

Experiment 7

Rectifiers, Capacitors and Inductors

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1 Introduction

In this experiment, as students, we are expected to experiment with different kinds of Op-Amp circuits by completing the steps described in the sixth experiment laboratory manual. Throughout these steps, some characteristics of Op-Amps and the behavior of the Op-Amp circuits are expected to be learned. The output versus input characteristics is observed by connecting the signal generator to the oscilloscope and the circuit. The non-ideal behavior of the components is compared with the ideal simulation plots. Also, some measurements are expected to be finalized via manipulating the output. The results of the steps were recorded and plotted for further comments.

2 Experimental Results

In this section, the results of Experiment 7 are discussed.

2.1 Step 1

In this step, circuit shown in the Figure 1 is constructed.

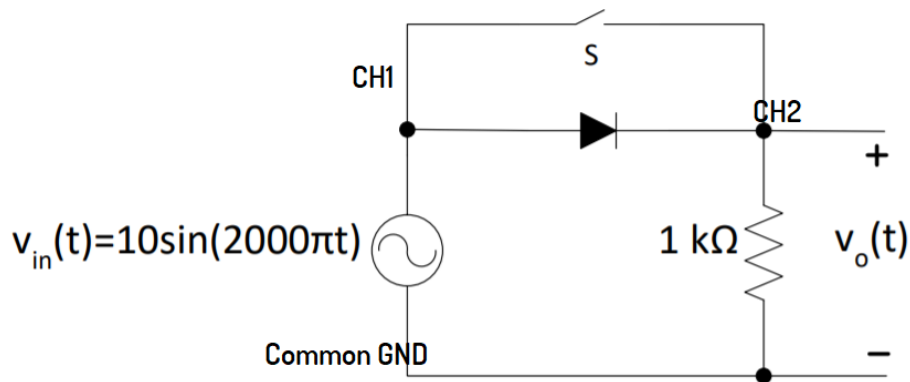


Figure 1: Half wave rectifier circuit

2.1.1 a)

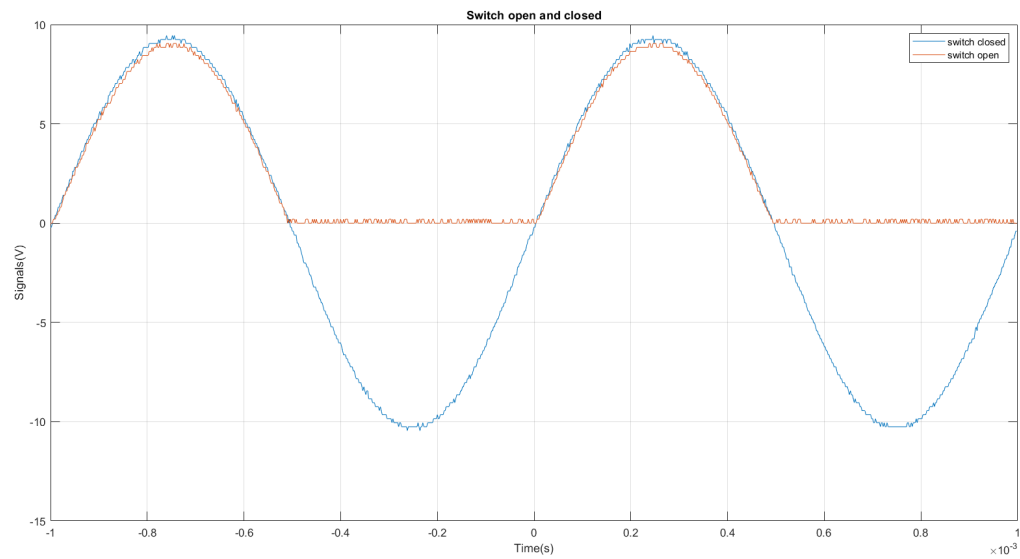


Figure 2: Output waveforms

2.1.2 b)

