Modeling Multiple Leaders and Followers using Equilibrium Problems under Equilibrium Constraints

Approximate Syllabus – DIW Masterclass

Instructor: Prof. Dr. Sauleh Siddiqui

Monday 24 June

Morning: Energy markets with multiple leaders and followers. Applications that use EPECs. Motivation of mathematical structure.

Afternoon: Mathematical formulation and properties. Presence of non-convexities. Presence of multiple solutions. Properties apparent in applications

Tuesday 25 June

Morning: Solving EPECs using diagonalization. Proposed NLP formulations. Other formulations.

Afternoon: GAMS exercise to try and develop your own application and/or algorithm. Focus on discussion and new ideas as opposed to success.

For Participation

If you are interested in participating this course, please send an email indicating you full name and affiliation to rmendelevitch@diw.de. We will provide you with further information and course material.

***= should read, other readings are optional depending on interests**

Required Reading:

1. *S.A. Gabriel, A.J. Conejo, J.D. Fuller, B.F. Hobbs, C.Ruiz. 2013. *Complementarity Modeling in Energy Markets* (Chapter 7)

Recommended Reading:

2. S. Leyffer, T. Munson. 2007. "Solving Multi-Leader-Common-Follower Games," *Argonne National Laboratory*, Preprint ANL/MCS-P1243-0405.

Dissertations on EPECs:

3. C.-L. Su. 2005. "Equilibrium Problems with Equilibrium Constraints: Stationarities, Algorithms, and Applications," *Department of Management Science and Engineering, Stanford University*, PhD Dissertation.
4. A. Ehrenmann. 2004. "Equilibrium Problems with Equilibrium Constraints and their Applications to Electricity Markets," *Fitzwilliam College, Cambridge University*, PhD Dissertation.

EPEC Articles, Energy Focus:

5. C.Ruiz, A.J. Conejo, Y. Smeers. 2011. "Equilibria in an Oligopolistic Electricity Pool With Stepwise Offer Curves," *IEEE Transactions on Power Systems*, DOI: 10.1109/TPWRS.2011.2170439.
6. X. Hu, D. Ralph. 2007. "Using EPECs to Model Bilevel Games in Restructured Electricity Markets with Locational Prices", *Operations Research*, 55 (5), 809-827.

EPEC Articles, Algorithm/Mathematical Structure Focus:

7. C.-L. Su. 2004. "A Sequential NCP Algorithm for Solving Equilibrium Problems with Equilibrium Constraints,"' *Working Paper Stanford University*.
8. A. Kulkarni, U. Shanbhag. 2013 "Global Equilibria of Multi-leader Multi-follower Games," *arXiv*, 1206.2968v2 [math.OC] 26 March, 2013.
9. B. Colson, P. Marcotte, G. Savard. 2007. "An Overview of Bilevel Optimization," *Ann Oper Res*, 153, pp. 235-256.

Additional References:

1. R.W. Cottle, J.-S. Pang, R.E. Stone. 1992. *The Linear Complementarity Problem*, Acdemic Press (is out of print now but should be reprinted in July 2009), ISBN-10: 0121923509, ISBN-13: 978-0121923501.
2. F. Facchinei and J.-S. Pang, 2003. *Finite-Dimensional Variational Inequalities and Complementarity Problems, Volume I,* Springer, ISBN: 978-0-387-95580-3.
3. "Mathematical Programs with Equilibrium Constraints," Z.-Q. Luo, J.-S. Pang, and D. Ralph.