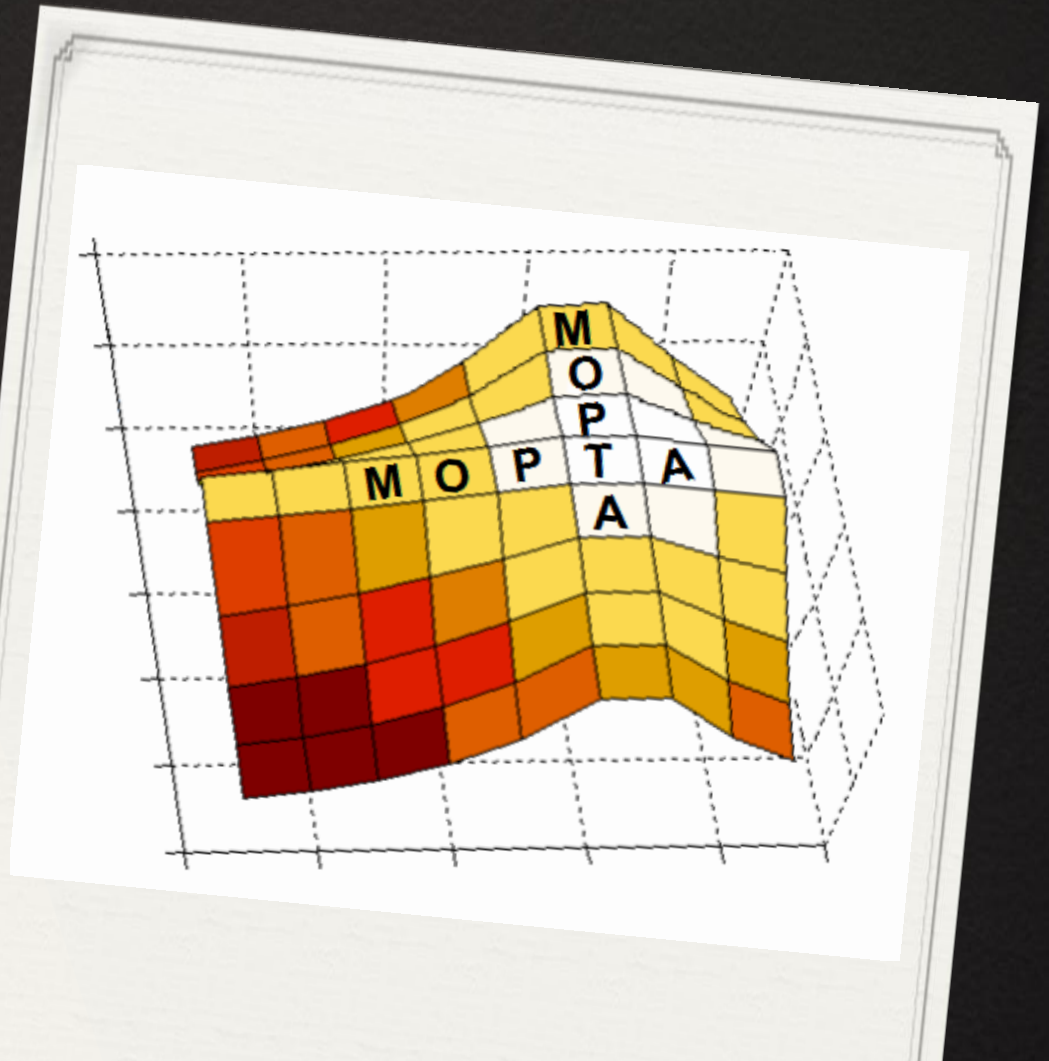


# MOPTA 2012

*Modeling and Optimization:  
Theory and Applications*

**July 30-  
August 1,  
2012**



**Lehigh University, Bethlehem, PA, USA**

# Welcome to the 2012 MOPTA Conference!

## Mission Statement

The Modeling and Optimization: Theory and Application (MOPTA) conference is planned as an annual event aiming to bring together a diverse group of people from both discrete and continuous optimization, working on both theoretical and applied aspects. The format will consist of a number of invited talks from distinguished speakers and selected contributed talks, spread over three days.

The goal is to present a diverse set of exciting new developments from different optimization areas while at the same time providing a setting which will allow increased interaction among the participants. We aim to bring together researchers from both the theoretical and applied communities who do not usually have the chance to interact in the framework of a medium-scale event. MOPTA 2012 is hosted by the Department of Industrial and Systems Engineering at Lehigh University.

## Organization Committee

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Amanda Fabrizio and Kathy Rambo

## We thank to our Sponsors!



# Program

## Monday, July 30 – Iacocca Hall

7:30-8:15 - Registration and continental breakfast – Wood Dining Room Lobby (WDR)

8:15-8:30 – Welcome and Opening Remarks: Mohamed S. El-Aasser, VP for International Affairs, Lehigh University – WDR

8:30-9:30 - Plenary talk

### Andrew Goldberg (Microsoft Research), “The Hub Labeling Algorithm”

Chair: Ted Ralphs - WDR

9:30-9:45 - Coffee break - WDR

9:45-11:15 - Parallel technical sessions

Quadratic and Semidefinite Programming Room: WDR Chair: Sam Burer	Constraint Programming Gov. Suite Chair: Willem-Jan van Hoeve	Mathematical Optimization Room: B013 Chair: Getachew Befekadu
“The interplay between QPB and BQP” Hongbo Dong, (U. of Wisconsin-Madison)	“Graph Coloring Cuts for All-Different Systems” David Bergman (Carnegie Mellon)	“Polynomial Approximation Scheme for the Chance Constraint on Affine Inequalities with Random Vector in the Right-hand Side” Lijian Chen (University of Louisville)
“A block-decomposition framework for solving large-scale convex optimization problems” Camilo Ortiz (Georgia Tech)	“Flow-Based Combinatorial Chance Constraints” Elvin Coban (Carnegie Mellon)	“0/1 Constraint-Satisfaction Problems and Tensor Contraction Networks” Susan Margulies (Pennsylvania State University)
“A Semidefinite Optimization Approach to Multi-Row Facility Layout” Miguel Anjos (Ecole Polytechnique de Montreal)	“MDD Propagation for Disjunctive Scheduling” Willem-Jan van Hoeve (Carnegie Mellon)	“Characterization of reliable stabilization using self-bounded controlled invariant subspaces” Getachew K. Befekadu (Notre Dame)

11:15-11:30 - Coffee break – WDR

11:30-12:30 - Plenary talk

### Kurt M. Anstreicher (University of Iowa), “Optimization with Copositive and Completely Positive Matrices”

Chair: Luis F. Zuluaga – WDR

12:30-1:30 - Lunch - WDR

1:30-3:00 - Parallel technical sessions

Integer/Combinatorial Optimization WDR Chair: Yanjun Li	Interior-Point Methods and Applications Gov. Suite Chair: Hande Y. Benson	Mathematical and Applied Optimization B013 Chair: Jason Hicken
“Multi-branch split cuts for mixed-integer polyhedral” Oktay Günlük (IBM Research)	“Portfolio Optimization with Cone Constraints and Discrete Decisions” Umit Saglam (Drexel University)	“Efficiently Solving Large Cable-Trench and Steiner Cable-Trench Problems with applications in Vascular Imaging” Eric Landquist and Francis J. Vasko (Kutztown University)
“A procedure for generating a polynomial size collection of points for a cut generating set” Selvaprabu Nadarajah (Carnegie Mellon)	“Mathematical Programming for Multi-Vehicle Motion Planning” Pramod Abichandani (Drexel University)	“A comparison of non linear constrained derivative free optimization methods applied on a reservoir characterization inverse problem” Delphine Sinoquet (IFPEN)
“A Class of Rank 2 Facets for the 1-Restricted Simple 2-Matching Polytope” Yanjun Li (Purdue University)	“Interior-Point Methods for Nonconvex Nonlinear Programming: Primal-Dual Methods and Cubic Regularization” Hande Y. Benson (Drexel University)	“Reduced-space inexact-Newton-Krylov methods for PDE-constrained optimization” Jason Hicken (Rensselaer Polytechnic Institute)

3:00-3:15 - Coffee break – WDR

3:15-4:45 - Parallel technical sessions

Nonlinear Programming WDR Chair: Katya Scheinberg	Hybrid Optimization Gov. Suite Chair: Michael R. Bartolacci	Linear Programming B013 Chair: Yuriy Zinchenko
“On Sparse Hessian Recovery and Trust-Region Methods based on Probabilistic Models” Afonso S. Bandeira (Princeton University)	“A Probabilistic Tabu Search Approach for the Unequal Area Facility Layout Problem” Sadan Kulturel-Konak (Penn State Berks)	“On Convex Sets as Invariant Sets for Linear Systems” Yunfei Song (Lehigh University)
“Using Second Order Information in Large Scale $L_1$ Convex Optimization” Xiaocheng Tang (Lehigh University)	“A Hybrid Genetic Algorithm and Lagrangian Heuristic Approach to Survivable Network Design Problem with Relays” Abdullah Konak (Penn State Berks)	“Geometry of Online Packing Linear Programs” Marco Serpa Molinaro (Carnegie Mellon)
“Convex envelopes generated from finitely many compact convex sets” Aida Khajavirad (IBM T.J. Watson Research)	“Optimization of Wireless Connectivity for Disaster Planning and Management” Michael R. Bartolacci (Penn State Berks)	“Shrink-Wrapping trajectories for Linear Programming” Yuriy Zinchenko (University of Calgary)

4:45-5:00 - Coffee break – WDR

5:00-6:00 - Plenary talk

### Edgar Blanco (MIT), “Mega-City Logistics”

Chair: Luis F. Zuluaga – WDR

6:30-9:30 - Student Social – Graduate Student Center – Packer House

# Program

**Tuesday, July 31 – Iacocca Hall**

8:00-8:30 - Continental Breakfast – Wood Dining Room Lobby

8:30-9:30 - Plenary talk

**Reha Tütüncü (Goldman Sachs), “New Optimization Problems in Quantitative Portfolio Construction”**

Chair: Aurélie Thiele - WDR

9:30-9:45 - Coffee break – WDR

9:45-11:15 - AIMMS /MOPTA Optimization Modeling Competition Final (Winner will be announced at Conference Banquet)

**AIMMS/MOPTA Optimization Modeling Competition Final - WDR – Chair: Peter Nieuwesteeg**

**SMART, University of Twente, Enschede, The Netherlands**

Dorien Meijer Cluwen and Irana Denissen. Advised by Bodo Manthey

**Smart Power Engineers, Berlin University of Technology, Germany**

Florian Huber and Soner Emec. Advised by Rüdiger Stephan

**Yie Galindo, University at Buffalo, Buffalo, NY United States**

Gina M. Galindo-Pacheco and Ruben D. Yie-Pinedo. Advised by Rajan Batta

11:15-11:30 - Coffee break – WDR

11:30-12:30 - Plenary talk

**Henry Wolkowicz, (University of Waterloo) “Taking advantage of Degeneracy in Cone Optimization with Applications to Sensor Network Localization and Molecular Conformation.”**

Chair: Tamás Terlaky – WDR

12:30-1:30 – Lunch – WDR

1:30-3:00 - Parallel technical sessions

<b>Optimization for the Smart Grid WDR Chair: Miguel F. Anjos</b>	<b>Financial Optimization Gov. Suite Chair: Miguel Lejeune</b>	<b>Derivative-free/Surrogate Optimization B013 Chair: Rommel Regis</b>
“Unit Commitment Challenges” Bala Venkatesh (Ryerson University)	“Mixed integer portfolio optimization models with p-order cone constraints” Pavlo Krokhmal (University of Iowa)	“Assessing Constraint Handling for Particle Swarm Optimization” Ahmad Almomani (Clarkson University)
“Symmetry in the Unit Commitment Problem” Jim Ostrowski (University of Tennessee)	“A New Framework for Portfolio Selection” Nan Xiong (Carnegie Mellon)	“Derivative Free Optimization for Noisy Functions” Ruobing Chen (Lehigh University)
“Impact of Sub-hourly Wind Power Forecasting on Unit Commitment and Dispatch” Jiadong Wang (Lehigh University)	“Risk-Averse Enhanced Indexation” Miguel Lejeune (George Washington U.)	“Pushing the Limits of High-Dimensional Surrogate-Based Black-Box Optimization” Rommel G. Regis (Saint Joseph's U.)

3:00-3:15 – Coffee Break - WDR

3:15-4:45 - Parallel Session

<b>First Order Methods &amp; Complexity WDR Chair: Javier Peña</b>	<b>Optimization Models for Electricity Systems Gov. Suite Chair: Larry Snyder</b>	<b>Financial Optimization B013 Chair: Zhen Liu</b>
"A smooth perceptron algorithm" Javier Peña (Carnegie Mellon)	“Generation and Storage Dispatch in Stochastic Electricity Networks” MohammadMohsen Moarefdoost (Lehigh U.)	“Bounds for Nested Law Invariant Coherent Risk Measures” Linwei Xin (Georgia Tech)
"A smooth von Neumann/perceptron algorithm" Negar Soheili (Carnegie Mellon)	“Managing Wind-based Electricity Generation with Storage and Transmission Capacity” Yangfang Zhou (Carnegie Mellon)	“Robust and data-driven portfolio management with quantile constraints” Elcin Cetinkaya (Lehigh University)
“The Duality between the Perceptron Algorithm and the von Neumann Algorithm” Dan Li (Lehigh University)	“Electric Power Grid Generation Expansion Optimization Considering Uncertainty and Risk” David W. Coit (Rutgers University)	“Large-scale Portfolio Optimization with Proportional Transaction Costs” Zhen Liu (Missouri U. of Science & Tech.)

4:45-5:00 – Coffee Break – WDR

5:00-6:00 - Plenary talk

**Santosh S. Vempala (Georgia Tech), “On the Complexity of Integer Programming”**

Chair: Ted Ralphs - WDR

6:00-7:00 – Cocktail Reception, Siegel Gallery (First Floor) – Iacocca Hall

7:00-9:30 - Conference Banquet and Competition Results – Wood Dining Room – Iacocca Hall

Dinner Remarks: **Patrick V. Farrell, Provost and Vice President for Academic Affairs, Lehigh University**

# Program

**Wednesday, August 1 – Iacocca Hall**

8:00-8:30 - Continental Breakfast – Wood Dining Room Lobby

8:30-9:30 - Plenary talk

**Michael Trick (Carnegie Mellon), “Optimization Methods in Sports Scheduling”**

Chair: Luis F. Zuluaga - WDR

9:30-9:45 - Coffee break - WDR

9:45-11:15 - Parallel technical sessions

<b>Optimization for the Smart Grid WDR Chair: Miguel F. Anjos</b>	<b>Robust and Convex Optimization Gov. Suite Chair: Fatma Kiliç-Karzan</b>	<b>Nonlinear Programming B013 Chair: Frank E. Curtis</b>
“Optimal Operation of Distribution Feeders in Smart Grids” Kankar Bhattacharya (University of Waterloo)	“An accelerated proximal framework with a fast implementation for solving large-scale convex optimization problems” Camilo Ortiz (Georgia Tech)	“Optimal control of boundary-value problem” Elena Khoroshilova (Lomonosov Moscow State U.)
“A Bilevel Model for Retail Electricity Pricing with Flexible Loads” Lin He (Lehigh University)	“Optimal Trade Execution with Dynamic Risk Measures” Qihang Lin (Carnegie Mellon)	“A Primal-Dual Active-Set Algorithm for Convex Quadratic Optimization” Zheng Han (Lehigh University)
“OR in the Energy Market – Winning the Franz Edelman Award 2011” Peter Nieuwesteeg (AIMMS)	“Robust Stochastic First- and Zero-order Methods for Nonconvex Stochastic Programming” Guanghui Lan (University of Florida)	“Matrix Inequalities and Combinatorial Optimization Problems” Earls Barnes (Morgan State University)

11:15-11:30 - Coffee break – WDR

11:30-12:30 - Plenary talk

**Stephen J. Wright (U. of Wisconsin-Madison), “Packing Ellipsoids and Circles: Algorithms and Application”**

Chair: Katya Scheinberg – WDR

12:30-1:30 - Lunch - WDR

1:30-3:00 - Parallel technical sessions

<b>Stochastic Optimization/Statistical Learning WDR Chair: Peter Frazier</b>	<b>Optimization Models for Electricity Systems Gov. Suite Chair: Larry Snyder</b>	<b>“Optimization Software” B013 Chair: Yunfei Song</b>
“On Approximating Optimal Sampling Laws for Simulation Optimization on Large Finite Sets” Raghu Pasupathy (Virginia Tech)	“Multi-Layered Optimization Of Demand Resources Using Lagrange Dual Decomposition” Jhi-Young Joo (Carnegie Mellon)	“SAS Developments” Matthew Galati (SAS)
“Speeding Up the Cross Entropy Method for Global Optimization” Yuting Wang (University of Virginia)	“Efficient Algorithms and Policies for Demand Response Scheduling” Fang Chen (Lehigh University)	“Optimization and nonlinear parameter estimation with R” John C Nash (University of Ottawa)
“Parallel Global Optimization with Expensive Function Evaluations: A One-Step Bayes-Optimal Method” Peter Frazier (Cornell University)	“On the Value of Better Models for the Electricity Sector” Alberto J. Lamadrid (Lehigh University)	“A hyperbolic smoothing approach for fuzzy clustering” Javier Trejos (University of Costa Rica)

