and-constraint generation algorithm that can derive an exact solution in finite steps. An example of robust rostering problem is investigated to demonstrate its solution capability.

3 - A Unified Classification Model Based on Robust Optimization

Akiko Takeda, Keio University, 3-14-1 Hiyoshi, Kouhoku, Yokohama, Kanagawa, 223-8522, Japan, takeda@ae.keio.ac.jp, Takafumi Kanamori, Hiroyuki Mitsugi

SVM, MPM and FDA are well-known binary classification models. The purpose of this work is to provide a unified model for them using a robust optimization approach. The unified model is help in clarifying relationships among existing models and in finding new classifiers and new algorithms.

4 - Supermodularity and Affine Policies in Dynamic Robust Optimization

Dan Iancu, Assistant Professor, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, daniancu@stanford.edu, Mayank Sharma, Maxim Sviridenko

We discuss conditions on the uncertainty sets and value functions in dynamic robust optimization(DRO) that ensure the optimality of policies depending affinely on model uncertainties.Our proofs use ideas from discrete and global optimization,suggesting new modeling paradigms and applications of DRO.

■ SB03

Classroom AGB 332

Optimization Applications in Operations Planning

Cluster: Invited Sessions

Invited Session

Chair: Joseph Geunes, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, geunes@ise.ufl.edu

1 - Integrated Network Design and Scheduling Problems with Release Dates

Sarah Nurre, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, United States of America, nurres@rpi.edu, Thomas Sharkey

We consider the problem of allocating resources to process tasks, each with a release date, that correspond to installing components into a network. We provide a heuristic optimization framework for these problems that is motivated by dispatching rules for scheduling problems.

2 - Truckload Relay Network Design Optimization

Hector Vergara, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hvergara@uark.edu, Sarah Root

We propose a mathematical formulation for truckload relay network design that minimizes total costs while considering operational constraints such as load circuity and driver tour length within the variable definition. Computational results are presented as well as directions for future research.

3 - Approximation Algorithms for Selective Newsvendor Problems

Edwin Romeijn, Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, romeijn@umich.edu, Zohar Strinka

A selective newsvendor chooses a set of markets to serve as well as an order quantity. We provide an algorithmic approach that yields a solution that, with high probability, has objective value bounded by an affine function of the optimum when the vector of market demands has nonnegative support.

4 - Optimizing Exclusivity Agreements in a Three-state Procurement Game

J. Cole Smith, Professor, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, cole@ise.ufl.edu, Mike Prince, Joseph Geunes

We consider a procurement game in which firms compete for limited capacity at multiple suppliers, and one firm can purchase exclusivity rights from any of the suppliers. The resulting formulation is a three-stage MIP that, depending on the followerís goals, may contain an embedded bilevel program.

Saturday, 12:00pm - 1:30pm

Storer Auditorium

Plenary

Cluster: Invited Sessions

Invited Session

Chair: Manoj Saxena, General Manager, IBM Watson Solutions, United States of America

1 - Putting IBM Watson to Work

Manoj Saxena,General Manager, IBM Watson Solutions, United States of America

IBM's Watson captured the imagination of over 34 million viewers when it beat the all time champions of the US game show, Jeopardy!. To do so, it navigated the complexities of human speech, churned through 200 million pages of unstructured data in under 3 seconds, delivered a confidence based response, all while learning and getting smarter with each outcome. But as impressive as this accomplishment was, it was only the beginning. IBM is working with leading organizations across industries to put Watson to work. The possibilities are endless! Join Manoj Saxena, General Manager of IBM Watson Solutions, in an engaging discussion of how IBM Watson can fundamentally transform the way businesses and individuals make decisions and how next generation systems will be designed.

Saturday, 1:40pm - 3:10pm

■ SC01

Storer Auditorium

Mixed-integer Programming

Cluster: Invited Sessions

Invited Session

Chair: Oktay Gunluk, IBM Research, IBM T.J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, gunluk@us.ibm.com

1 - Split Cuts for Convex Nonlinear Mixed Integer Programming

Juan Pablo Vielma, Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, jvielma@pitt.edu, Daniel Dadush, Santanu Dey, Mustafa Kilinc, Sina Modaresi

In this talk we study split cuts for convex nonlinear mixed integer programming. We give closed form expressions of split cuts for some quadratic sets and show that the split closure of a strictly convex set is generated by a finite number of split disjunctions, but is not necessarily a polyhedron.

