Experiment 6
Operational Amplifiers-II

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Contents

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, the basic 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. The results of the steps were recorded and plotted for further comments.

2 Experimental Results

In this section, the results of Experiment 6 are discussed. Before the experiment begins, necessary adjustments are made to the DC power supply. LM 741 operational amplifier integrated circuit is used in this experiment.

2.1 Step 1

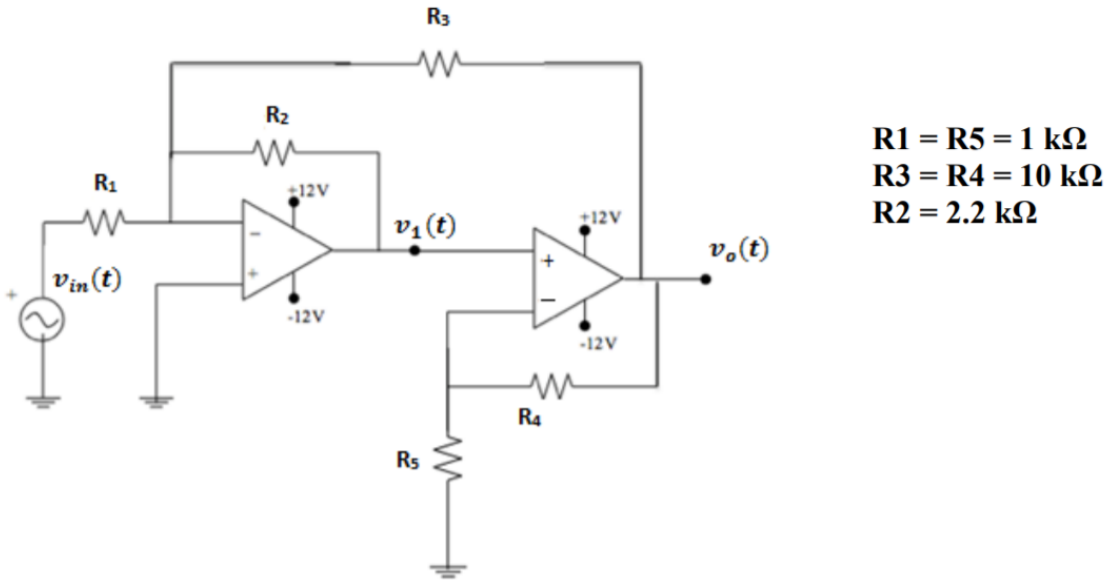


Figure 1: Circuit schematic for Step 1

2.1.1 a)

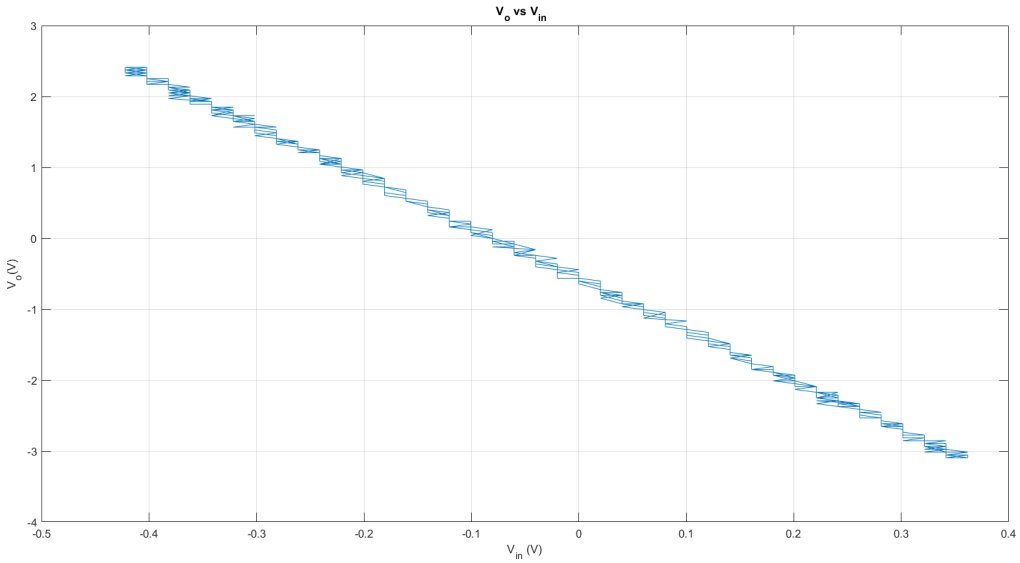


Figure 2: V_o vs V_{in}

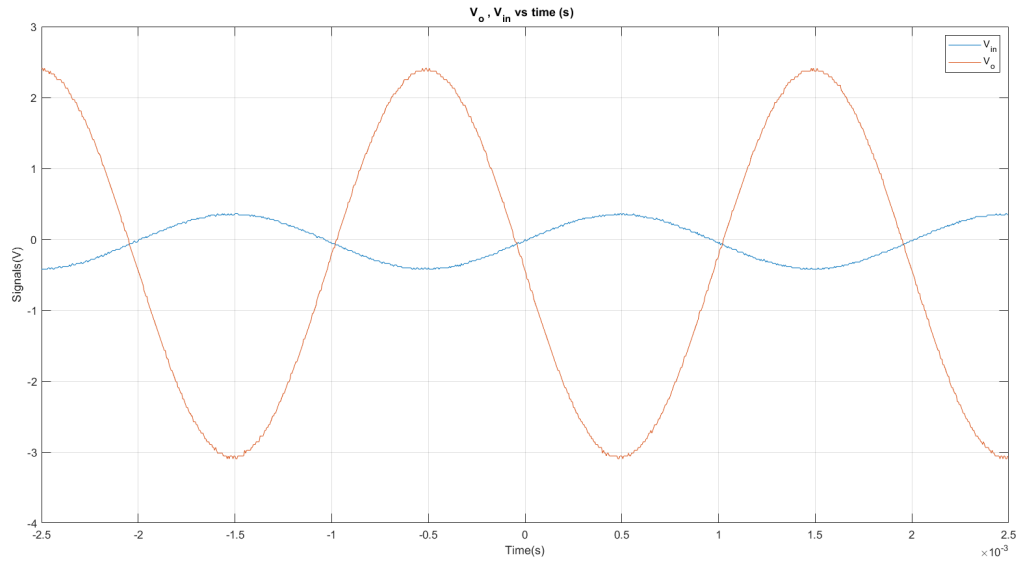


Figure 3: V_o , V_{in} vs time (s)