3:00-3:15 - Coffee break – WDR

3:15-4:45 - Parallel technical sessions

<b>Optimization for the Smart Grid WDR Chair: Miguel F. Anjos</b>	<b>Healthcare Management Room: Gov. Suite Chair: Turgay Ayer</b>	<b>Optimization, Information &amp; Complexity B013 Chair: Eugene Perevalov</b>
“The Energy Hub Management System (EHMS)” Claudio Canizares (University of Waterloo)	“Optimal Design of the Annual Influenza Vaccine with Manufacturer Autonomy” Osman Ozaltin (University of Waterloo)	“Decomposition Strategies for Network Management” Brandon Pope (Texas A&M)
“Residential power scheduling using multi-level moving window algorithm” Marc Beaudin (University of Calgary)	“Valuing Prearranged Paired Kidney Exchanges: A Stochastic Game Approach” Murat Kurt (SUNY at Buffalo)	“A Complex Activity Recognition Approach Using Random Graphs” Alexander Nikolaev (SUNY at Buffalo)
	“Automatic prioritization of vaccine initiatives: A multi-objective optimization group decision making approach” Rubén A. Proaño (Rochester Institute of Tech.)	“Dealing with big data in online social networks ? overlapping community detection algorithm” Soundar Kumara (Penn. State)
“A System Architecture for Autonomous Demand Side Load Management in Smart Buildings” Miguel Anjos (Ecole Polytechnique de Montreal)	“Heterogeneity in Women's Adherence and Its Role on Optimal Breast Cancer Screening Policies” Turgay Ayer (Georgia Tech)	“Information chain: the missing links.” Eugene Perevalov (Lehigh University)

4:45-5:00 - Coffee break – WDR

5:00-6:00 - Plenary talk

**Mark S. Roberts (U. of Pittsburgh), “Pushing the Envelope of Operations Research: Applying Management Science to Optimize Health Care Decisions”**

Chair: Bob Storer – WDR

# Program Highlights

## Monday, July 30

8:30am-9:30am – **Andrew Goldberg**, Microsoft Research (see page 9)

11:30am-12:30pm – **Kurt M. Anstreicher**, University of Iowa (see page 7)

5:00pm-6:00pm – **Edgar Blanco**, MIT (see page 8)

## Tuesday, July 31

8:30am-9:30am – **Reha Tütüncü**, Goldman Sachs (see page 12)

9:45am-11:15am – **AIMMS/MOPTA Optimization Modeling Competition Final** (see page 16)

11:30am-12:30pm - **Henry Wolkowicz**, University of Waterloo (see page 14)

5:00p.m.-6:00p.m. – **Santosh S. Vempala**, Georgia Tech University (see page 13)

## Wednesday, August 1

8:30am-9:30am – **Michael Trick**, Carnegie Mellon University (see page 11)

11:30am-12:30pm – **Stephen J. Wright**, The University of Wisconsin-Madison (see page 15)

5:00pm-6:00pm – **Mark S. Roberts**, University of Pittsburgh (see page 10)

# Social Program

## Monday, July 30

- 7:30am-8:15am – **Continental Breakfast (WDR)**
- 9:30am-9:45am – Coffee Break
- 11:15am-11:30am – Coffee Break
- 12:30pm-1:30pm – **Lunch (WDR)**
- 3:00pm-3:15pm – Coffee Break
- 4:45pm-5:00pm – Coffee Break
- 6:30pm-9:30pm – **Student Social – Graduate Student Center**

## Tuesday, July 31

- 8:00am-8:30am - **Continental Breakfast (WDR)**
- 9:30am-9:45am - Coffee break
- 11:15am-11:30am - Coffee break
- 12:30pm-1:30pm - **Lunch (WDR)**
- 3:00pm-3:13pm - Coffee break
- 4:45pm-5:00pm – Coffee break
- 6:00pm-7:00pm – **Cocktail Reception (Siegel Gallery, First Floor, Iacocca Hall)**
- 7:00pm-9:30pm - **Conference Banquet and Competition Results (WDR)**

## Wednesday, August 1

- 8:00am-8:30am - **Continental Breakfast (WDR)**
- 9:30am-9:45am - Coffee break
- 11:15am-11:30am – Coffee break
- 12:30pm-1:30pm – **Lunch (WDR)**
- 3:00pm-3:15pm – Coffee Break
- 4:45pm-5:00pm – Coffee Break

# Speaker Biographies



## Kurt M. Anstreicher

Professor and Department Executive Officer  
Henry B. Tippie Research Professor of Management Sciences  
The University of Iowa  
kurt-anstreicher@uiowa.edu

Kurt M. Anstreicher is the Tippie Research Professor and Senior Associate Dean at the University of Iowa Tippie College of Business. Professor Anstreicher received his Ph.D. from the Department of Operations Research at Stanford University in 1983, under the direction of George Dantzig. He was an assistant and associate professor of Operations Research at Yale University from 1982-1991, and joined the faculty of the University of Iowa as a professor of Management Sciences in 1991. He was appointed Daly Professor in 1998 and Tippie Research Professor in 2002. He was the Department Executive Officer (Chair) of Management Sciences from 2003-2012, and was named Senior Associate Dean in 2012. He has twice (in 1989-1990 and 1996-97) been a Research Fellow at the Center for Operations Research and Econometrics (CORE), in Louvain-la-Neuve, Belgium.

Professor Anstreicher is an internationally recognized researcher in mathematical optimization and has authored over 60 refereed journal articles, mainly in the areas of interior-point algorithms, semidefinite programming and nonlinear discrete optimization. In 2002 he was awarded the SIAM Activity Group on Optimization (SIAG/OPT) Prize for the best paper in optimization in 2000-2002.

Professor Anstreicher has been the organizer or co-organizer of research workshops in the US, Canada and Germany and was a co-chair of the 2008 SIAM Conference on Optimization. He was a member of the founding editorial board of the SIAM Journal on Optimization and served as an associate editor from 1991-1997. He served as a co-editor of Mathematical Programming Series A from 1999-2005 and was appointed editor-in-chief of MPA in 2007. He was a member of the INFORMS Lanchester Prize committee in 1991, the Mathematical Optimization Society (MOS) Tucker Prize committee in 1997 and 2000 (chair), and the INFORMS Von Neumann Prize committee in 2008, 2009 and 2010 (chair). He is currently a member of the SIAM Lagrange Prize committee and the chair of the INFORMS Optimization Society Khachiyan Prize committee. He served on the elected Council of the MOS from 1997 to 2000, was the elected Chair of SIAG/OPT from 2004 to 2007, and was appointed Chair of the Executive Committee of the MOS in 2010. Professor Anstreicher was elected as an INFORMS Fellow in 2011.

**Talk Title: Optimization with Copositive and Completely Positive Matrices**

**Date: 11:30am, Monday, July 30, Wood Dining Room**

**Abstract:** An  $n \times n$  real symmetric matrix  $X$  is called copositive (COP) if  $a^T X a \geq 0$  for every nonnegative vector  $a$ , and completely positive (CP) if  $X = NN^T$  for some nonnegative matrix  $N$ . The cones of copositive and completely positive matrices are dual to one another. In recent years it has been shown that a variety of NP-hard optimization problems can be formulated as conic linear programs over the COP and CP cones. We describe these formulation results, as well as different algorithmic approaches for problems posed over these cones. One approach is based on computable matrix hierarchies that give better and better approximations of the CP and COP cones, and another is based on generating a COP cut matrix that separates a given non-CP matrix from the CP cone, or a CP cut matrix that separates a non-COP matrix from the COP cone. Computational results show that these algorithmic approaches generate improved bounds on some difficult instances.



# Speaker Biographies



## Edgar Blanco

Research Director  
Executive Director, MIT SCALE Latin America  
MIT  
eblanco@mit.edu

Dr. Edgar Blanco is a Research Director at the MIT Center for Transportation & Logistics and is the Executive Director of the MIT SCALE Network in Latin America. His current research focus is the design of environmentally efficient supply chains. He also leads research initiatives on supply chain innovations in emerging markets, logistics operations in megacities and disruptive mobile technologies in value chains.

Dr. Blanco has over thirteen years of experience in designing and improving logistics and supply chain systems, including the application of operations research techniques, statistical methods, GIS technologies and software solutions to deliver significant savings in business operations.

Prior to joining MIT, he was leading the Inventory Optimization practice at Retek (now Oracle Retail). He received his Ph.D. from the School of Industrial and Systems Engineering at the Georgia Institute of Technology. His educational background includes a B.S. and M.S. in Industrial Engineering from Universidad de los Andes (Bogotá, Colombia) and a M.S. in Operations Research from the Georgia Institute of Technology.

**Talk Title: Mega-City Logistics**

**Date: 5:00pm, Monday, July 30, Wood Dining Room**

**Abstract:** The field of Supply Chain and Logistics Management has evolved over the last 15 years from practices and experiences from Europe and the United States. As academic and practitioners try to apply the same approaches and techniques to emerging economies in Asia and Latin America, they quickly realize that the unique environment characteristics, creates challenges that are usually not addressed in traditional approaches. Through a series of real-life examples, this presentation will illustrate why academics and practitioners should re-evaluate their approach to urban logistics in "megacities", especially in the context of emerging markets. Megacities – cities with a population of at least 10 million people – are increasing in both number and size, and their share of world GDP is expected to grow from about 14% to over 20% in a decade. Most of the 23 megacities that currently exist are located in emerging markets. The discussion will include initial results of on-going field research in Latin-American.

# Speaker Biographies



## Andrew V. Goldberg

Principal Researcher  
Microsoft Research Silicon Valley  
goldberg@microsoft.com

Andrew V. Goldberg is a Principal Researcher at Microsoft Research -- Silicon Valley. His research interests include design, analysis, and experimental evaluation of algorithms, data structures, algorithm engineering, and computational game theory. Goldberg received his PhD degree in Computer Science from M.I.T. in 1987. Before joining Microsoft, he worked for Stanford University, NEC Research Institute, and InterTrust STAR Lab. His graph algorithms are taught in computer science and operations research classes and their implementations are widely used in industry and academia. Goldberg received a number of awards, including the NSF Presidential Young Investigator Award, the ONR Young Investigator Award, the Mathematical Programming Society A.W. Tucker Prize, and INFORMS Optimization Society Farkas Prize. He is an ACM Fellow.

More information, including software downloads, is available at [www.avglab.com/andrew](http://www.avglab.com/andrew).

**Talk Title: The Hub Labeling Algorithm**

**Date: 8:30am, Monday, July 30, Wood Dining Room**

**Abstract:** Given a weighted graph, a distance oracle takes as an input a pair of vertices and returns the distance between them. The labeling approach to distance oracle design is to precompute a label for every vertex so that distances can be computed from the corresponding labels. This approach has been introduced by [Gavoille et al. '01], who also introduced the Hub Labeling algorithm (HL). HL has been further studied by [Cohen et al. '02].

We study HL in the context of graphs with small highway dimension (e.g., road networks). We show that under this assumption HL labels are small and the queries are sublinear. We also give an approximation algorithm for computing small HL labels that uses the fact that shortest path set systems have small VC-dimension.

Although polynomial-time, precomputation given by theory is too slow for continental-size road networks. However, heuristics guided by the theory are fast, and compute very small labels. This leads to the fastest currently known practical distance oracles for road networks.

The simplicity of HL queries allows their implementation inside of a relational database (e.g., in SQL), and query efficiency assures real-time response. This approach brings the power of location-based services to SQL programmers, and benefits from external memory implementation and query optimization provided by the underlying database.

Joint work with Ittai Abraham, Daniel Delling, Amos Fiat, and Renato Werneck.

# Speaker Biographies



## Mark S. Roberts, M.D., MPP

Professor of Health Policy and Management, Professor of Medicine, Professor of Industrial Engineering and Professor of Clinical and Translational Science  
Chair, Department of Health Policy and Management  
University of Pittsburgh Graduate School of Public Health  
mroberts@Pitt.edu

Mark S. Roberts, MD, MPP is Professor and Chair of Health Policy and Management, and hold secondary appointments in Medicine, Industrial Engineering and Clinical and Translational Science. A practicing general internist, he has conducted research in decision analysis and the mathematical modeling of disease for over 25 years, and has expertise in cost effectiveness analysis, mathematical optimization and simulation, and the measurement and inclusion of patient preferences into decision problems. He has used decision analysis to examine clinical, costs, policy and allocation questions in liver transplantation, vaccination strategies, operative interventions, and the use of many medications. His recent research has concentrated in the use of mathematical methods from operations research and management science, including Markov Decision Processes, Discrete Event Simulation and integer programming to problems in health care.

**Talk Title: Pushing the Envelope of Operations Research: Applying Management Science to Optimize Health Care Decisions**

**Date: 5:00pm, Wednesday, August 1, Wood Dining Room**

**Abstract:** Historically, application of operations research in health care has been focused on the process and delivery of care. Viewing health care delivery as a production process, operations research and industrial engineering techniques have been used to optimize operating room and ambulance schedules, eliminate bottlenecks in emergency rooms, and re-organize the delivery of radiological services. There have been some applications in optimizing care; most notable perhaps is the development of algorithms to optimize the delivery of radiation therapy, but these remain rare.

Over the past 15 years, we have been applying methods from operations research to optimize the treatment of disease. The preferred methodology in medicine for acquiring this type of knowledge is the randomized controlled trial. However, randomized trials are designed to answer simple questions such as “Is A better than B?” when, in fact, most clinical and policy questions are much more complex, and involve picking the best treatment out of a wide array of possibilities, or understanding under what conditions A is better than B. Answering these types of optimization questions is the purpose of operations research. This talk will describe our efforts to apply operations research techniques to patient care decision and policies, using examples from liver transplantation, HIV care and Cardiology.

# Speaker Biographies



## Michael Trick

Senior Associate Dean, Education and  
Harry B. and James H. Higgins Professor of Operations Research  
Tepper School of Business  
Carnegie Mellon University  
trick@cmu.edu

Dr. Trick is a researcher and educator in the field of operations research, with a specialization in computational methods in optimization. After receiving his doctorate in industrial engineering from Georgia Tech, Dr. Trick embarked on two years of postdoctoral fellowships, first at the Institute for Mathematics and its Applications in Minneapolis, then at the Institut fuer Oekonometrie und Operations Research in Bonn, Germany. He then joined the faculty of the Graduate School of Administration (now the Tepper School of Business) at Carnegie Mellon University. From 1998 through 2005, he was also President of the Carnegie Bosch Institute for Applied Studies in International Management, a research institute specializing in research support, conferences, and executive education on international management issues, and the recipient of the Bosch Professorship from 2003-2005. The students of GSIA awarded him the George Leland Bach Award as the top teacher in the program in 1991 and re-nominated him for that award in 1997, 1998 and 2000. In 1995, he was appointed the founding Editor of INFORMS Online, the electronic information service of the Institute for Operations Research and the Management Sciences, a 14,000 member professional society. In 2002 he was President of that society. Starting 2004, he became Vice-President/North America for the International Federation of Operational Research Societies, an umbrella organization of 46 national operations research societies. In 2007, Trick visited the University of Auckland as a Hood Fellow.

Trick is the author of forty professional publications and is the editor of five volumes of refereed articles. Trick has consulted extensively with the United States Postal Service on supply chain design, with Major League Baseball and a number of college basketball conferences on scheduling issues, and with companies such as Motorola and Sony on machine scheduling. Trick is a Fellow of the Institute for Operations Research and the Management Sciences (INFORMS).

**Talk Title: Optimization Methods in Sports Scheduling**

**Date: 8:30am, Wednesday, August 1, Wood Dining Room**

**Abstract:** In the last decade, sports scheduling has grown to be a robust, vibrant area of optimization. This is due to the economic impact of the work, with dozens of professional and amateur leagues now relying on optimization to create their schedules, as well as the inherent difficulty of creating good or optimal sports schedules. Despite this interest, there still exist small, well-defined sports scheduling problems that have defied exact solution. I cover some of the key models in sports scheduling, and show how innovative optimization approaches, including combinatorial Benders methods and optimization-based large scale local search, address these problems.

# Speaker Biographies



## Reha Tütüncü

Managing Director  
Goldman Sachs Asset Management  
Reha.Tutuncu@gs.com

Reha is a managing director in the Quantitative Investment Strategies group within Goldman Sachs Asset Management. Prior to joining GSAM, he was a tenured associate professor at Carnegie Mellon University's Department of Mathematical Sciences. He is the co-author of the book *Optimization Methods in Finance* and several articles on quantitative finance and optimization in academic and practitioner journals.

