ECE 617: Economic Control of Interconnected Power Systems
Fall 2014

Description:: Advanced techniques for operating power systems in the most economic manner while meeting various network constraints; economic dispatch, penalty factors, optimal power flow, short-term electricity markets and locational marginal prices will be studied. Smart grids will be discussed.

Prerequisite: All Engineering Graduate Students are encouraged to take this course

Instructor: Don Gies, Adjunct Professor
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Classroom: Tiernan Hall 105, Time: Thursday 6:00PM-9:00PM

Office hours: ECE 312 Thursday 4-5:30, or by appointment

Text: Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheblé, "*Power Generation, Operation, and Control*," 3rd Edition, John Wiley & Sons, 2014

Topics:

1. Power generation characteristics
2. Electric power industry as a business
3. Economic dispatch and the general economic dispatch problem
4. Thermal unit economic dispatch and methods of solution
5. Optimization with constraints
6. Optimization methods such as linear programming, dynamic programming, nonlinear optimization, integer programming, and interior point optimization
7. Transmission system effects
   a. Power flow equations and solutions
   b. Transmission losses
   c. Effects on scheduling
8. The unit commitment problem and solution methods
   a. Dynamic programming
   b. Lagrange relaxation
   c. Integer programming
9. Generation scheduling in systems with limited energy supplies including fossil fuels and hydroelectric plants, need to transport energy supplies over networks such as pipelines, rail networks, and river/reservoir systems, and power system security techniques
10. Optimal power flow techniques
11. Power system state estimation
12. Automatic generation control
13. Interchange of power and energy, power pools and auction mechanisms, and modern power markets
14. Load forecasting techniques
15. Smart Grid

Objectives:

1. Acquaint electric power engineering students with power generation systems, their operation in an economic mode, and their control.
2. Introduce students to the important "terminal" characteristics for thermal and hydroelectric power generation systems.
3. Introduce mathematical optimization methods and apply them to practical operating problems. 4. Introduce methods for solving complicated problems involving both economic analysis and network analysis and illustrate these techniques with relatively simple problems.
4. Introduce methods that are used in modern control systems for power generation systems.
5. Introduce "current topics": power system operation areas that are undergoing significant, evolutionary changes. This includes the discussion of new techniques for attacking old problems and new problem areas that are arising from changes in the system development patterns, regulatory structures, and economics.
6. Introduce the smart grid to the students.
7. Acquaint the students with putting their ideas and research results into IEEE-style papers.
8. Acquaint the students with presenting their ideas and research results into presentations to be shared with the class.

Course Policy:

- Homework/quizzes-25%
- Midterm Exam-25%
- Final Exam-25%
- Paper and Presentation on Smart Grid -25%

Class Rules:

- Homework must be submitted before lecture starts.
- No food or drink is allowed in the Lecture or Lab Rooms.
- Arrive to class on time.
- Silence or turn off cell phones prior to arrival at class.
- **No Cell Phones or Computers during exams. Only Calculators**.
- Participate! This class should be interactive.

Honor code:

- All students are expected to follow the NJIT Honor Code in this course. This includes pledging all homework assignments, mid-term and final exams.