Welcome to the 2010 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 small number of invited talks from distinguished speakers and a set of 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 2010 is hosted by the Department of Industrial and Systems Engineering at Lehigh University.

Organization Committee

Tamás Terlaky – Chair
terlaky@lehigh.edu

Pietro Belotti
belotti@lehigh.edu

Frank E. Curtis
frank.e.curtis@lehigh.edu

Imre Pólik
imre.polik@gmail.com

Ted K. Ralphs
ted@lehigh.edu

Lawrence V. Snyder
larry.snyder@lehigh.edu

Robert Storer
rhs2@lehigh.edu

Aurélie Thiele
aurelie.thiele@lehigh.edu

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Program

Wednesday, August 18 – Rauch Business Center (RBC)

7:30-8:40 - Registration and continental breakfast - Perella Lobby
8:40-8:50 - Welcome: Dr. Tamás Terlaky – Perella Auditorium RBC 184
8:50-9:00 - Opening Remarks: Dr. Patrick Farrell, Provost of Lehigh University - RBC 184
9:00-10:00 - **H. Edwin Romeijn, "Radiation therapy treatment plan optimization"** – Chair: Bob Storer - RBC 184
10:00-10:15 - Coffee break - Perella Lobby
10:15-12:15 - Parallel technical sessions

Logistics Applications (RBC 184) Chair: Lawrence V. Snyder	**Semidefinite and Convex Optimization (RBC 271)** Chair: Angelia Nedich
Assemble-to-Order Systems with Exogenous Lead Times **Alp Muharremoglu**	Applying first order methods to packing and covering SDPs **David Phillips**
Flight Sequence Model for Flight Conflict Resolving Problem **Zhe Liang**	Eigenvalue Techniques in Convex Objective, Nonconvex Optimization **Daniel Bienstock**
Resell versus Direct Models in Brand Drug Distribution **Katie Martino**	Strengthening semidefinite relaxations of maximum stable set problem via heuristics **Hongbo Dong**
A Competitive Facility Location Model **Tolga Seyhan**	Solving linear programs with complementarity constraints **John Mitchell**

12:15-1:15 - Lunch – RBC 292
1:15-3:15 - Parallel technical sessions

Planning and Scheduling Applications (RBC 184) Chair: John Mitchell	**Mixed Integer Programming (RBC 271)** Chair: Claudia D'Ambrosio
Models for Production Planning Under Power Uncertainty **Cagri Latifoglu**	New Inequalities for the Piecewise Linear Optimization Polytope and Extensions **Ismael de Farias**
Improved Lagrangian Relaxation Schemes for Production Scheduling **Daniel Bienstock**	Reduce-and-Split Revisited: Efficient Generation of Split Cuts for MILP **Giacomo Nannicini**
A Decomposition Method for Production Planning in Manufacturing Systems **Mingyuan Chen**	Two Dimensional Lattice-Free Cuts and Asymmetric Disjunctions for Mixed-Integer Polyhedra **Oktay Günlük**
Optimizing Performance Funding at Kutztown University of Pennsylvania **Francis Vasko**	Disjunctive conic cuts for second order cone optimization **Julio C. Góez**

3:15-3:30 - Coffee break – Perella Lobby
3:30-5:00 - Parallel technical session

Financial Optimization (RBC 184) Chair: Arkadi Nemirovski	**Network Optimization (RBC 271)** Chair: Ismael de Farias
Constructing Sparse Replicating Portfolios by Weighted Regularized Optimization **Oleksandr Romanko**	A Reduced Vertex-Triples Formulation of the Maximum Concurrent Flow Problem **Eli Olinick**
Log-Robust Portfolio Management With Parameter Ambiguity **Aurélie Thiele**	Two-stage Interdiction Models and Algorithms for Attacking Nodes in Networks **Siqian Shen**
Robust R&D Project Management **Ruken Duzgun**	Pooling Problems with Binary Variables **Claudia D'Ambrosio**

5:00-5:15 - Coffee break (Perella Lobby)
5:15-6:15 - **Mung Chiang, "Optimization in Networking"** – Chair: Larry Snyder - RBC 184
6:30-9:30 Student Social – Graduate Student Center