**Talk Title: New Optimization Problems in Quantitative Portfolio Construction**

**Date: 8:30am, Tuesday, July 31, Wood Dining Room**

**Abstract:** Classical quantitative portfolio construction models evolved around the single-period, single-portfolio mean-variance optimization formulation of Markowitz. More recent studies focused on variations addressing multi-period or multi-portfolio instances as well as formulations with different objectives. For example, "risk parity" portfolios seek better diversification through more balanced risk allocations across asset classes. We survey some of these recent approaches and the challenging optimization problems that result from them.

# Speaker Biographies



## Santosh S. Vempala

Distinguished Professor of Computer Science  
Georgia Institute of Technology  
vempala@gatech.edu

Santosh Vempala is Distinguished Professor of Computer Science and Industrial and Systems Engg. (by courtesy) at Georgia Tech. His research interests are in algorithms, randomness, geometry and computing-for-good (C4G). He graduated from CMU in 1997, advised by Avrim Blum and was at MIT until 2006 except for a year at UC Berkeley as a Miller Fellow. He has written two books, "The Random Projection Method," (2004) and "Spectral Algorithms" (with Ravi Kannan, 2009). Vempala has also been a Sloan fellow and a Guggenheim fellow and continues to get unreasonably excited when a phenomenon that appears complex from one perspective turns out to be simple from another. More information can be found on his webpage:

<http://www.cc.gatech.edu/~vempala>

**Talk Title: On the Complexity of Integer Programming**

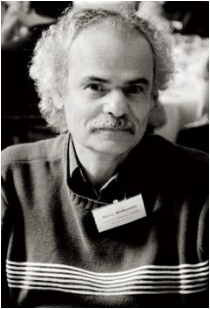
**Date: 5:00pm, Tuesday, July 31, Wood Dining Room**

**Abstract:** We discuss three directions:

1. The status of the worst-case complexity of IP, with some recent improvements based on using M-ellipsoids.
2. A phase transition phenomenon for the feasibility of random IPs based on a connection to discrepancy theory.
3. A cutting-plane based algorithm for minimum-cost perfect matchings.

We will highlight open questions for each of these.

# Speaker Biographies



## Henry Wolkowicz

Professor  
Department of Combinatorics and Optimization  
The University of Waterloo  
hwolkowi@uwaterloo.ca

Henry Wolkowicz is currently a professor in mathematics, in the department of combinatorics and optimization at the University of Waterloo in Canada. Prior, he was a professor at the University of Delaware and the University of Alberta. He received his Ph.D. from McGill University in Mathematics in 1978. Dr. Wolkowicz's research deals with applications of optimization and matrix theory to algorithmic development for both continuous and discrete optimization problems. His research interests include: optimization in finite dimensional and abstract spaces; linear, nonlinear and semidefinite programming; matrix eigenvalue problems; and numerical analysis of algorithms. His combinatorial optimization work applies convex relaxations to hard combinatorial optimization problems. The relaxations are based on Lagrangian duality, and in many cases they result in Semidefinite Programming relaxations.

Dr. Wolkowicz was chair for the SIAM Activity Group on Optimization (SIAG/OPT) from 2001-2004 and the SIAM Council from 2005-2011. He is the Associate Editor of the SIAM J. of Optimization; Math. Progr. B; J. of Computational Optimization and Applications, COAP; J. of Combinatorial Optimization, JOCO; Optimization and Engineering, OPTE; American J. of Mathematical and Management Sciences and has been organizer of several conferences and workshops. Dr. Wolkowicz has held several visiting research positions at Universite Paul Sabatier, Princeton University, Emory University and the University of Maryland.

**Talk Title: Taking advantage of Degeneracy in Cone Optimization with Applications to Sensor Network Localization and Molecular Conformation**

**Date: 11:30am, Tuesday, July 31, Wood Dining Room**

**Abstract:** The elegant theoretical results for strong duality and strict complementarity for linear programming, LP, lie behind the success of current algorithms. However, the theory and preprocessing techniques that are successful for LP can fail for cone programming over nonpolyhedral cones.

Surprisingly, many instances of semidefinite programming, SDP, problems that arise from relaxations of hard combinatorial problems are degenerate. (Slater's constraint qualification fails.) Rather than being a disadvantage, we show that this degeneracy can be exploited. In particular, several huge instances of SDP completion problems can be solved quickly and to extremely high accuracy. In particular, we illustrate this on the sensor network localization and Molecular conformation problems.

# Speaker Biographies



## Stephen J. Wright

Professor  
Department of Computer Sciences, and Department of  
Industrial and Systems Engineering  
The University of Wisconsin - Madison  
swright@cs.wisc.edu

Stephen J. Wright is a Professor of Computer Sciences at the University of Wisconsin-Madison. His research interests lie in computational optimization and its applications to science and engineering. Prior to joining UW-Madison in 2001, Wright was a Senior Computer Scientist (1997-2001) and Computer Scientist (1990-1997) at Argonne National Laboratory, and Professor of Computer Science at the University of Chicago (2000-2001). From 2007-2010, he served as chair of the Mathematical Optimization Society, the leading professional society in optimization. He has been elected three times to the Board of Trustees of the Society for Industrial and Applied Mathematics (SIAM), serving from 2005-2014. Wright is the author or co-author of three widely used books in numerical optimization, including "Primal Dual Interior-Point Methods" (SIAM, 1997) and "Numerical Optimization" (2nd Edition, Springer, 2006, with J. Nocedal). He has also authored over 90 refereed journal papers on optimization theory, algorithms, software, and applications, along with over 40 refereed conference papers. He is coauthor of widely used software for linear programming (PCx) and quadratic programming (OOQP) based on interior-point methods and GPSR and SpaRSA for compressed sensing. His recent work includes the use of optimization in machine learning and compressed sensing applications.

**Talk Title: Packing Ellipsoids and Circles: Algorithms and Application**

**Date: 11:30am, Wednesday, August 1, Wood Dining Room**

**Abstract:** Problems of packing shapes with maximal density, possibly into a container of restricted size, are classical in discrete mathematics. We describe here the problem of packing ellipsoids of given (varying) dimensions into a finite container, in a way that minimizes the maximum overlap between adjacent ellipsoids. A bilevel optimization algorithm is described for finding local solutions of this problem, both the general case and the easier special case in which the ellipsoids are spheres. Tools from conic optimization, especially semidefinite programming, are key to the approach. Theoretical and computational results will be summarized.

We apply the method to the problem of chromosome arrangement in cell nuclei, and compare our results with the experimental observations reported in the biological literature.



# AIMMS/MOPTA Optimization Modeling Competition 2012

The fourth AIMMS/MOPTA Optimization Modeling Competition is a result of cooperation between Paragon Decision Technology (the developers of the AIMMS modeling system) and the organizers of the MOPTA conference. Teams of two or three graduate students participated and solved a problem of scheduling appliances in a “Smart Grid”. The teams were asked to consider that energy demands in a single home or across multiple homes in a neighborhood are often flexible, and develop a tool to handle the scheduling of appliances in a home (or in a neighborhood) that aims to reduce costs for the consumer while maintaining level loads for the utility company.

The teams had to form a mathematical model of the problem, implement it in AIMMS, solve it, create a graphical user interface, and write a 15 pages report on the project. We are happy that 20 teams from different countries registered and downloaded the problem. The panel of judges (Shalinee Kishore, Frank E. Curtis, and Luis F. Zuluaga from Lehigh University and Peter Nieuwesteeg from Paragon Decision Technology) selected the following three teams for the final:

**SMART, University of Twente, Enschede, The Netherlands**

Dorien Meijer Cluwen and Irana Denissen. Advised by Bodo Manthey

**Smart Power Engineers, Berlin University of Technology, Berlin, Germany**

Soner Emec and Florian Huber. Advised by Rüdiger Stephan

**Yie Galindo, University at Buffalo, Buffalo, NY, United States**

Gina M. Galindo-Pacheco and Ruben D. Yie-Pinedo. Advised by Rajan Batta

The finalist teams will each give 30 minute presentations (20 minute talks + 10 minutes for questions) on their work on Tuesday starting at 9:45am in the Wood Dining Room. The winning team will be announced at the conference banquet on Tuesday evening.

One other team has received an honorable mention for their work:

**Management Science Lab, Korea University, Seoul, Korea**

Gilhyeon Do, Gigyoung Park and Junsang Yuh. Advised by Youngho Lee

We thank all the teams for their participation. We believe that it has been a very positive experience for all parties involved in the process.

# Detailed Program and Abstracts

Monday, July 30

7:30am-8:15am	Registration/Breakfast	Wood Dining Room (2nd floor)
8:15am-8:30am	Welcome, Mohamed S. El-Aasser (VP for Int'l. Affairs, Lehigh University)	Wood Dining Room (2nd floor)
8:30am-9:30am	Plenary presentation	Wood Dining Room (2nd floor)
<i>Chair:</i>	Ted Ralphs	
<i>Speaker:</i>	<b>Andrew Goldberg</b> (Microsoft Research, goldberg@microsoft.com)	
<i>Title:</i>	<b>The Hub Labeling Algorithm</b>	
<i>Abstract:</i>	Given a weighted graph, a distance oracle takes as an input a pair of vertices and returns the distance between them. The labeling approach to distance oracle design is to precompute a label for every vertex so that distances can be computed from the corresponding labels. This approach has been introduced by [Gavoille et al. '01], who also introduced the Hub Labeling algorithm (HL). HL has been further studied by [Cohen et al. '02]. We study HL in the context of graphs with small highway dimension (e.g., road networks). We show that under this assumption HL labels are small and the queries are sublinear. We also give an approximation algorithm for computing small HL labels that uses the fact that shortest path set systems have small VC-dimension. Although polynomial-time, precomputation given by theory is too slow for continental-size road networks. However, heuristics guided by the theory are fast, and compute very small labels. This leads to the fastest currently known practical distance oracles for road networks. The simplicity of HL queries allows their implementation inside of a relational database (e.g., in SQL), and query efficiency assures real-time response. This approach brings the power of location-based services to SQL programmers, and benefits from external memory implementation and query optimization provided by the underlying database.	
<i>Coauthor(s):</i>	<b>Ittai Abraham</b> , <b>Daniel Delling</b> , <b>Amos Fiat</b> , and <b>Renato Werneck</b>	
9:30am-9:45am	Coffee break	Wood Dining Room (2nd floor)
9:45am-11:15pm	Parallel session (Track 1 of 3)	Wood Dining Room (2nd floor)
<i>Session title:</i>	QUADRATIC AND SEMIDEFINITE PROGRAMMING	
<i>Session chair:</i>	Sam Burer	
<i>Speaker:</i>	<b>Hongbo Dong</b> (University of Wisconsin-Madison, hdong6@wisc.edu)	
<i>Title:</i>	<b>The interplay between QPB and BQP</b>	
<i>Abstract:</i>	We consider (nonconvex) quadratic programming with box constraints and binary indicators, where each binary variable indicates the "on/off" status of the continuous variable. This problem has the structure of box-constrained quadratic program (QP) on the continuous side, and the boolean quadric polytope (BQP) on the binary side. However, we illustrate that relaxation that solely considers QP or BQP provides very loose bound. To improve this, we show how to lift a class of valid inequalities for QP to include the binary information, and discuss the separation problem for these lifted cuts. Preliminary computational results are reported.	
<i>Coauthor(s):</i>	<b>Jeff Linderoth</b> (linderoth@wisc.edu) , <b>Hyemin Jeon</b> (jeon5@wisc.edu)	
<i>Speaker:</i>	<b>Camilo Ortiz</b> (Georgia Institute of Technology, camiort@gatech.edu)	
<i>Title:</i>	<b>A block-decomposition framework for solving large-scale convex optimization problems</b>	
<i>Abstract:</i>	This work generalizes the block-decomposition developments on conic programming (Monteiro, Ortiz and Svaiter; 2011) to the context of general convex optimization problems. We developed a simple framework, with great flexibility in the definition of each block, for solving convex optimization problems. In this talk we review the main ideas behind this framework and the corresponding complexity bounds. We also report very encouraging computational results comparing our methods with the second order algorithm SDPNAL (X. Zhao et al.) and the first order method SDPAD (Z. Wen et al.). With an appropriate definition of each block, the results on specific large-scale conic problems are quite promising.	
<i>Coauthor(s):</i>	<b>Renato D.C Monteiro</b> (monteiro@isye.gatech.edu) , <b>Benar F. Svaiter</b> (benar@impa.br)	

*Speaker:* **Miguel Anjos** (École Polytechnique de Montréal, miguel-f.anjos@polymtl.ca)  
*Title:* **A Semidefinite Optimization Approach to Multi-Row Facility Layout**  
*Abstract:* Multi-row facility layout seeks an optimal placement of departments along rows. Large single-row problems have been solved to global optimality, and very large ones to near-optimality, using semidefinite optimization. We extend the semidefinite approach to multi-row layout problems and show that it provides high-quality results in reasonable time for this more general class of layout problems.

*Coauthor(s):* **Philipp Hungerländer** (philipp.hungerlaender@uni-klu.ac.at)

9:45am-11:15pm Parallel session (Track 2 of 3) Governor's Suite (2nd floor)  
*Session title:* CONSTRAINT PROGRAMMING  
*Session chair:* Willem-Jan van Hoeve

*Speaker:* **David Bergman** (Carnegie Mellon University, dbergman@andrew.cmu.edu)  
*Title:* **Graph Coloring Cuts for All-Different Systems**  
*Abstract:* In this talk we investigate the relationship between the graph coloring problem and the system of all-different constraints from a polyhedral perspective. Specifically, we consider facets in the space of the all-different system and discuss their relative strength with classical 0-1 cuts for the graph coloring problem.

*Coauthor(s):* **John Hooker** (jh38@andrew.cmu.edu)

*Speaker:* **Elvin Coban** (Carnegie Mellon University, ecoban@andrew.cmu.edu)  
*Title:* **Flow-Based Combinatorial Chance Constraints**  
*Abstract:* We study stochastic variants of flow-based global constraints as combinatorial chance constraints. As a specific case study, we focus on the stochastic weighted alldifferent constraint. We first show that determining the consistency of this constraint is NP-hard. We then show how the combinatorial structure of the alldifferent constraint can be used to define chance-based filtering, and to compute a policy. Our propagation algorithm can be extended immediately to related flow-based constraints such as the weighted cardinality constraint. The main benefits of our approach are that our chance-constrained global constraints can be integrated naturally in classical deterministic CP systems, and are more scalable than existing approaches for stochastic constraint programming.

*Coauthor(s):* **Andre A. Cire** (acire@andrew.cmu.edu), **Willem-Jan van Hoeve** (vanhoeve@andrew.cmu.edu)

*Speaker:* **Willem-Jan van Hoeve** (Carnegie Mellon University, vanhoeve@andrew.cmu.edu)  
*Title:* **MDD Propagation for Disjunctive Scheduling**  
*Abstract:* We present new propagation methods for disjunctive scheduling, based on limited-width Multivalued Decision Diagrams (MDDs). We show how our method can be integrated efficiently with existing propagation algorithms. Experimental results indicate that the MDD propagation can outperform state-of-the-art propagators especially when minimizing sequence-dependent setup times, in certain cases by several orders of magnitude.

*Coauthor(s):* **Andre Cire** (acire@andrew.cmu.edu)

9:45am-11:15pm Parallel session (Track 3 of 3) B013 (1st floor)  
*Session title:* MATHEMATICAL OPTIMIZATION  
*Session chair:* Getachew Befekadu

*Speaker:* **Lijian Chen** (University of Louisville, lijian.chen@louisville.edu)  
*Title:* **Polynomial Approximation Scheme for the Chance Constraint Imposed on Affine Inequalities with Joint Logarithmically Concave Continuous Random Vector in the Right-hand Side**  
*Abstract:* We establish a Bernstein polynomial based approximation scheme for a specific type of chance constrained optimization in which the chance constraint is imposed on quasi-concave constraints with logarithmically concave (log-concave in short) continuous random vector on the right hand side. Although the model is indeed convex, it is still computationally demanding due to the costs of calculating the chance constraint's value and gradient. More importantly, we only assume the log-concave and continuous joint distribution for the random vector without further assuming any close-form expression. We address the following computational issues. (1) We choose the initial solution by the Boolean bounding technique. (2) We showed that our approximation scheme will require smaller sample in comparison to the crude Monte Carlo. (3) The method is polynomial. And (4) We showed that obtained optimal solution is converging to the original through the epigraph convergence analysis. Numerical results on logistics and air traffic control are presented.

