Laboratory One — DC Circuits

Rishabh Shah
4655 4192

Partner: Matthew Remillard

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Pre-Lab

Post-Lab

Thevenin Equivalent

Component	Nominal Value (Ω)	Measure (Ω)	Measured V_L (V)	$I_L = V_{L,meas}/R_{L,meas}$ (mA)
R_S	100	99.049	0	0
R_{L1}	20	19.784	1.0149	50.62121
R_{L2}	51	50.824	2.0349	40.03817
R_{L3}	100	97.885	2.9804	30.44797
R_{L4}	200	199.000	4.0036	20.11859
R_{L5}	470	474.040	4.9625	10.46853
R_{L6}	1000	984.600	5.4515	5.53676

Table 1: Thevenin Equivalent circuit data

Light Sensor

I

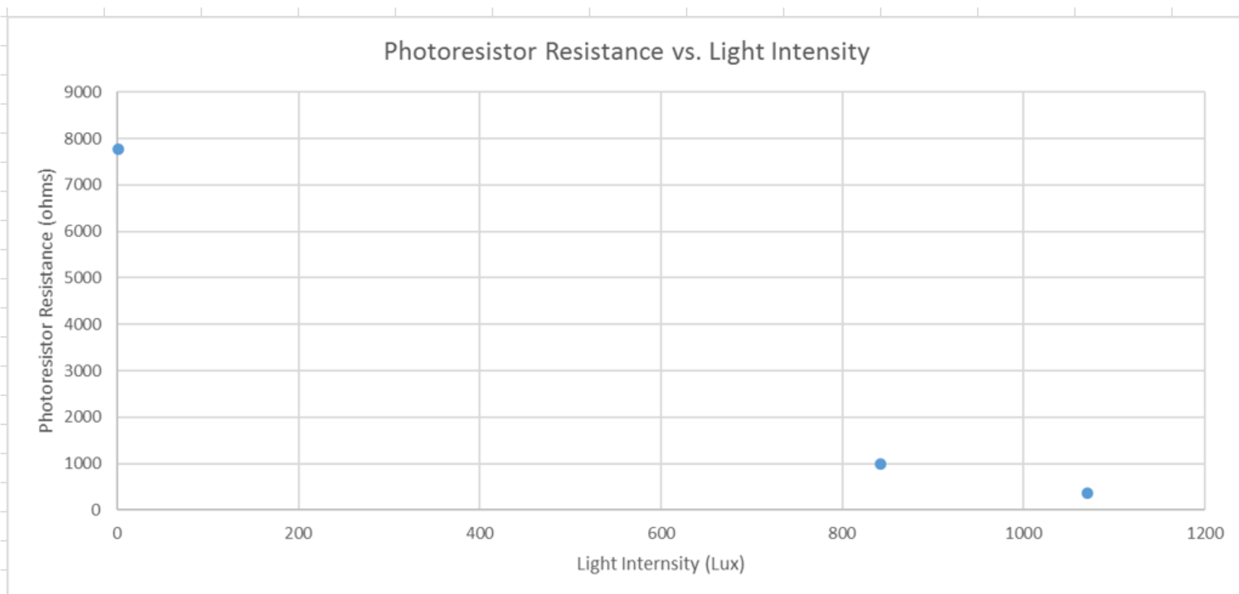

Figure 1: Graph of photoresistor resistance versus light intensity

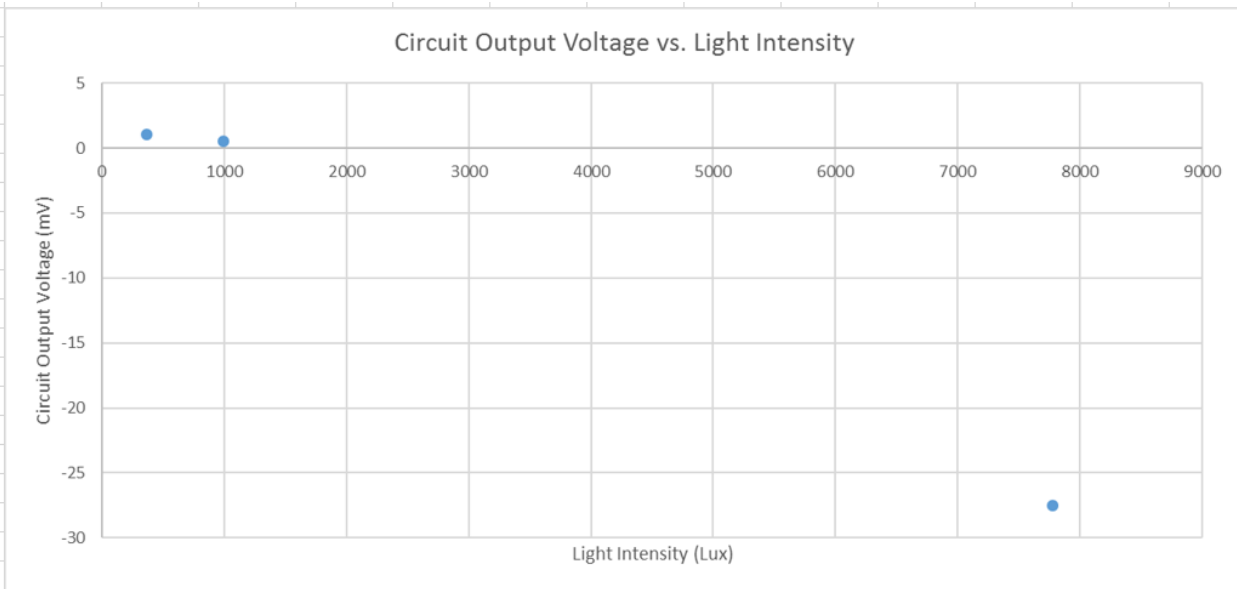

Figure 2: Graph of circuit output voltage versus light intensity

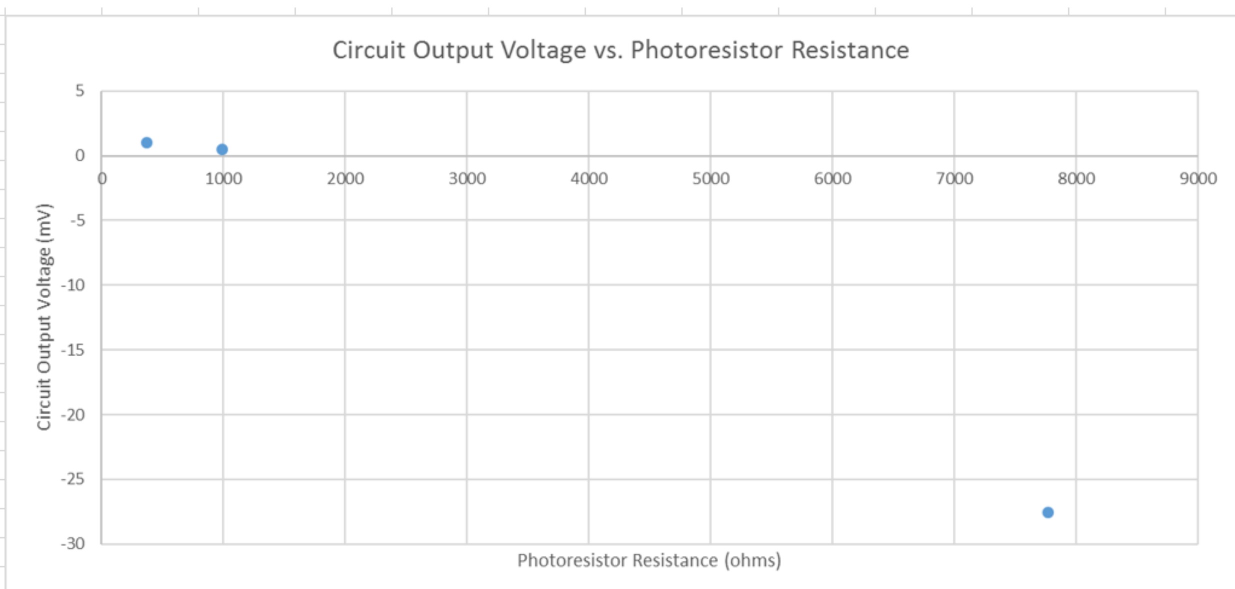

Figure 3: Graph of circuit output voltage versus photoresistor resistance

II

$$S = \frac{\Delta R}{\Delta lux} = \frac{7775.2 - 370.45}{1 - 1070} = -6.9268$$

$$S = \frac{\Delta V_{out}}{\Delta lux} = \frac{-27.530 - 1.123}{1 - 1070} = 0.0268$$

