

UNIVERSITY OF CALIFORNIA, BERKELEY
EE40: Introduction to Microelectronic Circuits

Equivalent Circuits Guide

Important Notes

- Please make sure the current limit set higher than the current required by the circuit but lower than 2 amps. This is to ensure that you provide your circuit with enough power without damaging the equipment.
- Always use measuring devices (DMM) to take your measurements. Do not depend on the power supply to report accurate voltage and current values.
- In this lab, you will use $1.2\text{k}\Omega$, $2.2\text{k}\Omega$, 220Ω , and $1\text{k}\Omega$ resistors. For this lab, you can use resistor values are at within 10% of your theoretical value. If you require the use of other valued resistors, then your theoretical calculations are incorrect.
- These circuits are complicated. Good breadboard practice will be key in completing this lab.

Equivalent Resistor Networks

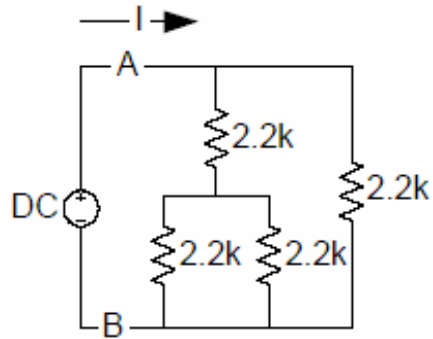


Figure 1

1. Build the circuit shown in Figure 1. Please use the breadboard to build this circuit. Assuming a maximum of 10 volts, what is the maximum amount of current supplied by the power supply?
2. From your prelab, you calculated the theoretical resistance across **A** and **B**. Disconnect the circuit from the power supply and use the DMM to measure the actual resistance across terminals **A** and **B**.
3. Reconnect the power supply, and record V_{AB} and I for 5 different supply voltages between 0 and 10 volts. Plot the IV curve of this circuit.
 - a. When recording the value of V_{AB} and I , it is important that you use the digital multimeter (DMM) to take your measurements. The readings from the power supply are inaccurate.
 - b. Please set the current limit of the power supply to a value higher than that calculated in Step 1, but lower than 2 amps.

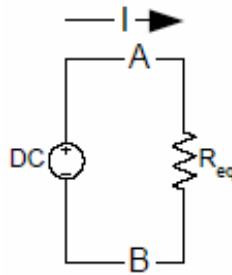


Figure 2

4. Build the circuit shown in Figure 2. Use the value of R_{eq} calculated in the prelab exercises and measured in step 2.
5. Using the power supply, record V_{AB} and I for 5 different supply voltages between 0 and 10 volts. Plot the IV curve of this circuit.

Thévenin's and Norton's Equivalence

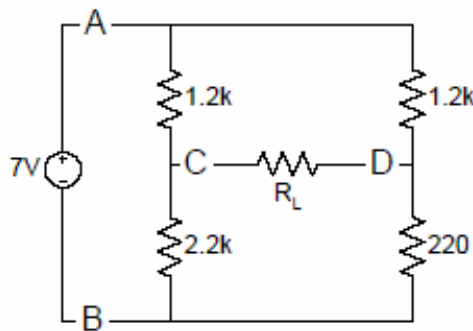


Figure 3

6. Build the circuit shown in Figure 3 *leaving out the resistor labeled R_L* for now. Measure the voltage across terminals **C** and **D**. This is your open circuit voltage (V_{TH}) and should be the same as you calculated in your prelab.
7. Now measure the current flowing through terminals **C** and **D**. Remember, when measuring current using the DMM, there is 0-resistance across the probes. Then you are essentially measuring the short-circuit current (I_{sc}) and should be the same as you calculated in your prelab.
8. Disconnect the power supply, and short terminals **A** and **B**. You *killed* the voltage source. Measure the resistance across terminals **C** and **D**. This is your Thévenin resistance (R_{TH}) and should be the same as what you calculated in prelab.

9. Now, “unshort” terminals **A** and **B** and reconnect the power supply (thus restoring the circuit in figure 3). For 3 different values of $R_L=220\Omega$, $1.2k\Omega$, and $2.2k\Omega$, install the resistor and measure the voltage across and the current through R_L .

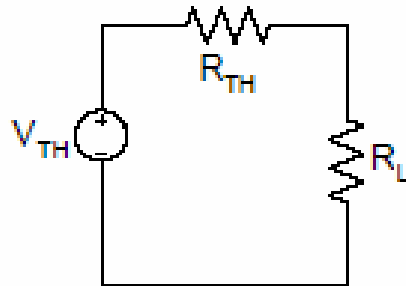


Figure 4

10. Build the circuit shown in Figure 4 with the appropriate values of V_{TH} and R_{TH} you calculated in your prelab and measured in steps 6 and 8.
11. For the three values of R_L , measure the voltage across and current through R_L .

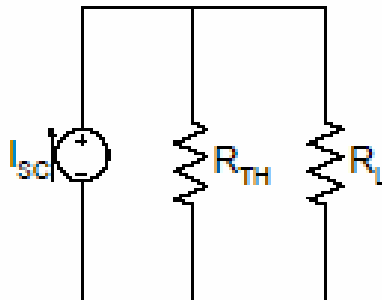


Figure 5

12. Build the circuit shown in Figure 5 with the appropriate values of I_{SC} and R_{TH} that you calculated in your prelab and measured in steps 7 and 8.
13. For the three values of R_L , measure the voltage across and current through R_L .