**Lab 2: Measuring Electrical Signals with the Oscilloscope**

650:361 Introduction to Mechatronics

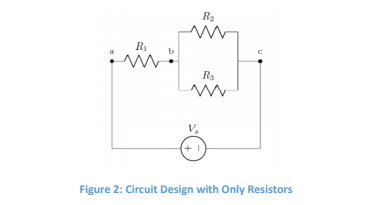
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**Introduction**

In this lab, we will use a variable power supply on NI Elvis in order to input different voltages into the circuit. By using *Variable Power Supply* function on the NI Elvis software, we were able to vary the voltage through the circuit. We then compared our measured values with our theoretical values, which were obtained using circuit theory (Kirchhoff’s Voltage law, Kirchoff’s Current Law, and Ohm’s Law). In the second task, we used the *Function Generator*, which produced different signals, such as sine, square, and triangular waves, through the circuit. We used the *Oscilloscope* to observe the generated signal.

**TASK 1: Variable Power Supply**

In the last lab, the power source was 5 V. We set our power source to 10V by using the Variable Power Supply function in the NI Elvis software. Then, we built our circuit on NI Elvis and measured voltages across points A and B, and points B and C, and currents through each resistor. To measure voltage, connect the measuring device in parallel.



|  |  |
| --- | --- |
| **Resistors** | **Code Value** |
| *R1* | 1 kΩ |
| *R2* | 330 Ω |
| *R3* | 100 Ω |

Table 1: Code Value of Resistors Used in the Circuit Shown in Figure 2

We calculated the equivalent resistance by using resistance formulas for resistors in series and in parallel. We first used the formula to calculate the resistance across R2 and R3. Then we used the formula to calculate the equivalent resistance felt by the voltage source.

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| --- | --- | --- |
| **Resistors** | **Code Value** | **Measured Value** |
| *Req* | 1076.744 Ω | 1076.023 Ω |

Table 2: Measured and Code Values of Equivalent Resistance [Ohm]

The theoretical and measured values of *Req* agree with each other.

|  |  |
| --- | --- |
| **Voltage** | **Measured Value** |
| *Vab* | 9.2711 V |
| *Vbc* | 0.71447 |

Table 4: Measured Voltage Values of Resistors for 10V Power Supply in [V]

The theoretical voltage of the power supply is 10V. Our measured value of the power source is 9.98557V, which is the sum of *Vab* and *Vbc*. The measured value and the theoretical value agree.

Using the same 10V power source, we measured the current through each resistor. We connected the ammeter in series in order to produce a current reading.

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| --- | --- |
| **Current** | **Measured Value** |
| *i1* | 0.925 mA |
| *i2* | 0.224 mA |
| *i3* | 0.74 mA |

Table 5: Measured Current Values for 10V Power Supply Currents in [mA]

According to the lecture, current should stay the same when flowing through a circuit in series and change when flowing through a circuit in parallel. We can apply this logic to evaluate our measured values. Resistor R2 and resistor R3 are in parallel, therefore their measured current values should add up to be the same as the current through resistor R1. When we add the measured values 0.224 mA and 0.74 mA, we get 0.967 mA. This value is greater than 0.925 mA. The value has a margin of error of 4.5%, which is small enough to be negligible.

**TASK 2: Function Generator and Oscilloscope**

**Part A)**

In this section, we used the *Function Generator* function to produce a sine wave signal. We also used the *Oscilloscope* to observe the generated signal, and to output amplitude, output frequency, and output period.

|  |  |
| --- | --- |
|  | **Measured Value** |
| Waveform | sin |
| Output amplitude | 1.014 vp-p (peak to peak) |
| Output frequency | 100.0240 Hz |
| Output period | 0.009997 s |

Table 6: FGen and Oscilloscope

**Part B)**

We did not have enough time in class to start Part B. The TA said we will be able to do this part next lab class.

**TASK 3: Led-Diode Circuit**

We did not have enough time in class to start Task 3. The TA said we will be able to do this part next lab class.

**Conclusion**

For this lab, we used a new part of the software to control the current in the broad. Using this software, we were able to measure current, voltage, and resistance across three resistors. The software also gave us more information about the signal sine wave, such as amplitude and frequency. In conclusion, this lab allowed us to practice measuring circuits using new resources.