2 - Network Design with Stochastic Arc Capacities

Alper Atamturk, Professor, University of California-Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States of America, atamturk@berkeley.edu, Avinash Bhardwaj

We present models and branch-and-cut algorithms to find a min cost fixed-charge network with stochastic arc capacities. We derive strong valid inequalities for the convex hull of the solutions. We provide inequality extension and lifting algorithms to obtain the facets of the convex hull.

3 - T-branch Split Cuts for Mixed-integer Programs

Oktay Gunluk, IBM Research, IBM T.J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, gunluk@us.ibm.com

Li/Richard (2008) conjectured that the convex hull of MIPs with n integer variables have unbounded rank wrt $(n-1)$-branch split cuts. We prove this result. We also show that facets of a rational MIP is a rank-1 t-branch split cut. This gives a finite cutting-plane algorithm to solve MIPs.

■ SC02

Classroom AGB 331

Derivative-Free Global Optimization

Cluster: Invited Sessions

Invited Session

Chair: Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

1 - Bayesian Optimization via Simulation with Correlated Sampling and Correlated Prior Beliefs

Jing Xie, Cornell University, 206 Rhodes Hall, Ithaca, NY, 14853, United States of America, jx66@cornell.edu, Stephen Chick, Peter Frazier

We consider optimization via simulation over a finite set of alternatives. We employ a Bayesian value-of-information approach in which we allow both correlated prior beliefs and correlated sampling to improve overall efficiency.

2 - Average-case Complexity Bounds for Global Optimization

James Calvin, New Jersey Institute of Technology, University Heights, Newark, NJ, 07102, United States of America, calvin@njit.edu

Suppose that we have a random function with known distribution and want to approximate the minimum based on evaluations of the function at sequentially chosen points. This talk describes algorithms and addresses the question of how good an approximation we can hope to achieve.

3 - Parallel Global Optimization Using An Improved Multi-points Expected Improvement Criterion

Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu, Scott Clark

We consider the multi-points criterion for parallel global optimization proposed by Ginsbourger et al. (2010). While conceptually appealing, optimizing this criterion in an algorithm is difficult. Using stochastic approximation, we provide a new method for optimizing this criterion efficiently.

■ SC03

Classroom AGB 332

Applications in Operations Management

Cluster: Invited Sessions

Invited Session

Chair: Milind Dawande, Professor, The University of Texas at Dallas, School of Management, 800 West Campbell Road, Richardson, TX, 75080, United States of America, milind@utdallas.edu

1 - Dedicated Transportation Subnetworks: Models, Analysis, and Insights

Tharanga Rajapakshe, Assistant Professor, University of Florida, Warrington School of Business Administra, Gainesville, FL, 32606, United States of America, tharanga@ufl.edu, Milind Dawande, Chelliah Sriskandarajah, Srinagesh Gavirneni

A Dedicated Subnetwork (DSN) refers to a subset of lanes with associated loads in a shipper's transportation network, for which a fleet of resources is exclusively assigned to carry out all shipping requirements. We address a problem of identifying a "good" DSN.

2 - Fixed-dimensional Stochastic Dynamic Programs: An Approximation Scheme and Inventory Applications

Wei Chen, PhD Student, The University of Texas at Dallas, School of Management, 800 West Campbell Road, Richardson, TX, 75080, United States of America, wei.chen@utdallas.edu, Ganesh Janakiraman, Milind Dawande

We study fixed-dimensional stochastic dynamic programs in a discrete setting. Under the assumption that the cost-to-go functions are discrete convex and sub-/supermodular, we propose a pseudopolynomial approximation scheme that solves this problem to within an arbitrary pre-specified additive error.