III

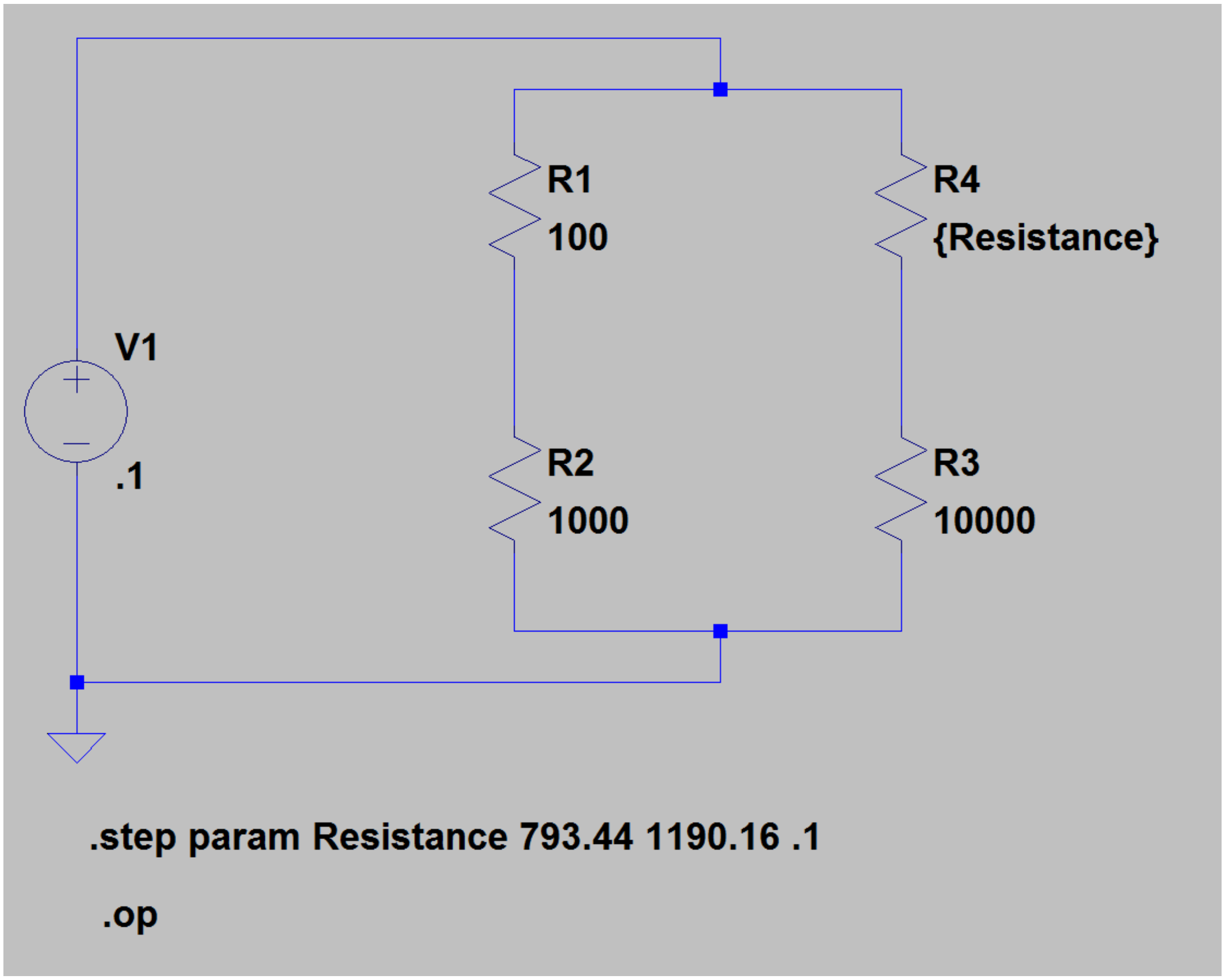

Figure 4: Photoresistor circuit simulated in LTSPice

IV

