# Welcome to the 2013 MOPTA Conference!

## Mission Statement

The Modeling and Optimization: Theory and Applications (MOPTA) conference is 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 consists 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 that 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 2013 is hosted by the Department of Industrial and Systems Engineering at Lehigh University.

## Organization Committee


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Kathy Rambo


## We thank our sponsors!

# Program

**Wednesday, August 14 – Rauch Business Center**

7:30-8:10 - Registration and continental breakfast - Perella Auditorium Lobby
8:10-8:20 - Welcome: Tamás Terlaky, Department Chair, Lehigh ISE - Perella Auditorium (RBC 184)
8:20-8:30 - Opening remarks: Patrick Farrell, Provost, Lehigh University - Perella Auditorium (RBC 184)
8:30-9:30 - Plenary talk - Perella Auditorium (RBC 184)

**Zhi-Quan (Tom) Luo, On the Linear Convergence of the Alternating Direction Method of Multipliers**
Chair: Tamás Terlaky

9:30-9:45 - Coffee break - Perella Auditorium Lobby
9:45-11:15 - Parallel technical sessions

| **Mathematical Models in Health Insurance**<br>**Room: RBC 184**<br>**Chair: Aurelie Thiele** | **Computational Techniques for Smart Grids**<br>**Room: RBC 271**<br>**Chair: Larry Snyder** | **Optimization Algorithms**<br>**Room: RBC 91**<br>**Chair: Xi Bai** |
|---|---|---|
| Robust Partial Capitation<br>Aurelie Thiele | Security-Constrained Optimal Power Flow with Sparsity Control and Efficient Parallel Algorithms<br>Andy Sun | An Inexact Block-Decomposition CG Hybrid Method for Dense and Large-Scale Conic Programming<br>Camilo Ortiz |
| Robust Risk Adjustment in Health Insurance<br>Tengjiao Xiao | Convex Quadratic Approximations of AC Power Flows<br>Hassan L. Hijazi | A Tight Iteration-Complexity Bound for IPM via Redundant Klee-Minty Cubes<br>Murat Mut |
| Robust Value-Based Insurance Design<br>Shuyi Wang | Relaxations of Approximate Linear Programs for the Real Option Management of Commodity Storage<br>Selvaprabu Nadarajah | Risk Parity in Portfolio Selection: Models and Algorithms<br>Xi Bai |

11:15-11:30 - Coffee break - Perella Auditorium Lobby
11:30-12:30 - Plenary talk - Perella Auditorium (RBC 184)

**Brian Denton, Optimization of Planning and Scheduling of Health Care Delivery Systems**
Chair: Aurélie Thiele

12:30-1:30 - Lunch - (RBC 292)
1:30-3:00 - Parallel technical sessions

| **Energy Management Systems**<br>**Room: RBC 184**<br>**Chair: Miguel Anjos** | **Nonsmooth and Derivative-Free Optimization**<br>**Room: RBC 271**<br>**Chair: Frank E. Curtis** | **Optimization Under Uncertainty**<br>**Room: RBC 91**<br>**Chair: Luis Zuluaga** |
|---|---|---|
| MPC-Based Appliance Scheduling for Residential Building Energy Management Controller<br>Chen Chen | Full Stability in Nonlinear Optimization with Applications to Semidefinite Programming<br>Nghia Tran | Extensions of Scarf's Max-Min Order Formula<br>Luis F. Zuluaga |
| A Centralized Energy Management System for Isolated Microgrids<br>Daniel Olivares | Handling Equality Constraints in Expensive Black-Box Optimization Using Radial Basis Function Surrogates<br>Rommel Regis | Linear Solution Scheme for the Candinality Constarined Portfolio Allocation Models<br>Onur Babat |
| Optimization of Wind, Diesel and Battery Systems for Remote Areas<br>Miguel Anjos | A BFGS-Based SQP Method for Constrained Nonsmooth, Nonconvex Optimization<br>Tim Mitchell | Computing Semiparametric Bounds on the Expected Payments of Insurance Instruments via Column Generation<br>Robert Howley |