3 - Efficient Distribution of Water Between Head-reach and Tail-end Farms in Developing Countries

Mili Mehrotra, Assistant Professor, University of Minnesota, Minneapolis, MN, United States of America, milim@umn.edu, Srinagesh Gavirneni, Milind Dawande, Vijay Mookerjee

In developing countries, inequity in surface water distribution to farms arises due to their relative physical locations: water for tail-end farms must pass via their head-reach counterparts. We propose two decentralized coordination schemes: rate-card and water-guarantee for efficient distribution.

Saturday, 3:10pm - 3:40pm

Store Auditorium Lobby

Poster Session B

Cluster: Posters

1 - Heuristics for the School Bus Fleet Size Problem

Sreekanth Mallikarjun, Doctoral Student, SUNY StonyBrook University, Department of Technology and Society, StonyBrook, NY, 11790, United States of America, sreekanth.mallikarjun@stonybrook.edu, Herbert Lewis, Thomas Sexton

This paper shows how to minimize the number of school buses required while satisfying constraints on school bell times,school pickup,delivery time windows,and travel time.By minimizing the number of buses,the school district saves tax dollars,reduces fuel consumption,and minimizes air pollution.

2 - Impact of Brazilian Regional Airlines Efficiency Over Full Service and Low Cost Segments

Maria Cristina Gramani, Insper Institute of Education and Research, Rua Quatá, 300, São Paulo, SP, 04546-042, Brazil, mariacng@insper.edu.br

In general studies point to the impact of low cost companies in full service carriersí efficiency, however, there is great potential for regional airlines growth in Brazil. In that sense this study seeks to investigate the impact of regional companies in the efficiency of the two other segments.

3 - Sequential Estimation of the Posterior Density and False-alarm for On-line Quality Control Models

Chang Dorea, Professor, Universidade de Brasilia, Instituto de Ciencias Exatas, Universidade de Brasilia, Brasilia, DF, 70910-900, Brazil, changdorea@unb.br

For on-line quality control during production and under the setting of a HMM, posterior density estimates are sequentially obtained via particle filter type algorithms. And kernel density methods are used to derive estimates for malfunctioning false-alarm probabilities.

4 - The Evaluation of Automatic Identification Efficiency by DEA Method

Atena Esmaeili, University, No1163,Vakilabad Street, between 55 and 5, Mashhad, Iran, atena_esmaeili2000@yahoo.com

The set of technologies for the identification of objects, humans and animals are used by machine is called automatic identification or Auto ID for short. The purpose of automatic identification systems are increasing efficiency, reducing data entry errors and free staff time for more important tasks such as better service to our customers. One of the methods for estimating efficiency frontier and measuring performance there is a linear programming method that it is not considered a particular form for the efficiency frontier and called "Data Envelopemnet Analysis".The main purpose of the comparison and evaluation of a number of homogeneous units is the decision maker which the input and output are the same but have different amounts of inputs used and outputs produced. In this study using DEA is evaluated for efficiency of automatic identification systems for goods and wood products by Astan Qods Razavi and introduced the best model for this evaluation.then the benefits of this approach compared with other methods are mentioned.

Saturday, 3:40pm - 5:10pm

■ SD01

Storer Auditorium

Cutting Plane Methods

Cluster: Invited Sessions

Invited Session

Chair: Alper Atamturk, Professor, University of California-Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States of America, atamturk@berkeley.edu

1 - Cutting Planes for Complementarity Constraints

Jean-Philippe Richard, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, richard@ise.ufl.edu, Trang Nguyen, Mohit Tawarmalani

We describe a convexification technique for linear and convex programs with linear complementarity constraints that generalizes the reformulation-linearization technique of Sherali and Adams. We then discuss the derivation of strong tableaux cutting planes from LP relaxations of these problems.

2 - Multistage Robust Network Problems

Muhong Zhang, Assistant Professor, Arizona State University, Tempe, AZ, United States of America, Muhong.Zhang@asu.edu

In this talk, we consider the multi-stage robust network flow and design problems under a polyhedral uncertainty set. The multi-stage problems are reduced to a two-stage problem to avoid the "curse of dimensionality". A special case of Lot-sizing problem is discussed as an example.