Program

Thursday, August 19 – Rauch Business Center (RBC)

7:15-8:00 - Continental Breakfast - Perella Lobby
8:00-9:00 - **Egon Balas, "Intersection Cuts Revisited or the Geometry of Lift-and-Project"** – Chair: Imre Pólik - RBC 184
9:00-9:15 - Coffee break - Perella Lobby
9:15-10:45 - Parallel technical sessions

Convex Optimization (RBC 184) Chair: Darinka Dentcheva	**Environmental and Health Applications (RBC 271)** Chair: H. Edwin Romeijn
Safe Tractable Approximations for Joint Chance Constraint Programs **Tao Yao**	The Treatment Planning Optimization of Volumetric Modulated Arc Therapy **Vicky Mak**
Convergence Analysis of Proximal-Point Nonlinear Rescaling Method for Convex Optimization **Igor Griva**	A Parallel Algorithm for the Min Cardinality Problem in IMRT **Luke Mason**
Nomination Validation and Network Extension in Gas Transmission Networks **Jácint Szabó**	Mathematical Modeling of Consumer Behaviour with Applications to Eco-Products **Christopher Hogg**

10:45-11:00 - Coffee break – Perella Lobby
11:00-12:30 - AIMMS /MOPTA Optimization Modeling Competition Final (Winner will be announced at banquet)

AIMMS/MOPTA Optimization Modeling Competition Final - RBC 184 – Chair: Imre Pólik
Team Gladiator, University of Florida, Department of ISE Siqian Shen, Zhili Zhou, Ruiwei Jiang, advised by George Lan
Team ORTEC, Gouda, The Netherlands Arjan Thomas, Cindy de Groot, and Ilse Louwerse, advised by Ineke Meuffels
Team Twente, University of Twente, The Netherlands Stijn Duyzer, Joshua Euwijk, advised by Gerhard Post (Team Twente was unable to attend MOPTA due to a scheduling conflict.)

12:30-1:30 - Lunch - RBC 292
1:30-3:00 - Parallel Session

First Order Methods in Convex Optimization (RBC 184) Chair: Donald Goldfarb	**Monte Carlo Methods (RBC 271)** Chair: János D. Pintér
A Unified Approach for Minimizing Composite Norms **Necdet Aybat**	Accelerated Hit-and-Run: Preliminary Results on New Search Direction Strategies **Richard Caron**
First Order Methods for Matrix Rank Minimization **Shiqian Ma**	"Optimal" Parameter Choice in Sample-Path Methods for Root Finding and Optimization **Raghu Pasupathy**
Fast iterative shrinkage thresholding algorithm with full line search **Katya Scheinberg**	Bayesian Constrained Optimization and Uncertainty Analysis Using Radial Basis Random Local Fitting **Able Mashamba**

3:00-3:15 - Coffee Break – Perella Lobby
3:15-4:45 - Parallel technical sessions

Parallel and Problem Decomposition Methods (RBC 184) Chair: Joaquim Martins	**Risk-Averse Optimization (RBC 271)** Chair: Mung Chiang
Decomposition in Sequential Quadratic Programming **Andrew Lambe**	Numerical Methods for Optimization Problems with Inverse Dominance Constraints **Darinka Dentcheva**
Distributed Multi-Agent Optimization with State-Dependent Communication **Ilan Lobel**	Regularization Method for Probabilistic Optimization **Gabriela Martinez**
Asynchronous Broadcast-Based Convex Optimization Over a Network **Angelia Nedich**	Stochastic Optimization of Sensor Placement for Diver Detection **Anton Molyboha**

4:45-5:00 - Coffee break - Perella Lobby
5:00-6:00 – **Donald Goldfarb, "Alternating Direction Augmented Lagrangian Algorithms for Convex Optimization"** – Chair: Ted Ralphs - RBC 184
6:30-9:30 - Conference Banquet and Competition Results – Banana Factory
Dinner Remarks: Dr. S. David Wu, Dean of the P.C. Rossin College of Engineering and Applied Science at Lehigh University

