

ECE 523: Homework #2

Due Session 10 (Sept. 16 on campus, Sept. 30 for Engineering Outreach)

1. Determine the symmetrical components for the following currents and sketch a phasor diagram, based on

- (a) Phase "a" referenced components
- (b) Phase "b" referenced components
- (c) Phase "c" referenced components

$$I_A := 5000A \cdot e^{-j \cdot 90\text{deg}}$$

$$I_B := 0A \cdot e^{-j \cdot 120\text{deg}}$$

$$I_C := 0A \cdot e^{j \cdot 120\text{deg}}$$

2. Repeat problem 1. with the following currents:

$$I_A := 8053.8A e^{-j \cdot 59.81\text{deg}}$$

$$I_B := 4500A \cdot e^{-j \cdot 145.84\text{deg}}$$

$$I_C := 4500A \cdot e^{j \cdot 94.16\text{deg}}$$

3. Determine the phase voltage given the following phase "a" referenced symmetrical components. Repeat assuming they are instead phase "b" and then phase "c" referenced symmetrical components

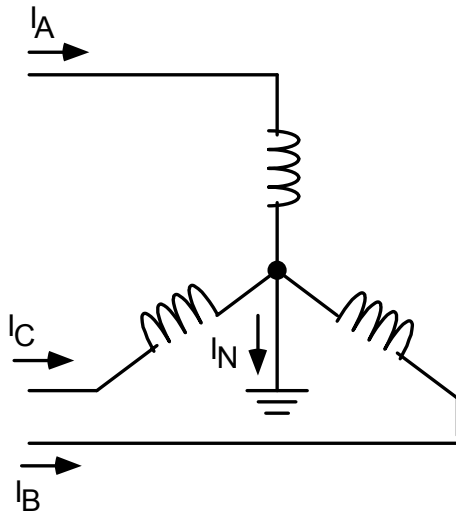
$$\text{pu} := 1$$

$$V_0 := 0.274\text{pu} \cdot e^{-j \cdot 90\text{deg}}$$

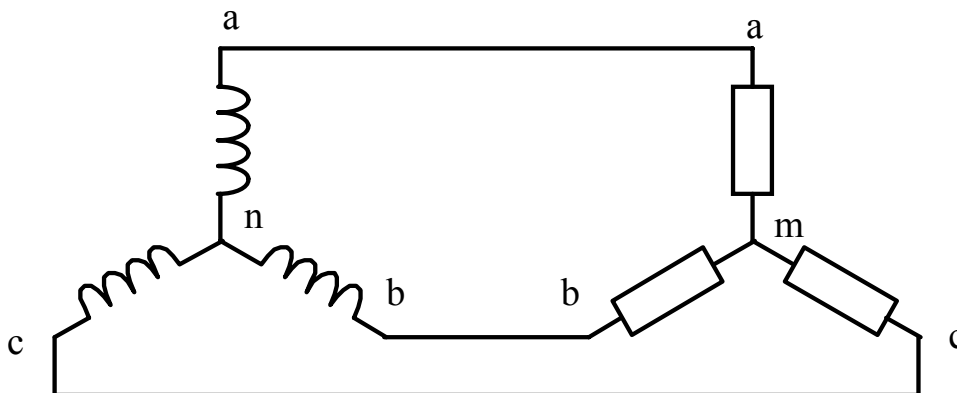
$$V_1 := 0.709\text{pu} \cdot e^{j \cdot 90\text{deg}}$$

$$V_2 := 0.299\text{pu} \cdot e^{-j \cdot 90\text{deg}}$$

4. Derive the relationship between the neutral current and the zero sequence current calculated from the phase current measurements for the grounded Y load.



5. If a load is unbalanced, its neutral, m, will not be at the same potential as the source neutral, n. Derive the relationship between the neutral shift V_{mn} and the zero sequence voltage, V_{am0} for the system shown below.



6. The ungrounded systems below has a phase to ground fault on phase "a". Assume that the line to ground (and line to neutral voltages) were balanced three phase set before the fault occurred. Do the following:

- (a) Find the symmetrical components of the phase a line-to-neutral voltages when a ground fault is applied (V_{an0} , V_{an1} , V_{an}).
- (b) Repeat part (a) using line to ground voltages instead of the line to neutral voltages and find (V_{ag0} , V_{ag1} , V_{ag2}).