3 - Convex Hull Representation of the Deterministic Bipartite Network Interdiction Problem

Kelly Sullivan, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, kmsullivan@ufl.edu, J. Cole Smith, David P. Morton

We consider a bipartite network interdiction problem in which a leader installs sensors in attempt to detect a network-traversing evader. We develop the convex hull polytope that links the interdictor's and smuggler's variables for the case in which the smuggler's origin and destination are known.

4 - A Branch-and-cut Method for Dynamic Decision Making under Joint Chance Constraints

Simge Kucukyavuz, Assistant Professor, Ohio State University, Columbus, OH, 43210, United States of America, kucukyavuz.2@osu.edu, Minjiao Zhang, Saumya Goel

We consider a finite-horizon multi-stage stochastic mixed-integer program under a constraint on the reliability over the entire horizon. We formulate this problem as a jointly chance-constrained program, and propose and test a branch-and-cut method that utilizes the continuous mixing substructure.

■ SD02

Classroom AGB 331

Advances in Interior-Point Methods and their Applications

Cluster: Invited Sessions

Invited Session

Chair: Miguel F. Anjos, Ecole Polytechnique de Montreal, C.P. 6079, succ. Centre-ville, Montreal, Canada, anjos@stanfordalumni.org

1 - Matrix-free Interior Point Method for Large-scale Optimization Problems

Jacek Gondzio, University of Edinburgh, Edinburgh, EH9 2EA, United Kingdom, J.Gondzio@ed.ac.uk

A redesign of interior point methods will be addressed. It has two objectives: (i) to avoid an explicit access to the problem data and to allow only matrix-vector products to be executed with the Hessian and Jacobian and its transpose; and (b) to allow the method to work with a limited-memory.

2 - IPM Warmstarts and Stochastic Programming
Andreas Grothey, University of Edinburgh, School of Mathematics, Edinburgh, EH9 3JZ, United Kingdom, A.Grothey@ed.ac.uk

We present progress on an Interior Point based multi-step solution approach for stochastic programming problems. Our approach works with a series of scenario trees that can be seen as successively more accurate discretizations of an underlying probability distribution and IPM warmstarts.

■ SD03

Classroom AGB 332

Supply Chain Management

Contributed Session

Chair: Alain Martel, Professor, Universite Laval, Faculté des Sciences de L'administration, PAP 2640, Quebec, QC, G1V 0A6, Canada, alain.martel@cirrelt.ca

1 - A Comparative Study between Vendor Managed Inventory and Quantity Discounts
Abhishek Chakraborty, Indian Institute of Management Calcutta, Fellow Programmes and Research Office, Kolkata, 700104, India, abhishekc08@iimcal.ac.in, Asish Chatterjee

In this paper we try to find the parallelism between VMI and quantity discounts and try to look into those conditions where one coordinating mechanism performs better than the other.

2 - A Lifted Compact Formulation for the Daily Aircraft Maintenance Routing Problem
Shengzhi Shao, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, szshao@vt.edu, Mohamed Haouari, Hanif Sherali

We present a novel compact (polynomial sized) model for the aircraft routing problem, which is transformed and lifted using the Reformulation-Linearization Technique to provide a tight representation. Numerical experiments show significant savings in computational effort.

3 - Flow Line Scheduling with General Worker Learning and Forgetting
Frank Bentefouet, The Pennsylvania State University, State College, PA, 16801, United States of America, bentefouet@psu.edu

The flow line scheduling problem with general human performance is studied. Instantaneous availability is of interest; a necessary condition is obtained for the optimal switching time with two tasks and for a general floor shop, a maximum number of changes is established.

4 - Solving Supply Network Design Problems with the Cat Metaheuristic
Alain Martel, Professor, Universite Laval, Faculté des Sciences de L'administration, PAP 2640, Quebec, QC, G1V 0A6, Canada, alain.martel@cirrelt.ca, Marc-André Carle, Nicolas Zufferey

We propose a multi-period supply chain (SC) network design model covering the entire SC, from vendor selection to marketing policy choices. The model is based on the mapping of a SC activity graph on potential network locations. It is solved with a Collaborative Agent Team (CAT) metaheuristic.

