ECE 526: HW 4

Out-of-Step Detection

***Due session 25 (April 13)***



System Data:

Primary nominal voltage 

Nominal frequency 60 Hz

Voltage Transformer Ratio 

Current Transformer Ratio 

Primary pos.-seq. line impedance 

Sending source transient impedance 

Receiving source transient impedance 

Voltage behind the transient impedance Z1S 3 % above nominal

Voltage behind the transient impedance Z1R 3 % below nominal

Load angle between ES and ER 40 deg

1. Calculate nominal secondary voltage.
2. Calculate ES secondary voltage.
3. Calculate ER secondary voltage.
4. Calculate the secondary line impedance.
5. Calculate the voltage and current at the relay location for the 40 deg load angle.
6. Calculate the apparent impedance at the relay location for the 40 deg load angle.
7. Calculate the 3-phase apparent power seen by the relay at S.
8. Set the Zone 2 reach at 120% of the line impedance and plot the line impedance and Mho Distance element characteristic in the impedance plane.
9. In the same impedance plane, plot the swing locus of the apparent impedance and identify the apparent impedance calculated in 6).
10. Calculate the inner and outer right blinder and out-of-step timer settings to identify swings slower than 4 Hz.
11. Plot the inner and outer right blinders in the same impedance plot.
12. Plot 2 seconds of the secondary voltages and currents at the relay location for slip frequency = 4 Hz.