Voltage Divider (Basic DC Curcuits)

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Purpose

The purpose of this lab is to give students experience in building circuits that exhibit ohmic and non-ohmic behaviors, allow students some practice experimenting with voltage dividers, and give students some experience in working with virtual instruments.

Procedure

In this experiment several circuits were made for testing resistance, it's laws, and many of it's other useful properties. The first was a circuit with two power sources used to test Kirchhoff's laws usefulness in obtaining the actual occurrences of a circuit. The second circuit was made to test the properties of a resistor by fitting a curve to the current passing through the resistor based on the voltage across it. This same circuit was used to test if a light-bulb exhibits the same Ohmic properties. The final two circuits were made to test how the the voltage changed across the load of a voltage divider depending on where the resistance was varied from.

Data

Kirchhoff's Law

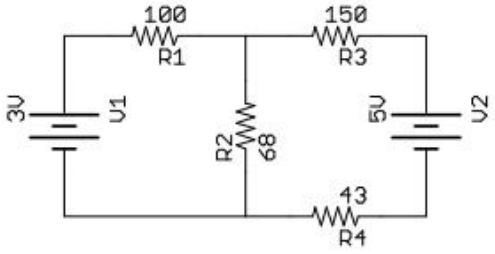

Figure 1: Circuit used for analysis of Kirchhoff's Laws

Data used to calculate values of resistors were taken by Digital Multi-meter as voltage across each resistor and current through each resistor. Kirchhoff's Laws were then used to evaluate each resistor.

Resisters(Ohms)	Labeled	deviation	range	Calculated
R1:	100	0.05	95 - 105	105.5
R2:	68	0.05	64.6 - 71.4	69.35
R3:	150	0.05	142.5 - 157.5	150.01
R4:	43	0.05	40.85 - 45.15	43.1

Table 1: Actual values(Calculated) of resistance to compare to labeled values

Ohm's Law

Measurement of resistance for Ohm's law to be evaluated against was taken by four wire Multi-meter. Data to evaluate was taken by labVIEW as a plot of voltage across the resistor and current through the resistor. Data for resistance was then taken as the inverse slope of our best fit line.

Resistance with four-wire	
Resistance(Ohm):	199.8 Ohm
Resistance from ELVIS board	
Slope(1/Ohm):	0.0
Resistance(Ohm):	204.96

Table 2: Measured Resistance

LabVIEW Windows

Front Panel

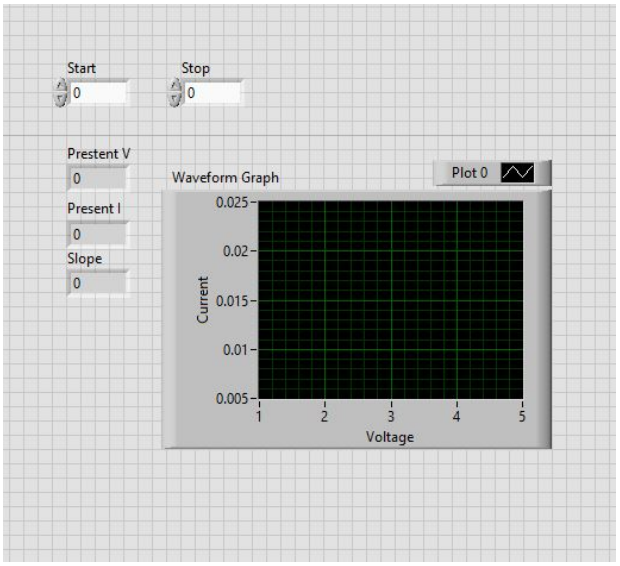

Figure 2: Voltage vs. Current graph for visualization of Ohmic properties

Block Panel

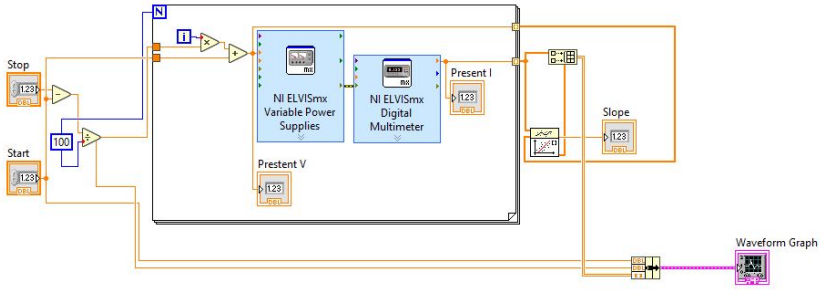

Figure 3: Lab View Configuration to input and analyse data

Voltage Divider

First we tested how varying the load across a voltage divider would change the effective voltage across the load. A 390 Ohm resistor was used in series with a 300 Ohm resistor in parallel with a decade box.

Resistance - load(Ohm)	Voltage - load (V)
10k	2.14
5k	2.1
2.5k	2.03
1.25k	1.92
600	1.7
300	1.39
150	1.03
70	0.65
30	0.33
20	0.23
10	0.13

Table 3: Change in voltage with varied load

Results

Kirchhoff's Law

All values of resistors fit into the appropriate range as provided by the manufacturer except for resistor one which shows a slight discrepancy.

Ohm's Law

Visual evaluation of our data for the resistor and for the light-bulb shows that our resistor has an appropriate linear relationship between voltage and current as predicted by Ohm's law where the light-bulb does not.

Resistor

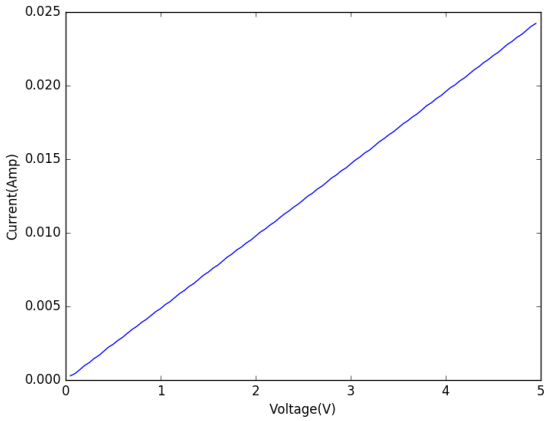

Figure 4: Data as taken by labVIEW for resistor

Light-bulb

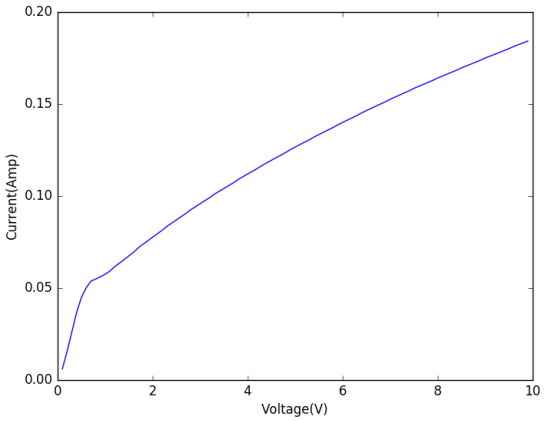

Figure 5: Data as taken by labVIEW for lightbulb

Voltage Divider

The last five data points from our evaluation with the decade box seem approximately linear. With this I said that we would get approximately linear results for the voltage across the load when it's resistance was half that of the resistor it was put in parallel with. Connection a 500 Ohm resistor as a load and using a 2000 Ohm trimpot (potentiometer) as a voltage divider yielded approximately linear results for voltage which grew rapidly at the high end of voltage across the load.