2.1.1.1 Comparison with the simulation results

asdasdasdasd

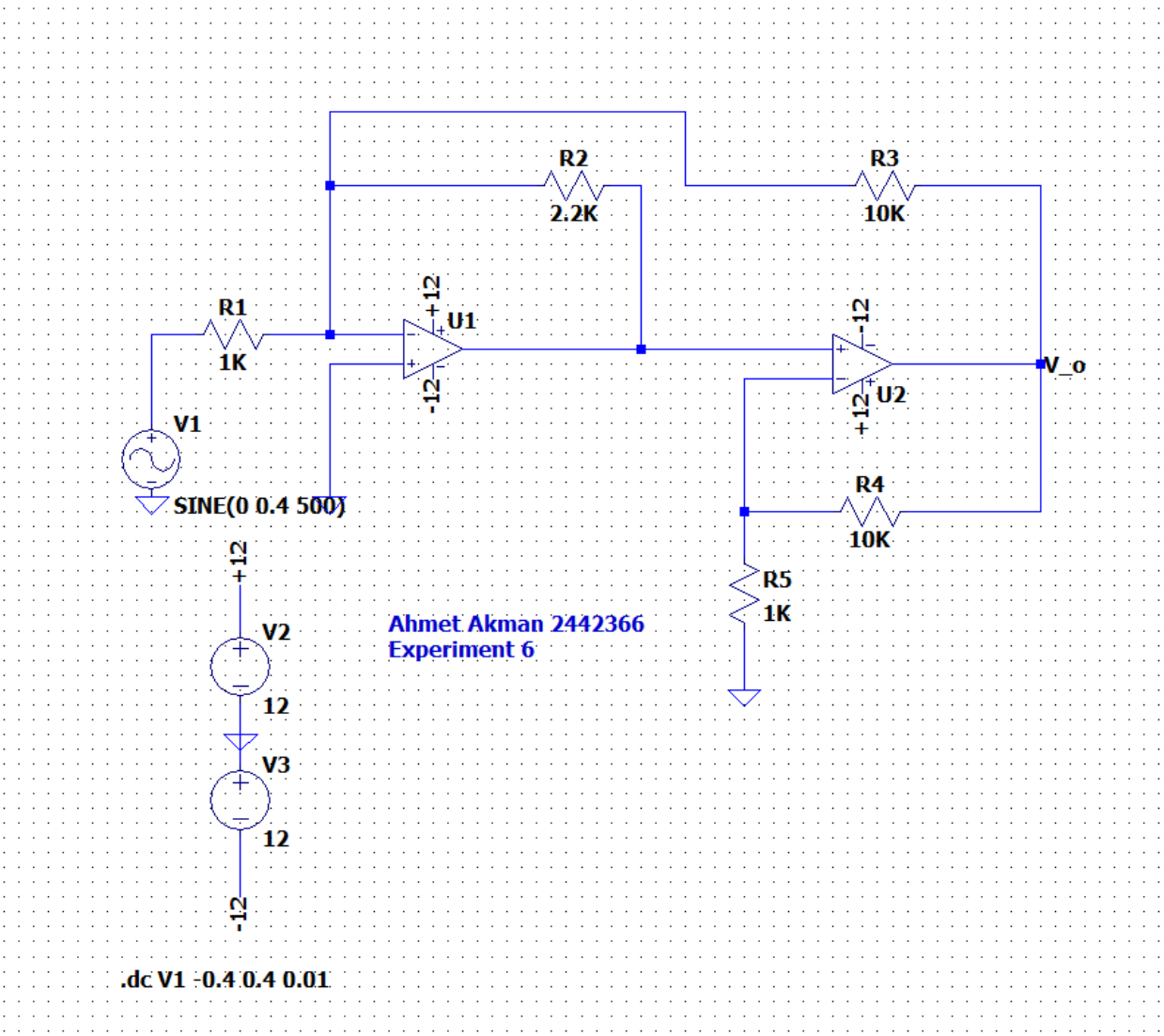


Figure 4: LTSpice schematic for the simulation 1a

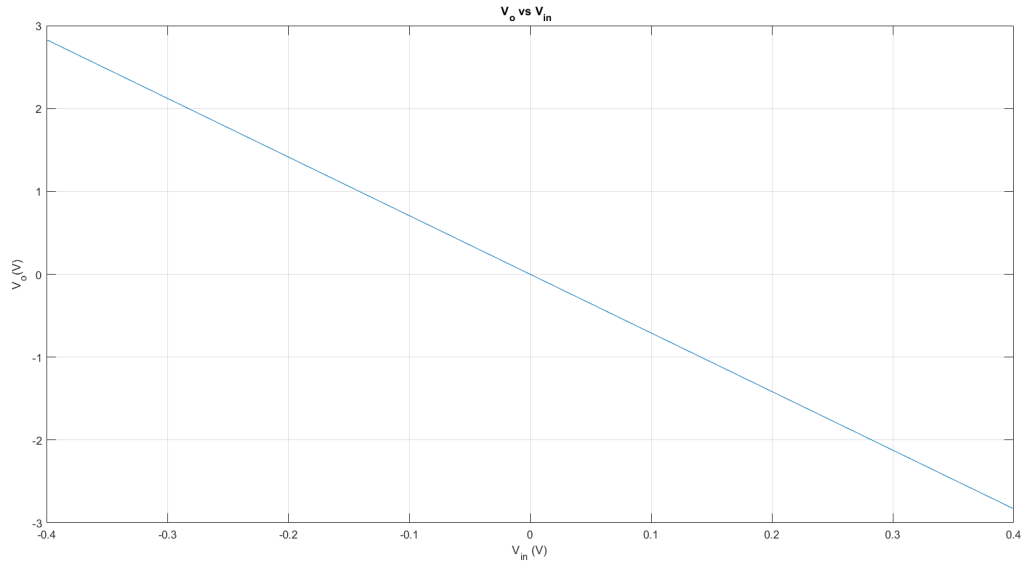


Figure 5: V_o vs V_{in}

2.1.2 b)

