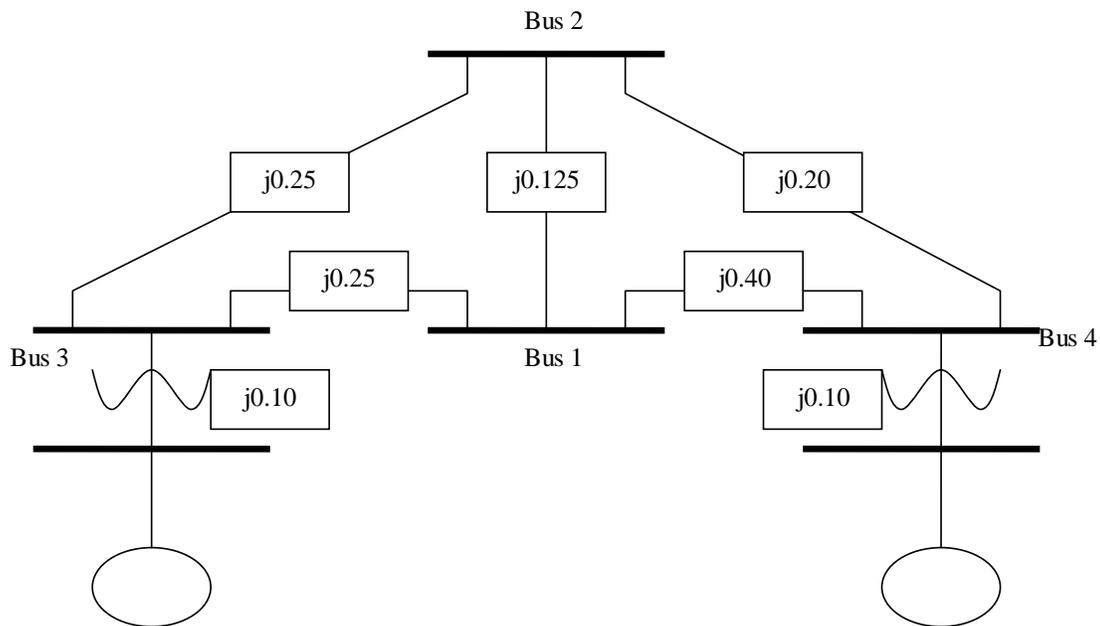


Homework #3: Due Tuesday, Feb 3.

1. Work problem 9.8 in the book.
2. Consider the 4-bus system shown below. Both machines have subtransient reactances of 0.20 pu (you can combine the machine subtransient reactance with the transformer impedance to get a single reactance connecting the machine internal voltage with the network).



- a. Construct the Y-bus for this network (should be a 4×4 matrix).

- b. Consider that there is a three-phase (symmetrical) fault at bus 2.
- i. Use LU decomposition to obtain the 2nd column of the Z-bus.
 - ii. Compute the subtransient fault current.
 - iii. Use eq. (12) to find the voltages during the fault.
 - iv. Use eq. (17) to find the subtransient currents in lines 3-2, 1-2, and 4-2.
3. A Y-connected load has balanced currents with a-c-b sequence given by

$$\underline{I}_{abc} = \begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix} = \begin{bmatrix} 10 \angle 0^\circ \\ 10 \angle +120^\circ \\ 10 \angle -120^\circ \end{bmatrix}$$

Calculate the sequence currents. How does your answer differ from the answer obtained in Example 1 in the notes called “Examples”?

4. A feeder provides service to a delta-connected load having the following phase currents:

$$I_{ab} = 208.3 \angle -18.19^\circ$$

$$I_{bc} = 138.89 \angle -151.788^\circ$$

$$I_{ca} = 131.94^\circ \angle 145.84$$

- a. For the phase currents:
 - i. Are they balanced or unbalanced?
 - ii. What is their sum?
 - iii. Obtain their sequence quantities.
 - iv. What is the 0-sequence quantity?
- b. Obtain the line currents. For these currents:
 - i. Are they balanced or unbalanced?
 - ii. What is their sum?
 - iii. Obtain their sequence quantities.
 - iv. What is the 0-sequence quantity?
- c. Use what you have learned in the parts (a) and (b) to answer the questions (ii, iv) from part (b) for the following a-b-c quantities:
 - i. Unbalanced currents into a grounded-Y.
 - ii. Unbalanced currents into an ungrounded-Y.
 - iii. Unbalanced line-to-line voltages.