Program

Friday, August 20 – Rauch Business Center (RBC)

7:15-8:00 - Continental Breakfast – Perella Lobby
8:00-9:00 - **Andrzej Ruszczyński, "Dynamic Risk-Averse Optimization"** – Chair: Aurélie Thiele - RBC 184
9:00-9:15 - Coffee break - Perella Lobby
9:15-11:15 - Parallel technical sessions

Optimization Theory (RBC 184) Chair: Frank E. Curtis	**Global Optimization and Software (RBC 271)** Chair: Rommel Regis
On Solving Large-Scale Finite Minimax Problems using Exponential Smoothing **Eng Yau Pee**	Optimization Software Benchmarking in Technical Computing Environments **János D. Pintér**
A Large-update Infeasible Interior-Point Algorithm for Linear Optimization **Alireza Asadi**	Radial Basis Function Methods for the Optimization of Expensive Black-Box Objective Functions Subject to Expensive Black-Box Constraints **Rommel Regis**
Carathéodory selections from Minkowski sums **James Blevins**	An FPTAS for Optimizing a Class of Low-Rank Functions Over a Polytope **Shashi Mittal**
A New Proof for a Theorem on the Second-Order Optimality Conditions of Quadratic Programming **Zhouhong Wang**	Global Optimization with General Continuous Functions Reduced to Global Optimization with Convex Separable nearly Linear Functions **Elmor Peterson**

11:15-11:30 - Coffee break - Perella Lobby
11:30-12:30 - **Anthony Patera, "Reliable Solution of Partial Differential Equations on Smartphones; Application to Real-Time Parameter Estimation, Design, and Optimization"**– Chair: Frank E. Curtis – RBC 184

12:30-1:30 - Lunch – Rauch Business Center Art Gallery
1:30-3:30 - Parallel technical sessions

Combinatorial Optimization Chair: Elmor Peterson	**Nonlinear Optimization and Applications (RBC 271)** Chair: Igor Griva
Robust Optimization - Handling Uncertainty with AIMMS **Deanne Zhang**	Measuring NMR Relaxation Time Using an Exact Solution of the Bloch Equations **Zhenghua Nie**
Effective Modeling of Max of Max Function in MIP **Yuri Smirnov**	Second-Order Stagewise Procedures for Nonlinear Optimization Applications **Eiji Mizutani**
A Generalized Framework for Formulating 'Hard' Combinatorial Optimization Problems as Linear Programs **Moustapha Diaby**	A Model for Social Network Interaction with the Stock Market **Veronica Gheorghiade**
Use of Continuous Optimization Methods to Find Carbon Links In 2D INADEQUATE Spectra **Sean Watson**	A Regularized Inverse Problem to Determine Both Fast and Slow Flow from Multi-Scale Phase Contrast Angiographic Magnetic Resonance Imaging **Jessica Pavlin**

3:30-3:45 – Coffee Break (Perella Lobby)
3:45-4:45 - **Arkadi Nemirovski, "On Efficiently Computable Compressed Sensing"** – Chair: Katya Scheinberg – RBC 184
4:45-5:00 – Closing Remarks: Tamás Terlaky – RBC 184

Program Highlights

Poster Session will be available for viewing during the entire conference in the Rauch Lobby

Wednesday, August 18

9:00a.m.-10:00a.m. - **H. Edwin Romeijn**, University of Michigan (see page 12)

5:15p.m.-6:15p.m. - **Mung Chiang**, Princeton University (see page 8)

Thursday, August 19

8:00a.m.-9:00a.m. - **Egon Balas**, Carnegie Mellon University (see page 7)

11:00a.m.-12:30p.m. - **AIMMS/MOPTA Optimization Modeling Competition Final** (see page 14)

5:00p.m.-6:00p.m. - **Donald Goldfarb**, Columbia University (see page 9)

Friday, August 20

8:00a.m.-9:00a.m. - **Andrzej Ruszczyński**, Rutgers University (see page 13)

11:30a.m.-12:30p.m. - **Anthony Patera**, Massachusetts Institute of Technology (see page 11)

