DIW Graduate Center Masterclass

Advanced Methods of Operations Research

Prof. Steven A. Gabriel
University of Maryland

22.06.2015 to 26.06.2015

1. Course Prerequisites

GAMS

- Course assumes at least a working knowledge of GAMS (more is better) and demo version (at least) loaded up on a laptop and brought to class each day.
- Go to GAMS.com to download and try out the tutorial by Rosenthal if not already familiar with GAMS (done before the class starts)

2. Course Outline

Overall Schedule

- 9:30-12:30 Lectures: Professor Steven A. Gabriel (Short coffee break around 10:30)
- 12:30-13:30 Lunch break
- 13:30-17:30 GAMS and other exercises led by Junior Trainer
- 17:30, presentation of GAMS and other exercises by students

Assignments

Homework will be given out and due during the class.
An exam and project will be given to students and graded by junior trainers (dates will be decided by DIW)

Day 1, 22 June:

- Integer programming plus applications (Chapter from Winston)
  (Junior Trainer: Roman Mendelevitch)

Day 2, 23 June:

- 50% on integer programming plus applications (finish up IP, chapter from Winston)
- 50% on review of KKT and MCP (read the tutorial by Ruiz et al. or the book by Gabriel et al. (Chapter 1 at least) as needed)
  (Junior Trainer: Roman Mendelevitch)

Day 3, 24 June:

- Discretely constrained MCPs, DC-MCP with applications in energy and spatial price equilibria (e.g., C. Ruiz , A.J. Conejo, S.A. Gabriel, "Pricing Non-Convexities in an Electricity Pool," 2012. *IEEE Transactions on Power Systems*, 27(3), 1334-1342. Very interesting area esp. at FERC these days.)
  (Junior Trainer: Alex Zerrahn)

Day 4, 25 June:

- Stochastic programming, recourse method (Chapter 1 of Birge and Louveaux)
  (Junior Trainer: Alex Zerrahn)

Day 5, 26 June:

- Recap- morning
  (Junior Trainer: Alex Zerrahn)

3. Background Literature

- Integer Programming (IP): *Operations Research: Applications and Algorithms* (Wayne L. Winston), just the chapter on IP
- Karush-Kuhn-Tucker (KKT) and Mixed Complementarity Problems (MCP):
  - *Complementarity Modeling in Energy Markets*, Gabriel, Conejo, Fuller, Hobbs, Ruiz
  - C. Ruiz, A.J. Conejo, J.D. Fuller, S.A. Gabriel, B.F. Hobbs, 2014. "A Tutorial Review of Complementarity Models for Decision-Making in Energy Markets," *EURO Journal of Decision Processes*, 2(1-2), 91-120. (file attached)

- Stochastic Programming: *Introduction to Stochastic Programming*, Birge and Louveaux (Chapter 1 only)
- Discretely constrained MCPs: three references provided (files attached)
  - S.A. Gabriel, A.J. Conejo, C. Ruiz, S. Siddiqui , 2013. "Solving Discretely-Constrained, Mixed Linear Complementarity Problems with Applications in Energy, " *Computers and Operations Research*, 40(5), 1339-1350.
  - S.A. Gabriel, S. Siddiqui, A.J. Conejo, C. Ruiz, 2013, "Discretely-Constrained, Nash-Cournot Games with an Application to Power Markets," *Networks and Spatial Economics*, 13(3), 307-326.
  - C. Ruiz , A.J. Conejo, S.A. Gabriel, "Pricing Non-Convexities in an Electricity Pool," 2012. *IEEE Transactions on Power Systems*, 27(3), 1334-1342.

4. Instructor

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Other Affiliations
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Adjunct Professor, Norwegian University of Science and Technology, Trondheim
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