

# California State University, Fresno

## Department of Electrical and Computer Engineering

ECE 90L Principles of Electronic Circuits Laboratory

Experiment No. 4: Superposition in DC Circuits

### Objective

The objective of this laboratory is to measure and calculate voltages and currents in a linear circuit using the method of superposition. In the process of calculating various voltages and currents, you will also employ resistive combination and mesh analysis.

### Prelab

1.) For the circuit shown in Figure 1, use the principle of superposition to calculate the branch currents  $I_1$ ,  $I_3$ , and  $I_5$ , and the node voltages  $V_A$  and  $V_B$  using the theoretical resistance values provided in the diagram. Use mesh analysis for calculations with  $V_1$  in the circuit, and use resistance combination for calculations with  $V_2$  in the circuit.

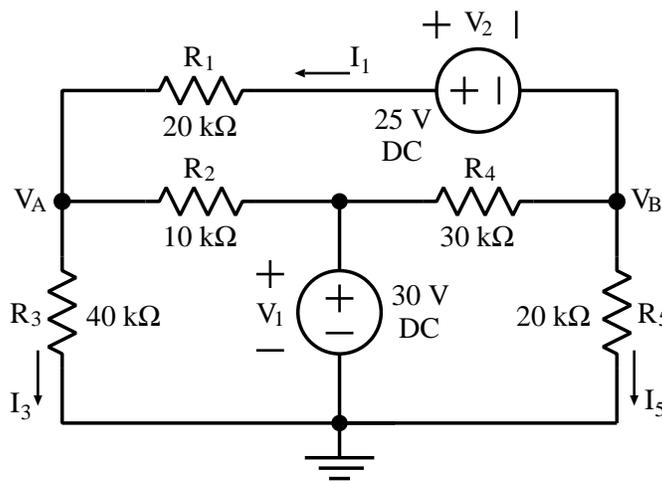


Figure 1: Superposition Circuit

### Procedure

1.) Set up the circuit shown in Figure 1 after verifying that the resistors you choose to use meet the appropriate power requirements, and after measuring their respective resistances.

Use the Mastech DC Power Supply for both of your voltage sources.

Be sure to follow the appropriate steps outlined in the previous laboratory procedure when setting up (or making modifications to) your circuit.

2.) Using the principle of superposition, measure and determine the branch currents  $I_1$ ,  $I_3$ , and  $I_5$ , and the node voltages  $V_A$  and  $V_B$ . To do this, first disable  $V_1$  by disconnecting the banana plugs attached to the + and - outputs from

the power supply, and connect them together before taking your measurements. Next, repeat the process for  $V_2$ .

3.) Measure the branch currents  $I_1$ ,  $I_3$ , and  $I_5$ , and the node voltages  $V_A$  and  $V_B$  when both sources are connected in the circuit. Verify that the currents and voltages are consistent with the results you obtained in Part 2. Calculate the percent difference for each value.

### **Conclusion**

Briefly discuss your conclusions regarding the relationship between linearity and superposition when performing voltage and current measurements. Is superposition a valid method of analysis for an electrical circuit?

### **Group Report**

- 1.) Compare the values of currents and voltages obtained by superposition in Part 2 of the Procedure with the values measured directly in Part 3. Account for any discrepancies.
- 2.) Using the measured values of resistance, calculate branch currents  $I_1$ ,  $I_3$ , and  $I_5$ , and node voltages  $V_A$  and  $V_B$ . Compare your results with the values measured directly in Part 3 of the procedure. Account for any discrepancies.