

## Laboratory #5

# Three-Phase Circuit Analysis and Simulation.

## I. Pre-Laboratory Assignments

1. Copy and paste this entire laboratory assignment into your laboratory notebook. Do all of your pre-lab and laboratory work in your lab book in ink. Do not bring any loose paper to the lab.
2. Two balanced three-phase circuits, shown in Figs. 1 and 2 below, will be analyzed to determine the load and line voltages and currents, as well as the time-average power consumed by the load. Both circuits have the same balanced Y-connected three-phase source. The load in Fig. 1 is Y-connected 100- $\Omega$  resistors while the other in Fig. 2 is  $\Delta$ -connected 100- $\Omega$  resistors.

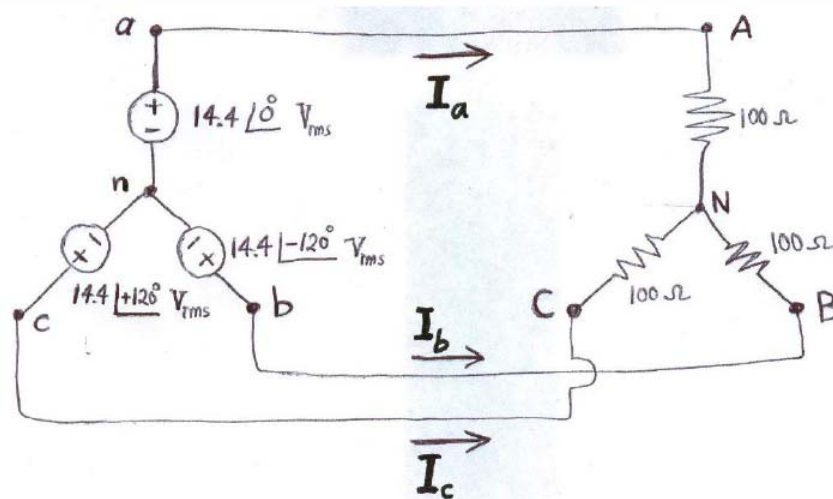


Figure 1.

3. Analyze the circuit of Fig. 1 by hand to calculate the load and line voltages and currents, and the total time-average power consumed by the load. Once that is completed, use your results to populate a table of data in your lab book in the form shown in Table I below.
4. Repeat part 3 for the circuit of Fig. 2.

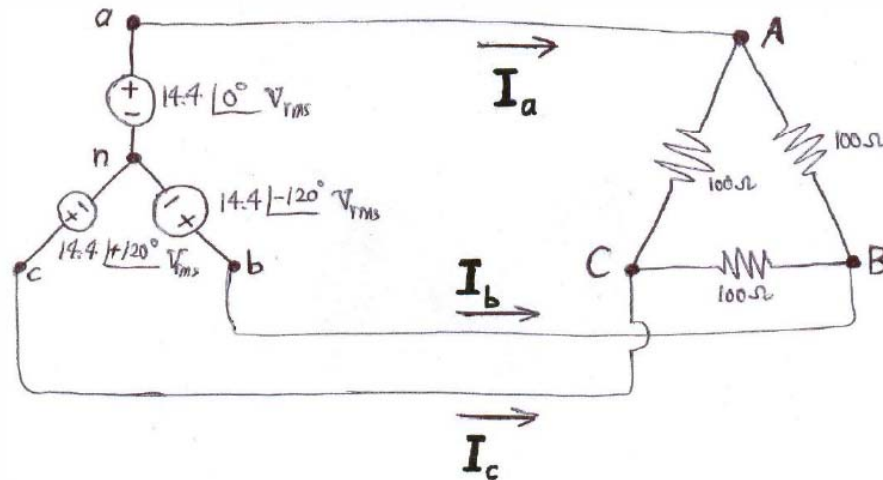


Figure 2.

Table I.

	Circuit 1		Circuit 2	
	Parameter	Value (magnitude, phase, unit)	Parameter	Value (magnitude, phase, unit)
Load voltages	$V_{AN}$		$V_{AB}$	
	$V_{BN}$		$V_{BC}$	
	$V_{CN}$		$V_{CA}$	
Load currents	$I_a$		$I_{AB}$	
	$I_b$		$I_{BC}$	
	$I_c$		$I_{CA}$	
Line voltages	$V_{AB}$		$V_{AB}$	
	$V_{BC}$		$V_{BC}$	
	$V_{CA}$		$V_{CA}$	
Line currents	$I_a$		$I_a$	
	$I_b$		$I_b$	
	$I_c$		$I_c$	
Complex power per phase	$S_p$		$S_p$	
Power per phase	$P_p$		$P_p$	

## II. Laboratory Experiments

1. Use a circuit simulation package (such as PSpice, B2Spice, or ADS) to obtain all of the parameters listed in Table I for the circuit of Fig. 1. Generate four plots. One plot must contain all three load voltages, the second must contain all three load currents, the third plot must contain all three line voltages, and the fourth plot must contain all three line currents.

You must **explicitly and exceedingly clearly** show how you extracted your data from these simulation results.

2. Repeat the previous part for the circuit of Fig. 2.
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### III. Analysis and Conclusions

1. Compare the results of your hand analysis in the preliminary section with your data from simulations in the laboratory section. Perform an error analysis. Create a table to organize your data comparisons.
  2. Explain any notable differences.
  3. When you are finished with your lab, make a photocopy of all the right side pages and print them out. Turn in your lab at the beginning of lecture on the due date. If you don't have easy access to a photocopier machine, the app GeniusScan works with your smartphone and allows you to easily create a pdf that can be printed.
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† Adapted from D. Anagnostou, "Lab Experiment – 5," 2015.