3:45p.m.-4:45p.m. - **Arkadi Nemirovski**, Georgia Institute of Technology (see page 10)

Social Program

Poster Session will be available for viewing during the entire conference in the Rauch Lobby

Wednesday, August 18

7:30a.m.-8:40a.m. – **Continental Breakfast (Perella Lobby)**

10:00a.m.-10:15a.m. - Coffee break (Perella Lobby)

12:15p.m.-1:15p.m. - **Lunch (RBC 292)**

3:15p.m.-3:30p.m. - Coffee break (Perella Lobby)

5:00p.m.-5:15p.m. - Coffee break (Perella Lobby)

6:30p.m.-9:30p.m. - **Student Social (Graduate Student Center)**

Thursday, August 19

7:15a.m.-8:00a.m. - **Continental Breakfast (Perella Lobby)**

9:00a.m.-9:15a.m. - Coffee break (Perella Lobby)

10:45a.m.-11:00a.m. - Coffee break (Perella Lobby)

12:30p.m.-1:30p.m. - **Lunch (RBC 292)**

3:00p.m.-3:15p.m. - Coffee break (Perella Lobby)

4:45p.m.-5:00p.m. - Coffee break (Perella Lobby)

6:30p.m.-9:30p.m. - **Conference Banquet and Competition Results (Banana Factory)**

Friday, August 20

7:15a.m.-8:00a.m. - **Continental Breakfast (Perella Lobby)**

9:00a.m.-9:15a.m. - Coffee break (Perella Lobby)

11:15a.m.-11:30a.m. - Coffee break (Perella Lobby)

12:30p.m.-1:30p.m. - **Lunch (Rauch Business Center Art Gallery)**

3:30p.m.-3:45p.m. – Coffee Break (Perella Lobby)

Speaker Biographies

Egon Balas

University Professor of Industrial Administration and Applied Mathematics
The Thomas Lord Professor of Operations Research
Carnegie Mellon University Tepper School of Business
eb17@andrew.cmu.edu

Egon Balas is University Professor of Industrial Administration and Applied Mathematics, as well as the Thomas Lord Professor of Operations Research, at Carnegie Mellon University. He has a doctorate in Economic Science from the University of Brussels and a doctorate in Mathematics from the University of Paris. Dr. Balas' research interests are in mathematical programming, primarily integer and combinatorial optimization. He has played a central role in the development of enumerative and cutting plane techniques for 0-1 programming. In the mid-sixties he wrote a pioneering paper on implicit enumeration, which later became a Citation Classic as the most frequently cited paper of the journal Operations Research between 1954 and 1982. In the 70's he developed a theory for optimization over unions of polyhedra, known as disjunctive programming. In the 80's he followed this up with the approach known as extended formulation or lifting followed by projection, which has been successfully used by many researchers to describe combinatorial objects otherwise hard to characterize. In the 90's Balas and his coworkers developed the cutting plane approach known as lift-and-project, an outgrowth of disjunctive programming, which has played a crucial role in the revolution in the state of the art in Integer Programming that occurred during that decade. Balas also contributed theory and algorithms for various combinatorial optimization problems, like set packing and covering, traveling salesman and its generalizations, knapsack, three dimensional assignment, vertex separator, etc. On the practical side, he has developed various scheduling algorithms and software.

Dr. Balas has taught a variety of courses at different levels, and has acted as thesis advisor to 27 doctoral students. He has served or is serving on the editorial boards of numerous professional journals and is involved in a variety of other professional activities.In 1980, Balas received the US Senior Scientist Award of the Alexander von Humboldt Foundation. In 1995 he was awarded the John von Neumann Theory Prize of INFORMS, and in 2001 he received the EURO Gold Medal of the European Association of Operational Research Societies. In 2002 Balas became a Fellow of INFORMS; in 2004 he was elected an external member of the Hungarian Academy of Sciences; in 2006 he was inducted into the National Academy of Engineering and into the IFORS (International Federation of Operational Research Societies) Hall of Fame. Balas has honorary doctorates in Mathematics from the University of Elche, Spain (2002), the University of Waterloo, Canada (2005), and the University of Liege, Belgium (2008). Egon Balas has published over 220 articles and studies in the professional literature. He is the author of Will to Freedom: A Perilous Journey Through Fascism and Communism. Syracuse University Press, 2000 (paperback edition 2008), a memoir of his life before migrating to the US, also published in Romanian, Hungarian, French and Italian.