*Speaker:* **Susan Margulies** (Pennsylvania State University, margulies@math.psu.edu)  
*Title:* **0/1 Constraint-Satisfaction Problems and Tensor Contraction Networks**  
*Abstract:* In a series of papers dating from 2007, J. Cai and V. Choudhary developed tensor contraction networks as an alternative description of L. Valiant's "holographic algorithms". In this paper, we apply algebraic methods to design very specific tensor contraction networks under a change of basis that are meant to simulate 0/1 constraint-satisfaction problems. Using algebraic methods, we capture the combinatorial notion of a "Pfaffian" tensor contraction network under a change of basis, and construct particular partial tensor contraction network pieces meant to simulate 0/1 variables and a "swap" gates or wire crossings. Finally, we show that these planar, Pfaffian tensor contraction network pieces can be algebraically linked with another explicitly codified set of gates, and thus, we illustrate a class of 0/1 constraint-satisfaction problems that are solvable in polynomial-time.

*Coauthor(s):* **Jason Morton** (morton@math.psu.edu)

*Speaker:* **Getachew K. Befekadu** (University of Notre Dame, gbefekadu1@nd.edu)  
*Title:* **Characterization of reliable stabilization using self-bounded controlled invariant subspaces**  
*Abstract:* In this talk, we consider the problem of reliable stabilization for generalized multi-channel systems. We specifically link the problem of stabilization of the multi-channel system to certain properties of self-bounded controlled invariant subspaces that are associated with the problem of disturbance decoupling, where the structure induced from this family of invariant subspaces is used for characterizing the problem of reliable stabilization. We also provide conditions for the existence of a set of state feedback controllers that maintain the stability of the system under possible single-channel controller failure as well as in the presence of unknown disturbances in the system.

*Coauthor(s):* **Vijay Gupta** (vgupta2@nd.edu) , **Panos J. Antsaklis** (antsaklis.1@nd.edu)

11:15am-11:30am    Coffee break    Wood Dining Room (2nd floor)

11:30am-12:30pm    Plenary presentation    Wood Dining Room (2nd floor)

*Chair:* Luis F. Zuluaga

*Speaker:* **Kurt Anstreicher** (University of Iowa, kurt-anstreicher@uiowa.edu)  
*Title:* **Optimization with Copositive and Completely Positive Matrices**  
*Abstract:* An  $n \times n$  real symmetric matrix  $X$  is called copositive (COP) if  $a'Xa \geq 0$  for every nonnegative vector  $a$ , and completely positive (CP) if  $X = NN'$  for some nonnegative matrix  $N$ . The cones of copositive and completely positive matrices are dual to one another. In recent years it has been shown that a variety of NP-hard optimization problems can be formulated as conic linear programs over the COP and CP cones. We describe these formulation results, as well as different algorithmic approaches for problems posed over these cones. One approach is based on computable matrix hierarchies that give better and better approximations of the CP and COP cones, and another is based on generating a COP cut matrix that separates a given non-CP matrix from the CP cone, or a CP cut matrix that separates a non-COP matrix from the COP cone. Computational results show that these algorithmic approaches generate improved bounds on some difficult instances.

12:30pm-1:30pm    Lunch    Wood Dining Room (2nd floor)

- 1:30pm-3:00pm Parallel session (Track 1 of 3) Wood Dining Room (2nd floor)
- Session title:* INTEGER/COMBINATORIAL OPTIMIZATION
- Session chair:* Yanjun Li
- Speaker:* **Oktay Günlük** (IBM Research, gunluk@us.ibm.com)
- Title:* **Multi-branch split cuts for mixed-integer polyhedra**
- Abstract:* In this paper we study the  $t$ -branch split cuts introduced by Li and Richard (2008). They presented a family of mixed-integer programs with  $n$  integer variables and a single continuous variable and conjectured that the convex hull of integer solutions for any  $n$  has unbounded rank with respect to  $(n - 1)$ -branch split cuts. It was shown earlier by Cook, Kannan and Schrijver (1990) that this conjecture is true when  $n = 2$ , and Li and Richard proved the conjecture when  $n = 3$ . In this paper we show that this conjecture is also true for all  $n > 3$ .
- Coauthor(s):* **Sanjeeb Dash** (sanjeebd@us.ibm.com)
- Speaker:* **Selvaprabu Nadarajah** (Carnegie Mellon University, snadaraj@andrew.cmu.edu)
- Title:* **A procedure for generating a polynomial size collection of points for a cut generating set**
- Abstract:* We study the new cut generating paradigm recently introduced in Balas and Margot (2011). A major component of this paradigm involves intersecting edges of a non-conic polyhedron with the boundary of a lattice-free convex set to obtain a collection of intersection points. We call this collection a cut generating set, since it can be used to generate valid cuts in a non-recursive fashion. The method of hyperplane activation used for obtaining the intersection points, in its original form produces exponentially many points and is thus computationally too expensive. We introduce a polynomial time algorithm to produce a valid cut generating set of a size linear in the number of variables and quadratic in the number of hyperplanes activated. We also discuss a procedure for generating the cuts in a subspace and lifting them to inequalities that are valid for the original problem. Computational results will be presented.
- Coauthor(s):* **Egon Balas** (eb17@andrew.cmu.edu), **Francois Margot** (fmargot@andrew.cmu.edu)
- Speaker:* **Yanjun Li** (Purdue University, li14@purdue.edu)
- Title:* **A Class of Rank 2 Facets for the 1-Restricted Simple 2-Matching Polytope**
- Abstract:* A simple 2-matching in a simple undirected graph is a subgraph all of whose nodes have degree 1 or 2. A simple 2-matching is called 1-restricted if each of its connected components has at least two edges. As a continuation of the study of 1-restricted simple 2-matchings in a published paper, we introduce a new class of valid inequalities for the 1-restricted simple 2-matching polytope, called the r-2 blossom inequalities. Using the concept of hypomatchable graph (from classical matching theory), we define a subclass of the r-2 blossom inequalities. We show that these inequalities are facet inducing and that they can have Chvatal rank 2, which illustrates the complexity of this polytope. We give a simple condition that characterizes the rank 2 inequalities in this subclass. A complete description of this polytope for general graphs is still open.
- Coauthor(s):* **David Hartvigsen** (dhartvig@nd.edu)
- 1:30pm-3:00pm Parallel session (Track 2 of 3) Governor's Suite (2nd floor)
- Session title:* INTERIOR-POINT METHODS AND APPLICATIONS
- Session chair:* Hande Y. Benson
- Speaker:* **Umit Saglam** (Drexel University, us26@drexel.edu)
- Title:* **Portfolio Optimization with Cone Constraints and Discrete Decisions**
- Abstract:* We consider a portfolio optimization problem where the investor's objective is to choose a trading strategy that maximizes expected return penalized by transaction costs. We include portfolio diversification constraints in our single and multiperiod models. The overall problem is a mixed-integer second-order cone programming problem, which we solve with the Matlab-based solver MILANO. This talk will focus on the solution and warm-start of the second-order cone programming subproblems.
- Coauthor(s):* **Hande Benson** (hvb22@drexel.edu)

- Speaker:* **Pramod Abichandani** (Drexel University, pva23@drexel.edu)  
*Title:* **Mathematical Programming for Multi-Vehicle Motion Planning**  
*Abstract:* Real world Multi-Vehicle Motion Planning (MVMP) problems require the optimization of suitable performance measures under an array of complex and challenging constraints involving kinematics, dynamics, communication connectivity, target tracking, and collision avoidance. The general MVMP problem can thus be formulated as a mathematical program (MP). In this paper we present a mathematical programming (MP) framework that captures the salient features of the general MVMP problem. To demonstrate the use of this framework for the formulation and solution of MVMP problems, we examine in detail four representative works and summarize several other related works. As MP solution algorithms and associated numerical solvers continue to develop, we anticipate that MP solution techniques will be applied to an increasing number of MVMP problems and that the framework and formulations presented in this paper may serve as a guide for future MVMP research.
- Coauthor(s):* **Dr. Hande Benson , Dr. Moshe Kam**
- Speaker:* **Hande Y. Benson** (Drexel University, benson@drexel.edu)  
*Title:* **Interior-Point Methods for Nonconvex Nonlinear Programming: Primal-Dual Methods and Cubic Regularization**  
*Abstract:* We present a primal-dual interior-point method for solving nonlinear programming problems. It employs a Levenberg-Marquardt (LM) perturbation to the Karush-Kuhn-Tucker (KKT) matrix to handle indefinite Hessians and a line search to obtain sufficient descent at each iteration. We show that the LM perturbation is equivalent to replacing the Newton step by a cubic regularization step with an appropriately chosen regularization parameter. This equivalence allows us to use the favorable theoretical results of Griewank (1981), Nesterov and Polyak (2006), and Cartis et.al. (2011), but its application at every iteration of the algorithm, as proposed by these papers, is computationally expensive. We propose a hybrid method: use a Newton direction with a line search on iterations with positive definite Hessians and a cubic step, found using a sufficiently large LM perturbation to guarantee a steplength of 1 otherwise. Numerical results are provided on a large library of problems to illustrate the robustness and efficiency of the proposed approach on both unconstrained and constrained problems.
- 1:30pm-3:00pm Parallel session (Track 3 of 3) B013 (1st floor)  
*Session title:* MATHEMATICAL AND APPLIED OPTIMIZATION  
*Session chair:* Jason Hicken
- Speaker:* **Francis J. Vasko** (Kutztown University, vasko@kutztown.edu) , **Eric Landquist** (Kutztown University, elandqui@kutztown.edu)  
*Title:* **Efficiently Solving Large Cable-Trench and Steiner Cable-Trench Problems with applications in Vascular Image Analysis**  
*Abstract:* In 2002, Vasko et. al. defined the Cable-Trench Problem (CTP) as the combination of the shortest path problem and the minimum spanning tree problem. They showed that this combination of two easy problems is difficult to solve, i.e., the CTP is NP-complete. Recently, vascular imaging problems have been modeled as large CTPs. In this paper, we will define the Steiner CTP and discuss heuristic solution approaches for solving CTPs and Steiner CTPs. Empirical results from graphs with up to 25,000 vertices and 30 million edges will be given.
- Coauthor(s):* **Adam Tal** (atal822@live.kutztown.edu) , **Yifeng Jiang** (jiang1feng@gmail.com)

*Speaker:* **Delphine Sinoquet** (IFPEN, delphine.sinoquet@ifpen.fr)  
*Title:* **A comparison of non linear constrained derivative free optimization methods applied on a reservoir characterization inverse problem**

*Abstract:* Reservoir characterization inverse problem in petroleum industry aims at building consistent reservoir models with available production and seismic data for a better forecast of the hydrocarbon production. Observed data (pressures, oil/water/gas rates at the wells and 4D seismic data) are compared with simulated data to determine unknown petrophysical properties of the reservoir. The underlying optimization problem is usually formulated as the minimization of a least-squares objective function composed of two terms : the production data and the seismic data mismatch. In practice, this problem is often solved by nonlinear optimization methods, such as Sequential Quadratic Programming (SQP) methods with derivatives approximated by finite differences. In applications involving 4D seismic data, the use of the classical Gauss-Newton algorithm is often infeasible because the computation of the Jacobian matrix is CPU time consuming and its storage is impossible for large datasets like seismic-related ones. Consequently, we develop an adapted derivative free optimization method, called SQA (Sequential Quadratic Approximation), based on a trust region method with quadratic interpolation models. Both derivative based and derivative free non linear constraints are taken into account, thanks to a SQP solver used to solve internal optimization problems and by defining quadratic models of the derivative free constraints. Moreover, the least-square property of the objective function is handled by modelling individually (or by physically coherent groups) the residuals. This method is applied on a reservoir characterization application with the joint inversion of production data and 4D seismic data with different methodologies: constrained formulation to handle the two data types and bi-objective optimization. SQA method is compared with other methods as a classical SQP method, evolutionary algorithms (CMAES and its multi-objective version MO-CMAES) coupled with surrogate models (based on kriging).

*Speaker:* **Jason Hicken** (Rensselaer Polytechnic Institute, jason.hicken@gmail.com)  
*Title:* **Reduced-space inexact-Newton-Krylov methods for PDE-constrained optimization**

*Abstract:* In the context of PDE-constrained optimization, reduced-space inexact-Newton-Krylov (iNK) methods offer a potential compromise between full-space Newton-Krylov methods (e.g. LNKS) and reduced-space quasi-Newton methods; however, previous work suggests that the Hessian-vector products used in reduced-space iNK methods must be computed with high precision to maintain orthogonality between the Krylov subspace vectors. We will show how this accuracy requirement can be relaxed, so that the Hessian-vector products can be computed approximately (or inexactly). These inexact Hessian-vector products are essential to the efficient performance of iNK methods applied in the reduced-space. Indeed, numerical examples illustrate that iNK in the reduced-space can be competitive with the full-space approach on some problems. The examples also confirm that, like their full-space counterparts, reduced space iNK methods retain superior algorithmic scaling relative to quasi-Newton reduce d-space approaches.

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3:00pm-3:15pm      Coffee break      Wood Dining Room (2nd floor)

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3:15pm-4:45pm      Parallel session (Track 1 of 3)      Wood Dining Room (2nd floor)

*Session title:* NONLINEAR PROGRAMMING

*Session chair:* Katya Scheinberg

*Speaker:* **Afonso S. Bandeira** (Princeton University, ajsb@math.princeton.edu)

*Title:* **On Sparse Hessian Recovery and Trust-Region Methods based on Probabilistic Models**

*Abstract:* In many application problems in optimization, one has little or no correlation between problem variables, and such (sparsity) structure is unknown in advance when optimizing without derivatives. We will show that quadratic interpolation models computed by l1-minimization recover the Hessian sparsity of the function being modeled, when using random sample sets. Given a considerable level of sparsity in the unknown Hessian of the function, such models can achieve the accuracy of second order Taylor ones with a number of sample points (or observations) significantly lower than  $O(n^2)$ . The use of such modeling techniques in derivative-free optimization led us to the consideration of trust-region methods where the accuracy of the models is given with some positive probability. We will show that as long as such probability of model accuracy is over 1/2, one can ensure, almost surely, some form of convergence to first and second order stationary points.

*Coauthor(s):* **Katya Scheinberg** (katyas@lehigh.edu) , **Luis Nunes Vicente** (lnv@mat.uc.pt)

- Speaker:* **Xiaocheng Tang** (Lehigh University, xct@lehigh.edu)  
*Title:* **Using Second Order Information in Large Scale  $\ell_1$  Convex Optimization**  
*Abstract:* Recently, a variety of first-order methods have emerged for large scale machine learning problems where traditional state-of-the-art second-order methods like interior point methods fail. In this work, we present a novel coordinate descent type two phase algorithm for sparse logistic regression, requiring only function and gradient evaluations. Particularly, we show that a two-level active-set phase can quickly identify the nonzero subspace in the solution, and that the use of a compact form of limited-memory BFGS will greatly accelerate the soft-thresholding steps in coordinate descent, thus facilitating the minimization of that subspace.
- Coauthor(s):* **Katya Scheinberg** (katyas@lehigh.edu)
- Speaker:* **Aida Khajavirad** (IBM Research, aida@cmu.edu)  
*Title:* **Convex envelopes generated from finitely many compact convex sets**  
*Abstract:* We consider the problem of constructing the convex envelope of a lower semi-continuous function defined over a compact convex set. We formulate the envelope representation problem as a convex optimization problem for functions whose generating sets consist of finitely many compact convex sets. Our development unifies all prior results in the convexification of functions with non-polyhedral envelopes and extends to many additional classes of functions that appear frequently in nonconvex NLPs and MINLPs. We focus on functions that are products of convex and component-wise concave functions and derive closed-form expressions for the convex envelopes of a wide class of such functions. Several examples demonstrate that these envelopes reduce significantly the relaxation gaps of widely used factorable relaxation techniques.
- Coauthor(s):* **Nick Sahinidis** (sahinidis@cmu.edu)
- 3:15pm-4:45pm Parallel session (Track 2 of 3) Governor's Suite (2nd floor)  
*Session title:* HYBRID OPTIMIZATION  
*Session chair:* Michael R. Bartolacci
- Speaker:* **Sadan Kulturel-Konak** (Penn State University - Berks, sadan@psu.edu)  
*Title:* **A Probabilistic Tabu Search Approach for the Unequal Area Facility Layout Problem**  
*Abstract:* In this study, the facility layout problem (FLP) with unequal area departments is solved using the flexible bay structure (FBS), which is a very common layout in many manufacturing and retail facilities. In addition, the FBS is relaxed by allowing empty spaces within bays, which results in more flexibility in assigning departments into bays. Moreover, departments are allowed to be located more freely within the bays, and they can have different side lengths as long as they are within the bay boundaries and do not overlap. To achieve these goals, department shapes and their locations within bays are determined by linear programming (LP). A Probabilistic Tabu Search (PTS) approach is developed to search an overall layout structure that describes relative positions of departments for the relaxed FBS. The comparative results show that the proposed approach is very promising and able to find new best solutions for several test problems.
- Speaker:* **Abdullah Konak** (Penn State University - Berks, konak@psu.edu)  
*Title:* **A Hybrid Genetic Algorithm and Lagrangian Heuristic Approach to Survivable Network Design Problem with Relays**  
*Abstract:* This paper presents the network design problem with relays considering the two-edge network connectivity. The problem arises in telecommunication and logistic networks where a constraint is imposed on the distance that a commodity can travel on a route without being processed by a relay, and the survivability of the network is critical in case of a component failure. The network design problem involves selecting two edge-disjoint paths between source and destination node pairs and determining the location of the relays to minimize the network design cost. The formulated problem is solved by a hybrid genetic algorithm (GA) and a Lagrangian heuristic. The GA searches for two-edge disjoint paths for each commodity, and the Lagrangian heuristic is used to determine relays on these paths. The performance of the proposed hybrid approach is compared to the previous approaches from the literature with promising results.



