Complementarity Modeling in Energy Markets

Graduate Center Masterclass

Speaker: Steven A. Gabriel

Place: DIW, Mohrenstr. 58, 10117 Berlin
Room no. 3.3.002C,

We will review optimization problems (linear/nonlinear) and then introduce equilibrium problems expressed as mixed complementarity problems (MCPs). These latter problems have a diverse set of applications including market equilibrium/non-cooperative games in energy, transportation, and water, and have been the subject of much research in the last 25+ years.

The class will be held the afternoon of 28 September and the morning of 29 September as follows:

Day 1, 28 September
14:00-15:30, Optimization Review (part 1)
15:30-15:00, break
16:00-17:30, Optimization Review (part 2)
Topics will include: linear programming, Karush-Kuhn-Tucker (KKT) optimality conditions, convexity, some examples of optimization and energy problems

Day 2, 29 September
9:00-10:30, Introduction to mixed complementarity problems (part 1)
10:30-11:00, break
11:00-12:30, Introduction to mixed complementarity problems (part 2)
Topics will include: Game theory (non-cooperative) basics, Nash equilibria, MCP definitions, a few examples of MCPs in energy and transportation.

About the instructor:

Prof. Steven A. Gabriel is an applied mathematician whose research focuses on optimization and equilibrium modeling applied to energy and infrastructure sectors. He has published numerous theoretical and applied contributions to the numerical modeling literature. His textbook "Complementarity modeling in energy markets" (2012) is a standard reference. Steven has investigated market structure and policy design of markets such as electricity, natural gas, water, transportation etc. Steve is a full professur at the University of Maryland, an adjunct professor at the Norwegian University of Science and Technology where he contributes to the NTNU Energy Transition Program, an associated member of GERAD Montréal and a research fellow at DIW Berlin.

Readings (strongly recommended to prepare before the class):

1) Gabriel et al. (2012): Complementarity Modeling in Energy Markets. Springer. Chapter 1. (password: mcp2012)

2) Ruiz et al. (2013): A tutorial review of complementarity modelsfor decision-making in energy markets. EURO Journal on Decision Processes.

Additional readings:

3) Brotcorne et al. (2008): Bilevel Programming: The Montreal School.

4) Gabriel and Leuthold (2010): Solving discretely-constrained MPEC problems with applications in electricpower markets. Energy Economics, 32: 3–14.

5) Siddiqui and Gabriel (2012): An SOS1-Based Approach for Solving MPECswith a Natural Gas Market Application. Networks & Spatial Economics.

6) U-tapao et al. (2016): A stochastic, two-level optimization model for compressed natural gasinfrastructure investments in wastewater management. Journal of Natural Gas Science and Engineering, 28: 226-240.