ECEN 214 Lab 3

Equivalent Networks and Superposition

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Section 502
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Date Performed: 2/19/18
Date Lab Report Due: 2/26/18

Task 1

Procedure

1. Construct the circuit below

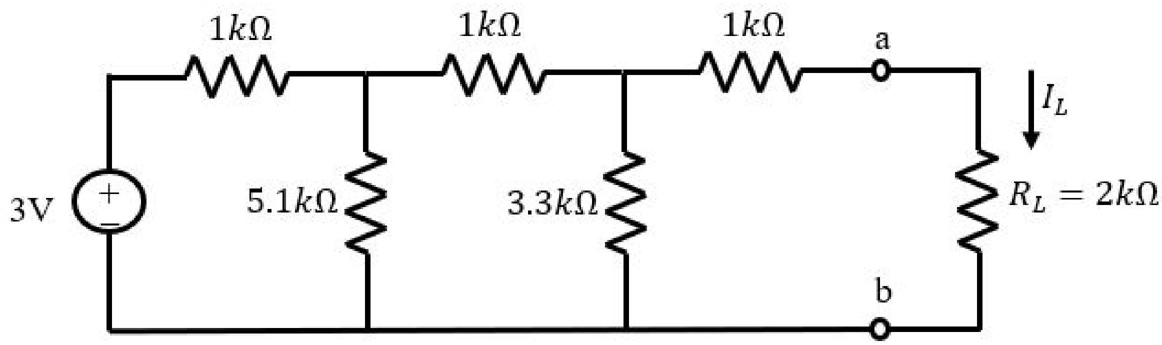


Figure 3.4

2. Measure the voltage across the resistor RL for 2 values of RL not equal to 2k Ω
3. Measure the voltage across the resistor RL for RL equal to 2k Ω
4. Calculate the Thevenin equivalent of the circuit

Data Tables

RL (Ω)	VL (V)
100	.1304
3300	1.799
2000	1.4286

Sample Calculations

VL / RL = IL

3 = IL * (RL + Rth)

1.

.1304 / 100 = IL = .001304

3 = .001304 * (100 + Rth)

Rth = 2200

2.

1.799 / 3300 = IL = .000552

3 = .000545 * (3300 + Rth)

Rth = 2200

Rth = 2200

Discussion

I arrived at my Thevenin equivalent for the circuit pictured above by taking the voltage measurements, VL, for different values of the load resistor, RL. I could then set up a system of equations to determine what the total resistance of the rest of the circuit was (all those resistors other than RL).This allowed me to arrive at an accurate value of Rth and set up a Thevenin model of the circuit to arrive at the correct values for VL.