<i>Speaker:</i>	<b>Michael R. Bartolacci</b> (Penn State University - Berks, mbartolacc@aol.com)	
<i>Title:</i>	<b>Optimization of Wireless Connectivity for Disaster Planning and Management</b>	
<i>Abstract:</i>	In light of recent disasters in Haiti, Japan, and New Orleans, the need for coordinated disaster planning and response in times of crisis has come to the forefront. As seen in particular in the Japanese earthquake and resulting tsunami, telecommunication systems that emergency responders and the general population have come to rely on and assume will always be available fail in times of crisis necessitating alternate means of communication. Planning for the deployment of portable wireless base stations and other similar mobile communications infrastructure is an important step to ensure coordinated disaster response. This work examines the development of an optimization model for the deployment of such an infrastructure.	
3:15pm-4:45pm	Parallel session (Track 3 of 3)	B013 (1st floor)
<i>Session title:</i>	QUEUEING AND LINEAR PROGRAMMING	
<i>Session chair:</i>	Yuriy Zinchenko	
<i>Speaker:</i>	<b>Ho Woo Lee</b> (Sungkyunkwan University (Korea), hwlee@skku.edu)	
<i>Title:</i>	<b>Analysis of M/M/1 queueing system with power supply and consumption</b>	
<i>Abstract:</i>	This talk analyzes the performance of an M/M/1 queueing system with power-supplied server and power-consuming customers. Power requirements of customers follow the exponential distribution. If the server runs out of its energy(power), it enters a charging period and is charged up to S. The mean level of energy and the mean number of customers are computed.	
<i>Coauthor(s):</i>	<b>Feng, Liyan , Se Won Lee , and Jung Woo Baek</b>	
<i>Speaker:</i>	<b>Marco Serpa Molinaro</b> (Carnegie Mellon University, molinaro@cmu.edu)	
<i>Title:</i>	<b>Geometry of Online Packing Linear Programs</b>	
<i>Abstract:</i>	We consider packing LP's with $m$ rows where all constraint coefficients are normalized to be in the unit interval. The $n$ columns arrive in random order and the goal is to set the corresponding decision variables irrevocably when they arrive so as to obtain a feasible solution maximizing the expected reward. Previous $(1 - \epsilon)$ -competitive algorithms require the right-hand side of the LP to be $\Omega((m/\epsilon^2)\log(n/\epsilon))$ , a bound that worsens with the number of columns and rows. However, the dependence on the number of columns is not required in the single-row case and known lower bounds for the general case are also independent of $n$ . Our goal is to understand whether the dependence on $n$ is required in the multi-row case, making it fundamentally harder than the single-row version. We refute this by exhibiting an algorithm which is $(1 - \epsilon)$ -competitive as long as the right-hand sides are $\Omega((m^2/\epsilon^2)\log(m/\epsilon))$ . Our techniques refine previous PAC-learning based approaches which interpret the online decisions as linear classifications of the columns based on sampled dual prices. The key ingredient of our improvement comes from a non-standard covering argument together with the realization that only when the columns of the LP belong to few 1-d subspaces we can obtain small such covers; bounding the size of the cover constructed also relies on the geometry of linear classifiers. General packing LP's are handled by perturbing the input columns, which can be seen as making the learning problem more robust.	
<i>Coauthor(s):</i>	<b>R. Ravi</b> (ravi@cmu.edu)	
<i>Speaker:</i>	<b>Yuriy Zinchenko</b> (University of Calgary, yzinchen@ucalgary.ca)	
<i>Title:</i>	<b>Shrink-Wrapping trajectories for Linear Programming</b>	
<i>Abstract:</i>	Hyperbolic Programming (HP) – minimizing a linear functional over an affine subspace of a finite-dimensional real vector space intersected with the so-called hyperbolicity cone – is a class of convex optimization problems that contains well-known Linear Programming (LP). In particular, for any LP one can readily provide a sequence of HP relaxations. Based on these hyperbolic relaxations, a new Shrink-Wrapping approach to solve LP has been proposed by Renegar. The resulting Shrink-Wrapping trajectories, in a sense, generalize the notion of central path in interior-point methods. We study the geometry of Shrink-Wrapping trajectories for Linear Programming. In particular, we analyze the geometry of these trajectories in the proximity of the so-called central line, and contrast the behavior of these trajectories with that of the central path for some pathological LP instances.	

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4:45pm-5:00pm	Coffee break	Wood Dining Room (2nd floor)
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5:00pm-6:00pm Plenary presentation Wood Dining Room (2nd floor)  
*Chair:* Luis F. Zuluaga  
*Speaker:* **Edgar Blanco** (Massachusetts Institute of Technology, eblanco@mit.edu)  
*Title:* **Mega-City Logistics**  
*Abstract:* The field of Supply Chain and Logistics Management has evolved over the last 15 years from practices and experiences from Europe and the United States. As academic and practitioners try to apply the same approaches and techniques to emerging economies in Asia and Latin America, they quickly realize that the unique environment characteristics, creates challenges that are usually not addressed in traditional approaches. Through a series of of real-life examples, this presentation will illustrate why academics and practitioners should re-evaluate their approach to urban logistics in “megacities”, specially in the context of emerging markets. Megacities ð cities with a population of at least 10 million people ð are increasing in both number and size, and their share of world GDP is expected to grow from about 14% to over 20% in a decade. Most of the 23 megacities that currently exist are located in emerging markets. The discussion will include initial results of on-going field research in Latin-American.

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6:30pm-9:30pm Graduate Student Social Graduate Student Center

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# Detailed Program and Abstracts

Tuesday, July 31

8:00am-8:30am	Breakfast	Wood Dining Room (2nd floor)
8:30am-9:30am	Plenary presentation	Wood Dining Room (2nd floor)
<i>Chair:</i>	Aur�lie Thiele	
<i>Speaker:</i>	<b>Reha T�t�nc�</b> (Goldman Sachs Asset Management, reha.tutuncu@gs.com)	
<i>Title:</i>	<b>New Optimization Problems in Quantitative Portfolio Construction</b>	
<i>Abstract:</i>	Classical quantitative portfolio construction models evolved around the single-period, single-portfolio mean-variance optimization formulation of Markowitz. More recent studies focused on variations addressing multi-period or multi-portfolio instances as well as formulations with different objectives. For example, “risk parity” portfolios seek better diversification through more balanced risk allocations across asset classes. We survey some of these recent approaches and the challenging optimization problems that result from them.	
9:30am-9:45am	Coffee break	Wood Dining Room (2nd floor)
9:45am-11:15am	AIMMS-MOPTA Modeling Competition Finalist Presentations	Wood Dining Room (2nd floor)
<i>Session chair:</i>	Peter Nieuwesteeg	
<i>Finalist:</i>	Team SMART	
<i>Institution:</i>	University of Twente, Enschede, The Netherlands	
<i>Members:</i>	<b>Irana Denissen</b> (i.f.c.denissen@student.utwente.nl), <b>Dorien Meijer Cluwen</b> (f.t.f.meijercluwen@student.utwente.nl)	
<i>Advisor:</i>	<b>Bodo Manthey</b> (B.Manthey@utwente.nl)	
<i>Finalist:</i>	Smart Power Engineers	
<i>Institution:</i>	Berlin University of Technology, Berlin, Germany	
<i>Members:</i>	<b>Soner Emec</b> (emec@mf.tu-berlin.de), <b>Florian Huber</b> (huber@mf.tu-berlin.de)	
<i>Advisor:</i>	<b>R�diger Stephan</b> (stephan@math.tu-berlin.de)	
<i>Finalist:</i>	Yie Galindo	
<i>Institution:</i>	State University of New York at Buffalo, Buffalo, United States	
<i>Members:</i>	<b>Ruben D. Yie-Pinedo</b> (rubenyie@buffalo.edu), <b>Gina M. Galindo-Pacheco</b> (ggalindo@buffalo.edu)	
<i>Advisor:</i>	<b>Rajan Batta</b> (batta@buffalo.edu)	
11:15am-11:30am	Coffee break	Wood Dining Room (2nd floor)
11:30am-12:30pm	Plenary presentation	Wood Dining Room (2nd floor)
<i>Chair:</i>	Tam�s Terlaky	
<i>Speaker:</i>	<b>Henry Wolkowicz</b> (University of Waterloo, hwolkowi@uwaterloo.ca)	
<i>Title:</i>	<b>Taking advantage of Degeneracy in Cone Optimization with Applications to Sensor Network Localization and Molecular Conformation</b>	
<i>Abstract:</i>	The elegant theoretical results for strong duality and strict complementarity for linear programming, LP, lie behind the success of current algorithms. However, the theory and preprocessing techniques that are successful for LP can fail for cone programming over nonpolyhedral cones. Surprisingly, many instances of semidefinite programming, SDP, problems that arise from relaxations of hard combinatorial problems are degenerate. (Slater’s constraint qualification fails.) Rather than being a disadvantage, we show that this degeneracy can be exploited. In particular, several huge instances of SDP completion problems can be solved quickly and to extremely high accuracy. In particular, we illustrate this on the sensor network localization and Molecular conformation problems.	
12:30pm-1:30pm	Lunch	Wood Dining Room (2nd floor)

1:30pm-3:00pm	Parallel session (Track 1 of 3)	Wood Dining Room (2nd floor)
<i>Session title:</i>	OPTIMIZATION FOR THE SMART GRID	
<i>Session chair:</i>	Miguel F. Anjos	
<i>Speaker:</i>	<b>Bala Venkatesh</b> (Ryerson University, bala@ryerson.ca)	
<i>Title:</i>	<b>Unit Commitment Challenges</b>	
<i>Abstract:</i>	Unit commitment is a challenging problem to solve. Its key attributes include: (1) A set of nonlinear power balance equations that are hourly. The number of sets equal 24 for the day-ahead challenge. The number of equations in each set equals 2N where N is the number of buses in the system. (2) A set of intertemporal constraints that bind the 24 hourly solutions together. These include generator status and ramping limits on generator outputs. (3) A whole host of operating limits such as generator output limits, line flow limits, bus voltage limits, etc. The objective for the problem is to minimize the total generation cost. This paper outlines the challenges and discusses a possible solution process using sequential mixed integer linear programming algorithm.	
<i>Coauthor(s):</i>	<b>Peng Yu</b> (peng.yu@ryerson.ca)	
<i>Speaker:</i>	<b>Jim Ostrowski</b> (University of Tennessee, jostrows@utk.edu)	
<i>Title:</i>	<b>Symmetry in the Unit Commitment Problem</b>	
<i>Abstract:</i>	Adding symmetry-breaking to a highly symmetric instance of a MILP problem can reduce the size of the problem's feasible region considerably. The same can be said for good dominance constraints. In this talk we will examine the impact of using dominance arguments to strengthen symmetry breaking constraints for the Unit Commitment (UC) problem. Symmetry is present in (traditional formulations of) the UC problem when there are several generators of the same type. We show that by adding dominance strengthened cuts, the number of feasible solutions that need to be considered only grows polynomially as the number of generators increases (so long as the number of unique generators is fixed).	
<i>Coauthor(s):</i>	<b>Jianhui Wang</b> (jianhui.wang@anl.gov)	
<i>Speaker:</i>	<b>Jiadong Wang</b> (Lehigh University, jiw508@lehigh.edu)	
<i>Title:</i>	<b>Impact of Sub-hourly Wind Power Forecasting on Unit Commitment and Dispatch</b>	
<i>Abstract:</i>	We propose a new unit commitment model that captures the sub-hourly variability of wind power. Scenarios are included in the stochastic unit commitment formulation to represent the uncertainty and intermittency of wind power output. A modified Benders decomposition method is used to improve the convergence of the algorithm. The numerical results show the benefit of the proposed model based on finer granularity compared with the conventional model of hourly resolution.	
<i>Coauthor(s):</i>	<b>Jianhui Wang</b> (jianhui.wang@anl.gov) , <b>Cong Liu</b> (liuc@anl.gov) , <b>Juan Ruiz</b> (ziur.nauj@gmail.com)	
1:30pm-3:00pm	Parallel session (Track 2 of 3)	Governor's Suite (2nd floor)
<i>Session title:</i>	FINANCIAL OPTIMIZATION	
<i>Session chair:</i>	Miguel Lejeune	
<i>Speaker:</i>	<b>Pavlo Krokhmal</b> (University of Iowa, pavlo-krokhmal@uiowa.edu)	
<i>Title:</i>	<b>Mixed integer portfolio optimization models with p-order cone constraints</b>	
<i>Abstract:</i>	We consider mixed integer p-order cone programming problems that arise from stochastic optimization models with higher moment coherent risk measures. Several approaches to solving mixed integer p-cone programming problems are considered, including branch and bound that uses polyhedral approximations of p-cones and branch-and-cut with MIR and lifted cuts for p-cone constraints. Numerical studies on several portfolio optimization problems illustrate the effectiveness of the proposed techniques.	
<i>Coauthor(s):</i>	<b>Alexander Vinel</b> (alexander-vinel@uiowa.edu)	

- Speaker:* **Nan Xiong** (Carnegie Mellon University, nxiong@andrew.cmu.edu)  
*Title:* **A New Framework for Portfolio Selection**  
*Abstract:* The classical portfolio selection describes the task of asset allocation as having two-stages: estimation and optimization. In this paper, we propose a new framework for portfolio construction, which incorporates the estimation and optimization into a one-stage problem. That is, rather than estimate the parameters first and then compute the optimal portfolio, we realize both of these in one stage by computing the portfolio weights directly. We show that most existing portfolio strategies based on two-stage rules can be cast under our one-stage framework. We also propose a new portfolio allocation strategy based on our one-stage formulation. For the proposed portfolios, we analytically show that the resulting portfolio weights are more stable than those of portfolios based on two-stage rules. Moreover, the proposed portfolio, in some cases, can be better in the sense of expected loss function.
- Speaker:* **Miguel Lejeune** (George Washington University, mlejeune@gwu.edu)  
*Title:* **Risk-Averse Enhanced Indexation**  
*Abstract:* We propose a partial replication strategy to construct risk-averse enhanced index funds. Our model takes into account the parameter estimation risk by defining the asset returns and the return covariance terms as random variables. The variance of the index fund return is required to be below a low-risk threshold with a large probability, thereby limiting the market risk exposure. The resulting stochastic integer problem is reformulated through the derivation of a deterministic equivalent for the risk constraint and the use of a block decomposition technique. We develop an exact outer approximation method that provides a hierarchical organization of the computations with expanding sets of integer-restricted variables. The method scales well and can solve large (up to 1000 securities) instances.
- 1:30pm-3:00pm Parallel session (Track 3 of 3) B013 (1st floor)  
*Session title:* DERIVATIVE-FREE/SURROGATE OPTIMIZATION  
*Session chair:* Rommel Regis
- Speaker:* **Ahmad Almomani** (Clarkson University, almomaar@clarkson.edu)  
*Title:* **Assessing Constraint Handling for Particle Swarm Optimization**  
*Abstract:* We consider constraint handling for the Particle Swarm Optimization (PSO) algorithm for global optimization problems. We consider the filter method which treats linear and nonlinear constraints with a bi-objective approach. The filter method chooses points based on either decreasing the objective function value or improving a measure of feasibility and is incorporated within the PSO algorithm as opposed to aggregating the original objective function. We give a comparison of the new method (FPSO) to PSO with the classical penalty method on a suite of test problems that include smooth objectives and some with additional low amplitude noise to mimic simulation-based problems.
- Coauthor(s):* **Katie Fowler** (kfowler@clarkson.edu)
- Speaker:* **Ruobing Chen** (Lehigh University, ruc310@lehigh.edu)  
*Title:* **Derivative Free Optimization for Noisy Functions**  
*Abstract:* We apply a model-based trust-region derivative-free algorithm for optimizing the alignment of proteins. This problem arises in Structural Bio-informatics. The objective is computed via a noisy simulation, which causes the standard DFO approaches to fail. We design a special noise handling strategy within the trust region framework and produce a convergent method. Positive numerical results will be presented to show the effectiveness of our method.
- Coauthor(s):* **Katya Scheinberg** (katyas@lehigh.edu) , **Brian Chen** (byc210@lehigh.edu)

*Speaker:* **Rommel G. Regis** (Saint Joseph's University, rregis@sju.edu)  
*Title:* **Pushing the Limits of High-Dimensional Surrogate-Based Black-Box Optimization**  
*Abstract:* Some of the most challenging engineering optimization problems are those that involve black-box functions that are outcomes of computationally expensive simulations. Even more challenging are expensive black-box problems with large numbers of decision variables and constraints. Surrogates such as kriging, radial basis functions, and linear and quadratic models are widely used to solve these problems. However, surrogate-based methods tend to require considerably more computational overhead and memory than other optimization methods so their applicability to high-dimensional problems is somewhat limited. Moreover, the ability of surrogates to guide the selection of promising iterates tends to diminish as the problem dimension increases. For instance, kriging-based methods have mostly been applied to problems with less than 10 decision variables. This talk explores the limits of current surrogate-based methods in terms of the problem size that they can successfully handle. Two classes of problems are considered: bound constrained problems with an expensive objective function, and problems with expensive black-box constraints. This talk also presents preliminary comparisons of surrogate-based and other black-box optimization approaches on high-dimensional problems with 50 to over 1000 decision variables. The alternative approaches include direct search, derivative-free trust-region methods, evolutionary algorithms, particle swarm optimization, and traditional derivative-based optimization.