Talk Title: *Intersection Cuts Revisited or the Geometry of Lift-and-Project*
Date: Thursday, August 19 – 8:00 a.m. - RBC 184

Abstract: Lift-and-project cuts have played a crucial role in revolutionizing the state of the art in integer programming. When generated from the LP simplex tableau, they represent a reliable and measurable way of improving any disjunctive cuts generated from such a tableau, among them mixed integer Gomory cuts. Geometrically, such lift-and project cuts are intersection cuts derived from a vertex of the polyhedral (cell) complex associated with the linear relaxation of the mixed integer program at hand. We give a geometric interpretation of this convexification procedure which opens the way to generating higher rank cuts directly, without recursion.

Speaker Biographies

Mung Chiang

Associate Professor
Electrical Engineering Department
Princeton University
chiangm@princeton.edu

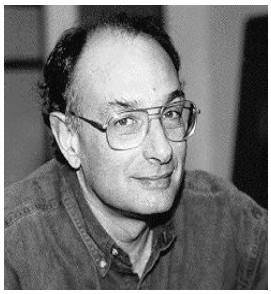
Mung Chiang is an Associate Professor of Electrical Engineering, and an Affiliated Faculty of Applied and Computational Mathematics and of Computer Science, at Princeton University. He received the B.S. (Honors) in Electrical Engineering and Mathematics, M.S. and Ph.D. degrees in Electrical Engineering from Stanford University in 1999, 2000, and 2003, respectively, and was an Assistant Professor at Princeton University 2003-2008. His research areas include optimization, distributed control, and stochastic analysis of communication networks, with applications to the Internet, wireless networks, broadband access networks, content distribution, and network economics.

His awards include Presidential Early Career Award for Scientists and Engineers 2008 from the White House, TR35 Young Innovator Award 2007 from Technology Review, Young Investigator Award 2007 from ONR, Young Researcher Award Runner-up in Continuous Optimization 2004-2007 from Mathematical Programming Society, CAREER Award 2005 from NSF, as well as Frontiers of Engineering Symposium participant 2008 from NAE and Engineering Teaching Commendation 2007 from Princeton University. He was a Princeton University Howard B. Wentz Junior Faculty and a Hertz Foundation Fellow. His paper awards include ISI citation Fast Breaking Paper in Computer Science, IEEE GLOBECOM Best Paper three times, and IEEE INFOCOM Best Paper finalist. His guest and associate editorial services include IEEE/ACM Trans. Netw., IEEE Trans. Inform. Theory, IEEE J. Sel. Area Comm., IEEE Trans. Comm., IEEE Trans. Wireless Comm., and J. Optimization and Engineering. He has filed 16 patents and co-chaired 38th Conference on Information Sciences and Systems.

Talk Title: *Optimization in Networking*
Date: Wednesday, August 18 - 5:15p.m. – RBC 184

Abstract: Optimization theory has provided both a modeling language and solution methodologies to a wide range of problems in communication networks. Recent successes include P2P streaming, TCP congestion control, IP routing, wireless scheduling, and power control. This talk surveys the current state and latest results on the applications of distributed, stochastic, robust, nonconvex, and combinatorial optimization in networking, and on the emergence of a first-principle based network design perspective enabled by the "optimization way of thinking". Throughout the talk, we highlight both mathematical challenges raised by these applications and practical impact made by theory to the Internet and wireless networks.

Speaker Biographies



Donald Goldfarb

Alexander and Hermine Avanessians Professor
Department of Industrial Engineering and Operations Research
Columbia University
goldfarb@columbia.edu

A member of Columbia University's Industrial Engineering and Operations Research Department since 1982, Professor Goldfarb served as chair of the department from 1984 to 2002. In addition, in 1994-95, he served as acting dean of the School of Engineering and Applied Science. Before coming to Columbia, Professor Goldfarb held positions as professor and acting chair in the Department of Computer Science at the City College of New York, visiting professor in the Department of Computer Science and at the School of Operations Research and Industrial Engineering at Cornell University, and assistant research scientist at the Courant Institute of Mathematical Sciences of New York University.