Task 2 & 3

Task 2 Procedure

1. Construct the circuit below

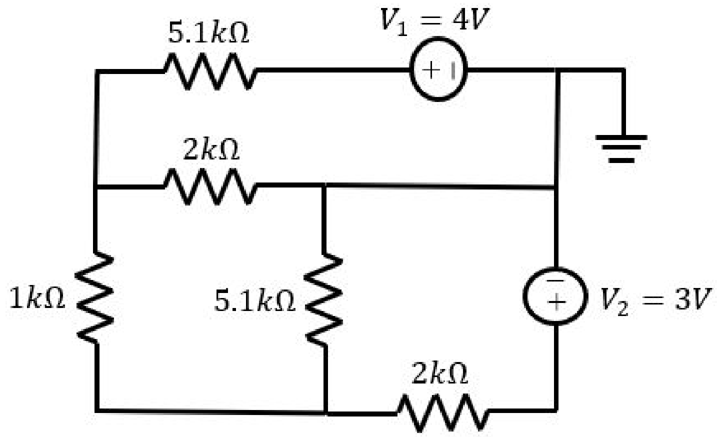


Figure 3.5

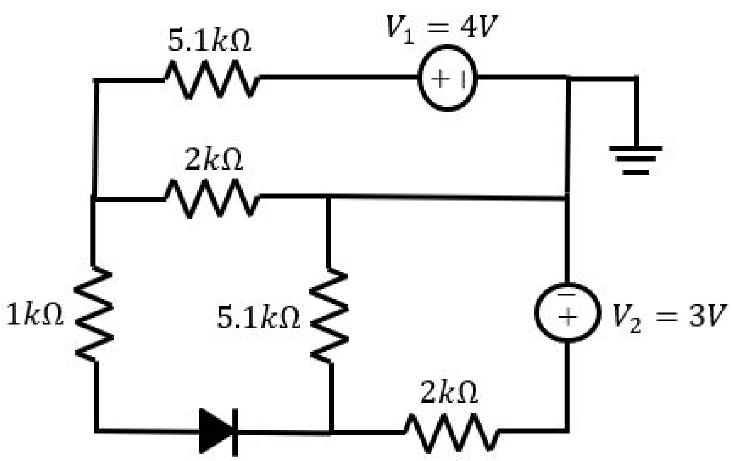


Figure 3.6

2. Measure and record the voltage across the 1k resistor.

3. To test the principle of superposition, measure the voltage across the 1k resistor when only the 4V battery is connected, and also when only the 3V battery is connected.