2.2 Step 2

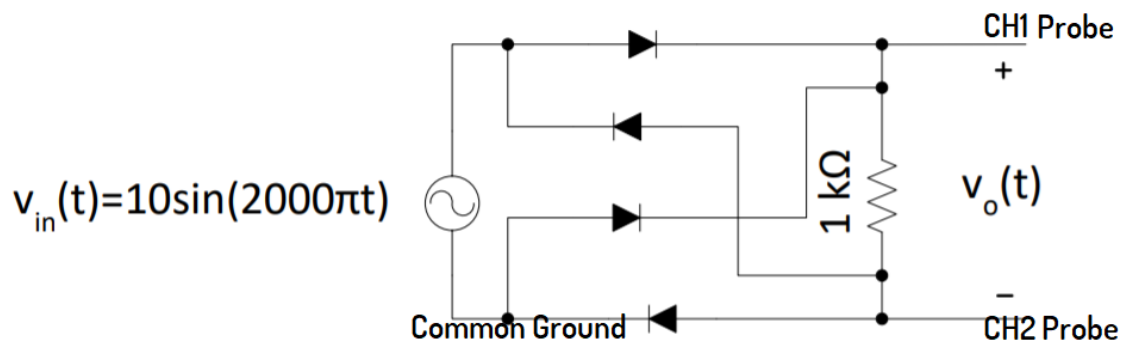


Figure 3: Full wave rectifier circuit

2.2.1 a)

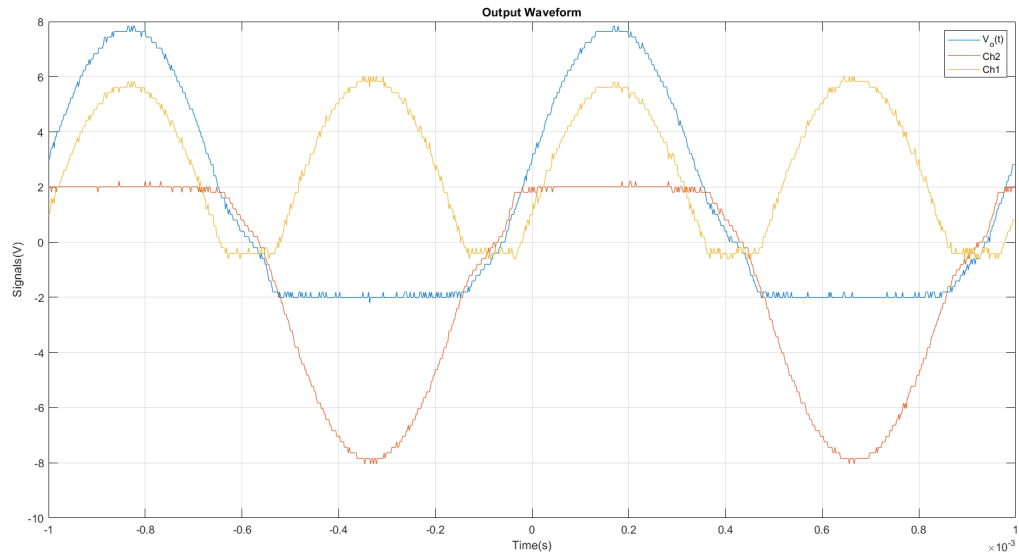


Figure 4: Output waveforms

2.2.2 b)

2.2.3 c)

2.3 Step 3

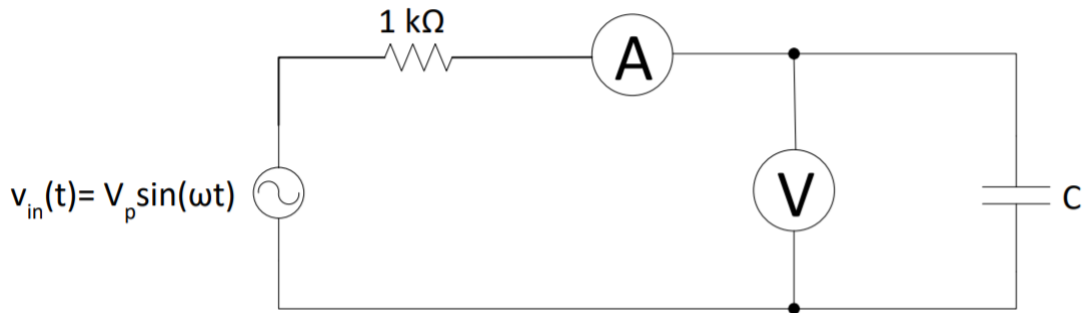


Figure 5: Capacitor measurement circuit

Table 1: Measurements for the capacitor circuit

| | Capacitor | Resistor |
|-----------------|-----------|----------|
| Voltage Reading | 1.1518 V | 1.69 V |

