



ABU DHABI UNIVERSITY

ELECTRIC CIRCUITS

Lab Report 4

RC Circuits

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Section 1

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Abstract

In this lab we learnt how to quickly/slowly charge and discharge a capacitor. Also we confirmed the relationship of how many Time Constants it takes to discharge or charge a capacitor to a particular level of its original charge.

1 Introduction

In First Exercise, we were just introduced to all the features of Multisim and we drew a simple circuit.

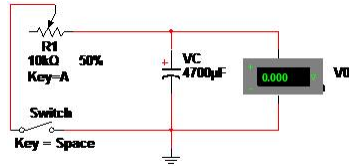


Figure 1: First Simulation Circuit

In Second Exercise, we drew, simulated and calculated the voltages and currents on various parts of the following circuit.

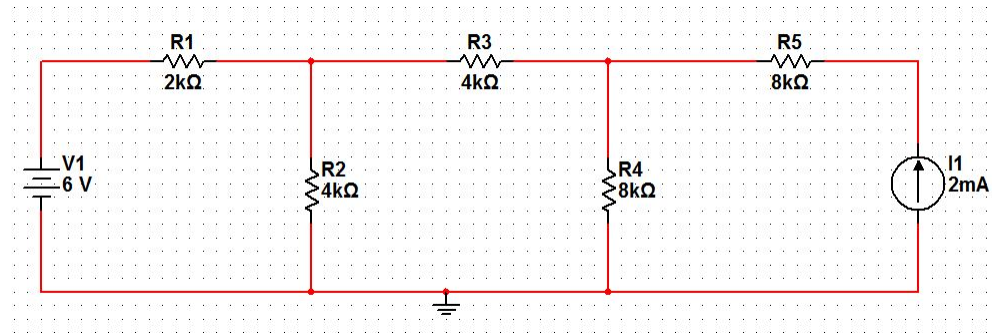


Figure 2: First Simulation Circuit

In Third Exercise, we drew, simulated and calculated the voltages and currents on various parts of the following circuit.

2 Experiment Set-up

The components were placed and fixed onto the training board and wires were used to connect the components in the circuit as shown in the figures. A multimeter was used to calculate all the values as the multi-meter can calculate Current, resistance, and voltage.

3 List of Equipment used

- Breadboard.

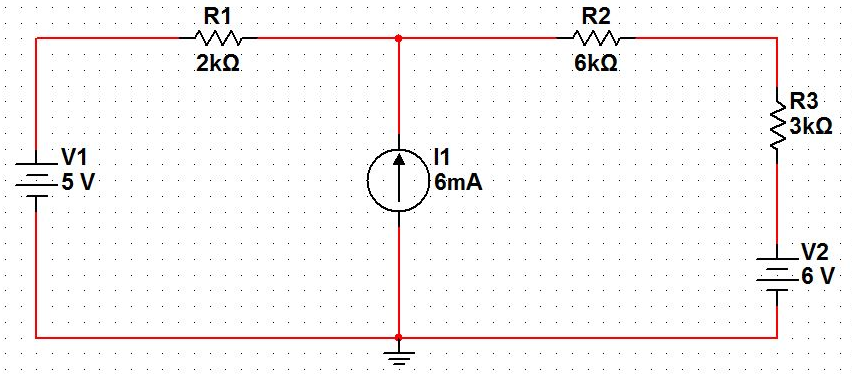


Figure 3: Second Simulation Circuit

- Digital Multi Meter.
- Training Board.
- Breadboard Cables.
- Potentiometer 10 k Ω .
- Electrolytic Capacitor of 4700uF.

4 Procedure

4.1 Noting the time taken for CHARGING a capacitor.

- Put the multimeter across the potentiometer and set it to measure resistance.
- Set the resistance of potentiometer to 2 k Ω .
- Set the DC supply voltage to 5V using a multimeter.
- Discharge any previously remaining charge on the capacitor by shorting the two legs together.
- Connect the components using wires as shown in the figure 4.
- Start the stopwatch at the same time you start the power.
- Keep note of the voltage across the capacitor while it is charging.
- Stop the stopwatch when the required voltage is achieved across the capacitor and stop the power too at the same time.
- Take note of the time.
- Repeat the steps for all required voltages and resistances.

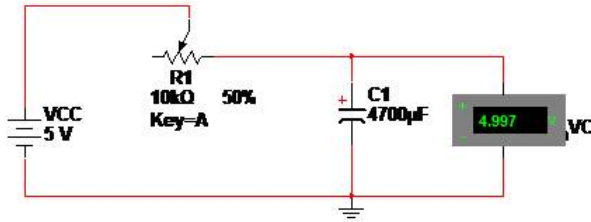


Figure 4: Measuring Voltage across capacitor while its charging

4.2 Noting the time taken for DISCHARGING a capacitor.

- Ensure that the capacitor is charged to the required Voltage.
- Place voltmeter across each components in the circuit using the place indicator button.
- Start the timer and at the same time short the wires which were previously connected to power.
- Keep note of the voltage across the capacitor while it is discharging.
- Stop the stopwatch when the voltage across the capacitor reaches nearly zero.
- Take note of the time.
- Repeat the steps for all required voltages and resistances.

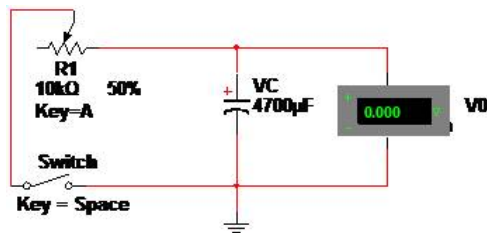


Figure 5: Discharging a capacitor while taking note of the voltage across it.

5 Results and Discussions

At the end of these exercises we got the following results:-

- Multisim values and calculated values were different from each other.
- Error Percentages were very low.
- Usually we applied Mesh Analysis to calculate the current in the circuit.

Branch Values	Multisim Results	Calculation Results	Error Percentage
V1	0.801V	0.8V	0.13%
V2	5.199V	5.2V	0.02%
V3	-3.597V	-3.6V	0.08%
V4	8.796V	8.8V	0.05%
V5	-15.987V	-16V	0.08%
I1	401 μ A	400 μ A	0.25%
I2	1.3mA	1.3mA	0%
I3	-900 μ A	-900 μ A	0%
I4	1.10mA	1.10mA	0%
I5	-2.00mA	-2.00mA	0%

Figure 6: Results for Exercise 1

Branch Values	Multisim Results	Calculation Results	Error Percentage
V1	-9.998V	-10V	0.02%
V2	5.998V	6V	0.03%
V3	3.000V	3V	0.00%
I1	-5.999mA	-6mA	0.02%
I2	-1.000mA	-1mA	0%
I3	5.000mA	5mA	0%

Figure 7: Results for Exercise 2

6 Conclusion

- Ohm's Law is valid for both experiments. Thus $V=IR$. But we used Kirchoff's Rules for easier circuit analysis.
- The calculated and multisim values are different because multisim assumes some small resistance of its ammeter and not assume not large resistance for volt meter.
- Multisim results will match the real life circuit much more closely than a calculated value.

7 Questions

Is the simulation exactly equal to the theoretical results? Why?

No, The simulation result are slightly different than the theoretical results. Because when we calculate results theoretically, we assume the resistance of voltmeter to be infinite, which is impossible in real life, and we assume the resistance of Ammeter to be exactly 0 Ohm, which is also impossible in real life. On the Other Hand Multisim assumes some very small resistance for the ammeter and

a very large resistance for voltmeter. Thus, calculates its results according to its assumptions which are close to real life circuit.