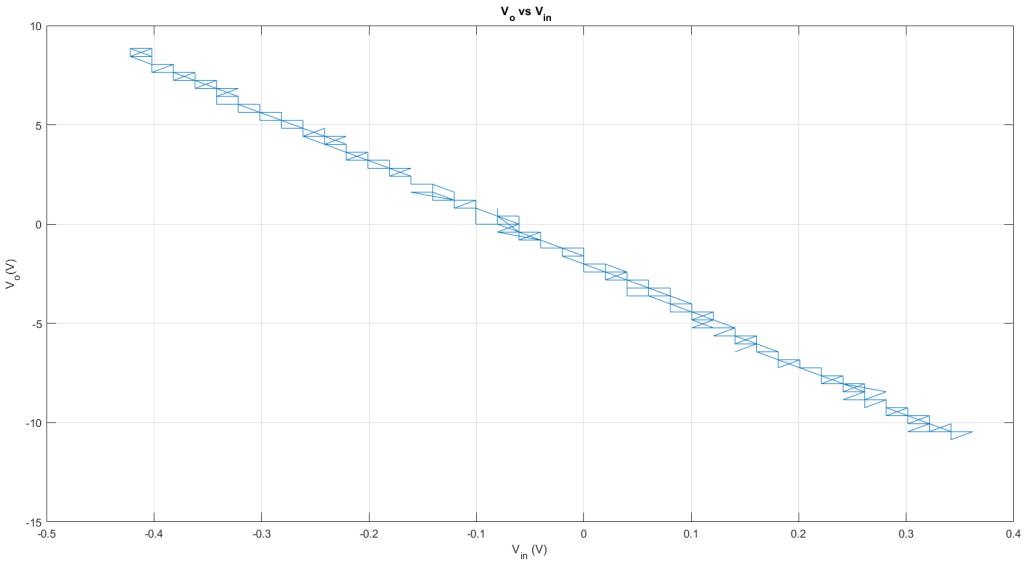


Figure 6: V_o vs V_{in}

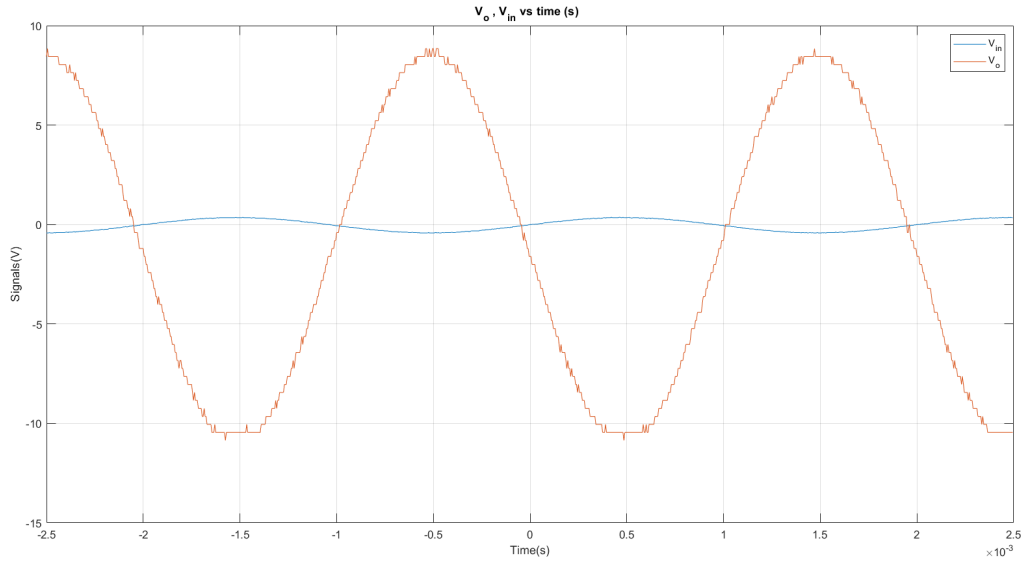


Figure 7: V_o , V_{in} vs time (s)

2.1.3 c)