Professor Goldfarb's teaching and research interests include algorithms for linear, quadratic, semidefinite, second-order cone and general nonlinear programming, network flows, large sparse systems, and applications in robust optimization, finance, and imaging. Professor Goldfarb has published approximately 85 technical papers and has served on the editorial boards of several journals including editor in chief of Mathematical Programming, editor of the SIAM Journal on Optimization, and the SIAM Journal on Numerical Analysis, and associate editor of Operations Research and Mathematics of Computation. He has been a member of the councils of the Mathematical Programming Society and the American Mathematical Society, numerous technical society program and award committees, and advisory committees to various universities and government research agencies. The 1995 recipient of the Institute for Operations Research and Management Sciences Prize for Research Excellence in the interface between operations research and computer science, Professor Goldfarb also received honorable mention for the 1996 SIAM Optimization Prize and was honored with the 1999 Great Teachers Award from the Society of Columbia Graduates.

Talk Title: ***Alternating Direction Augmented Lagrangian Algorithms for Convex Optimization***
Date: Thursday, August 19 - 5:00p.m. - RBC 184

Abstract: Alternating direction methods can facilitate the minimization of a convex function that is the sum of several functions, each of which is relatively easy to minimize separately. In this talk, we propose new first-order alternating direction augmented Lagrangian methods for minimizing the sum of several functions subject to linear constraints.

Both Gauss-Seidel-like and Jacobi-like algorithms are presented that compute an epsilon-optimal solution in O(1/epsilon) iterations. Nesterov-like accelerated versions that have an O(1/sqrt(epsilon)) iteration complexity are also given. For the case where the sum only involves two functions, our complexity results only require one of the functions to have a Lipschitz continuous gradient.

We present extensive numerical results on a varied set of problem classes, including matrix completion, robust principal component analysis (PCA), sparse PCA, sparse inverse covariance for graphical model selection and various semidefinite programming relaxations of NP-hard graphical problems, such as max-cut and the Lovasz theta function. Some of the problems solved have tens of millions of variables and constraints.

The results presented in this talk were obtained in collaboration with Bo Haung, Shiqian Ma, Tony Qin, Katya Scheinberg, Wotao Yin and Zaiwen Wen.

Speaker Biographies

Arkadi Nemirovski

John Hunter Chair and Professor
H. Milton Stewart School of Industrial & Systems Engineering
Georgia Institute of Technology
arkadi.nemirovski@isye.gatech.edu

Dr. Arkadi Nemirovski is a professor in ISyE and holds the John Hunter Chair. Dr. Nemirovski has made fundamental contributions in continuous optimization in the last thirty years that have significantly shaped the field. In recognition of his contributions to convex optimization, Nemirovski was awarded the 1982 Fulkerson Prize from the Mathematical Programming Society and the American Mathematical Society (joint with L. Khachiyan and D. Yudin), the Dantzig Prize from the Mathematical Programming Society and the Society for Industrial and Applied Mathematics in 1991 (joint with M. Grotschel). In recognition of his seminal and profound contributions to continuous optimization, Nemirovski was awarded the 2003 John von Neumann Theory Prize by the Institute for Operations Research and the Management Sciences (along with Michael Todd). He continues to make significant contributions in almost all aspects of continuous optimization: complexity, numerical methods, stochastic optimization, and non-parametric statistics.

Arkadi Nemirovski earned the Ph.D. in Mathematics (1974) from Moscow State University and the Doctor of Sciences in Mathematics (1990) from the Institute of Cybernetics of the Ukrainian Academy of Sciences, Kiev. He is the only individual to have won all three of these prestigious prizes (Fulkerson, Dantzig, and von Neumann).