3:00pm-3:15pm Coffee break Wood Dining Room (2nd floor)

3:15pm-4:45pm Parallel session (Track 1 of 3) Wood Dining Room (2nd floor)

*Session title:* FIRST ORDER METHODS & COMPLEXITY

*Session chair:* Javier Peña

*Speaker:* **Javier Peña** (Carnegie Mellon University, jfp@andrew.cmu.edu)

*Title:* **A smooth perceptron algorithm**

*Abstract:* The perceptron algorithm is a simple greedy algorithm to solve the homogeneous system of linear inequalities  $A^T y > 0$ . The algorithm is popular due to its simple computational steps at each iteration and noise tolerance. However, it has slow convergence rate. We propose a smooth version of the perceptron algorithm that has a significantly better convergence rate while maintaining its simplicity. Our approach extends to the more general conic system  $A^T y \in K$  provided a suitable smoothing oracle is available for the cone  $K$ . Such a smoothing oracle is readily available for cones of interest such as direct products of second-order and semidefinite cones.

*Coauthor(s):* **Negar Soheili** (nsoheili@andrew.cmu.edu)

*Speaker:* **Negar Soheili** (Carnegie Mellon University, nsoheili@andrew.cmu.edu)

*Title:* **A smooth von Neumann/perceptron algorithm**

*Abstract:* The von Neumann's algorithm, privately communicated by von Neumann to Dantzig in the late 40s, is a simple elementary algorithm to solve the homogeneous linear system  $Ax = 0, x \geq 0, x \neq 0$ . Von Neumann's algorithm can be seen as a dual version of the perceptron algorithm. As in the perceptron, the main drawback of von Neumann's algorithm is its slow rate of convergence. Building upon a smooth version of the perceptron algorithm, we develop a smooth version of von Neumann's algorithm that either solves the linear system  $Ax = 0, x \geq 0, x \neq 0$  or its alternative  $A^T y > 0$ . Our algorithm retains the simplicity of the perceptron and von Neumann's algorithms while significantly improving their convergence rates.

*Coauthor(s):* **Javier Peña** (jfp@andrew.cmu.edu)

*Speaker:* **Dan Li** (Lehigh University, dal207@lehigh.edu)

*Title:* **The Duality between the Perceptron Algorithm and the von Neumann Algorithm**

*Abstract:* The perceptron and the von Neumann algorithms were developed to solve Linear Feasibility Problems. In this paper, we investigate and reveal the duality relationship between these two algorithms. The specific forms of Linear Feasibility Problems solved by the perceptron and the von Neumann algorithms are a pair of alternative systems by the Farkas Lemma. Based on this observation, we interpret variants of the perceptron algorithm as variants of the von Neumann algorithm, and vice-versa; as well as transit the complexity results from one family to the other. A solution of one problem serves as an infeasibility certificate of its alternative system. Further, an Approximate Farkas Lemma enables us to derive bounds for the distance to the feasibility or infeasibility from approximate solutions of the alternative systems.

*Coauthor(s):* **Tamás Terlaky** (terlaky@lehigh.edu)

- 3:15pm-4:45pm Parallel session (Track 2 of 3) Governor's Suite (2nd floor)
- Session title:* OPTIMIZATION MODELS FOR ELECTRICITY SYSTEMS
- Session chair:* Larry Snyder
- Speaker:* **Mohammad Mohsen Moarefdoost** (Lehigh University, mom211@lehigh.edu)
- Title:* **Generation and Storage Dispatch in Stochastic Electricity Networks**
- Abstract:* We present models for optimizing generation and storage decisions in an electricity network with multiple generators, each co-located with one storage unit, and multiple loads under power flow constraints. The system faces either stochastic loads or supply disruptions. We solve the problems heuristically by decomposing them into several single-generator, single-battery, multi-load systems and solving them optimally using dynamic programming, then obtaining a solution for the original problem by recombining. We discuss our heuristic's computational performance as well as insights gained from the models.
- Coauthor(s):* **Gengyang Sun** (ges209@lehigh.edu) , **Larry Snyder** (larry.snyder@lehigh.edu)
- Speaker:* **Yangfang Zhou** (Carnegie Mellon University, yangfang@andrew.cmu.edu)
- Title:* **Managing Wind-based Electricity Generation with Storage and Transmission Capacity**
- Abstract:* Managing power generation from wind is conceptually straightforward: generate and sell as much as possible when the price is positive, and do nothing otherwise. However, this leads to curtailment when wind energy exceeds the transmission capacity or prices are negative, and possible revenue dilution when current prices are low and are expected to increase in the future. Electricity storage is being considered as a means to alleviate these issues, and also enables buying electricity from the market for later resale. The presence of storage complicates the management of electricity generation from wind, and the value of storage for a wind-based generator is not entirely understood. We demonstrate that managing such a combined generation and storage system is nontrivial, and that mismanaging such a system can significantly reduce its value. We also show that storage can greatly increase the monetary value of the wind farm, and, while it typically increases the total energy sold to the market, in certain situations it may also — paradoxically — decrease the total wind energy sold to the market.
- Coauthor(s):* **Alan Scheller-Wolf** (awolf@andrew.cmu.edu) , **Nicola Secomandi** (ns7@andrew.cmu.edu) , **Stephen Smith** (sfs@cs.cmu.edu)
- Speaker:* **David W. Coit** (Rutgers University, coit@rutgers.edu)
- Title:* **Electric Power Grid Generation Expansion Optimization Considering Uncertainty and Risk**
- Abstract:* Power generation expansion planning of electric systems is described, and a formulation and solution approach is proposed considering uncertainty and risk. Mean-risk models are used with risk objective functions of maximum regret and conditional value at risk (CVaR). Generation expansion planning problem can be described as the determination of the number of new generating units, the capacity and location of these units. In this paper, we propose a new approach to find solutions for the generation expansion planning which explicitly consider uncertainty, risk and the availability of the system components over the planning horizon and operational dispatching decisions. Monte Carlo simulation is used to generate the components availabilities and demand scenarios and then the optimization problem is solved to find solutions. Several examples are presented.
- Coauthor(s):* **Hatice Tekiner-Mogulkoc** (haticetekiner@sehir.edu.tr) , **Frank Felder** (ffelder@rutgers.edu)
- 3:15pm-4:45pm Parallel session (Track 3 of 3) B013 (1st floor)
- Session title:* FINANCIAL OPTIMIZATION
- Session chair:* Zhen Liu
- Speaker:* **Linwei Xin** (Georgia Institute of Technology, lxin@gatech.edu)
- Title:* **Bounds for Nested Law Invariant Coherent Risk Measures**
- Abstract:* We provide a new upper bound for the nested (composite) formulation of Average Value-at-Risk. We test the tightness of the bound and compare it to existing bounds. Furthermore, we extend the result to law invariant coherent comonotonic risk measures
- Coauthor(s):* **Alexander Shapiro** (ashapiro@isye.gatech.edu)

*Speaker:* **Elcin Cetinkaya** (Lehigh University, elcin.cetinkaya@lehigh.edu)  
*Title:* **Robust and data-driven portfolio management with quantile constraints**  
*Abstract:* We investigate an iterative, data-driven approximation to the problem where the investor seeks to maximize the expected return of her portfolio subject to a quantile constraint given historical realizations of the stock returns. Because our approach involves solving a series of linear programming problems, it can be solved quickly for problems of large scale. We compare its performance to that of methods commonly used in the finance literature, such as fitting a Gaussian distribution to the returns. We also analyze the resulting efficient frontier and extend our approach to the case where portfolio risk is measured by the interquartile range of its return.

*Coauthor(s):* **Aurélie Thiele** (aurelie.thiele@gmail.com)

*Speaker:* **Zhen Liu** (Missouri University of Science & Technology, zliu@mst.edu)  
*Title:* **Large-scale Portfolio Optimization with Proportional Transaction Costs**  
*Abstract:* We study the portfolio optimization problem with proportional transaction costs under Markov processes with multiple risky assets with infinite time horizon. The value function can be written as the solution to an infinite-dimensional linear program. We approximate the value function based upon simulation-based optimization methods, and solve for the optimal policy explicitly.

4:45pm-5:00pm      Coffee break      Wood Dining Room (2nd floor)

5:00pm-6:00pm      Plenary presentation      Wood Dining Room (2nd floor)

*Chair:* Ted Ralphs

*Speaker:* **Santosh Vempala** (Georgia Institute of Technology, vempala@gatech.edu)  
*Title:* **On the Complexity of Integer Programming**  
*Abstract:* We discuss three directions:

1. The status of the worst-case complexity of IP, with some recent improvements based on using M-ellipsoids.
2. A phase transition phenomenon for the feasibility of random IPs based on a connection to discrepancy theory.
3. A cutting-plane based algorithm for minimum-cost perfect matchings.

We will highlight open questions for each of these.

*Coauthor(s):* **Karthekeyan Chandrasekaran , Daniel Dadush , Laszlo Vegh**

6:00pm-7:00pm      Cocktail Reception      Sigel Gallery (Main Lobby)

7:00pm-9:30pm      Banquet, Patrick V. Farrell (Provost and VP for Academic Affairs, Lehigh U.)      Wood Dining Room (2nd floor)



# Detailed Program and Abstracts

## Wednesday, August 1

8:00am-8:30am	Breakfast	Wood Dining Room (2nd floor)
8:30am-9:30am	Plenary presentation	Wood Dining Room (2nd floor)
<i>Chair:</i>	Luis F. Zuluaga	
<i>Speaker:</i>	<b>Michael Trick</b> (Carnegie Mellon University, <a href="mailto:trick@cmu.edu">trick@cmu.edu</a> )	
<i>Title:</i>	<b>Optimization Methods in Sports Scheduling</b>	
<i>Abstract:</i>	In the last decade, sports scheduling has grown to be a robust, vibrant area of optimization. This is due to the economic impact of the work, with dozens of professional and amateur leagues now relying on optimization to create their schedules, as well as the inherent difficulty of creating good or optimal sports schedules. Despite this interest, there still exist small, well-defined sports scheduling problems that have defied exact solution. I cover some of the key models in sports scheduling, and show how innovative optimization approaches, including combinatorial Benders methods and optimization-based large scale local search, address these problems.	
9:30am-9:45am	Coffee break	Wood Dining Room (2nd floor)
9:45am-11:15am	Parallel session (Track 1 of 3)	Wood Dining Room (2nd floor)
<i>Session title:</i>	OPTIMIZATION FOR THE SMART GRID	
<i>Session chair:</i>	Miguel F. Anjos	
<i>Speaker:</i>	<b>Peter Nieuwesteeg</b> (AIMMS (Paragon Decision Technology), <a href="mailto:Peter.Nieuwesteeg@aimms.com">Peter.Nieuwesteeg@aimms.com</a> )	
<i>Title:</i>	<b>OR in the Energy Market – Winning the Franz Edelman Award 2011</b>	
<i>Abstract:</i>	Our society has a great dependence on electricity. It is therefore essential that the energy market is operated efficiently and reliably. The Midwest Independent Transmission System Operator (ISO) used Operations Research to ensure reliable operation and equal access to high-voltage power lines in 13 U.S. states and the Canadian province of Manitoba, while minimizing the cost of electricity for their 40 million end customers. In this presentation, we will demonstrate how the Midwest ISO was able to realize between 2 and 3 billion in cumulative savings between 2007 and 2010. In recognition of this achievement the Midwest ISO, together with Paragon Decision Technology (the developers of AIMMS) and Alstom Grid, was awarded the prestigious Franz Edelman Award at last year's INFORMS conference on business Analytics and Operations Research. Our presentation starts with an introduction to the design of the electricity market, both from a technical perspective as well as financial perspective and includes an overview of the different energy related products. This will be followed by an explanation of the optimization models that are solved as part of the grid operations, and the challenges related to model size and the tight performance requirements. We will then conclude the presentation with future challenges for the operations of the electric grid.	
<i>Speaker:</i>	<b>Lin He</b> (Lehigh University, <a href="mailto:lih308@lehigh.edu">lih308@lehigh.edu</a> )	
<i>Title:</i>	<b>A Bilevel Model for Retail Electricity Pricing with Flexible Loads</b>	
<i>Abstract:</i>	We consider an electricity service provider that wishes to set prices for a large customer with flexible loads so that the resulting load profile matches a predetermined profile as closely as possible. Assuming the customer minimizes its electricity and delay costs, we model this as a bilevel problem in which the provider sets prices and the customer responds by shifting loads forward in time. We derive optimality conditions for the lower-level problem to obtain a single-level problem.	
<i>Coauthor(s):</i>	<b>Larry Snyder</b> ( <a href="mailto:larry.snyder@lehigh.edu">larry.snyder@lehigh.edu</a> )	

- Speaker:* **Kankar Bhattacharya** (University of Waterloo, kankar@uwaterloo.ca)  
*Title:* **Optimal Operation of Distribution Feeders in Smart Grids**  
*Abstract:* In this presentation a generic and comprehensive distribution optimal power flow (DOPF) model, that can be used by local distribution companies (LDCs) to integrate their distribution system feeders into a Smart Grid, is presented. The three-phase DOPF framework incorporates detailed modeling of distribution system components and considers various operating objectives. Phase specific and voltage dependent modeling of customer loads in the three-phase DOPF model allows LDC operators to determine realistic operating strategies that can improve the overall feeder efficiency. The distribution system operation objective is based on the minimization of the energy drawn from the substation while seeking to minimize the number of switching operations of load tap changers and capacitors. A novel method for solving the three-phase DOPF model by transforming the mixed-integer nonlinear programming problem to a nonlinear programming problem is proposed which reduces the computational burden and facilitates its practical implementation and application. Two practical case studies, including a real distribution feeder test case, are presented to demonstrate the features of the proposed methodology. The results illustrate the benefits of the proposed DOPF in terms of reducing energy losses while limiting the number of switching operations.
- Coauthor(s):* **Claudio Canizares** (ccanizares@uwaterloo.ca) , **Sumit Paudyal** (spaudyal@engmail.uwaterloo.ca)
- 9:45am-11:15am Parallel session (Track 2 of 3) Governor's Suite (2nd floor)  
*Session title:* ROBUST AND CONVEX OPTIMIZATION  
*Session chair:* Fatma Kilinc-Karzan
- Speaker:* **Camilo Ortiz** (Georgia Institute of Technology, camiort@gatech.edu)  
*Title:* **An accelerated proximal framework with a fast implementation for solving large-scale convex optimization problems**  
*Abstract:* We describe a general framework for solving convex optimization problems that pinpoints some minimum requirements for convergence. This framework can be understood as a more general presentation of the A-HPE method recently introduced by Monteiro and Svaiter (2011). Moreover, various convex programming methods fit in this framework, including most variants of Nesterov's optimal methods. In this talk we review the main ideas behind this framework and the corresponding complexity bounds. Finally, we implemented an algorithm that pushes to the limit the main requirements of our framework. The performance of this algorithm on several large-scale conic quadratic programming problems is significantly faster in a benchmark that includes various accelerated optimal gradient methods.
- Coauthor(s):* **Renato D. C. Monteiro** (monteiro@isye.gatech.edu) , **Benar F. Svaiter** (benar@impa.br)
- Speaker:* **Qihang Lin** (Carnegie Mellon University, qihangl@andrew.cmu.edu)  
*Title:* **Optimal Trade Execution with Dynamic Risk Measures**  
*Abstract:* We propose a model for optimal trade execution in an illiquid market that minimizes a coherent dynamic risk of the sequential transaction costs. The prices of the assets are modeled as a discrete random walk perturbed by both temporal and permanent impacts induced by the trading volume. We show that the optimal strategy is time-consistent and deterministic if the dynamic risk measure satisfies a Markovian property. We also show that our optimal execution problem can be formulated as a convex program, and propose an accelerated first-order method that computes its optimal solution. The efficiency and scalability of our approaches are illustrated via numerical experiments.
- Coauthor(s):* **Javier Peña** (jfp@andrew.cmu.edu)

