ECE 523: Homework #3

Due Session 12 (October 3)

1. Create positive, negative and zero sequence Ybus and Zbus matrices for the system below to study faults on the line between BUS 1 and BUS 2. Use M=0.6

Start voltage bases using rated voltage for the generator at BUS 5

2. Analyze the following faults. Use Sbase=25 MVA and a voltage base of 5kV at BUS D. You can neglect load current in your fault current calculations. Treat all buses as being at 1.0pu magnitude prior to the fault.
   a. Three phase fault at Bus C. Find V and I at the fault location and at BUS A
   b. SLG fault with Rf=0 at Bus C. Find V and I at the fault location and at BUS A
   c. LL fault with Rf=0 at Bus C. Find V and I at the fault location and at BUS A
   d. DLG fault with Rf=Rg=0 at Bus C, Find V and I at the fault location and at BUS A
   e. Compare the fault current magnitudes and voltages between the different fault types, plus for faults at fault location at BUS B
3. Do the following for the circuit below. **Also check your results with a commercial fault program and show comparison in tables.**
   a. Calculate and sketch the positive, negative and zero sequence equivalent circuits based on a fault 40% of the way down line 2 (the lower of the two lines).
   b. Calculate the voltages and currents at RelayR1 and RelayR2, for SLG, LL, and DLG faults with Rf = 0. I recommend using Zbus matrix methods.
   c. Repeat the part (b) for a SLG fault, LL, and DLG with Rf = 0.75 pu. For the DLG put the fault resistance in the neutral to ground path.

![Circuit Diagram]

\[
\begin{align*}
Z_{L11} &= 1.1\text{pu} \angle 85^\circ \\
Z_{L12} &= Z_{L11} \\
Z_{L10} &= 3\times Z_{L11} \\
Z_{L21} &= 1.1\text{pu} \angle 85^\circ \\
Z_{L22} &= Z_{L21} \\
Z_{L20} &= 3\times Z_{L21} \\
V &= 1.0\text{pu} \\
Z_{S1} &= 0.1\text{pu} \angle 85^\circ \\
Z_{S2} &= Z_{S1} \\
Z_{S0} &= 3\times Z_{S1} \\
Z_{R1} &= 0.5\text{pu} \angle 85^\circ \\
Z_{R2} &= Z_{R1} \\
Z_{R0} &= 3\times Z_{R1}
\end{align*}
\]