

Electronic System Design Capsule Spring 2024

Laboratory Work #4

Overview

- The aim of this lab work is to introduce you Operational Amplifiers.
- The lab work is based on the questions/guidelines given below. Your results should be presented in the form of a report including the pre-lab tasks. The submission deadline for pre-lab reports is **Wednesday midnight of the lab manual publication week**, and for lab reports, it is **Sunday midnight of the laboratory week**. (All students must submit their pre-lab reports within the designated week, irrespective of their scheduled lab session.)
- The submissions should be done on Canvas. Submission of the reports by only one of the group members is enough with the condition that the names of all the group members are clearly shown on the cover page of your report.
- Note that lab reports explain what you did, what you observed, and how you explain these observations. These are the key questions that you need to give answers to.
- Be careful about the units in your plots and calculations. Especially, the axes of the plots should have titles and units.
- Show your measurements with clearly taken photos or exported images from the appropriate equipment. Make sure that you draw your circuit, show your calculations, and analyse your results based on these.

Pre-Laboratory Task:

Before engaging in the laboratory exercises, you should complete the following pre-laboratory task:

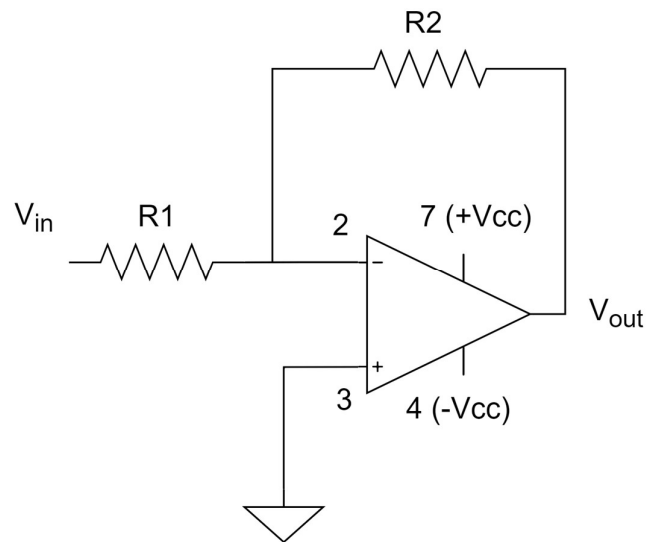
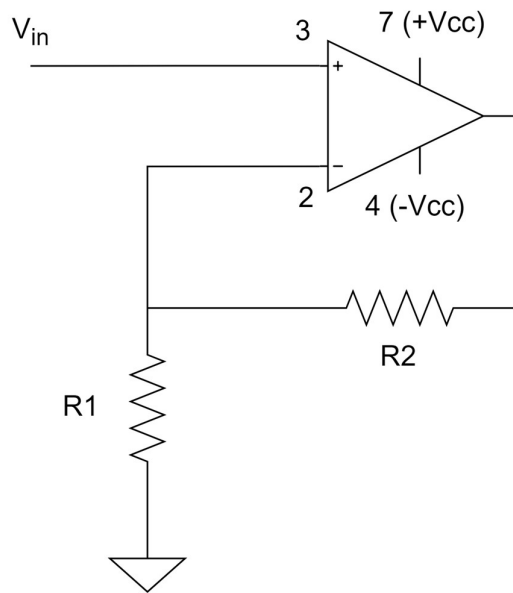
Theoretical Analysis:

- Analyse each circuit theoretically and calculate the expected values.

LTspice Simulations:

- Implement each circuit in LTspice and conduct simulations to validate the anticipated outcomes. Ensure that LTspice simulation results are labelled appropriately and complement the theoretical analysis.

Laboratory Exercises



Built the first circuit and apply the followings. Then repeat the same things for the second circuit.

Apply a sinusoidal signal for V_{in} with 100 mV amplitude and 1 kHz frequency. Use resistor value $R1=100\Omega$ and $R2=2.2k\Omega$.

- Observe the input voltage (V_{in}) and the output voltage (V_{out}) of the circuit.
- Slowly increase the amplitude of the input voltage (V_{in}) while monitoring the output voltage (V_{out}) on the oscilloscope. Determine the maximum amplitude of V_{in} at which the output voltage (V_{out}) begins to show signs of clipping. Explain Clipping.

Hint: You need two power sources (or one with two terminals). You need to connect negative terminal of one power source to positive terminal of the other one as follow.