Saturday, 5:20pm - 6:20pm

Storer Auditorium

Plenary

Cluster: Invited Sessions

Invited Session

Chair: Dimitris Bertsimas, Professor, Massachusetts Institute of Technology, Cambridge MA, United States of America, dbertsim@mit.edu

1 - A Computationally Tractable Theory of Performance Analysis in Stochastic Systems
Dimitris Bertsimas, Professor, Massachusetts Institute of Technology, Cambridge MA, United States of America, dbertsim@mit.edu

Modern probability theory, whose foundation is based on the axioms set forth by Kolmogorov, is currently the major tool for performance analysis in stochastic systems. While it offers insights in understanding such systems, probability theory is really not a computationally tractable theory. Correspondingly, some of its major areas of application remain unsolved when the underlying systems become multidimensional: Queueing networks, network information theory, pricing multi-dimensional financial contracts, auction design in multi-item, multi-bidder auctions among others. We propose a new approach to analyze stochastic systems based on robust optimization. The key idea is to replace the Kolmogorov axioms as primitives of probability theory, with some of the asymptotic implications of probability theory: the central limit theorem and law of large numbers and to define appropriate robust optimization problems to perform performance analysis. In this way, the performance analysis questions become highly structured optimization problems (linear, conic, mixed integer) for which there exist efficient, practical algorithms that are capable of solving truly large scale systems. We demonstrate that the proposed approach achieves computationally tractable methods for (a) analyzing multiclass queueing networks, (b) characterizing the capacity region of network information theory and associated coding and decoding methods generalizing the work of Shannon, (c) pricing multi-dimensional financial contracts generalizing the work of Black, Scholes and Merton, (d) designing multi-item, multi-bidder auctions generalizing the work of Myerson. This is joint work with my doctoral student at MIT Chaithanya Bandi.

Sunday, 8:30am - 10:00am

■ SunA01

Storer Auditorium

Optimization Methodology

Contributed Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Rd., Evanston, IL, United States of America, mehrotra@iems.northwestern.edu

1 - Spectral Scaling Diagonal Gradient Type Method for Large Scale Unconstrained Optimization
Mahboubeh Farid, University Putra Malaysia, Institute for Mathematical Research, Serdang, 43400, Malaysia, mfarid7@gmail.com, Leong Wah June

We derive new self scaling technique for obtaining positive definite Hessian approximation in diagonal form and combine with modified weak secant equation for better curvature approximation in diagonal-gradient method for unconstrained optimization. The global convergence of new method is proved.

2 - Optimization of the Sum of Linear Ratios in Lower Dimension and Related Topics
Jianming Shi, Professor, Muroran Institute of Technology (MuIT), 27-1 Mizumoto Chou, Muroran, Japan, shi@mmm.muroran-it.ac.jp

In this talk we consider a problem of maximizing the sum of linear ratios. We will show that the TSP can be formulated as a maximization problem of a sum of two linear ratios subject to linear constraints. We also report some numerical results on the proposed algorithm.

3 - Applying a Linear Programming Model for the Distribution of Milk in the City of Florence Armenia-Qu
Leonel Arias Montoya, Msc. Administración Financiera y Económica, Universidad Tecnológica de Pereira, Vereda la Julita, Pereira, Pereira, Colombia, leoarias@utp.edu.co, Jorge Hernan Restrepo Correa, Jorge Andrés Urrutia Mosquera

The proposed linear model generated a solution that improved the profitability of the company, the model provided solutions to the transport capacity constraints and lack of mathematical planning of units of milk to be distributed in the three presentations provided by the company.

4 - Robust and Stochastically Weighted Multi-objective Optimization Models and Reformulations
Jian Hu, Northwestern University, 2145 Sheridan Rd., IEMS Dept., Evanston, IL, 60208, United States of America, jianhu2010@u.northwestern.edu, Sanjay Mehrotra

We introduce a family of models (McRow) for multi-expert multi-criteria decision making. McRow generates a risk-averse decision by allowing ambiguity or randomness of criteria weights and objective functions. The use of McRow is illustrated in disaster planning and agriculture revenue management.

