Ongoing List of Topics:

- **URL:** [http://www.ece.mtu.edu/faculty/bamork/EE5223/index.htm](http://www.ece.mtu.edu/faculty/bamork/EE5223/index.htm)
- Term Project - last few proj/teams being firmed up.
  - Office Hr Mon, Wed, Fri 2-3pm, stop by to discuss if questions.
- Homework #8 - directional overcurrent protection
  - Phase impedances \((a,b,c)\) vs. sequence impedances \((0,1,2)\)
  - Glover & Sarma gives good explanation, §8.2.
- Next Homework - sequence networks, transformer phase shifts
- Symmetrical Components overview issues for today.
- Protection fundamentals (cont’d):
  - Distance relaying fundamentals: §6.5.6, §6.5.7
  - Bus diff, xfmr diff, synch check, capacitor banks, generators, motors, etc. (take a quick run through Ch.6, also Glover & Sarma, Ch.10).
Fault here

Vinto relay

G7 Relay

Solution:

"Memory" feature of holding angle of last known Vpol.
Voltage Measurement from CCVT

"Subsidence Transient"

Phase Relaying Metering

Ground Pol
Close-in fault, LG at peak voltage

Subsidence transient.
\[ Z = \frac{V_{\text{Relay}}}{I_{\text{Relay}}} \]

Effected:

\[ V_{A0}, V_{A1}, V_{A2} \]

\[ I_A, I_B, I_C \]

\[ I_{A0}, I_{B0}, I_{C0} \]

"Delta Currents": \((I_A - I_B), (I_B - I_C), (I_C - I_A)\)
Bus Diff:

KCL: \[ \sum I_s = 0 \]

Trip if \[ \sum I_s > I_{\text{pickup}} \]
CT Sec Currents

- Low Impedance
- Moderate Imp.
- High Impedance.

Trip CBI
Trip CBZ
Trip CBN

“Lockout Relay”
Complications/Details:
- Turns Ratio
- Phase Shift
- CT Ratios