University of Michigan
Department of Electrical Engineering & Computer Science
EECS 598: Power System Markets & Optimization
Winter 2016

Course Syllabus - DRAFT

Instructor: Prof. Johanna Mathieu
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Summary: This course covers the fundamentals of electric power system markets, and the optimization methods required to solve planning and operational problems including economic dispatch, optimal power flow, and unit commitment. The course will highlight recent advances including convex relaxations of the optimal power flow problem, and formulations/solutions to stochastic dispatch problems. Problems will be placed in the context of actual electricity markets, and new issues, such as incorporation of renewable resources and demand response into markets, will be covered. All students will conduct an individual research project.

Prerequisites: EECS 463 (Power System Design & Operation, or equivalent) or Permission of Instructor; Proficiency with MATLAB and linear algebra

Units: 3

References:
D.S. Kirschen and G. Strbac, *Fundamentals of Power System Economics* Wiley, 2004
A.J. Wood and B.F. Wollenberg, *Power Generation, Operation, and Control*, 3rd Edition, Wiley, 2014.
J.A. Taylor. *Convex Optimization of Power Systems.* Cambridge University Press, 2015.

Assessment:
Homework assignments (25%)
Midterm (20%)
Final exam (30%)
Research project (25%)

Topics:

- Basic principles of electricity markets, supply/demand balancing, price elasticity, market power
- Types of markets: capacity, energy, ancillary services, financial transmission rights, bilateral trading
- Economic dispatch, locational marginal prices, solution methods
- Optimal power flow (OPF), non-convex solution methods, convex relaxations, convex solution methods
- Unit commitment, mixed integer programming
- Comparison of actual markets (MISO, PJM, CAISO, ERCOT, etc.), co-optimization of energy and ancillary services
- Robust and stochastic optimal power flow/unit commitment
- Incorporating renewable resources and demand response into markets
- Optimal infrastructure planning