Talk Title: ***On Efficiently Computable Compressed Sensing***
Date: Friday, August 20 - 3:45p.m. - RBC 184

Abstract: Compressed Sensing is about recovery of sparse high-dimensional signals x from their low-dimensional noisy linear images y=Ax+<noise>. The standard recovery routine here is L1 minimization, where the estimate of x is the signal of the minimal L1 norm compatible with the observations. The Compressed Sensing theory presents necessary and sufficient conditions for L1 minimization to work well and demonstrates that these conditions are satisfied with overwhelming probability for large randomly generated matrices A. These conditions, however, are difficult to verify. In the first part of our talk, we present verifiable sufficient conditions for ``goodness" of a given sensing matrix A in the Compressed Sensing context, and discuss several applications of these conditions (error bounds for imperfect L1 recovery, "non-Euclidean matching pursuit", handling random noise, etc.) In the second part of the talk, we address the computational issues related to L1 minimization per se, with emphasis on acceleration of first order methods for solving extremely large scale problems of L1 minimization by randomization. The talk is based on joint research with Anatoli Iouditski (Joseph Fourier University, Grenoble, France) and Fatma Kilinc Karzan (ISyE GaTech).

Speaker Biographies

Anthony T. Patera

Ford Professor of Engineering
Department of Mechanical Engineering
Massachusetts Institute of Technology
patera@mit.edu

Anthony T. Patera[1] is Ford Professor of Engineering and Co-Director of the MIT Center for Computational Engineering. He has undergraduate and graduate degrees in Mechanical Engineering from MIT and a doctorate in Applied Mathematics also from MIT. His interests are in computational methods, numerical analysis, continuum mechanics, and transport. Professor Patera's current research focuses on reduced basis approximation and a posteriori error estimation for the parametrized partial differential equations of continuum mechanics and transport with emphasis on real-time and many-query applications such as parameter estimation, design, and optimization. Professor Patera's earlier research focused on hydrodynamic stability, heat transfer enhancement, viscous free surface flows, spectral element spatial discretizations for partial differential equations, numerical treatment of the Navier-Stokes equations, parallel processing, and a *posteriori* estimation in finite element analysis.

Talk Title: ***Reliable Solution of Partial Differential Equations on Smartphones; Application to Real-Time Parameter Estimation, Design, and Optimization***
Date: Friday, August 20 - 11:30a.m. - RBC 184

Abstract: We present reduced basis approximations and associated a posteriori error bounds for rapid and reliable solution of parametrized partial differential equations. The crucial ingredients are Galerkin approximation over a space spanned by "snapshots" on the parametrically induced manifold; rigorous a *posteriori* error bounds for the field variable and outputs of interest; efficient POD/Greedy selection of quasi-optimal snapshot samples; and finally Offline-Online computational procedures to wash it all down.

The Offline, or pre-processing stage, is very expensive; the Offline stage is typically associated to a large parallel supercomputer. In contrast, the Online stage - input-output prediction, rigorous error bounds, and visualization for each parameter value of interest - requires minimal FLOPs, memory, and bandwidth; the Online stage may thus be associated to a thin deployed platform. The Online stage is currently implemented on the (AndroidOS) Nexus One Google smartphone.

Finally, we consider the integration of our forward methodology with algorithms for "in-the-field" parameter estimation, individuated product design, and control and optimization. We illustrate the approach with a variety of problems taken from heat transfer, solid mechanics, acoustics, and fluid dynamics.

[1] Work with J Eftang, DBP Huynh, DJ Knezevic, & J Peterson.

Speaker Biographies

H. Edwin Romeijn

Professor
Department of Industrial and Operations Engineering
The University of Michigan
romeijn@umich.edu

Edwin Romeijn received his Ph.D. in 1992 from Erasmus University Rotterdam in The Netherlands. He has been a faculty member at the Rotterdam School of Management, the University of Florida, and (since 2008) at the Department of Industrial and Operations Engineering at the University of Michigan. He has taught courses in operations research, stochastic processes, applied probability and statistics, supply chain management, and decision support systems. His research focuses on optimization theory and applications, in particular in the areas of supply chain optimization and optimization in health care. He is the author of about eighty peer reviewed journal publications.