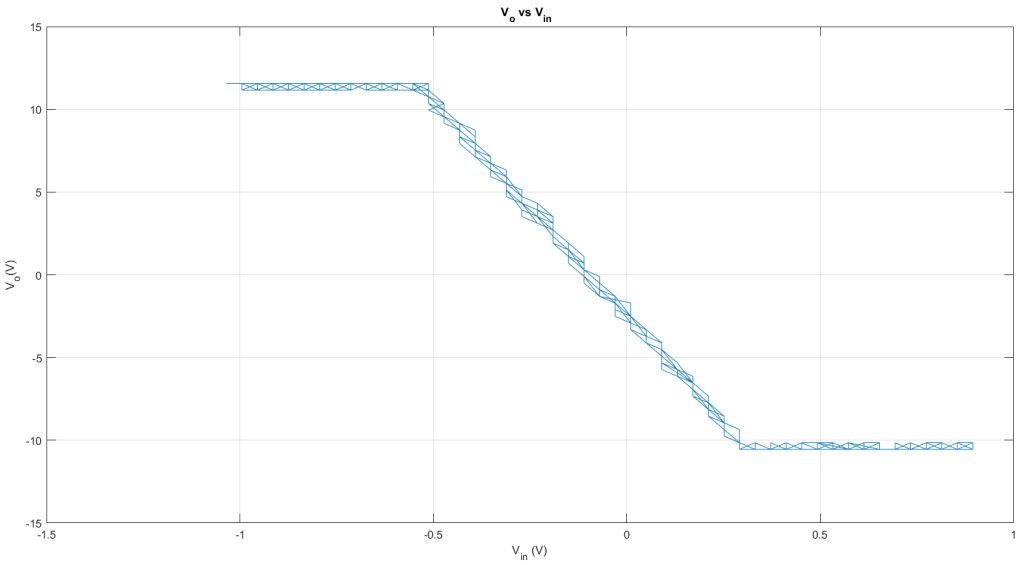


Figure 8: V_o vs V_{in}

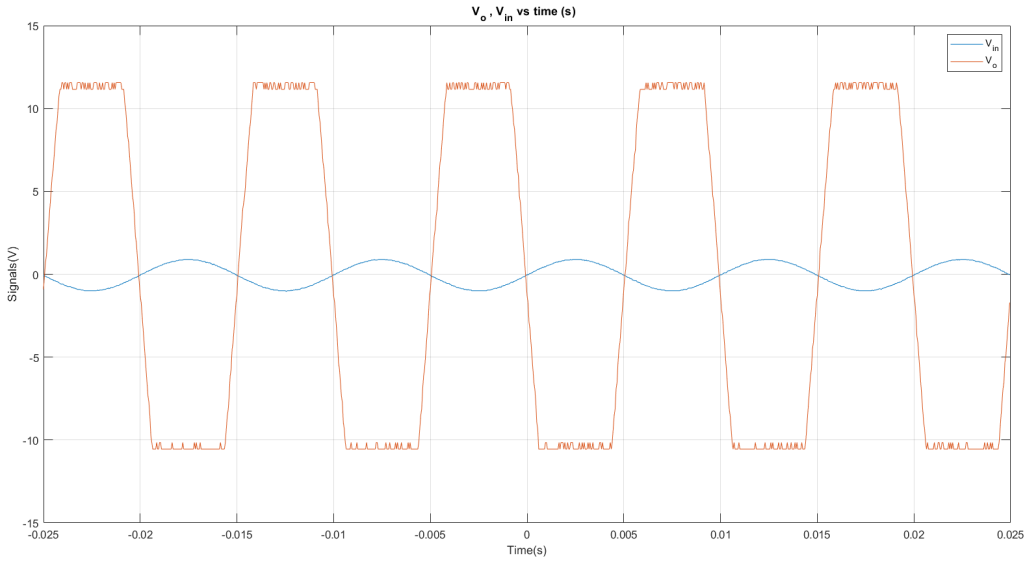
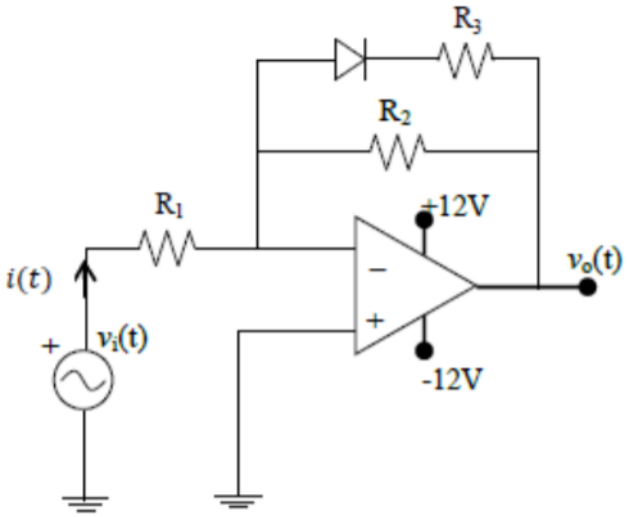


Figure 9: V_o , V_{in} vs time (s)

2.2 Step 2



R1 = R2 = R3 = 1 kΩ

Figure 10: Circuit schematic for Step 2

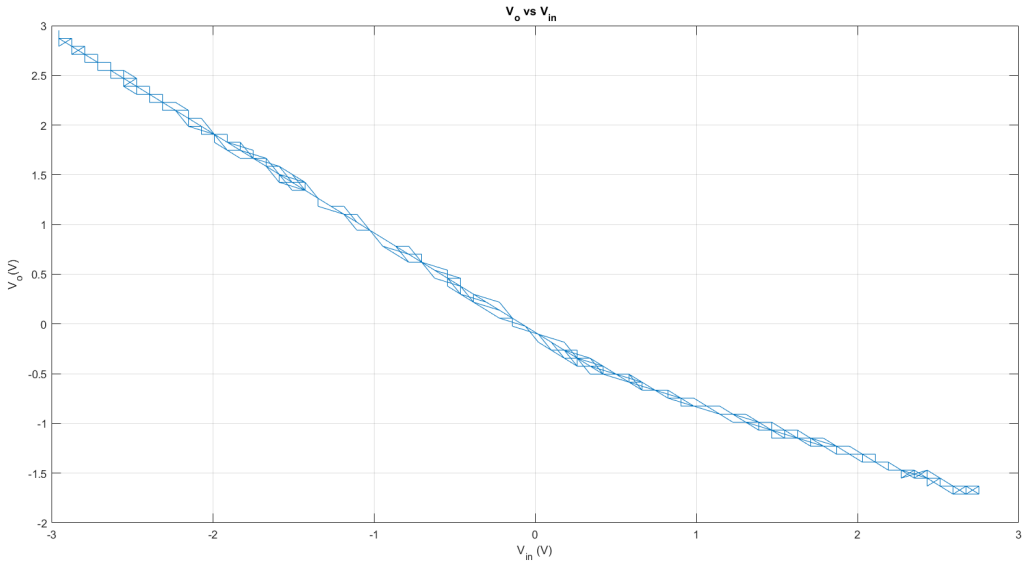


Figure 11: V_o vs V_{in}

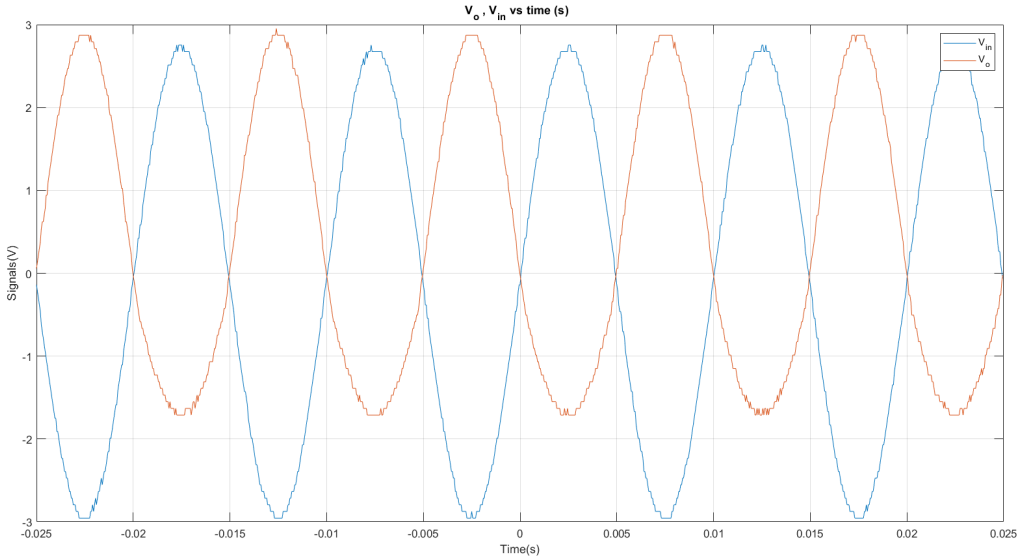


Figure 12: V_o , V_{in} vs time (s)