3:00-3:15 - Coffee break - Perella Auditorium Lobby
3:15-4:45 - Parallel technical sessions

| **Large-Scale Optimization with Applications to Machine Learning**<br>**Room: RBC 184**<br>**Chair: Katya Scheinberg** | **Disruption Management**<br>**Room: RBC 271**<br>**Chair: Lin He** | **Models for Electricity Market Mechanism Design**<br>**Room: RBC 91**<br>**Chair: Alberto Lamadrid** |
|---|---|---|
| Sparse Inverse Covariance Matrix Estimation Using Quadratic Approximation<br>Cho-Jui Hsieh | Inventory Management for a Distribution System Subject to Supply Disruptions<br>Lin He | Environmental SuperOPF Electricity Market Planning Tool<br>Biao Mao |
| A Deterministic Rescaled Perceptron Algorithm<br>Negar Soheili Azad | Optimal Dynamic Stochastic Scheduling with Partial Losses of Work<br>Xiaoqiang Cai | A Nested Look-Ahead Model for Unit Commitment with Joint Ramping Capability Requirements<br>Boris Defourny |
| Complexity of Inexact Proximal Newton Method<br>Xiaocheng Tang | A Modeling and Simulation Approach to Emergency Management<br>Brian J. Hunt | An Experimental Study of Complex-Offer Auctions: Payment Cost Minimization versus Offer Cost Minimization<br>Rimvydas Baltaduonis |

4:45-5:00 - Coffee break - Perella Auditorium Lobby
5:00-6:00 - Plenary talk - Perella Auditorium (RBC 184)

**Jorge Nocedal, Some Matrix Optimization Problems Arising in Machine Learning**
Chair: Katya Scheinberg

6:30-9:30 - Graduate student social - Graduate Student Center (Packer House)

# Program

**Thursday, August 15 – Rauch Business Center**

8:30-9:00 - Continental breakfast - Perella Auditorium Lobby

9:00-10:45 - AIMMS/MOPTA Optimization Modeling Competition: Final presentations - Perella Auditorium (RBC 184)

| Chair: Peter Nieuwesteeg (winner will be announced at conference banquet) |
|---|
| Team "OptNAR", Universidad Politécnica de Madrid (TU-Madrid) and INTEC<br>Raul Pulido Martinez, Natalia Ibañez Herrero (TU-Madrid), Adrian Marcelo Aguirre (INTEC); advised by Miguel Ortega Mier (TU-Madrid) |
| Team "ORopt", Technische Universität Berlin and ZIB<br>Alexander Tesch (TU-Berlin); advised by Ralf Borndörfer (ZIB) |
| Team "Universiteit Twente", Universiteit Twente<br>Corine Laan, Clara Stegehuis; advised by Bodo Manthey |
| Team "ORTEC", ORTEC, University of Amsterdam<br>Harmen Boersma, Tristan Hands, Jan-Willem Arentshorst; advised by Frans van Helden |

10:45-11:00 - Coffee break - Perella Auditorium Lobby

11:00-12:00 - Plenary talk - Perella Auditorium (RBC 184)

**Ignacio Grossmann, Relaxations for Convex Nonlinear Generalized Disjunctive Programs and their Application to Nonconvex Problems**

Chair: Ted Ralphs

12:00-1:00 - Lunch - (RBC 292)

1:00-2:30 - Parallel technical sessions

| **Approximation Algorithms**<br>**Room: RBC 184**<br>**Chair: Amir Ali Ahmadi** | **Models for Uncertainty and Demand Response in Smart Grids**<br>**Room: RBC 271**<br>**Chair: Larry Snyder** | **Applications of MINLP**<br>**Room: RBC 91**<br>**Chair: Hande Y. Benson** |
|---|---|---|
| Rounding by Sampling<br>Arash Asadpour | Optimizing Locations for Wave Energy Farms Under Uncertainty<br>Larry Snyder | Interior-Point Methods within a MINLP Framework<br>Hande Y. Benson |
| Approximation Algorithms for Graph Partitioning Problems using SDP Hierarchies<br>Ali Kemal Sinop | Generation and Storage Dispatch in Electricity Networks with Generator Disruptions<br>M.Mohsen Moarefdoost | Mixed Integer Nonlinear Programming for Multi Vehicle Motion Planning: Ground and Underwater Vehicles<br>Pramod Abichandani |
| Approximation of the Joint Spectral Radius via Dynamic and Semidefinite Programming<br>Amir Ali Ahmadi | Modeling Demand Response for FERC Order 745<br>Yanchao Liu | Multiperiod Portfolio Optimization with Cone Constraints and Discrete Decisions<br>Umit Saglam |

