6.691, Spring 2006

Plans and Directions

As of Feb 21, 2006
Here is a small power system
To see what is up we need to understand the parts:

Generating Plants

Are Connected to buses (numbered)

Lines Connect the buses (impedances noted in ohms)

Loads are noted at each loaded bus
Generating Plant: Source
Buses are Connection Points

Loads MW + jMVAR
Impedances In Ohms R + jX
- 61 kV
- 69 kV
Each line has an impedance: here in Ohms
Many buses are loaded, here MW+j*MVAR
Transformers connect 69 kV to 161 kV buses
To understand how the system works:

1. Load Flow -- how does power flow through the lines
   System Representation: Lines, Transformers, and Per-unit Systems (Chs 4, 5, 9)
   Load Flow Analysis (Ch 10)

2. What do generators do?
   Generator representation (Ch6, 7)
   Dynamics: fault behavior, dynamic swings
   Simplified models (voltage behind reactance)

3. What do exciters and voltage regulators do?
   They have dynamics of their own. (Ch 8)
4. System Control: generation control

How frequency is stabilized (Ch 11)

Transient stability: limits to operations (Ch 14)

This involves all those models from above

5. Abnormal operations

Unbalanced Operation

Symmetrical Components (Ch 12)

Faults: detection and system protection (Ch 13)
6. Power Systems Economics

   Cost of Service: Economic Dispatch (Ch 11)

   Deregulated System Economics

   Structure of some ‘markets’
Project Topics: (Suggestions-- I am open to negotiation)

Regulatory Lag: how often should rate cases be?
Carbon Tax and Nukes: can it be made to work?
DC vs. AC in vehicular systems: tradeoffs and performance
Market Power and Congestion
What are ancillary services worth?
Is there a case for deregulating transmission?
‘Net Metering’ and Standby power -- how do we pay for it?
Robust Utilities vs. Standby Generators: which is best?
Analysis of the blackout of ... (you pick a blackout)
How to (and should we) subsidize green electrons?