2.2.1 Comparison with the simulation results

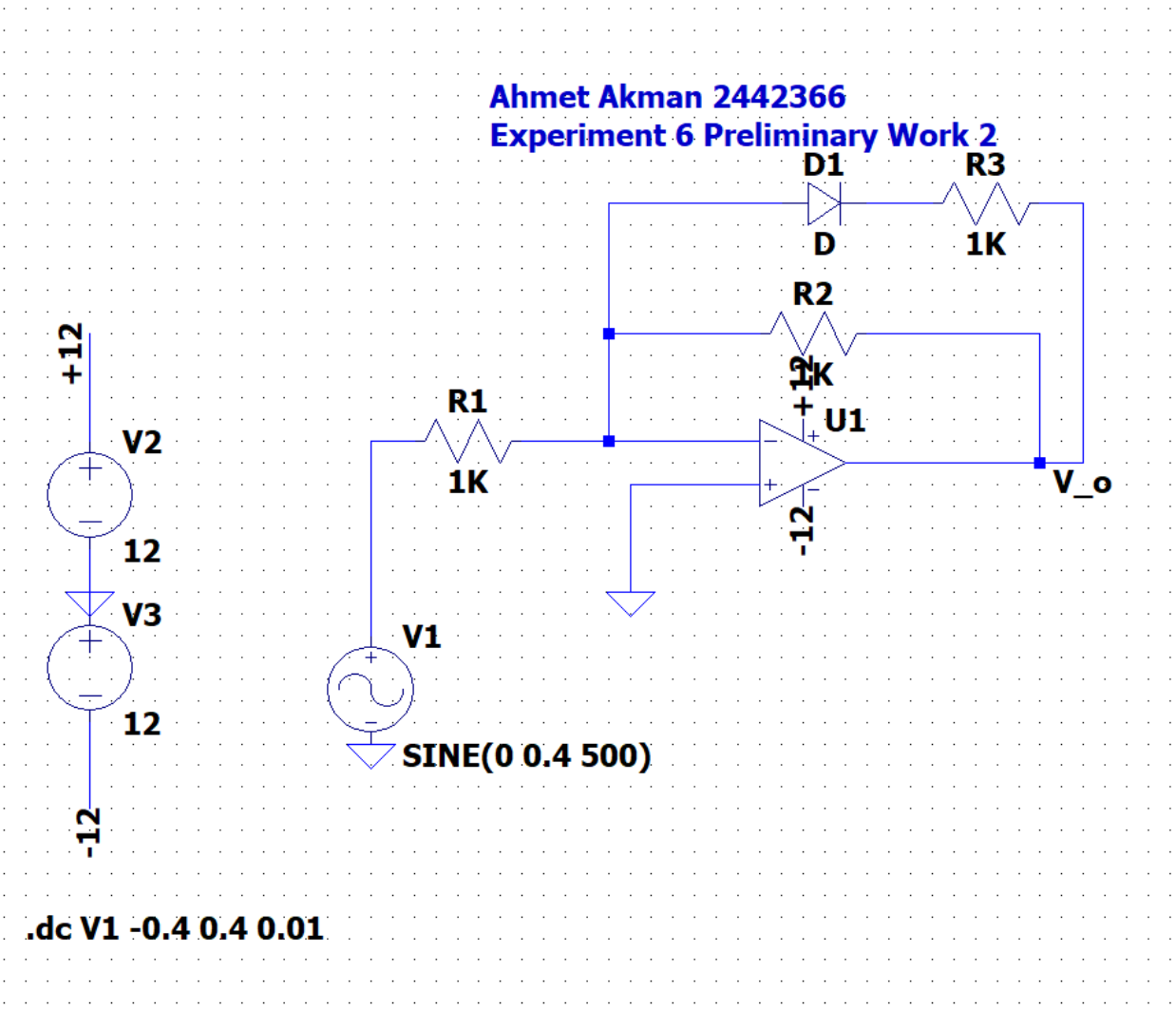


Figure 13: LTSpice schematic for the simulation 2

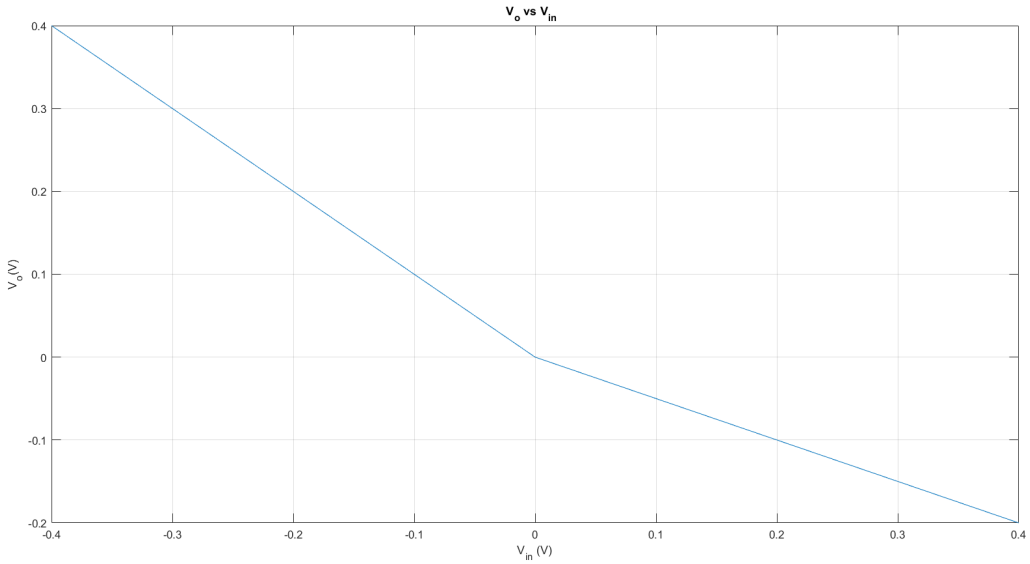


Figure 14: V_o vs V_{in}

2.3 Step 3

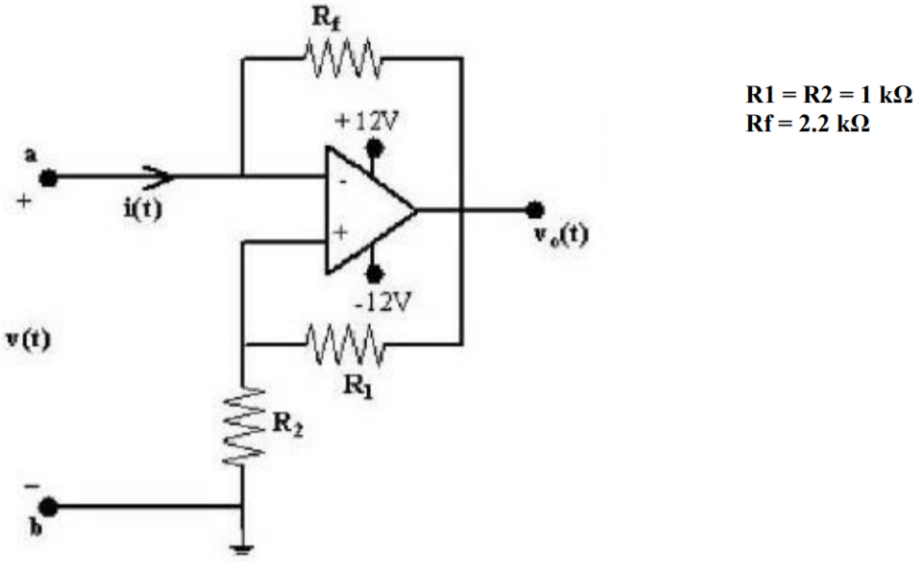


Figure 15: Circuit schematic for Step 3

2.3.1 a)