2:30-2:45 - Coffee break - Perella Auditorium Lobby

2:45-4:15 - Parallel technical sessions

| **Mixed Integer Optimization and Applications**<br>**Room: RBC 184**<br>**Chair: Ted Ralphs** | **PDE-Constrained Optimization**<br>**Room: RBC 271**<br>**Chair: Jason Hicken** | **Facility Layout Problems**<br>**Room: RBC 91**<br>**Chair: Abdul-Rahim Ahmad** |
|---|---|---|
| Evasive Flow Capture: Optimal Location of Weigh-in-Motion Systems, Tollbooths, and Safety Checkpoints<br>Nikola Markovic | A Matrix-Free Augmented Lagrangian Algorithm for Large-Scale Structural Design<br>Andrew Lambe | A Novel Adaptive Boundary Search Algorithm for Solving Facility Layout Problems<br>Abdul-Rahim Ahmad |
| Column Generation and Accelerating Schemes for Mixed-Mode Aircraft Sequencing Problems<br>Farbod Farhadi | Inexact and Truncated Parareal-in-time Krylov Subspace Methods for Parabolic Optimal Control Problems<br>Daniel B. Szyld | Cyclic Facility Layout Problem: A Hybrid Exact/Heuristic Optimization Approach<br>Abdullah Konak |
| Three Dimensional Knapsack Problem with Vertical Stability and Pre-Placed Boxes<br>Hanan Mostaghimi Ghomi and Walid Abdul-Kader | A Flexible Iterative Trust-Region Algorithm for Nonstationary Preconditioners<br>Jason Hicken | Solving the Unequal Area Facility Layout Problem: An Effective Hybrid Optimization Strategy Coupled with the Location/Shape Representation<br>Sadan Kulturel-Konak |

4:15-4:30 - Coffee break - Perella Auditorium Lobby

4:30-5:30 - Plenary talk - Perella Auditorium (RBC 184)

**Omar Ghattas, The Stochastic Newton Method: Combining Large-Scale Optimization and Markov Chain Monte Carlo Methods for the Solution of PDE-Constrained Bayesian Inverse Problems**

Chair: Frank E. Curtis

6:00-7:00 - Cocktail reception - Asa Packer Dining Room (University Center)

7:00-9:30 - Conference banquet and competition results - Asa Packer Dining Room (University Center)

# Program

**Friday, August 16 – Rauch Business Center**

8:30-9:15 - Continental breakfast - Perella Auditorium Lobby

8:45-10:45 - Parallel technical sessions

| **Optimization and Differential Equations**<br>**Room: RBC 184**<br>**Chair: Yunfei Song** | **Healthcare Applications**<br>**Room: RBC 271**<br>**Chair: Jackie Griffin** | **Advances in Portfolio Management and Pricing**<br>**Room: RBC 91**<br>**Chair: Elcin Cetinkaya** |
|---|---|---|
| On the Complexity of Steepest Descent for Minimizing Convex Quadratics<br>Clovis Gonzaga | TBD<br>Walter Massey | Full Characterization of Disjunctive-Conic-Cuts for Mixed Integer Second Order Cone Optimization<br>Julio Góez |
| Preconditioners for PDE Constrained Optimization<br>Ekkehard W. Sachs | Simulation Model for the Analyses and Cost Estimates of Combination HIV-Prevention Strategies for the Elimination of HIV<br>Chaitra Gopalappa | Implementing Real-Time Pricing in Wholesale Electricity Markets<br>Jingjie Xiao |
| A Primal-Dual Active-Set Algorithm for Large-Scale Convex Quadratic Optimization<br>Zheng Han | Patient-Bed Assignments in Hospital Systems<br>Jackie Griffin | Portfolio Risk Management with Moment Matching Approach<br>Elcin Cetinkaya |
| Convex Sets as Invariant Sets for Linear Systems<br>Yunfei Song | Efficient Learning of Donor Retention Strategies for the American Red Cross<br>Bin Han | Robust Manager Allocation for Investment Management<br>Yang Dong |

