ENGR 12 Assignment 13 Optional Due: next wed

Part I. Drills -- 1 point each

Note: All magnitudes are RMS

1) What is the phase sequence of each of these sets of voltages?

a) $v_a = 339 \cos 377t$ V
$v_b = 339 \cos (377t - 120°)$ V
$v_c = 339 \cos (377t + 120°)$ V

b) $v_a = 679 \cos 377t$ V
$v_b = 679 \cos (377t + 120°)$ V
$v_c = 679 \cos (377t + 240°)$ V

2) If the phase voltages of a Y-connected source are as follows, find the line voltages Vab, Vbc, Vca

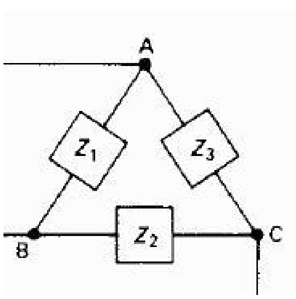
$v_{AN} = 169.71 \cos (\omega t + 60°)$ V,
$v_{BN} = 169.71 \cos (\omega t + 180°)$ V,
$v_{CN} = 169.71 \cos (\omega t - 60°)$ V.

3) If the phase currents of a Delta connected source are as follows, find the line currents Ia, Ib, Ic

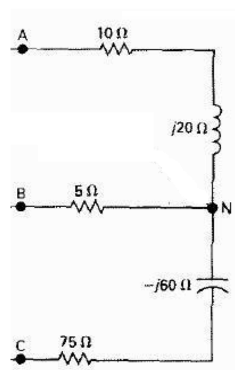
$I_{AB} = 339 \cos 377t$ V
$I_{BC} = 339 \cos (377t - 120°)$ V
$I_{CA} = 339 \cos (377t + 120°)$ V

4) Convert the Delta load to a Y, and the Y load to a Delta

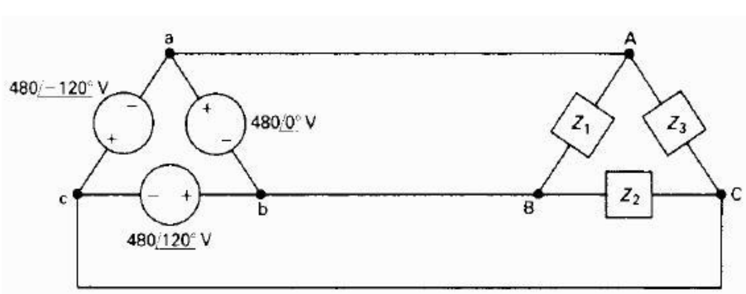
a) Z1 = 2.4 – j 0.7 , Z2 = 8 + j 6, Z3 = 20 + j0



b)



5) For the Delta-Delta circuit shown, the load impedances Z1 = Z2 = Z3 = 10 < 53.13° . Find the phase currents IAB, IBC and ICA, and the line currents Ia, Ib, Ic. Draw the voltage-current phasor diagram with all three quantities (line voltage, line and phase currents) on it.



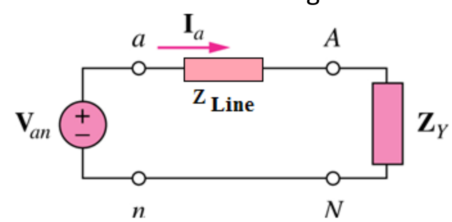
Part II. Assisted Problem Solving – 2 pts

6)

The magnitude of the phase voltage of an ideal balanced, three-phase, Y-connected source is 240 V. The source is connected to a balanced Y-connected load by a distribution line that has an impedance of $0.2 + j1.6\ \Omega/\phi$. The load impedance is $23.8 + j5.4\ \Omega/\phi$. The phase sequence of the source is abc. Use the a-phase voltage of the source as the reference. Specify the magnitude and phase angle of the following quantities: (a) the three line currents, (b) the three line voltages at the source, (c) the three phase voltages at the load, and (d) the three line voltages at the load.

Plan

1) Remember this is 240 Vrms.
2) Draw a single phase loop of this Y-Y system starting at Van, going over line aA to the load and label the impedances of the line and the load. It will look something like this

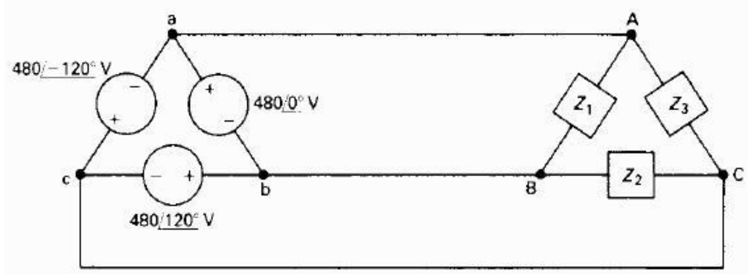


3) Van = 240<0, so you can find Ia using Ohm's law (Ib and Ic by symmetry +/-120^o)
4) VAN = Ia*ZY (the rest by symmetry)
5) use the chart to find VAB, VBC, and VCA

7) Repeat problem 5 with

Z1 = 2.4 – j 0.7 , Z2 = 8 + j 6, Z3 = 20 + j0

Draw the voltage-current phasor diagram with all three quantities (line voltage, line and phase currents) on it.



PLAN

1) This is not a balanced system, however, the delta configuration allows us to compute each phase current in the load as the line voltage divided by the load impedance.
2) Find each phase current in the load (Ohm's law)
3) use KCL to derive the line currents
4) draw the phasor diagram as before in problem 5

Part III. Unassisted Problem Solving – 3 points

8)

A balanced Δ-connected load having an impedance of $216 + j63\ \Omega/\phi$ is connected in parallel with a balanced Y-connected load having an impedance of $50\angle 0^\circ\ \Omega/\phi$. The paralleled loads are fed from a line having an impedance of $0.5 + j4.0\ \Omega/\phi$. The magnitude of the line-to-neutral voltage of the Y-load is 750 V.

a) Calculate the magnitude of the current in the line feeding the loads.

b) Calculate the magnitude of the phase current in the Δ-connected load.

c) Calculate the magnitude of the phase current in the Y-connected load.

d) Calculate the magnitude of the line voltage at the sending end of the line.