2.4 Step 4

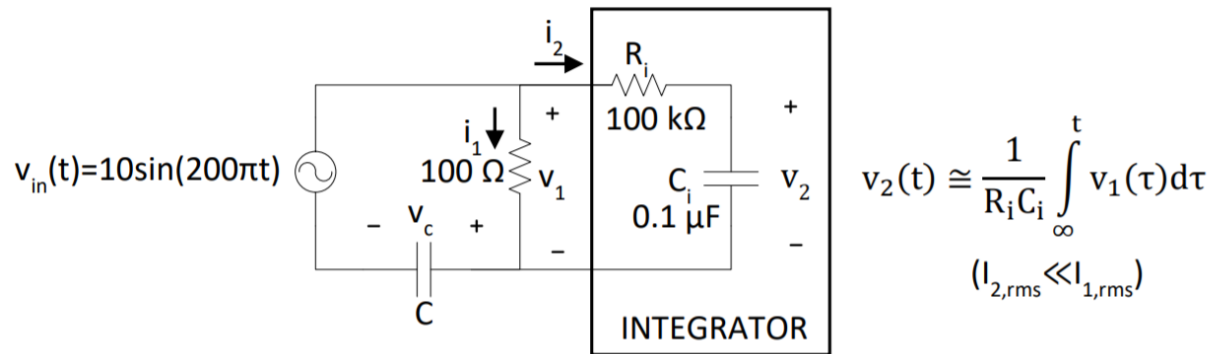


Figure 6: Circuit for the capacitance finding method

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Experiment 7 step 4

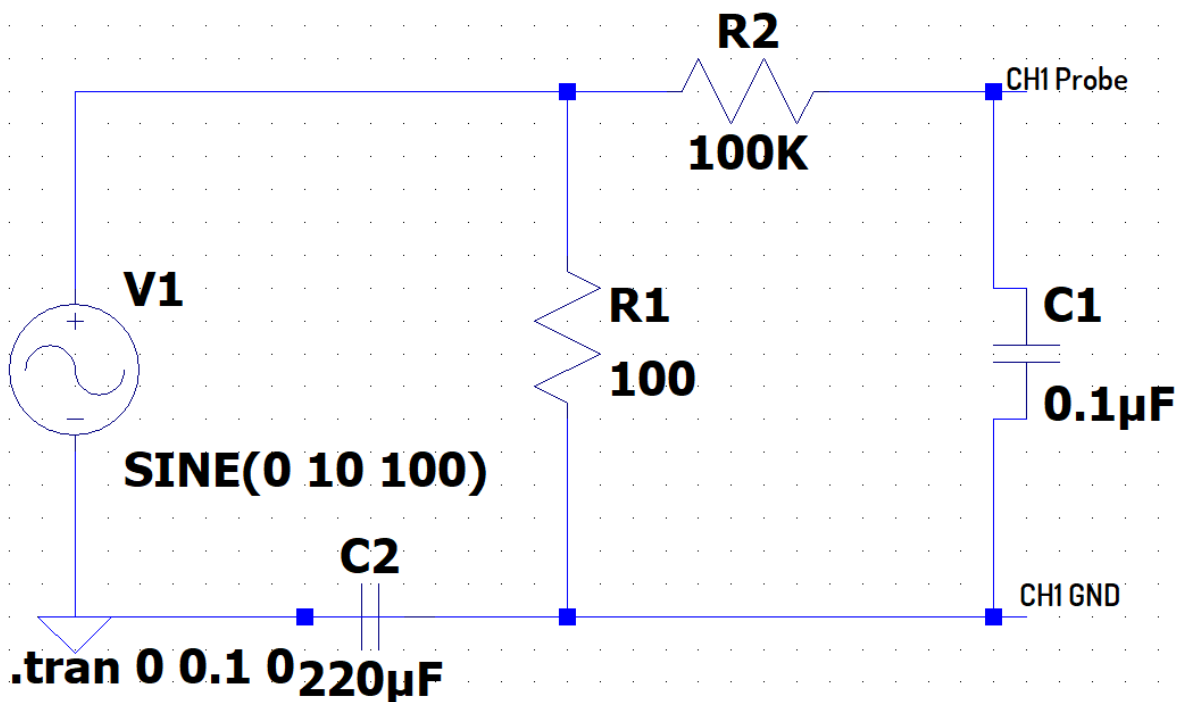


Figure 7: Simulation circuit for the capacitance finding method

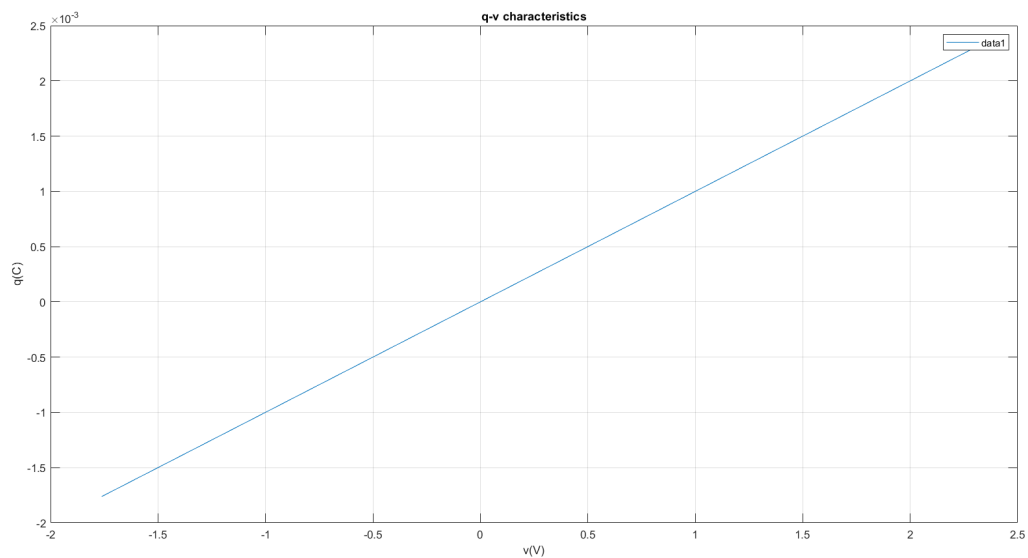


Figure 8: q-v characteristics

2.5 Step 5

Table 2: Measurements for the wooden inductor circuit

| | Inductor | Resistor |
|-----------------|-----------|----------|
| Voltage Reading | 0.68321 V | 1.862 V |

Table 3: Measurements for the compact inductor circuit

| | Inductor | Resistor |
|-----------------|-----------|----------|
| Voltage Reading | 0.59929 V | 1.912 V |

Table 4: Measurements for the inductors

| | Wooden | Compact |
|--------------------|----------------|----------------|
| LC Meter Reading | 0.15 H | 0.08 H |
| Resistance Reading | 29.13 Ω | 3.950 Ω |

2.6 Step 6

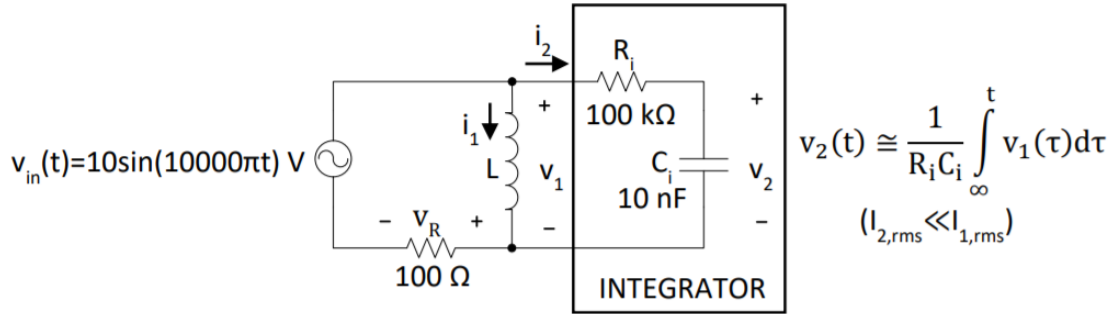


Figure 9: Circuit for the inductance finding method

2.6.1 a)

2.6.2 b)

3 Conclusion

In conclusion, in experiment 6, "Operational Amplifiers-II," as students, we have learned how various functional circuit setups of Op-Amps can be constructed. Preliminary laboratory work is done via simulations of the Op-Amp circuits in an LTSpice environment and by hand calculations. As students, we have observed how the amplifying job can be done in two-stage and its advantages. We have seen the effect of non-linear feedback on the Op-Amp setup. The characteristics of the negative resistance converter are observed. Also, implementing darkness and lightness sensors has experienced a real-life design approach. Lastly, a difference amplifier circuit is set, and the characteristics are observed with measurements. To sum up, in this experiment, as students, we have experimented with how different kinds of operational amplifier circuits operate.

Appendix I

Total time spent on/during:

- Pre-lab preparation: 6.5 hours (including the preliminary work and simulations)
- Experimental work: 2 hours (hours spent in lab)
- Report writing: 6 hours

Appendix II

The outputs of the simulations are fetched from LTSpice and plotted in MATLAB.