10:45-11:00 - Coffee break - Perella Auditorium Lobby

11:00-12:00 - Plenary talk - Perella Auditorium (RBC 184)

**Henry Wolkowicz, Taking Advantage of Degeneracy in Cone Optimization with Applications to Sensor Network Localization and Molecular Conformation**

Chair: Luis Zuluaga

12:00-1:00 - Lunch - (RBC 292)

1:00-2:30 - Parallel technical sessions

| **Networks**<br>**Room: RBC 184**<br>**Chair: Eric Landquist** | **Demand Systems**<br>**Room: RBC 271**<br>**Chair: Miguel Anjos** | **Recent Advances in Sparse Linear Programming**<br>**Room: RBC 91**<br>**Chair: Robert Vanderbei** |
|---|---|---|
| Multi-Agent Information Routing Under Dynamic and Uncertain Conditions<br>Dimitrios Papadimitriou | Scheduling of Multiproduct Pipelines for Transporting Liquid Fuels<br>Arun Sridharan | Estimating Sparse Precision Matrix by the Parametric Simplex Method<br>Haotian Pang |
| Dynamic-Programming-Based Link Assignment for Data Collection in Wireless Sensor Networks<br>Yanhong Yang and Huan Yang | Consumer Demand Systems Based on Discrete-Continuous Models<br>Walter Gomez | Fast-Fourier Optimization<br>Robert Vanderbei |
| A Simple and Efficient Strategy for Solving Large Generalized Cable-Trench Problems<br>Eric Landquist and Francis Vasko | Piecewise-Constant Regression with Implicit Filtering<br>Sanjay Yadav | Online PRSM<br>Xingyuan Fang |

2:30-2:45 - Coffee break - Perella Auditorium Lobby

2:45-4:15 - Parallel technical sessions

| **Optimizing Supply-Demand Match in Power Systems**<br>**Room: RBC 184**<br>**Chair: Alberto Lamadrid** | **Semidefinite Optimization**<br>**Room: RBC 271**<br>**Chair: Hongbo Dong** | **Optimization, Information, and Complexity**<br>**Room: RBC 91**<br>**Chair: Eugene Perevalov** |
|---|---|---|
| Adaptive Load Management: Scheduling and Coordination of Demand Resources in Power Systems<br>Jhi-Young Joo | The Trust Region Subproblem with Non-Intersecting Linear Constraints<br>Boshi Yang | On the Connection Between the Reliability of Systems and the Notion of Invariance Entropy<br>Getachew K. Befekadu |
| Co-Optimization of Grid-to-Vehicle Charging and Ancillary Services<br>Jonathan Donadee | Finding Hidden Cliques and Dense Subgraphs via Convex Optimization<br>Brendan Ames | Multiresolution Gaussian Process Model for the Analysis of Large Spatial Data Sets<br>Soutir Bandyopadhyay |
| The Effects of Bulk Electricity Storage on the PJM Market<br>Roger Lueken | Conic Relaxations for Convex Quadratic Optimization with Indicator Variables<br>Hongbo Dong | On Optimal Information Extraction from Large-Scale Datasets<br>Eugene Perevalov |

# Program Highlights

## Wednesday, August 14

8:30am-9:30am – Zhi-Quan (Tom) Luo, plenary talk (see page 9)

11:30am-12:30pm – Brian Denton, plenary talk (see page 6)

5:00pm-6:00pm – Jorge Nocedal, plenary talk (see page 10)

