EECS 498-9/598-5 Special Topics (Winter 2017)
Grid Integration of Renewable Energy Sources

Wednesday and Friday, 8:30-10:30am

The course will consider large-scale integration of renewable generation in electricity grids. Wind and solar (photovoltaic and thermal) technologies will be discussed, in the context of their influence on grid operation and control. Wind and solar forecasting will be introduced. Impacts of variability will be considered, with both local (voltage) and grid-wide (frequency regulation) effects being addressed. Methods of accounting for renewable uncertainty in optimal generation dispatch will be developed. The use of energy storage for offsetting variability will also be discussed. At the local level, the course will consider the design of renewable-based microgrid energy systems.

Syllabus:
1. Power systems: basic concepts, system operation.
2. Wind and solar resources: characteristics, variability, forecasting.
3. Wind power: principles of wind energy extraction, electromechanical energy conversion, characteristics of wind turbines, voltage regulation.
4. Photovoltaic (PV) cells: energy conversion principles, electrical modelling, optimal power extraction, shading.
5. Solar thermal: operating principles, storage capability.
6. Energy storage: technologies, operating strategies, degradation.
7. Grid operation and control: voltage control, frequency regulation, optimal generation dispatch, dynamics of low inertia systems.
8. Design of renewable energy systems using HOMER.

Note: EECS498 and 598 classes will meet together for lectures and discussions. Students enrolled in EECS598 will undertake extra homework questions and mini-projects that provide extended coverage of the material.

Prerequisites: EECS 215 or 314 (or permission of instructor), or graduate standing.
Credits: 4 hours.
Instructor: Prof Ian Hiskens, EECS, <hiskens@umich.edu>.