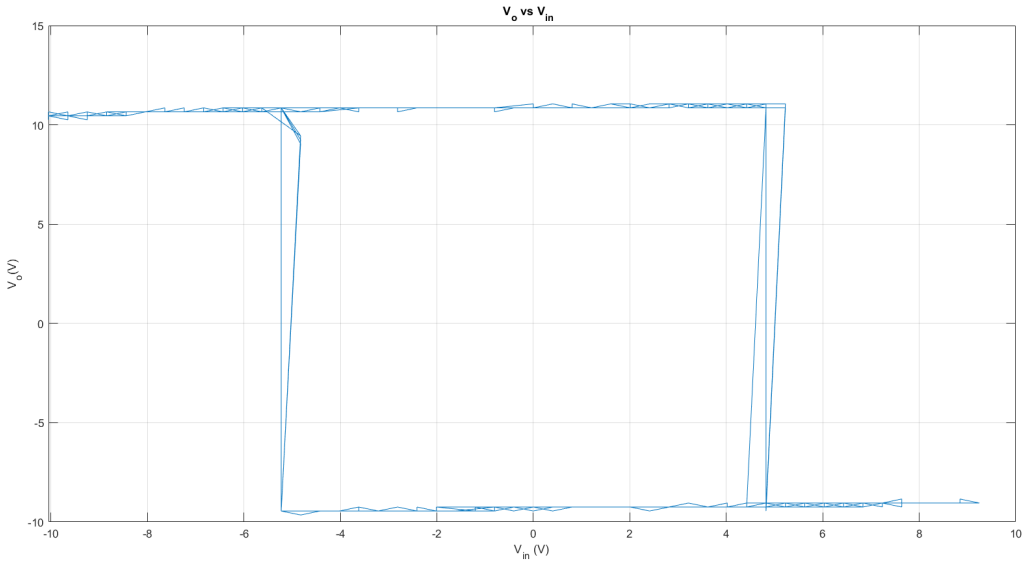


Figure 16: V_o vs V_{in}

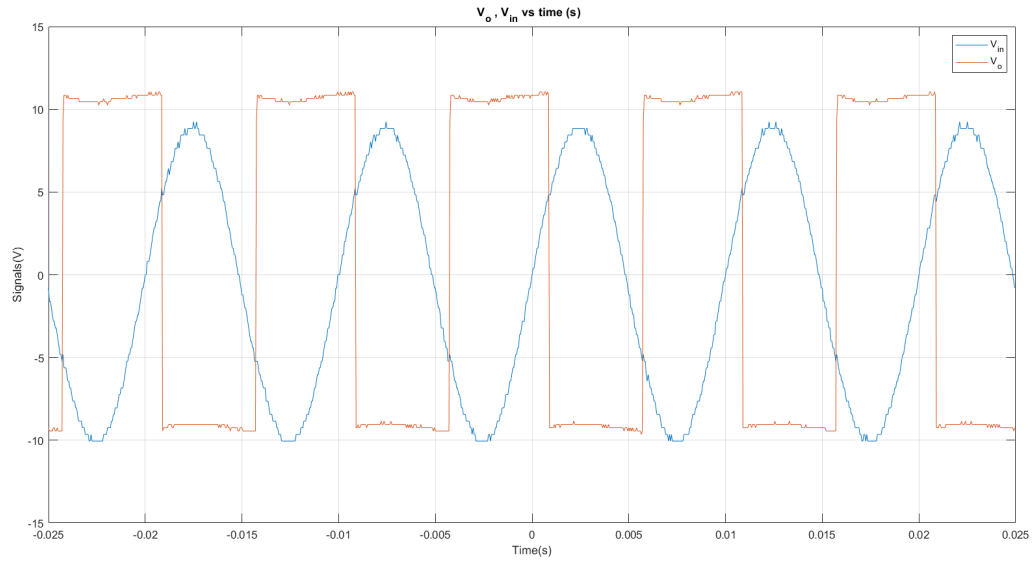


Figure 17: V_o , V_{in} vs time (s)

2.3.2 b)