6:30pm-9:30pm – Graduate student social

## Thursday, August 15

9:00am-10:45am – AIMMS/MOPTA Optimization Modeling Competition: Final presentations (see page 12)

11:00am-12:00pm – Ignacio Grossmann, plenary talk (see page 8)

4:30pm-5:30pm – Omar Ghattas, plenary talk (see page 7)

6:00pm-7:00pm – Cocktail reception

7:00pm-9:30pm – Conference banquet and competition results

## Friday, August 16

11:00am-12:00pm – Henry Wolkowicz, Plenary talk (see page 11)

# Speaker Biography


## Brian Denton

Associate Professor
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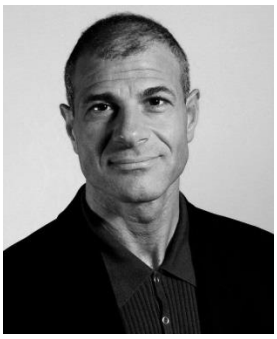
Dr. Brian Denton is an Associate Professor in the Department of Industrial and Operations Engineering at University of Michigan, in Ann Arbor, MI. Previously he has been an Associate Professor in the Department of Industrial & Systems Engineering at NC State University, a Senior Associate Consultant at Mayo Clinic in the College of Medicine, and a Senior Engineer at IBM. He is a Fellow at the Cecil Sheps Center for Health Services Research at University of North Carolina. His primary research interests are in optimization under uncertainty and applications to health care delivery and medical decision making. He completed his Ph.D. in Management Science at McMaster University, his M.Sc. in Physics at York University, and his B.Sc. in Chemistry and Physics at McMaster University in Hamilton, Ontario, Canada.

### Title: Optimization of Planning and Scheduling of Health Care Delivery Systems

### Date: Wednesday, August 14, 11:30am-12:30pm


**Abstract:** Optimization of planning and scheduling decisions under uncertainty is important in many service industries to increase the utilization of resources, match workload to available capacity, and smooth the flow of customers through the system. It is particularly important for healthcare delivery where applications include scheduling of patients to outpatient clinics, design of operating room schedules, and allocation of resources within healthcare facilities. In this talk I will discuss stochastic optimization models for scheduling services in outpatient procedure centers and hospitals. I will discuss three related problems. The first involves setting individual procedure start times for a single operating room (OR) given uncertainty in the duration of procedures. The objective of this problem is to minimize a weighted sum of three competing criteria: patient and OR team waiting time, OR idle time, and overtime. The second problem involves the allocation of surgeries across multiple ORs with the goal of balancing the fixed cost of opening ORs with the expected cost of total overtime. The third problem involves setting optimal arrival times for patients to an outpatient procedure center comprising multiple activities including: intake processes, surgery, and recovery. For each problem I will describe the model, stochastic optimization methods that can be applied, and numerical results based on real data to illustrate the potential impact of the model. I will also discuss open questions and future research opportunities related to optimization of health care delivery systems.

# Speaker Biography



## Omar Ghattas

John A. and Katherine G. Jackson Chair in Computational Geosciences
Professor, Department of Geological Sciences, Jackson School of Geosciences
Professor, Department of Mechanical Engineering
University of Texas at Austin
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Dr. Omar Ghattas is the John A. and Katherine G. Jackson Chair in Computational Geosciences, Professor of Geological Sciences and Mechanical Engineering, and Director of the Center for Computational Geosciences in the Institute for Computational Engineering and Sciences (ICES) at The University of Texas at Austin. He also is a member of the faculty in the Computational Science, Engineering, and Mathematics (CSEM) interdisciplinary PhD program in ICES, serves as Director of the KAUST-UT Austin Academic Excellence Alliance, and holds courtesy appointments in Computer Science, Biomedical Engineering, the Institute for Geophysics, and the Texas Advanced Computing Center. He earned BS, MS, and PhD degrees from Duke University in 1984, 1986, and 1988. He has general research interests in simulation and modeling of complex geophysical, mechanical, and biological systems on supercomputers, with specific interest in inverse problems and associated uncertainty quantification for large-scale systems. His center's current research is aimed at large-scale forward and inverse modeling of whole-earth, plate-boundary-resolving mantle convection; global seismic wave propagation; dynamics of polar ice sheets and their land, atmosphere, and ocean interactions; and subsurface flows, as well as the underlying computational, mathematical, and statistical techniques for making tractable the solution and uncertainty quantification of such complex forward and inverse problems on parallel supercomputers. He received the 1998 Allen Newell Medal for Research Excellence, the 2004/2005 CMU College of Engineering Outstanding Research Prize, the SC2002 Best Technical Paper Award, the 2003 IEEE/ACM Gordon Bell Prize for Special Accomplishment in Supercomputing, the SC2006 HPC Analytics Challenge Award, and the 2008 TeraGrid Capability Computing Challenge award, and was a finalist for the 2008, 2010, and 2012 Bell Prizes. He has served on the editorial boards or as associate editor of 12 journals, has been co-organizer of 12 conferences and workshops and served on the scientific or program committees of 40 others, has delivered plenary lectures at 23 international conferences, and has been a member or chair of 20 national or international professional committees.