<i>Speaker:</i>	<b>Guanghui Lan</b> (University of Florida, <a href="mailto:g1an@ise.ufl.edu">g1an@ise.ufl.edu</a> )	
<i>Title:</i>	<b>Robust Stochastic First- and Zero-order Methods for Nonconvex Stochastic Programming</b>	
<i>Abstract:</i>	We present a new stochastic approximation (SA) type algorithm, namely the randomized stochastic gradient (RSG) method, for solving a class of nonlinear (possibly nonconvex) stochastic programming problems. We establish the rate of convergence of this method for computing an approximate stationary point of a nonlinear programming problem. We also show that this method can handle stochastic programming problems with endogenous uncertainty where the distribution of random variables depend on the decision variables. We discuss a variant of the algorithm which consists of applying a post-optimization phase to evaluate a short list of solutions generated by several independent runs of the RSG method, and show that such modification allows to improve significantly the large-deviation properties of the algorithm. These methods are then specialized for solving a class of simulation-based optimization problems in which only stochastic zero-order information is available.	
<i>Coauthor(s):</i>	<b>Saeed Ghadimi</b> ( <a href="mailto:sghadimi@ufl.edu">sghadimi@ufl.edu</a> )	
9:45am-11:15am	Parallel session (Track 3 of 3)	B013 (1st floor)
<i>Session title:</i>	NONLINEAR PROGRAMMING	
<i>Session chair:</i>	Frank E. Curtis	
<i>Speaker:</i>	<b>Elena Khoroshilova</b> (Lomonosov Moscow State University, <a href="mailto:khorelena@gmail.com">khorelena@gmail.com</a> )	
<i>Title:</i>	<b>Optimal control of boundary-value problem</b>	
<i>Abstract:</i>	A method is proposed for solving the optimal control problem with free right end, and constraints in the form of a linear differential equation. The objective function of the terminal type is minimized on the attainability set under constraints such as a system of linear inequalities. We introduce an iterative process of extragradient type, formulated in a functional subspace of piecewise continuous controls. Original proof of its convergence to solution is given.	
<i>Speaker:</i>	<b>Zheng Han</b> (Lehigh University, <a href="mailto:zh210@lehigh.edu">zh210@lehigh.edu</a> )	
<i>Title:</i>	<b>A Primal-Dual Active Set Algorithm for Convex Quadratic Optimization</b>	
<i>Abstract:</i>	We present a novel active-set method for solving large-scale quadratic optimization problems. In contrast to classic active-set methods, ours allows for rapid changes in the active set estimates. By exploiting both primal and dual information in each iteration, it can identify the optimal active set much more rapidly, regardless of the initial estimate. The method is inspired by the primal-dual active-set method proposed by Hintermüller, Ito, and Kunisch [SIAM J. Optim., 13 (2003), pp. 865-888] for bound constrained quadratic optimization problems. It differs from that method, however, in its ability to solve general constrained quadratic optimization problems. Our method is generic and can be customized for certain specialized problems to achieve better performance. Global convergence guarantees are provided for two variants of the framework. Preliminary numerical results are also provided, illustrating that our method is efficient on general problems, and is superior for ill-conditioned problems. We attribute these latter benefits to the relationship between the framework and a semi-smooth Newton method.	
<i>Coauthor(s):</i>	<b>Frank E. Curtis</b> ( <a href="mailto:frank.e.curtis@lehigh.edu">frank.e.curtis@lehigh.edu</a> ), <b>Daniel P. Robinson</b> ( <a href="mailto:daniel.p.robinson@jhu.edu">daniel.p.robinson@jhu.edu</a> )	
<i>Speaker:</i>	<b>Earl R. Barnes</b> (Morgan State University, <a href="mailto:earl.barnes@morgan.edu">earl.barnes@morgan.edu</a> )	
<i>Title:</i>	<b>Matrix Inequalities and Combinatorial Optimization Problems</b>	
<i>Abstract:</i>	Let $A$ and $B$ be real symmetric $n \times n$ matrices. We would like to determine a permutation matrix $P$ that maximizes the trace of the matrix product $APBP^T$ . There are several combinatorial optimization problems that can be formulated in this way. These include the traveling salesman problem, the graph partitioning problem, and the maximum clique problem. Let $\alpha_1 \geq \alpha_2 \geq \dots \geq \alpha_n$ and $\beta_1 \geq \beta_2 \geq \dots \geq \beta_n$ denote the eigenvalues of $A$ and $B$ , respectively. The Hoffman-Wielandt inequality states that $\alpha_1\beta_n + \dots + \alpha_n\beta_1 \leq \text{Trace}(AB) \leq \alpha_1\beta_1 + \dots + \alpha_n\beta_n$ . This inequality has been used to obtain bounds on the optimum values of several combinatorial optimization problems, including the ones mentioned above. In this talk we prove the stronger inequality $\frac{1}{2}\ AB - BA\ ^2 \leq (\alpha_1\beta_1 + \dots + \alpha_n\beta_n - \text{Trace}(AB))(\text{Trace}(AB) - \alpha_1\beta_n - \dots - \alpha_n\beta_1)$ , and show how it can be used to sharpen some of the bounds obtained earlier by the Hoffman-Wielandt inequality. We also point out that several classical inequalities are special cases of this one.	

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11:15am-11:30am	Coffee break	Wood Dining Room (2nd floor)
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11:30am-12:30pm	Plenary presentation	Wood Dining Room (2nd floor)
<i>Chair:</i>	Katya Scheinberg	
<i>Speaker:</i>	<b>Stephen Wright</b> (University of Wisconsin-Madison, swright@cs.wisc.edu)	
<i>Title:</i>	<b>Packing Ellipsoids and Circles: Algorithms and Application</b>	
<i>Abstract:</i>	Problems of packing shapes with maximal density, possibly into a container of restricted size, are classical in discrete mathematics. We describe here the problem of packing ellipsoids of given (varying) dimensions into a finite container, in a way that minimizes the maximum overlap between adjacent ellipsoids. A bilevel optimization algorithm is described for finding local solutions of this problem, both the general case and the easier special case in which the ellipsoids are spheres. Tools from conic optimization, especially semidefinite programming, are key to the approach. Theoretical and computational results will be summarized. We apply the method to the problem of chromosome arrangement in cell nuclei, and compare our results with the experimental observations reported in the biological literature.	
<i>Coauthor(s):</i>	<b>Caroline Uhler</b>	
12:30pm-1:30pm	Lunch	Wood Dining Room (2nd floor)
1:30pm-3:00pm	Parallel session (Track 1 of 3)	Wood Dining Room (2nd floor)
<i>Session title:</i>	STOCHASTIC OPTIMIZATION/STATISTICAL LEARNING	
<i>Session chair:</i>	Peter Frazier	
<i>Speaker:</i>	<b>Raghu Pasupathy</b> (Virginia Polytechnic Institute and State University, pasupath@vt.edu)	
<i>Title:</i>	<b>On Approximating Optimal Sampling Laws for Simulation Optimization on Large Finite Sets</b>	
<i>Abstract:</i>	We consider the context of stochastically constrained simulation optimization on large finite sets. We demonstrate that in this context, the sampling laws characterizing an efficiently evolving algorithm are closed-form in a measure that we call "score." The score has the interpretation of a penalty for suboptimality and infeasibility of a candidate solution, and is easily estimated in many situations. The implications for implementation are substantial — our limited numerical experience suggests that we can solve problems with many thousands of systems within seconds on a laptop computer.	
<i>Coauthor(s):</i>	<b>Nugroho Pujowidianto</b> (nugroho@nus.edu.sg) , <b>Susan Hunter</b> (hunter@cornell.edu) , <b>Loo Hay Lee</b> (iseleelh@nus.edu.sg) , <b>Chun-Hung Chen</b> (cchen9@cc.ee.ntu.edu.tw)	
<i>Speaker:</i>	<b>Yuting Wang</b> (University of Virginia, hoperainstop@gmail.com)	
<i>Title:</i>	<b>Speeding Up the Cross Entropy Method for Global Optimization</b>	
<i>Abstract:</i>	We analyze a multi-start implementation of the CE method for global optimization in which sampled solutions are used as initial solutions or seeds for independent local searches. We provide a formal characterization for the speed of convergence (both worst-case and average) by developing a Markov chain model in which the state space is the set of all locally optimal solutions. The speed of convergence (worst-case) is determined by second largest eigenvalue associated with the transition probability matrix. This eigenvalue has a straightforward interpretation in terms of the "worst" possible state in which the process remains for a relatively large number of iterations. The average performance is characterized in terms of a classification of states into "clusters". The average performance of the single-thread CE methods deteriorates in problems with many clusters with relatively large basins of attraction. These results motivate a new parallel implementation of the method that is guaranteed to speed up convergence by means of an acceptance-rejection test aimed to prevent duplication in search effort.	
<i>Coauthor(s):</i>	<b>Alfredo Garcia</b> (agarcia@virginia.edu)	

- Speaker:* **Peter Frazier** (Cornell University, pf98@cornell.edu)  
*Title:* **Parallel Global Optimization with Expensive Function Evaluations: A One-Step Bayes-Optimal Method**  
*Abstract:* We consider the problem of parallel derivative-free global optimization with expensive function evaluations. A natural decision-theoretic approach for solving such problems is to combine Bayesian statistics and the value of information, placing a Gaussian process prior on the objective function, and choosing sets of points to evaluate based on the value of the information they provide. Ginsbourger, Le Riche, and Carraro (2008) proposed such an algorithm, called the multi-points expected improvement algorithm, but this algorithm was deemed too difficult to actually implement in practice. Using stochastic approximation, we show how this conceptual algorithm can be implemented efficiently, and demonstrate that the resulting practical algorithm provides a speedup over the single-threaded expected improvement algorithm.
- Coauthor(s):* **Scott C. Clark** (sc932@cornell.edu)
- 1:30pm-3:00pm Parallel session (Track 2 of 3) Governor's Suite (2nd floor)  
*Session title:* OPTIMIZATION MODELS FOR ELECTRICITY SYSTEMS  
*Session chair:* Larry Snyder
- Speaker:* **Jhi-Young Joo** (Carnegie Mellon University, jjoo@ece.cmu.edu)  
*Title:* **Multi-Layered Optimization Of Demand Resources Using Lagrange Dual Decomposition**  
*Abstract:* In this work we attempt to find the mathematical relations of the optima of the global system and of each system/market component. Especially, we attempt to show the implications of the objectives of demand resources within the context of the system optimum in the time scale of economic dispatch and in the near real-time scale. We start from defining the optimization problem of the system that includes the sub-objectives of many different players, both supply and demand entities in the system, and decompose the problem into each player's optimization problem, using Lagrange dual decomposition. A demand entity's, or a load serving entity's problem is further decomposed into problems of the many different end-users that the load serving entity serves. By examining the relationships between the global objectives and the local/individual objectives in these multiple layers and the optimality conditions of these decomposable problems, we define the requirements of these different objectives to converge. We illustrate the ideas by simulating simple examples with different conditions and objectives of each entity in the system.
- Coauthor(s):* **Marija Ilic** (milic@ece.cmu.edu)
- Speaker:* **Fang Chen** (Lehigh University, fac210@lehigh.edu)  
*Title:* **Efficient Algorithms and Policies for Demand Response Scheduling**  
*Abstract:* We consider efficient mechanisms to optimize the power consumption within a home, industrial facility, college campus, or other facility or set of facilities. The system is controlled centrally by an Energy Management Controller (EMC), which determines the timing of the operation of some of the devices within the facilities. We introduce an Approximate Dynamic Programming (ADP) algorithm for this problem and show that the ADP outperforms an existing dynamic programming (DP) algorithm. However, even the ADP fails to solve sufficiently quickly when applied to larger instances. Therefore, we also propose several scheduling policies that provide accurate solutions in a fraction of the time required by the ADP. We discuss the computational performance of our ADP algorithm and scheduling policies, as well as insights gained from the models.
- Coauthor(s):* **Lawrence Snyder** (larry.snyder@Lehigh.edu)

*Speaker:* **Alberto J. Lamadrid** (Lehigh University, [ajl259@cornell.edu](mailto:ajl259@cornell.edu))

*Title:* **On the Value of Better Models for the Electricity Sector**

*Abstract:* The electricity sector provides a platform for virtually all of the economic activity in developed economies. However, or maybe because of this, the reliability of the service has been a prime concern, often higher than economic efficiency, as System Operators (SOOs) and Regional Transmission Organizations (RTOOs) need to assure continuous delivery of energy according to often mandated reliability standards (NERC, 2011). As most of these economies aim to increase the share of renewable energy generated, and with expected demand increases around 25% (EIA, 2012), the operating reliability of the system is threatened by the variability in the output from these sources (Baldick, 2012). This paper measures the value of the stochastic solution for a system with high penetration of renewable energy sources (RES), by comparing it to a deterministic formulation with fixed locational reserves, as used by SOOs in their daily operations. The performance analysis focuses on measures of the true economic costs of the system. Our suggested model for operations of the electricity network has a system planner seeking to minimize the cost of providing both energy and ancillary services using a security constrained Optimal Power Flow (SC-OPF) and explicitly reproducing the uncertainty in the system by using a Markovian transition probability matrix. Though there is a substantial body of research integrating economic dispatch and unit commitment and analyzing different policies, the relative advantages of each method are generally not quantified or discussed. Therefore, disentangling the different assumptions for each model makes more complicated the selection of methods for the next generation of models for the electric grid, and the evaluation of policies for the sector.

*Coauthor(s):* **Tim D. Mount** ([tdm2@cornell.edu](mailto:tdm2@cornell.edu)) , **Ray Zimmerman** ([rz10@cornell.edu](mailto:rz10@cornell.edu)) , **Carlos Murillo** ([carlos\\_murillo@ieee.org](mailto:carlos_murillo@ieee.org))

1:30pm-3:00pm Parallel session (Track 3 of 3) B013 (1st floor)

*Session title:* OPTIMIZATION SOFTWARE

*Session chair:* Yunfei Song

*Speaker:* **Matthew Galati** (SAS, [Matthew.Galati@sas.com](mailto:Matthew.Galati@sas.com))

*Title:* **Decomposition, Network Optimization, and Other New Features in SAS/OR® Software**

*Abstract:* This talk demonstrates several new and upcoming features in SAS/OR's, optimization modeling language procedure, PROC OPTMODEL. The new DECOMP algorithm provides an automated decomposition-based technique for solving LPs and MILPs. The interface enables a user to experiment easily with different decompositions simply by defining the partition of constraints in the original compact space. We will present results from several client applications where DECOMP has been successfully used, including results in both shared and distributed memory parallel environments. Furthermore, we will demonstrate the upcoming NETWORK solver option, which provides access to a variety of network-based solvers using graph-based problem definitions instead of explicit formulations, thus greatly enhancing performance and scalability. We will also explore the new SUBMIT block feature, enabling execution of any SAS code within a PROC OPTMODEL invocation. Finally, we will present plans for future extensions and integration of these new features, which will be surfaced to the user directly through the modeling language.

*Coauthor(s):* **Leo Lopes** , **Rob Pratt**

*Speaker:* **John C. Nash** (University of Ottawa (retired), [nashjc@uottawa.ca](mailto:nashjc@uottawa.ca))

*Title:* **Optimization and nonlinear parameter estimation with R**

*Abstract:* At the MOPTA 2002 conference in Hamilton, the author presented a discussion of difficulties in estimating uncertainty in parameters of optimization solutions. This presentation used R to draw graphs, and questions about R hijacked the talk. There was sufficient interest that this became an article in SIAG-Opt News and Views, vol. 15, no. 1, pages 2-5, 2003. Ten years later, R has acquired significant capability in optimization and related nonlinear parameter estimation. Indeed, R is believed to be the leading package for research with statistics, and the optimization capabilities tend to reflect the interests of its creators and users, since it is an open-source, user-developed system. This talk will provide an overview of R's optimization tools, both those that are stable and in development. Some attention will be paid to the way in which R packages are created that make R a convenient tool in which other computational and data management capabilities can be operated and analyzed.

*Speaker:* **Javier Trejos** (University of Costa Rica, javier.trejos@ucr.ac.cr)  
*Title:* **A hyperbolic smoothing approach for fuzzy clustering**  
*Abstract:* The hyperbolic smoothing clustering method is a new general strategy for solving problems in cluster analysis scope; verily it corresponds to a fuzzy way for clustering. We analyze these features and present a new fuzzy clustering algorithm. The approach has three main stages: relaxation of the allocation to the nearest centerOs class, and smoothing the maximal and Euclidean norm functions. This leads to a continuous optimization problem which can be solved by Newton-Raphson iterations whose solution are the centroids of the classes. Then, allocation to the classes is made for each value of the relaxation step according to a simple rule, which is essentially a fuzzy clustering. Computational results obtained for solving a set of test problems of the literature show the efficiency and potentialities of the proposal. We show the possibility of obtaining a hard solution of the particular sum-of-squares clustering problem by a fuzzy strategy. The same methodology can be used for solving similar clustering problems. Moreover, we believe that the application of a sequence of fuzzy formulations that gradually approach the original one can be successfully used for solving a broad class of mathematical problems.