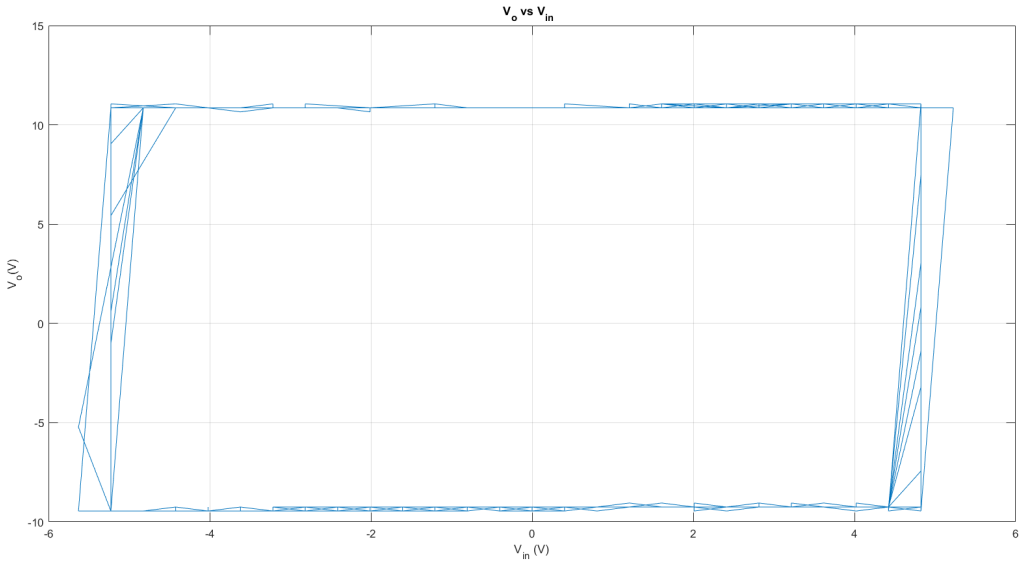


Figure 18: V_o vs V_{in}

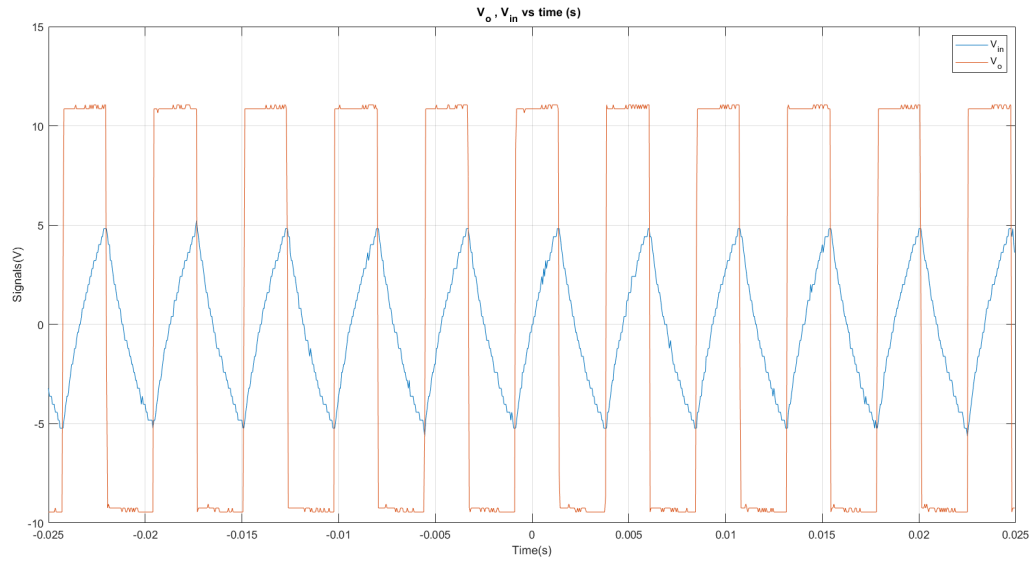


Figure 19: V_o , V_{in} vs time (s)

2.3.3 c)

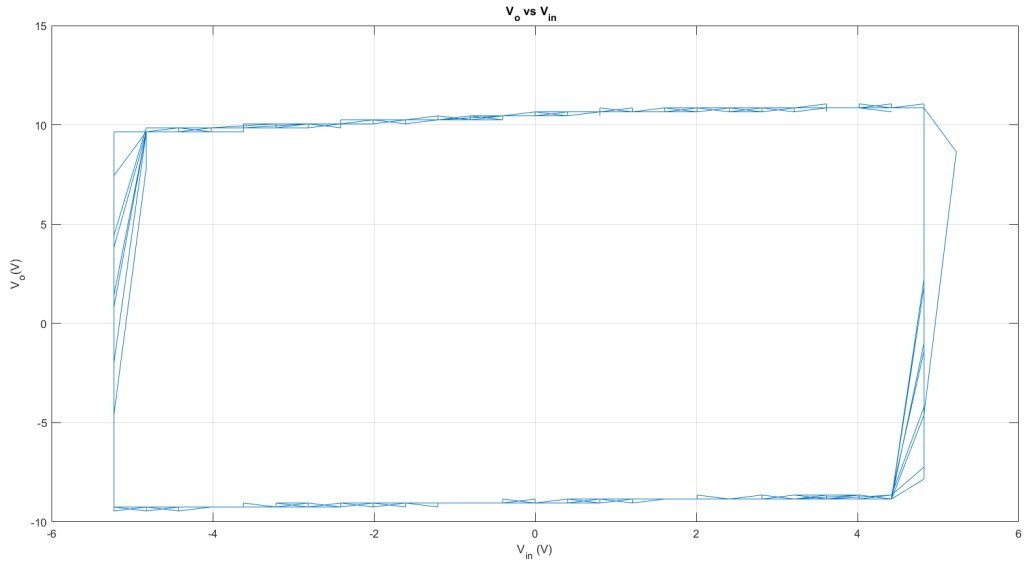


Figure 20: V_o vs V_{in}

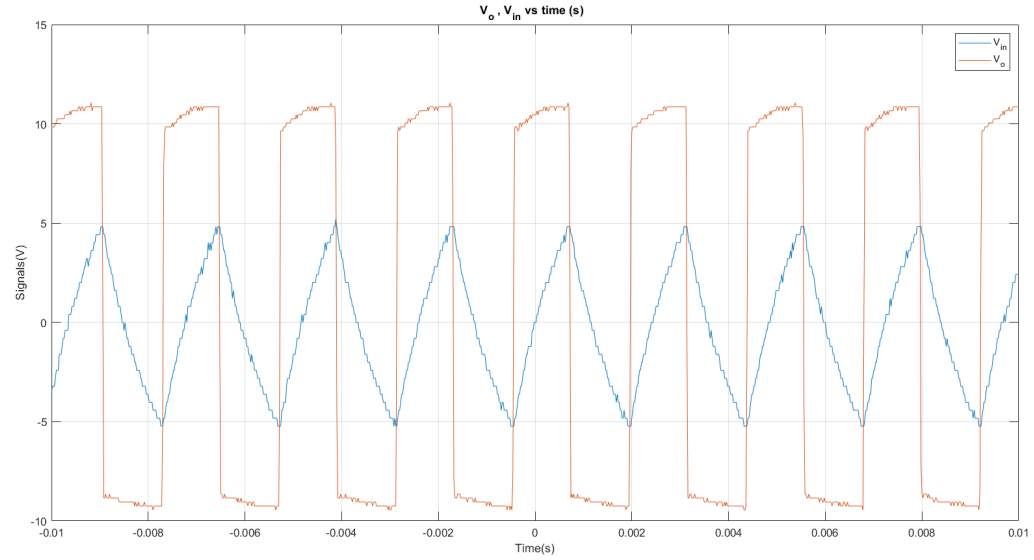


Figure 21: V_o , V_{in} vs time (s)

2.3.4 d)

