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