### Title: The Stochastic Newton Method: Combining Large-Scale Optimization and Markov Chain Monte Carlo Methods for the Solution of PDE-Constrained Bayesian Inverse Problems

### Date: Thursday, August 15, 4:30pm-5:30pm

**Abstract:** We address the problem of quantifying uncertainties in the solution of ill-posed inverse problems governed by expensive forward models (e.g., PDEs) and characterized by high-dimensional parameter spaces (e.g., discretized heterogeneous parameter fields). The problem is formulated in the framework of Bayesian inference, leading to a solution in the form of a posterior probability density. To explore this posterior density, we propose several variants of a so-called Stochastic Newton Markov chain Monte Carlo (MCMC) method, which employs, as an MCMC proposal, a local Gaussian approximation whose covariance is the inverse of a local Hessian of the negative log posterior, made tractable via randomized low rank approximations and adjoint-based matrix-vector products. We apply this Stochastic Newton method to several large-scale geophysical inverse problems and study its performance.

This is joint work with Tan Bui-Thanh, Carsten Burstedde, Tobin Isaac, James Martin, Noemi Petra, and Georg Stadler.

# Speaker Biography


## Ignacio Grossmann

Rudolph R. and Florence Dean University Professor of Chemical Engineering
Carnegie Mellon University
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Prof. Ignacio E. Grossmann is the Rudolph R. and Florence Dean University Professor of Chemical Engineering, and former Department Head at Carnegie Mellon University. He obtained his B.S. degree in Chemical Engineering at the Universidad Iberoamericana , Mexico City, in 1974, and his M.S. and Ph.D. in Chemical Engineering at Imperial College in 1975 and 1977, respectively. After working as an R&D engineer at the Instituto Mexicano del Petróleo in 1978, he joined Carnegie Mellon in 1979. He was Director of the Synthesis Laboratory from the Engineering Design Research Center in 1988-93. He is director of the "Center for Advanced Process Decision-making" which comprises a total of 20 petroleum, chemical and engineering companies. Ignacio Grossmann is a member of the National Academy of Engineering , Mexican Academy of Engineering, and associate editor of AIChE Journal and member of editorial board of Computers and Chemical Enginering, Journal of Global Optimization, Optimization and Engineering, Latin American Applied Research, and Process Systems Engineering Series. He was Chair of the Computers and Systems Technology Division of AIChE , and co-chair of the 1989 Foundations of Computer-Aided Process Design Conference and 2003 Foundations of Computer-Aided Process Operations Conference. He is a member of the American Institute of Chemical Engineers, Sigma Xi, Institute for Operations Research and Management Science, and American Chemical Society.