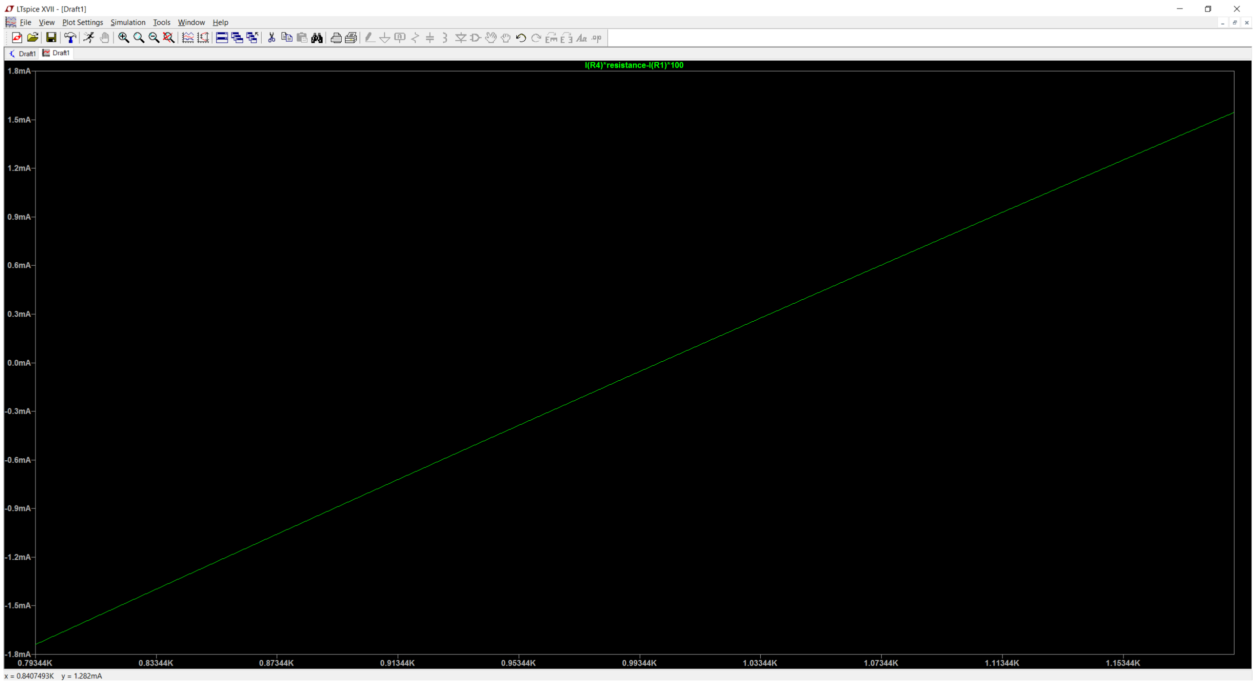

Figure 5: Simulated graph of circuit output voltage versus photoresistor resistance