*Coauthor(s):* **Eduardo Piza** (eduardojpiza@hotmail.com) , **Luiz Carlos Ferreira Souza** (luizcfs@petrobras.com.br) , **Alex Murillo** (alex.murillo@ucr.ac.cr) , **Vinicius Layter Xavier** (vinicius@cos.ufrj.br) , **Adilson Elías Xavier** (adilson@cos.ufrj.br)

3:00pm-3:15pm Coffee break Wood Dining Room (2nd floor)

3:15pm-4:45pm Parallel session (Track 1 of 3) Wood Dining Room (2nd floor)

*Session title:* OPTIMIZATION FOR THE SMART GRID  
*Session chair:* Miguel F. Anjos

*Speaker:* **Claudio Canizares** (University of Waterloo, ccanizar@uwaterloo.ca)

*Title:* **The Energy Hub Management System (EHMS)**

*Abstract:* The EHMS project (www.energyhub.uwaterloo.ca) consists on the study and development of hardware and software to empower energy managers at manufacturing, agricultural, commercial, institutional and residential facilities such as mills, greenhouses, retail stores, arenas and detached houses to manage effectively their energy requirements through increased information and control. This presentation will mainly concentrate on describing the project, providing a general overview and discussing its main motivations, objectives and some preliminary results. The optimization models developed for residential customers, which are the main intelligence of the residential EHMS, will be described in some detail. These models consider the optimal control of all major residential energy loads and energy storage/generation devices, including heating/air-conditioning, lighting, fridge, dishwasher, washer and dryer, stove, water heater, hot tub, and pool pumps, as well as solar PV panels and battery storage systems, with the objective of minimizing demand, total cost of electricity and gas, emissions and peak load over the scheduling horizon while considering end-user preferences. The results of the application of this model to a real household will be presented, demonstrating significant reductions in energy costs and peak demand while maintaining the household owner's desired comfort levels.

*Speaker:* **Marc Beaudin** (University of Calgary, mdbeaudi@ucalgary.ca)  
*Title:* **Residential power scheduling using multi-level moving window algorithm**  
*Abstract:* Load control strategies have been explored as a partial solution to address the rising cost of energy and increasing concern over greenhouse gas emissions. Residential energy management is considered as an attractive research topic due to the opportunities offered by expected technological enhancements to the electricity grid. The present work proposes a multi-level moving window scheduling algorithm, used to improve energy consumption and production schedules for a single dwelling. The proposed algorithm is designed to allow for high time-resolution scheduling over an extended period without excessive computational burden. It is also designed to correct for errors in forecasts with every rescheduling interval. The optimization model in the present work uses mixed integer linear programming to schedule devices such as space heaters, water heaters, plug-in hybrid vehicles, and pool pumps. The variations in solve time and solution quality are compared and discussed due to changes in rescheduling intervals, scheduling window, and scheduling time-resolution. The proposed algorithm outperforms the baseline model in all cases, and is shown to be more robust against forecast errors and fluctuations beyond the scope of the scheduling period.

*Coauthor(s):* **Hamidreza Zareipour** (h.zareipour@ucalgary.ca) , **Tony Schellenberg** (awschell@ucalgary.ca)

*Speaker:* **Miguel F. Anjos** (École Polytechnique de Montréal, miguel-f.anjos@polymtl.ca)  
*Title:* **A System Architecture for Autonomous Demand Side Load Management in Smart Buildings**  
*Abstract:* We present a new system architecture for demand-side load management. The system is composed of modules for admission control, load balancing, and demand/response management that operate using online operation control, optimal scheduling, and dynamic pricing respectively. It can integrate different energy sources and handle autonomous systems with heterogeneous dynamics in multiple time-scales. Simulation results confirm the viability and efficiency of the proposed framework.

3:15pm-4:45pm Parallel session (Track 2 of 3) Governor's Suite (2nd floor)  
*Session title:* HEALTHCARE MANAGEMENT  
*Session chair:* Turgay Ayer

*Speaker:* **Osman Ozaltin** (University of Waterloo, oozaltin@uwaterloo.ca)  
*Title:* **Optimal Design of the Annual Influenza Vaccine with Manufacturer Autonomy**  
*Abstract:* Frequent updates to the flu shot strains are required, because the circulating strains mutate each season in response to antibody pressure. The World Health Organization recommends which flu strains to include in the annual vaccine based on international surveillance. These recommendations have to be made under uncertainty at least six months before the epidemic because the production has many time-sensitive steps. Furthermore, there is a decision hierarchy between the government agencies, who design the flu shot, and the manufacturers. This hierarchy results from the fact that the Committee optimizes the societal vaccination benefit by taking into account production decisions of the manufacturers, who maximize their own profits. We quantify the tradeoffs involved through a bilevel stochastic mixed-integer model. Calibrated over publicly available data, our model determines the optimal flu shot composition and production in a stochastic and dynamic environment.

*Coauthor(s):* **Oleg Alexandrovich Prokopyev** (droleg@pitt.edu) , **Andrew Schaefer** (schaefer@ie.pitt.edu)



- Speaker:* **Murat Kurt** (State University of New York at Buffalo, muratkur@buffalo.edu)
- Title:* **Valuing Prearranged Paired Kidney Exchanges: A Stochastic Game Approach**
- Abstract:* End-stage renal disease (ESRD) is the ninth-leading cause of death in the U.S. Transplantation is the most viable therapy for ESRD patients, but there is a severe disparity between the demand for kidneys for transplantation and the supply. This shortage is further complicated by incompatibilities in blood-type and antigen matching between patient-donor pairs. Paired kidney exchange (PKE), a cross-exchange of kidneys among incompatible patient-donor pairs, overcomes many difficulties in matching patients with incompatible donors. In a PKE, transplantation surgeries take place simultaneously, so that no donor may renege after his/her intended recipient receives the organ. We consider a cyclic PKE with an arbitrary number of patients and construct life-expectancy-based edge weights under patient autonomy. Because the patients' health statuses are dynamic, and transplantation surgeries require compatibility between the patients' willingnesses to exchange, we model the patients' transplant timing decisions as a stochastic game in which each patient aims to maximize his/her life expectancy. We explore necessary and sufficient conditions for patients' decisions to be a Nash equilibrium to formulate a mixed-integer linear programming representation of equilibrium constraints. We calibrate our model using large-scale clinical data and empirically confirm that randomized strategies do not yield a social welfare gain over pure strategies. We also quantify the social welfare loss due to patient autonomy and highlight the importance of the disease severity on matching patient-donor pairs.
- Coauthor(s):* **Andrew Schaefer** (schaefer@ie.pitt.edu) , **Utku Unver** (unver@bc.edu) , **Mark Roberts** (mroberts@pitt.edu)
- Speaker:* **Rubén A. Proaño** (Rochester Institute of Technology, rpmeie@rit.edu)
- Title:* **Automatic prioritization of vaccine initiatives: A multi-objective optimization group decision making approach**
- Abstract:* New vaccines are difficult to deploy in low- and middle-income countries due to multiple challenges that strain their immunization supply systems. If the importance of these challenges are factored in before these vaccines are developed, it will be possible for other easier-to-deploy vaccines to be considered as better alternatives for development. Ideally, the expert judgment of multiple stakeholders should be used to assess the quantitative and qualitative attributes associated with vaccine prioritization. This talk presents an optimization based approach to automatically rank a list of vaccine initiatives at different developmental stages by a group of decision-makers, who have conflicting priorities and face non-homogenous information.

*Speaker:* **Turgay Ayer** (Georgia Institute of Technology, [ayer@isye.gatech.edu](mailto:ayer@isye.gatech.edu))

*Title:* **Heterogeneity in Women's Adherence and Its Role on Optimal Breast Cancer Screening Policies**

*Abstract:* Most major health institutions recommend women to undergo repeat mammography screening for early diagnosis of breast cancer, the leading cause of cancer deaths among women worldwide. Although the proportion of women who ever had a mammogram is increasing, there is significant heterogeneity in women's adherence to screening recommendations and a majority of women do not get repeat mammograms. This paper analyzes the role of heterogeneity in women's adherence on optimal mammography screening recommendations. We develop a dynamic modeling framework for breast cancer screening that simultaneously considers heterogeneity with respect to adherence and differences in women's breast cancer risks. We numerically solve this problem using real data based on two main data sources: a) a validated natural history model of breast cancer developed as part of the National Cancer Institute's Cancer Intervention and Surveillance Modeling Network (CISNET) program, and b) published experimental studies in medical and behavioral sciences. Unlike the existing breast cancer screening guidelines that recommend the same screening strategy for all women in the same age group, our results suggest that heterogeneity in women's adherence behaviors and breast cancer risks should be explicitly considered in clinical cancer screening recommendations. In particular, we find that for women who are less likely to adhere and in a higher risk group, more aggressive screening should be recommended; whereas for women who are highly likely to adhere and in a lower risk group, screening recommendations could be less frequent. Our results also shed light on the controversial mammography screening policies and provide managerial insights for the health policy-makers. In that regard, considering that about half of the eligible US women do not adhere to mammography screening recommendations, our findings support promoting aggressive screening recommendations for the general population, such as annual screening over age 40 as recommended by the American Cancer Society.

*Coauthor(s):* **Oguzhan Alagoz** ([alagoz@engr.wisc.edu](mailto:alagoz@engr.wisc.edu)) , **Natasha Stout** ([natasha\\_stout@hms.harvard.edu](mailto:natasha_stout@hms.harvard.edu)) , **Elizabeth Burnside** ([EBurnside@uwhealth.org](mailto:EBurnside@uwhealth.org))

3:15pm-4:45pm Parallel session (Track 3 of 3) B013 (1st floor)

*Session title:* OPTIMIZATION, INFORMATION & COMPLEXITY

*Session chair:* Eugene Perevalov

*Speaker:* **Brandon Pope** (Texas A&M University, [brandon\\_pope@tamu.edu](mailto:brandon_pope@tamu.edu))

*Title:* **Decomposition Strategies for Network Management**

*Abstract:* As networks and their data become increasingly prevalent, opportunities to leverage the structure of networks to harness peer effects also increase. Using a diffusion model of peer influence, we model a network manager's intervention problem as a Markov decision process. Since this MDP is unsolvable for reasonably sized problems, we propose decomposition algorithms inspired by renormalization strategies from the statistical physics literature. In this presentation we study the solution quality and computational reduction of these algorithms.

*Coauthor(s):* **Abhijit Deshmukh** ([abhi@purdue.edu](mailto:abhi@purdue.edu)) , **Eugene Perevalov** ([eup2@lehigh.edu](mailto:eup2@lehigh.edu))

*Speaker:* **Alexander Nikolaev** (State University of New York at Buffalo, [anikolae@buffalo.edu](mailto:anikolae@buffalo.edu))

*Title:* **A Complex Activity Recognition Approach Using Random Graphs**

*Abstract:* This paper discusses methodologies for representing complex activity. It motivates and focuses on the use of template objects modeled as random graphs. An activity template can be formed by fusing multiple realizations of the activity of a given type; once identified, activity templates can be used as tools for activity recognition. Graph entropy is considered as an objective function in the problem of finding an optimal isomorphism of attributed graphs corresponding to activity realizations. Serving as a distance measure between random graph objects, the entropy can then be used to classify observed activity realization by type.

*Coauthor(s):* **Michael Stearns**

*Speaker:* **Soundar Kumara** (Pennsylvania State University, skumara@psu.edu)  
*Title:* **Dealing with big data in online social networks' overlapping community detection algorithm**  
*Abstract:* In today's world, social media networks capture interactions among people through comments on blogs, posts and feeds. People tend to have more than one preference making it difficult to put them in a single community and therefore detecting overlapping communities becomes an important issue. In this paper we discuss game theory based community detection algorithm and validate our implementation, by running experiments on some real world on-line social networks. We also focus on selecting the important attributes leading to communities by using entropy based methods.

*Coauthor(s):* **Yi-Shan Sung , Akshay Ghurye , Supreet Reddy Mandala**

*Speaker:* **Eugene Perevalov** (Lehigh University, eup2@lehigh.edu)  
*Title:* **Information chain: the missing links**  
*Abstract:* Classical Information Theory can be thought of as a description of the middle link of the full information chain – the link responsible for information transmission. That link is largely independent of the other two which effect the information acquisition and its utilization, respectively. If the acquired information is used for making decisions with a quantitative objective, the theory of the “end links” of the information chain can be developed. We sketch the main ideas and current results of such a development.

*Coauthor(s):* **David Grace**

4:45pm-5:00pm      Coffee break      Wood Dining Room (2nd floor)

5:00pm-6:00pm      Plenary presentation      Wood Dining Room (2nd floor)

*Chair:* Robert Storer

*Speaker:* **Mark S. Roberts** (University of Pittsburgh, mroberts@pitt.edu)  
*Title:* **Pushing the Envelope of Operations Research: Applying Management Science to Optimize Health Care Decisions**  
*Abstract:* Historically, application of operations research in health care has been focused on the process and delivery of care. Viewing health care delivery as a production process, operations research and industrial engineering techniques have been use to optimize operating room and ambulance schedules, eliminate bottlenecks in emergency rooms, and re-organize the delivery of radiological services. There have been some applications in optimizing care; most notable perhaps is the development of algorithms to optimize the delivery of radiation therapy, but these remain rare. Over the past 15 years, we have been applying methods from operations research to optimize the treatment of disease. The preferred methodology in medicine for acquiring this type of knowledge is the randomized controlled trial. However, randomized trials are designed to answer simple questions such as “Is A better than B?” when, in fact, most clinical and policy questions are much more complex, and involve picking the best treatment out of a wide array of possibilities, or understanding under what conditions in A better than B. Answering these types of optimization questions is the purpose of operations research. This talk will describe our efforts to apply operations research techniques to patient care decision and policies, using examples from liver transplantation, HIV care and Cardiology.

# ISE Centers



## Enterprise Systems Center

<http://www.lehigh.edu/~inesc/>

The Enterprise Systems Center is committed to helping students learn while simultaneously providing value for our clients. We believe that our research should be driven by industry needs and enabled by close partnerships and collaboration.



## Center for Value Chain Research

<http://www.lehigh.edu/~inchain/>

The Center for Value Chain Research (CVCR) is committed to promoting and conducting research and information exchange through the integration of emerging theory and best practices. The Center's research focuses primarily on value chain planning and development activities, which connect corporate strategy with value chain execution systems.



## Computational Optimization Research at Lehigh

<http://coral.ie.lehigh.edu/>

COR@L aims at promoting and conducting graduate-level research, primarily in the areas that lie at the interface of optimization and high-performance computing. Research conducted at the COR@L lab in recent years has focused on cutting edge optimization theory and development of several open source optimization software. The lab brings together faculty and graduate students aimed at establishing a multi-disciplinary research agenda. Research findings are disseminated through refereed publications, national and international conferences, and scholarly presentations.

# Bus Schedules

## MOPTA Shuttle Schedule

Day	Locations	Time
<b>Monday</b>	Sands Casino Hotel to Iacocca Hall	7:15am – 9:00am
	Iacocca Hall to Sands Casino Hotel	6:15pm – 7:15pm
<b>Tuesday</b>	Sands Casino Hotel to Iacocca Hall	7:15am – 9:00am
	Iacocca Hall to Sands Casino Hotel	9:45pm – 10:30pm
<b>Wednesday</b>	Sands Casino Hotel to Iacocca Hall	7:15am – 9:00am
	Iacocca Hall to Sands Casino Hotel	6:15pm – 7:15pm

<b>Lehigh Shuttle Schedule Iacocca Hall</b>
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7:40 A.M.
8:00 A.M.
8:20 A.M.
8:40 A.M.
9:00 A.M.
9:20 A.M.
9:40 A.M.
10:00 A.M.
10:20 A.M.
10:40 A.M.
11:00 A.M.
11:20 A.M.
11:40 A.M.
12:00 P.M.
12:20 P.M.
12:40 P.M.
1:00 P.M.
1:20 P.M.
1:40 P.M.
2:00 P.M.
2:20 P.M.
2:40 P.M.
3:00 P.M.
3:20 P.M.
3:40 P.M.
4:00 P.M.
4:20 P.M.
4:40 P.M.
5:00 P.M.
5:20 P.M.

Throughout the rest of the days, participants can take the Lehigh bus service to Mountaintop; buses will be running on a summer schedule and the closest stop to Comfort Suites is up Brodhead Avenue in front of the Alumni Memorial Building. Participants that plan to drive to Mountaintop should park in the guest lot on the Mountaintop campus to avoid parking fees during business hours.

Please note: For the Graduate Student Social on Monday evening, separate transportation will be provided by the Lehigh INFORMS student chapter.





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