■ SunA02

Classroom AGB 331

Global Optimization Approaches

Cluster: Invited Sessions

Invited Session

Chair: Oleg Prokopyev, University of Pittsburgh, Pittsburgh, PA, 15261, United States of America, droleg@pitt.edu

1 - Solving a Class of Two-stage Stochastic Integer Programs (2SSIPs): Value Function Considerations
Andrew Trapp, Assistant Professor, Worcester Polytechnic Institute, School of Business, 100 Institute Road, Worcester, MA, 01609, United States of America, atrapp@wpi.edu, Oleg Prokopyev, Andrew Schaefer

2SSIPs with random right-hand sides can be solved via a value function reformulation, but explicit value function storage has both advantages and limitations. To overcome such limitations, we discuss theoretical and computational considerations of i) level-set; ii) constraint aggregation approaches.

2 - Integer Programming Approach to Determine Maximum Ambiguity in Fault Tolerant Sensor Networks
Sibel B. Sonuc, PhD Candidate, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, sibel.bilge@ufl.edu, J. Cole Smith

We are studying sensor networks where a subset of sensors might fail. When we cannot clarify the status of a node with the sensor reports, we call that node an ambiguous node. We propose an integer programming approach for finding the maximum number of ambiguous nodes subject to the sensor reports.

3 - Stochastic Batch Scheduling of a Surgical Suite under Block Booking
Oleg Prokopyev, University of Pittsburgh, Pittsburgh, PA, 15261, United States of America, droleg@pitt.edu, Oleg Shylo, Andrew Schaefer

We present an approach for batch scheduling within a block booking system that maximizes the expected utilization of operating room resources subject to probabilistic capacity constraints. The algorithm iteratively solves a set of MIPs based on a normal approximation of surgery durations.

■ SunA03

Classroom AGB 332

Stochastic Programming

Cluster: Invited Sessions

Invited Session

Chair: Shabbir Ahmed, Georgia Institute of Technology, 765 Ferst Avenue, Atlanta, GA, 30332, United States of America, sahmed@isye.gatech.edu

1 - Deterministic Bounds for Probabilistic Set Multi-cover Problems
Feng Qiu, Georgia Institute of Technology, 350516 Georgia Tech Station, Atlanta, GA, 30332, United States of America, fqiu@gatech.edu, Shabbir Ahmed, Santanu Dey

We consider a type of probabilistic set multi-cover problems where each element is to be covered by at least k sets with a certain prescribed probability. We use the LP-based probability bounds to derive inner and outer deterministic approximations. Preliminary computational results are presented.

2 - Modeling Minimum Cost Flows under Stochastic Arc Failure
Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48103, United States of America, siqian@umich.edu

This paper formulates a LP to compute flow losses given random arc failure, and integrates the LP to minimize a MCF cost subject to either the max- or min-loss is bounded by VaR or CVaR. We also model interdiction variants which minimize risk bounds, and use decomposition for solving all models.

3 - Smoothing for Nonsmooth Stochastic Optimization
Guanghui Lan, University of Florida, 302 Weil Hall, Gainesville, FL, United States of America, glan@ise.ufl.edu, Saeed Ghadimi

We introduce smoothing techniques that can improve stochastic approximation (SA) algorithms for certain stochastic convex programming problems. Extensions of these techniques to nonconvex problems will be discussed and numerical results on certain statistical learning problems will be presented.

4 - A Branch-and-cut Algorithms for the Chance Constrained Knapsack Problem
Yongjia Song, University of Wisconsin-Madison, Madison, WI, United States of America, ysong29@wisc.edu, Simge Kucukyavuz, James Luedtke

We study the probabilistic 0-1 knapsack problem with random item weights. We propose new inequalities based on probabilistic covers and various strategies for lifting them. Another class of valid inequalities is obtained by combining scenario-based inequalities.

