Workshop Stochastic Optimization

Date: Tuesday September 8, 2015

Venue: 5412.0028, Zernike Campus, University of Groningen

Chair: **Maarten van der Vlerk**   (University of Groningen)

Co-chair: **Wim Klein Haneveld**   (University of Groningen)

Time	Presentation
11:00 – 11:30	**Iris Vis** (University of Groningen) *Stochastic LNG facility location problem*
11:30 – 12:00	**Krzysztof Postek** (University of Tilburg) *Adjustable robust mixed-integer optimization via iterative splitting of the uncertainty set*
12:00 – 12:45	Lunch break (hosted by SOM)
12:45 – 13:15	**Rüdiger Schultz** (University of Duisburg-Essen) *Nomination Validation in Gas Transportation*
13:15 – 13:45	**Leen Stougie** (VU University Amsterdam, CWI) *Scheduling over Scenarios on Two Machines*
13:45 – 14:00	Short break
14:00 – 14:30	**David Morton** (Northwestern University, Chicago) *Forced and Natural Nestedness*
14:30 – 15:00	**Ward Romeijnders** (University of Groningen) *Twenty Years of Total Variation Error Bounds*

Zernike map: http://www.rug.nl/feb/contact/map-zernike-2015.pdf

Abstracts of the presentations

Speaker: **Prof. Iris Vis** (University of Groningen)

Title: **Stochastic LNG facility location problem**

Abstract: Inland waterway shipping is a sustainable mode of transportation suitable to overcome expected bottlenecks in road transportation in Europe. Even more benefits can be obtained by the use of more sustainable and cheaper fuels for the bunkering of vessels. Liquefied natural gas (LNG) is a promising alternative to the classical fuels currently used. An important challenge is to design the required fuel infrastructure efficiently and effectively to enable a phased introduction of the use of LNG. In this presentation we introduce the problem context, picture specific problem challenges and show how the problem can be classified in the field of facility location models.

Joint work with Evrim Ursavas and Paul Buijs.

Speaker: **Krzysztof Postek** (University of Tilburg)

Title: **Adjustable robust mixed-integer optimization via iterative splitting of the uncertainty set**

Abstract: Multiperiod problems where some parameters are uncertain and later-period decisions are integer are common, e.g., in inventory management, energy production, or manpower management. Key difficulty of applying Adjustable Robust Optimization in such problems, i.e., finding the best decisions under the assumption that the parameters take always their worst possible values, lies in providing adjustability of later decisions (giving better objective values) while keeping the solution time down. Both tasks grow even more difficult in the mixed-integer case. We propose a methodology for constructing decision rules for integer and continuous decision variables in multiperiod robust linear optimization problems. We show that by iteratively splitting the parameters' uncertainty set into smaller subsets one can differentiate the later-period decisions based on the revealed uncertain parameters. We provide theoretical results how to split the uncertainty set by identifying sets of uncertain parameter scenarios to be divided for an improvement in the worst-case objective value. Numerical example illustrate the advantages of the proposed approach and identify the difficult points for further research.

Speaker: **Prof. Rüdiger Schultz** (University of Duisburg-Essen)

Title: **Nomination Validation in Gas Transportation**

Abstract: The talk deals with mathematical aspects of gas transport in pipeline networks. The latter has been exposed to enormous deregulation in the recent past. This has created new types of economic activity, and has centered categories which had been rather marginal before. An example of the latter kind is the concept of network capacity of which the grid operator shall offer plenty in a flexible way, and this without discriminating potential market participants. Mathematically this poses the question of what capacity is and how to compute it.

Central objects of study are gas flows in the pipes and pressures at the nodes, both under uncertainty of gas withdrawals from the network (loads) at exit (delivery) nodes. Assuming the uncertainty of withdrawals is stochastic with known distributions, an efficient method for calculating probabilities for the feasibility of load coverage is presented. Numerical tests, confirm superiority of the proposed method over approaches relying on pure Monte Carlo rather than Quasi Monte Carlo sampling and/or which incorporate less structural knowledge on the (implicit) sets whose probability is looked for.

Joint work with Claudia Gotzes (University of Duisburg-Essen), Holger Heitsch (WIAS Berlin), and René Henrion (WIAS Berlin).

Speaker: **Prof. Leen Stougie** (VU University Amsterdam, CWI)

Title: **Scheduling over Scenarios on Two Machines**

Abstract: We consider scheduling problems over scenarios where the goal is to find a single assignment of the jobs to the machines which performs well over all possible scenarios. Each scenario is a subset of jobs that must be executed in that scenario and all scenarios are given explicitly. The two objectives that we consider are minimizing the maximum makespan over all scenarios and minimizing the sum of the makespans of all scenarios. For both versions, we give several approximation algorithms and lower bounds on their approximability. This work is one of the first examples of explicitly dealing with optimization problems over scenarios, a new and rich field of interesting problems.

Joint work with Esteban Feuerstein, Alberto Marchetti-Spaccamela, Frans Schalekamp, René Sitters, Suzanne van der Ster and Anke van Zuylen.

Speaker: **Prof. David Morton** (Northwestern University, Chicago)

Title: **Forced and Natural Nestedness**

Abstract: We consider two classes of combinatorial optimization problems in which we seek a family of nested solutions. For the first class, we formulate two types of two-stage stochastic integer programs to force the nested structure, given a probability distribution on the uncertain model parameters, e.g., resource availability. For the second class, we maximize a supermodular gain function subject to a single resource-availability constraint, and give conditions which lead naturally to nested solutions at certain budget increments. A stochastic facility location problem, a graph clustering problem, and a model with probabilistic constraints illustrate ideas.

Joint work with Ali Koc, Michael Nehme, and Ward Romeijnders.

Speaker: **Ward Romeijnders** (University of Groningen)

Title: **Twenty Years of Total Variation Error Bounds**

Abstract: In order to guarantee the quality of convex approximations for simple integer recourse models, several total variation error bounds have been derived over the past twenty years. In this talk we review these total variation error bounds and consider them from three different perspectives. Focusing on the third, which is relatively new, we discuss how it may be used to improve error bounds not only for simple but also for general mixed-integer recourse models.

Joint work with Maarten H. van der Vlerk and Willem K. Klein Haneveld.