2.4 Step 4

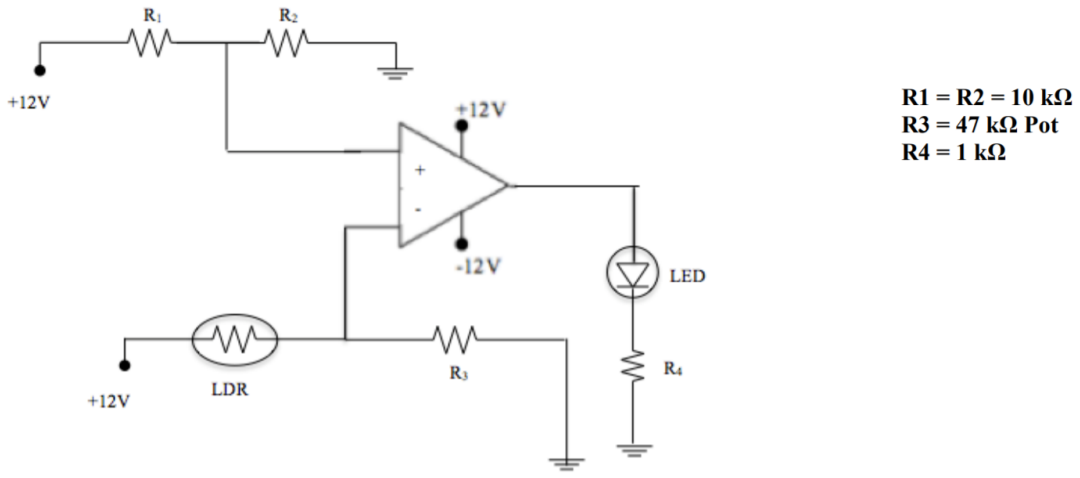


Figure 22: Circuit schematic for Step 4

2.4.1 a)

2.4.2 b)

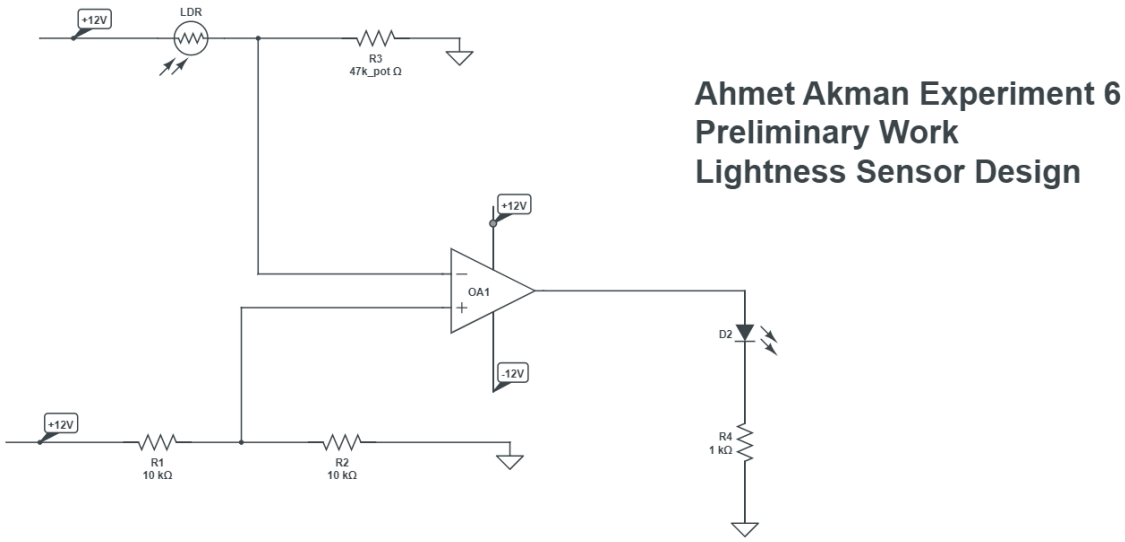


Figure 23: Lightness sensor circuit schematic for Step 4 part b

2.4.3 c)

2.5 5

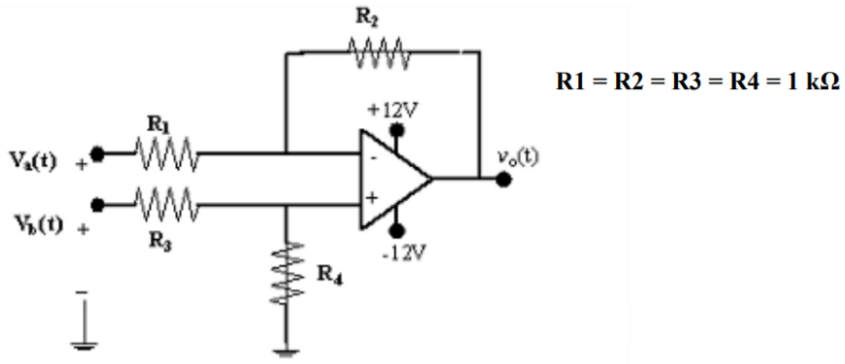


Figure 24: Difference amplifier circuit schematic for Step 5

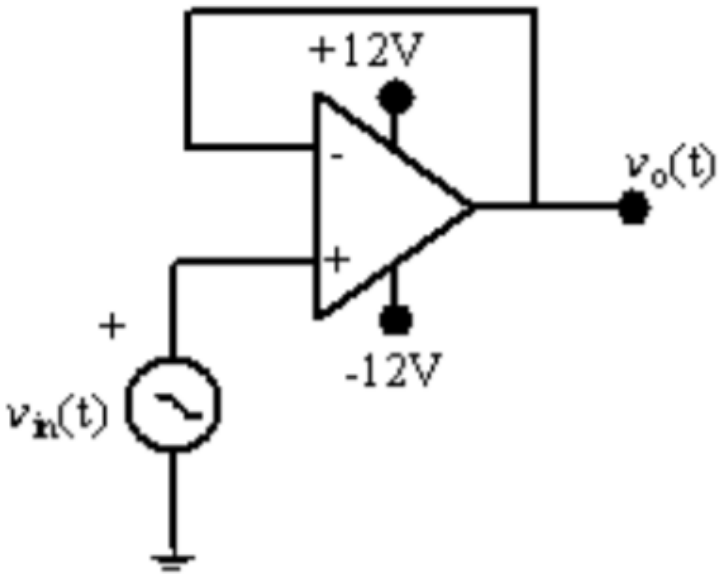


Figure 25: Buffer circuit schematic for Step 5

3 Conclusion

In conclusion, in experiment 5, "Operational Amplifiers," as students, we have learned how basic circuit setups of Op-Amps can be constructed. Preliminary laboratory work is done via simulations of the basic Op-Amp circuits in an LTSpice environment. As students, we have

observed different characteristics of Op-Amp comparator, buffer, non-inverting, inverting, and summing configurations, and we have learned how voltage divider should be used when there is a load to the output terminal. To sum up,in this experiment, as students, we have experimented with how operates different kinds of operational amplifier circuits and how to work with voltage dividers.

Appendix I

Total time spent on/during:

- Pre-lab preparation: 6 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.