Sunday, 10:30am - 11:30am

Storer Auditorium

Featured Session

Cluster: Invited Sessions

Invited Session

Chair: Suvrajeet Sen, Ohio State University, Dept. of Integrated Systems Engineering, Columbus OH 43210, United States of America, sen.22@osu.edu

1 - Algorithmic Advances in Stochastic Mixed-integer Programming
Suvrajeet Sen, Ohio State University, Dept. of Integrated Systems Engineering, Columbus OH 43210, United States of America, sen.22@osu.edu

This talk is devoted to a new generation of decomposition algorithms which are extensions of Benders' decomposition, and allow integer variables within sub-problems. Such situations occur naturally within stochastic mixed-integer programming problems. In addition to providing a unified treatment of the algorithms, we will also summarize some computational results.

Sunday, 12:30pm - 2:00pm

■ SunB01

Storer Auditorium

Bilevel Optimization and Extensions

Cluster: Invited Sessions

Invited Session

Chair: Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48103, United States of America, siqian@umich.edu

1 - Adversarial Patrolling Games

Yevgeniy Vorobeychik, Sandia National Labs, 7011 East Ave, Livermore, CA, United States of America, eug.vorobey@gmail.com, Bo An, Milind Tambe

We study Stackelberg security games in which the defender moves between targets on a graph, and the attacker observes the defender's current location and stochastic policy concerning future moves. We present NLP and MILP-based approaches for this problem, as well as its variations and extensions.

2 - Mixed Integer Bilevel Programming Model and Algorithm for a Competitive Product Introduction Problem

Soheil Hemmati, PhD Student, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, soheilmn@ufl.edu, J. Cole Smith

We develop a mixed-integer bilevel programming problem for a setting with two players, each aiming to maximize his own profit by deciding on the products to be introduced to multiple market segments with different preference lists. We also propose a cutting plane algorithm for the problem.

3 - Exact Interdiction Models and Algorithms for Disconnecting Networks via Node Deletions

Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor MI 48103, United States of America, siqian@umich.edu, J. Cole Smith

We study the problem of maximizing the graph disconnectivity by deleting a subset of nodes. We consider three connectivity metrics: the number of components (which we attempt to maximize), the largest component size (which we minimize), and the minimum cost required to reconnect the graph (which we maximize). We formulate each problem as a MIP, and study valid inequalities for the first two objectives by examining intermediate dynamic programming solutions to k-hole subgraphs.

■ SunB02

Classroom AGB 331

Large Scale Optimization

Contributed Session

Chair: Gabriel Haeser, Federal University of São Paulo, Institute of Science and Technology, São Jose dos Campos-SP, Brazil, gabriel.haeser@unifesp.br

1 - Limited-memory BFGS Systems with Diagonal Updates

Roummel Marcia, Assistant Professor, University of California, Merced, 5200 N. Lake Road, Merced, CA, 95340, United States of America, rmarcia@ucmerced.edu, Jennifer Erway

We investigate a formula to solve limited-memory BFGS quasi-Newton Hessian systems with full-rank diagonal updates. Under some conditions, the system can be solved via a recursion that uses only vector inner products. This approach has broad applications in trust region and barrier methods.

2 - IC Temperature Control via a Robust Integer Linear Programming Formulation

Laleh Behjat, Assistant Professor, University of Calgary, 2500 University Drive, Department of Electrical & Computer Eng, Calgary, AB, T2N1N4, Canada, laleh@ucalgary.ca, Bardia Samimi, Yangyang Li

Temperature management is one of the most challenging problems in Integrated Circuit (IC) design. In this paper, a robust optimization model for reducing IC temperature is introduced. The effectiveness of the model is proven by tests on real industry (IBM) circuits with more than 100,000 variables.

3 - Disaster Response Network Design

Fatma Gzara, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, fgzara@uwaterloo.ca, Ghazal Ghodsi

We model disaster response network design using stochastic facility location with two stages. We apply Lagrangian relaxation to decompose the model into first and second stage subproblems. We develop heuristics, derive valid cuts, and propose aggregated, disaggregated and hybrid decompositions.

