Ongoing List of Topics:

- URL: http://www.ece.mtu.edu/faculty/bamork/EE5223/index.htm
- Labs - EE4224/5224 - First pre-Lab Wed 11am or Fri 8am Week 3
- Software - Aspen Remote Desktop, ECE Computer Labs
- Radial Protection (read sections 12.5, 12.6, also G&S Ch.10)
- Coordinated operation of Recloser, sectionalizer(s), fuses
- Simple example of relay coordination (Homework 4)
- CTs - pedestal vs. bushing
- CT saturation & accuracy, ratios, multi-ratio CTs
- MOCTs - Magneto-Optic Current Transformers

Aspen
- Network HASP Key
- H:\aspen
- Relay data base
[13 pts] Explain how the recloser, sectionalizer, and fuses are coordinated. Use a fault at point A to illustrate.
2. [20 pts] Two time-overcurrent relays protect adjacent sections of a radial system. Bus 3 is at the end of the radial line. 7000 amps of fault current will flow for a fault at point A; 5000 amps for a fault at point B. Load currents at buses 2 and 3 are 100A and 350A respectively. Loads at buses 2 and 3 have the same power factor.

![Diagram of a radial system with relays at buses 1, 2, and 3.]

a) Determine the tap settings for the relays at buses 1 and 2. Assume that taps can be set so they are just above rated load current. Available tap settings are: 1.0, 1.2, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 5.0, 6.0, 7.0, 8.0, 10.0, and 12.0 amps.

b) Keeping in mind that the relay at bus 2 protects the last section at the end of the line, what must its time dial setting be? Why?

c) Based on the fault at point A, what should the time dial setting be for the relay at bus 1? Assume that the circuit breakers operate in 4 cycles, and that the CTI is 0.25 seconds.

d) How long will it take for the relay at bus 1 to pick up for a fault at point B if the relay at bus 2 fails to operate?
Fig. 15. Typical Time Curve of the Type CO-9 Relay

TYPICAL TIME CURVES
TYPE CO. 9
OVER CURRENT RELAY
50-60 HERTZ

RELAY
PRI
(5A)
600A
1200A
ex: 5A top

CTR: 120

10,000A PRI
83A Relay
16.6 X top

(100 A)
12,000 A
MAXIMUM CLEARING TCC
Curves of M-E fuse links in M-E cutouts • Basis for data: NEMA Standard SG2
Tests at rated cutout Volts ac, low pf, starting at no initial load, 25°C
Maximum test points plotted so variations should be minus

EEI-NEMA TYPE K-TIN
25-Amp Coil—
Recloser Clearing Time

Curve A: Maximum clearing time for one operation, variations negative.
Curves B, C, and D: Average clearing time for one operation, variations ±10%.
Tests conducted at 25 C.