Talk Title: ***Radiation therapy treatment plan optimization***
Date: Wednesday, August 18 - 9:00a.m. - RBC 184

Abstract: We consider the problem of determining high-quality radiation therapy treatment plans for cancer patients. Since radiation therapy kills both cancerous and normal cells, the treatment must be carefully planned so that a clinically prescribed dose is delivered to cancerous cells while sparing normal cells in nearby organs and tissues to the greatest extent possible. We will start by discussing the evaluation of the quality of treatment plans and establish a connection between risk management and radiation therapy treatment planning. This aspect of the optimization model is independent on the treatment modality, i.e., it applies to conventional conformal therapy, Intensity Modulated Radiation Therapy (IMRT), as well as a newer technique called Volumetric Modulated Arc Therapy (VMAT). We next discuss a flexible modeling and optimization approach that can be used to explicitly incorporate aspects related to the architecture of the delivery equipment as well as treatment time into the model. We conclude the talk by discussing computational results on clinical patient cases.

Speaker Biographies

Andrzej Ruszczyński

Professor II
Department of Management Science and Information Systems
Rutgers University
rusz@business.rutgers.edu

Andrzej Ruszczyński received his Ph.D. degree in control theory in 1977 from Warsaw University of Technology (Poland). He has held positions with Warsaw University of Technology, University of Zurich (Switzerland), Princeton University, International Institute of Applied Systems Analysis (Austria), and University of Wisconsin-Madison. He is currently with Rutgers University. His interests are in the area of stochastic optimization, in particular, risk-averse optimization. Dr. Ruszczyński is an author of 3 books and numerous articles in this area.

Talk Title: ***Dynamic Risk-Averse Optimization***
Date: Friday, August 20 - 8:00a.m. - RBC 184

Abstract: We present the concept of a dynamic risk measure and discuss its important properties. In particular, we focus on time-consistency of risk measures and their local property. Next, we focus on dynamic optimization problems for Markov models. We introduce the concept of a Markov risk measure and we use it to formulate risk-averse control problems for two Markov decision models: a finite horizon model and a discounted infinite horizon model. For both models we derive risk-averse dynamic programming equations and a value iteration method. For the infinite horizon problem we also develop a risk-averse policy iteration method and we prove its convergence. We propose a version of the Newton method to solve a non-smooth equation arising in the policy iteration method and we prove its global convergence. Finally, we discuss relations to Markov games.

AIMMS/MOPTA Optimization Modeling Competition 2010

The second 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 they solved a tax-aware portfolio optimization problem. Classical models used in portfolio optimization focus on return and risk. More complicated models take into account the effect of trading costs and in this case study each team had to develop a tool to optimize a portfolio in the presence of different tax rules.

The teams had to form a mathematical model of the problem, implement it in AIMMS, solve it, formulate recommendations to the decision makers, create a graphical user interface for the end-user, and write a 15 page report on the project. We are happy that 19 teams from 9 countries registered and downloaded the problem. Eight teams submitted a complete project. The panel of judges (Robert Storer and Imre Pólik from Lehigh University, Peter Nieuwesteeg from Paragon Decision Technology and Reha Tütüncü from Goldman Sachs) selected the following three teams for the final:

Team Gladiator, University of Florida, USA
Siqian Shen, Zhili Zhou, and Ruiwei Jiang, advised by George Lan

Team ORTEC, Gouda, The Netherlands
Arjan Thomas, Cindy de Groot, and Ilse Louwerse, advised by Ineke Meuffels

Team Twente, University of Twente, The Netherlands
Stijn Duyzer and Joshua Euwijk, advised by Gerhard Post

The finalists will give a 20-minute presentation on their work on Thursday at 11:00am in RBC 184. The winners will be announced at the conference banquet.

Two other teams have received an honorable mention for their work:

Team ETH, Zürich, Switzerland
Abel Camacho Guardian, Lydia van ´t Veer, advised by Marco Laumanns

Team UWaterloo, University of Waterloo, Canada
Brendan Ames, Vris Cheung, Sahar Karimi, advised by Stephen Vavasis

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.