4 - New Weak Constraint Qualifications with Applications

Gabriel Haeser, Federal University of São Paulo, Institute of Science and Technology, São Jose dos Campos-SP, Brazil, gabriel.haeser@unifesp.br, Paulo J. S. Silva, Roberto Andreani, Maria Laura Schuverdt

We present new constraint qualifications that are weaker than the usual Mangasarian-Fromowitz condition. All of our conditions can be used to analyse global convergence of algorithms such as Sequential Quadratic Programming, augmented Lagrangians, interior point algorithms, and inexact restoration.

■ SunB03

Classroom AGB 332

Stochastic Optimization

Contributed Session

Chair: David Papp, Postdoctoral Fellow, Northwestern University, IEMS, 2145 Sheridan Rd, C210, Evanston, IL, 60208, United States of America, dpapp@iems.northwestern.edu

1 - An Optimal Path Model for the Risk-averse Traveler

Tito Homem-de-Mello, Universidad Adolfo Ibañez, School of Business, Santiago, Chile, tito.hmello@uai.cl, Leilei Zhang

We discuss the problem of finding a path in a network that has minimal expected cost and is less risky than a given benchmark path. We discuss models and algorithms, and present some numerical experiments for a 1,500-arc system corresponding to a portion of the Chicago area network.

2 - Adaptive Convex Enveloping for Multidimensional Convex Stochastic Dynamic Programming

Sheng Yu, George Washington University, 1776 G Street, N.W., Suite 101, Washington, DC, 20052, United States of America, yusir@gwmail.gwu.edu, Enrique Campos-Nanez

We present Adaptive Convex Enveloping (ACE), a fast and accurate general purpose algorithm for solving convex stochastic dynamic programs. ACE easily optimizes large amount of actions, thanks to its optimization-friendly design, and controls the error of the estimated value function on any state.

3 - Optimal Policies of Non-cross-resistant Chemotherapy on a Cancer Model

Jeng-Huei Chen, Assistant Professor, Dept. of Mathematical Sciences, National Chengchi University, NO.64,Sec.2,ZhiNan Rd.,Wenshan District,, Taipei, Taiwan - ROC, jhchen@nccu.edu.tw, Ya-Hui Kuo, Paul H. Luh

Goldie and Coldman proposed the first drug resistant model on cancer and later prove that alternating therapy is optimal under equal efficacy assumption. With a weaker assumption, we extend their work and provide necessary and sufficient conditions under which a therapy will be optimal.

4 - Generating Moment Matching Scenarios Using Optimization Techniques

David Papp, Postdoctoral Fellow, Northwestern University, IEMS, 2145 Sheridan Rd, C210, Evanston, IL, 60208, United States of America, dpapp@iems.northwestern.edu, Sanjay Mehrotra

A flexible scenario generation method for stochastic programs is presented. The generation of scenarios whose moments match those of the original distribution is a semi-infinite LP; its generation problem (a POP) can be solved by random sampling. Comparison to MC and QMC sampling is favorable.

Sunday, 2:30pm - 3:30pm

Storer Auditorium

Featured Session

Cluster: Invited Sessions

Invited Session

Chair: David Alderson, David Alderson,Assistant Professor, Naval Postgraduate School, Monterey CA, United States of America, dlalders@nps.edu

1 - Defender-Attacker-Defender Optimization for Protecting Critical Infrastructure

David Alderson, Assistant Professor, Naval Postgraduate School, Monterey CA, United States of America, dlalders@nps.ed

We introduce two- and three-stage optimization models that represent the strategic, game-theoretic interactions between preparations to defend critical infrastructure, an "attacker" who observes these preparations before acting, and a "defender" who operates the surviving infrastructure as best as possible after an optimal attack. We identify worst-case disruptions in the operation of a system by solving a system interdiction problem. Then, given an available budget and list of possible defensive investments (e.g., hardening, redundancy, capacity expansion), we solve for a combination of investments that makes the system maximally resilient to worst-case disruption. We show some unexpected results that have proven insightful. These models apply equally well to government, military, and commercial systems. Between our NPS student-officers and faculty, we have conducted over 150 case studies on systems ranging from electric power, to transportation, to supply chains, to the Internet.

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