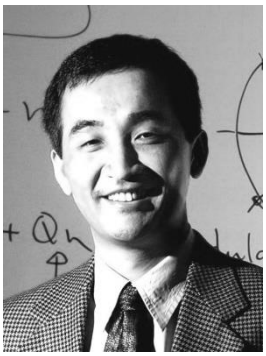
### Title: Relaxations for Convex Nonlinear Generalized Disjunctive Programs and their Application to Nonconvex Problems

### Date: Thursday, August 15, 11:00am-12:00pm


**Abstract:** This talk deals with the theory of reformulations and numerical solution of generalized disjunctive programming (GDP) problems, which are expressed in terms of Boolean and continuous variables, and involve algebraic constraints, disjunctions and propositional logic statements. We propose a framework to generate alternative MINLP formulations for convex nonlinear GDPs that lead to stronger relaxations by generalizing the seminal work by Egon Balas (1988) for linear disjunctive programs. We define for the case of convex nonlinear GDPs an operation equivalent to a basic step for linear disjunctive programs that takes a disjunctive set to another one with fewer conjuncts. We show that the strength of relaxations increases as the number of conjuncts decreases, leading to a hierarchy of relaxations. We prove that the tightest of these relaxations, allows in theory the solution of the convex GDP problem as an NLP problem. We present a guide for the generation of strong relaxations without incurring in an exponential increase of the size of the reformulated MINLP. We apply the proposed theory for generating strong relaxations to a dozen convex GDPs which are solved with a NLP-based branch and bound method. Compared to the reformulation based on the hull relaxation, the computational results show that with the proposed reformulations significant improvements can be obtained in the predicted lower bounds, which in turn translates into a smaller number of nodes for the branch and bound enumeration. We then briefly describe an algorithmic implementation to automatically convert a convex GDP into an MILP or MINLP using the concept of basic steps, and applying both big-M and hull relaxation formulations to the set of disjunctions.

Finally, we address the extension of the above ideas to the solution of nonconvex GDPs that involve bilinear, concave and linear fractional terms. In order to solve these nonconvex problems with a spatial branch and bound method, a convex GDP relaxation is obtained by using suitable under- and over-estimating functions of the nonconvex constraints. In order to predict tighter lower bounds to the global optimum we exploiting the hierarchy of relaxations for convex GDP problems. We illustrate the application of these ideas in the optimization of several process systems to demonstrate the computational savings that can be achieved with the tighter lower bounds.

# Speaker Biography




## Zhi-Quan (Tom) Luo

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Zhi-Quan (Tom) Luo is a professor in the Department of Electrical and Computer Engineering at the University of Minnesota (Twin Cities) where he holds an endowed ADC Chair in digital technology. He received his B.Sc. degree in Applied Mathematics in 1984 from Peking University, China, and a Ph.D degree in Operations Research from MIT in 1989. From 1989 to 2003, Dr. Luo was with the Department of Electrical and Computer Engineering, McMaster University, Canada, where he later served as the department head and held a senior Canada Research Chair in Information Processing. His research interests lie in the union of optimization algorithms, data communication and signal processing.

Dr. Luo is a fellow of IEEE and SIAM. He is a recipient of the IEEE Signal Processing Society's Best Paper Award in 2004, 2009 and 2011, as well as the EURASIP Best Paper Award and the ICC's Best Paper Award in 2011. He was awarded the Farkas Prize from the INFORMS Optimization Society in 2010. Dr. Luo has chaired of the IEEE Signal Processing Society's Technical Committee on Signal Processing for Communications and Networking (SPCOM) during 2010-2012. He has held editorial positions for several international journals, including currently being the editor-in-chief for IEEE Transactions on Signal Processing.

### Title: On the Linear Convergence of the Alternating Direction Method of Multipliers

### Date: Wednesday, August 14, 8:30am-9:30am


**Abstract:** We analyze the convergence rate of the alternating direction method of multipliers (ADMM) for minimizing the sum of two or more nonsmooth convex separable functions subject to linear constraints. Previous analysis of the ADMM typically assumes that the objective function is the sum of only two convex functions defined on two separable blocks of variables even though the algorithm works well in numerical experiments for three or more blocks. Moreover, there has been no rate of convergence analysis for the ADMM without strong convexity. In this work, we establish the global linear convergence of the ADMM for minimizing the sum of any number of convex separable functions. This result settles a key question regarding the convergence of the ADMM when the number of blocks is more than two or if the strong convexity is absent. It also implies the linear convergence of the ADMM for several contemporary applications including LASSO, Group LASSO and Sparse Group LASSO without any strong convexity assumption. Our proof is based on estimating the distance from a dual feasible solution to the optimal dual solution set by the norm of a certain proximal residual.

