

Course Topics

EEE 598: Power Plant Control & Monitoring

Prerequisites: Graduate Engineering student

Course Description:

This class deals with the Dynamics, Control, and Operations of Electric Power Systems. The perspective is that of the relationships between load and generation; transmission details are referred to when needed but are not a primary aspect of the discussion. Practical aspects of power system operation and the analytical processes used in modeling the power system will be woven together throughout the class.

Course Topics:

- Basic aspects of dynamic simulation of large power systems
 - Technique and economics of computation
 - Network solutions
 - Stability of numerical integration
 - Selection of state variables
- Fundamentals of stability / control system design
 - Control system elements - physical aspects - hydraulic/electrical/mechanical
 - mathematical aspects
 - Design of feedback loops (in power plant context)
- Characteristics of power system elements
 - Synchronous machines - synchronizing and damping torques
 - characteristic reactances
 - operational issues - operating limits - protection
 - generator controls
 - Induction machines - electrical details - driven loads
 - Reactive power control elements
 - Real power control/energy storage elements
- Characteristics of power system loads
 - Traditional load representations
 - Evolving load properties - air conditioning
 - electronic motor drives - constant / adjustable speed
- Power plant characteristics
 - Steam plants - turbine dynamics - boiler configurations, dynamics, controls
 - Gas turbines - control fundamentals
 - operational limits, constraints - emission controls
 - Combined cycle plants - configuration - operation - dynamic characteristics
 - Hydro plants - dynamic characteristics - operational aspects
 - Renewable resource plants - wind - solar
 - Electronic coupling of generation to the grid
- Power system control
 - Primary and secondary control concepts
 - Scope and scale of control - time scale - geographic scale - voltage level scale
- Control of interconnected power systems
 - Control of frequency
 - Control of real power flows
 - net interchange control
 - frequency bias

Equipment testing and data management

- Test techniques

- Collection and validation of modeling data

- Validation of simulation results