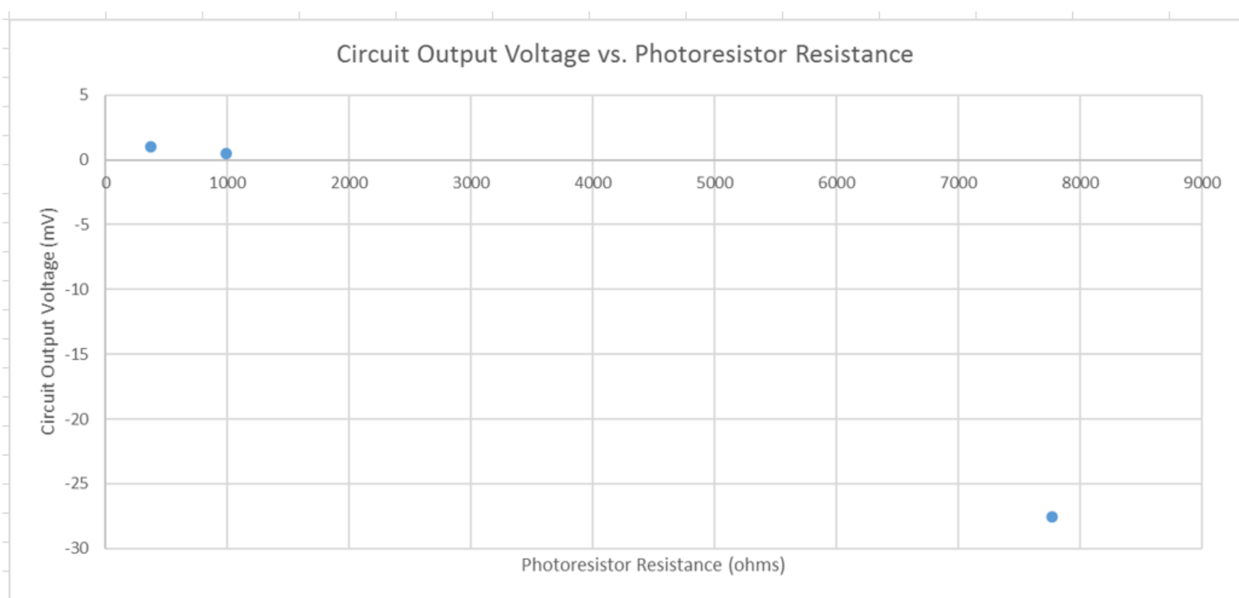

Figure 6: Graph of circuit output voltage versus photoresistor resistance

When comparing the measured data to the simulated data, it looks like the slope of the graph is opposite. This is due to the voltmeter having the reversed polarity when measuring. Disregarding the reversed polarity, the two graphs are fairly similar.

V

The sensitivity of our circuit is fairly high, as we have a sensitivity of 6 Ω per lux. This means that for every increase in lux, the resistance of the photoresistor increases by 6 Ω. The circuit is fairly linear, as shown by the graphs in Part I. The accuracy of the circuit is also fairly high due to the similarities between the simulated graph and the measured data, including the slope of both graphs.

VI

An application of our circuit is on a solar tracking device. In such a device, photoresistors are used to compare the amount of light on all sides of a solar panel. Then the output voltages are compared, and the side with the highest amount of light is the direction in which the solar panel will be moved. This results in maximum electrical output for the solar panel. The sensitivity of the photoresistor circuits is fairly important, especially if the device is tracking at a high rate. This results in the light variation per side being much lower than if the device is tracking at a low rate. The accuracy of the photoresistor is also important, as noisy data will result in the device incorrectly tracking. The linearity of the photoresistors is not important, as the values are compared, rather than used individually.