# Speaker Biography

## Jorge Nocedal

Director of Optimization Center
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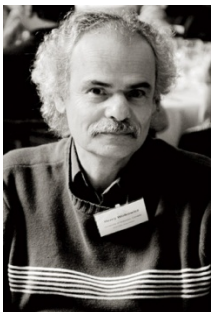
Jorge Nocedal is a professor in the Industrial Engineering Department at Northwestern University. His research interests are in optimization algorithms and their application in areas such as machine learning and energy management. His current research is being driven by a collaboration with Google Research. Jorge is passionate about undergraduate education; he was one of the developers of the "Engineering First" Curriculum at Northwestern that exposes students to engineering design in their freshman year. He is currently the Editor in Chief for the SIAM Journal on Optimization, is a SIAM Fellow, and was awarded the 2012 George B. Dantzig Prize.

### Title: Some Matrix Optimization Problems Arising in Machine Learning

### Date: Wednesday, August 14, 5:00pm-6:00pm

**Abstract:** The research presented in this talk is motivated by three applications: recommendation systems, speech recognition, and the training of vary large neural nets. In all these applications there is a need to solve large nonlinear optimization problems in which the unknown is a matrix. We describe state-of-the-art methods for solving these problems, and illustrate their performance using realistic data sets.

# Speaker Biography



## Henry Wolkowicz

Professor
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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.

### Title: Taking Advantage of Degeneracy in Cone Optimization with Applications to Sensor Network Localization and Molecular Conformation

### Date: Friday, August 16, 11:00am-12:00pm

**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.

# AIMMS/MOPTA Optimization Modeling Competition 2013

The fifth 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 critical importance to hospital organizations. The teams were asked to consider an Operating Room (OR) manager's task of scheduling and sequencing surgeries in a set of ORs, where, besides the inherent complexity of typical scheduling problems, OR scheduling is further complicated by the uncertainty of the time required to perform surgical procedures (including preparation, surgery, and clean-up times). The teams were asked to develop a tool to handle the scheduling and sequencing of surgeries in a hospital that aims to reduce the downtime for an OR, waiting time for a surgeon, and overtime for the OR staff, all of which create costs for the hospital organization.

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 page report for the project. We are happy that 11 teams from 7 different countries participated in the competition. The panel of judges (Robert Storer and Luis F. Zuluaga from Lehigh University and Peter Nieuwesteeg from Paragon Decision Technology) selected the following three teams for the final:

**Team "OptNAR", Universidad Politécnica de Madrid and INTEC**
Raul Pulido Martinez, Natalia Ibañez Herrero (TU-Madrid), Adrian Marcelo Aguirre (INTEC)
advised by Miguel Ortega Mier (TU-Madrid)

**Team "ORopt", Technische Universität Berlin and ZIB**
Alexander Tesch (TU-Berlin)
advised by Ralf Borndörfer (ZIB)

**Team "Universiteit Twente", Universiteit Twente**
Corine Laan, Clara Stegehuis
advised by Bodo Manthey

**Team "ORTEC", ORTEC, University of Amsterdam**
Harmen Boersma, Tristan Hands, Jan-Willem Arentshorst
advised by Frans van Helden

The finalist teams will each give 25 minute presentations (20 minute talks + 5 minutes for questions) on their work on Thursday starting at 9:00am in the Perella Auditorium. The winning team will be announced at the conference banquet on Thursday evening.

One other team has received honorable mention for their work:

**Team "PolytHEC", École Polytechnique de Montréal and HEC**
Jean Bertrand Gauthier (HEC), Antoine Legrain, Étienne Beauchamp (École Polytechnique de Montréal)
Advised by Louis-Martin Rousseau (École Polytechnique de Montréal)

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.