Task 3 Procedure

4. Repeat steps 2 and 3 of the task 2 procedure except insert a diode so the circuit so it looks like the one below.

Data Tables

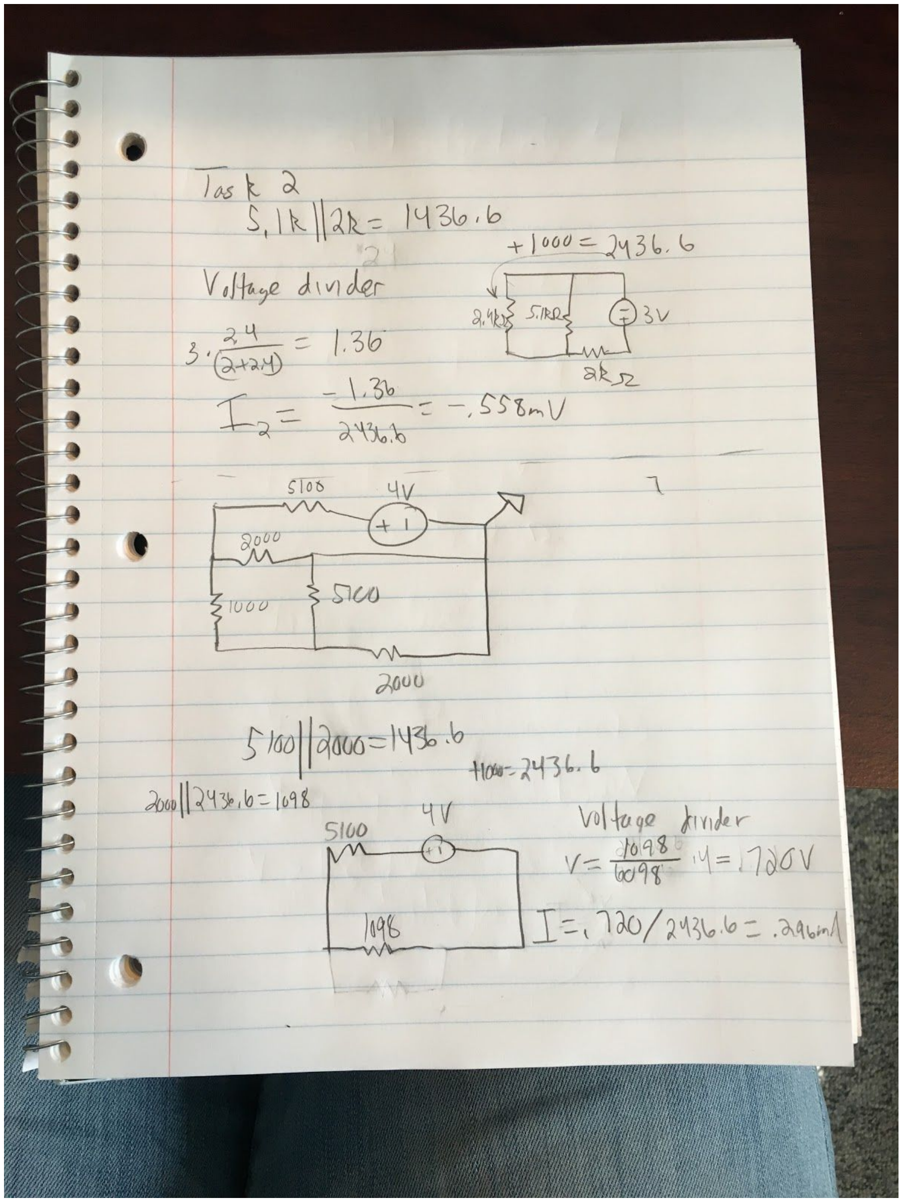
Task 2 Table

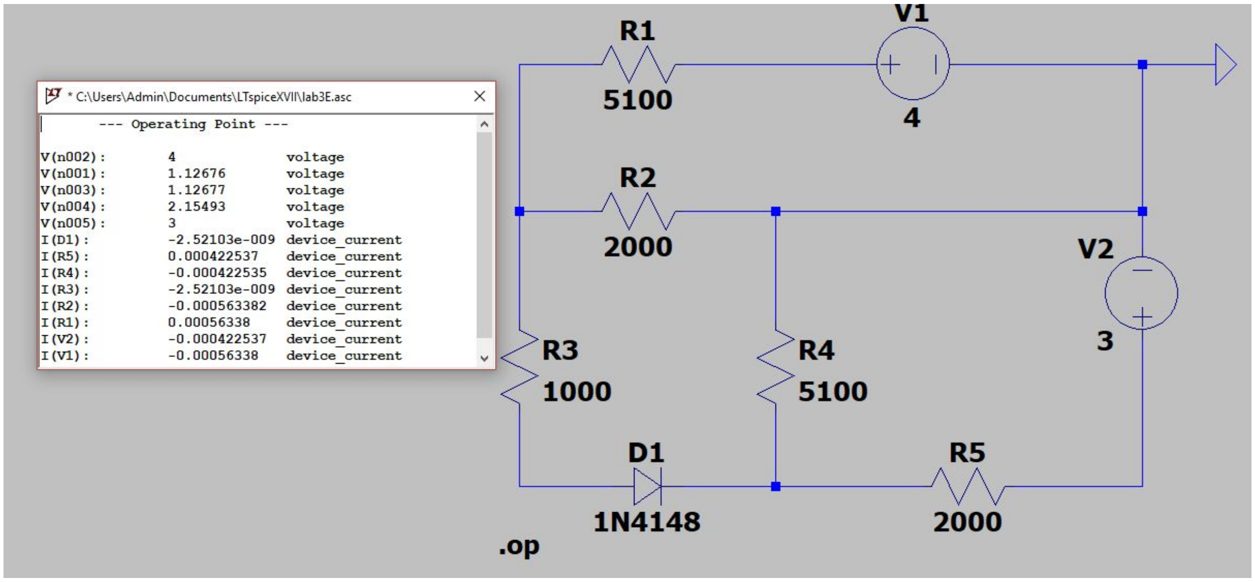
Parameter	Measured (mA)	Calculated (mA)	% difference	SPICE (mA)	% difference (SPICE to measured)
VL	.523	-.265	-151%	-.265	-151%
VL,1	.739	.296	-60%	.291	-61%
VL,2	-.216	-.558	-158%	-.556	-157%
VL,1+VL,2	.523	-.265	-151%	-.265	-151%

Task 3 Table

Parameter	Measured (mA)	Calculated (mA)	% difference	SPICE (mA)	% difference (SPICE to measured)
VL	0	0	0%	0	0%
VL,1	.152	.161	5.9%	.161	5.9%
VL,2	0	0	0%	0	0%
VL,1+VL,2	.152	.161	5.9%	.161	5.9%

Sample Calculations





Discussion

Superposition worked to figure out the current across the 1k resistor in task 2 but not in task 3. This is because the diode is a non linear element; it will only allow current to flow in one direction. That means when the 3 V battery was the current flowing through the 1k resistor was zero. The only time that current could flow through is when just the 4 V battery was connected. Resistors are linear elements because they obey Ohm's law, a diode does not. That is what makes a circuit element linear, its current, voltage, and resistance being related in a linear way.