Lab 5: Operational Amplifier Application: Electronic Security System Design: Part 2 of 2

ECEN 214 - 517

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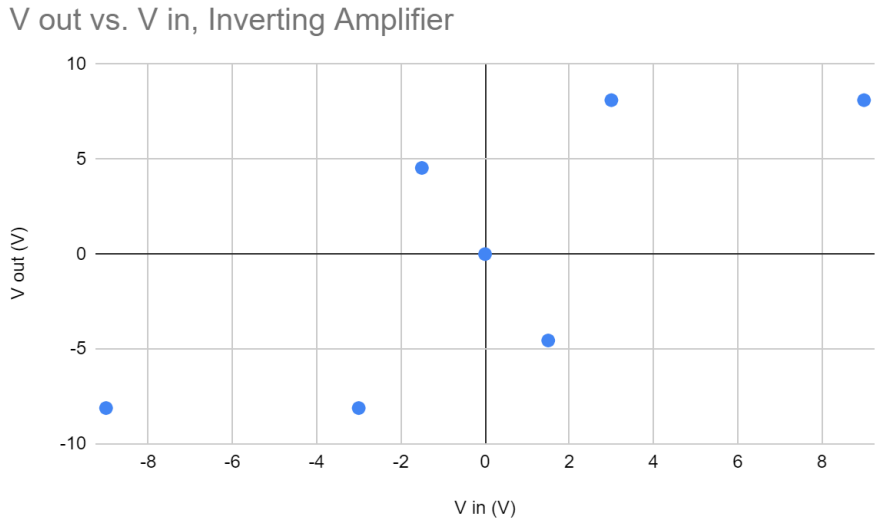
Due Date: October 21, 2020

Task 1

For Task 1 in this lab, the student is required to produce multiple voltages in the range between -9V and +9V while using the resistors of 3.3k Ohm and 10k Ohm. We provided results for various voltages, which are -9V, -3V, -1.5V, 0V, +1.5V, +3V, +9V. When the amplifier did not saturate, there was a gain of about 3.03.

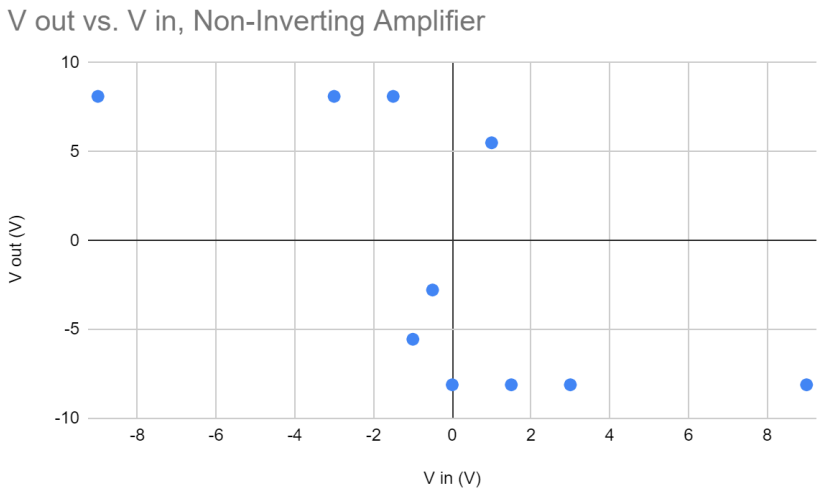
V_{in}	V_{out}
-9	-8.11
-3	-8.11
-1.5	4.54
0	0
1.5	-4.55
3	8.11
9	8.11



Task 2

In task 2, we created a non-inverting amplifier and followed the same procedures as in task 1. Throughout testing, the amplifier saturated for many of the tested values, so additional smaller values for V_{in} were also tested. The amplifier showed a gain of about 5.5 for the values of V_{in} in which the amplifier did not saturate.

V_{in}	V_{out}
-9	8.11
-3	8.11
-1.5	8.11
-1	-5.55
-0.5	-2.78
0	-8.11
1	5.5
1.5	-8.11
3	-8.11
9	-8.11



Task 3

We recreated the circuit shown in the figure and used 1 Ohm resistors to limit the current through the LEDs. When the voltage V_0 is set to 0 V, all of the voltage drops occurs in the section with the red LED and its respective resistor, so the red LED lights up. There is no voltage drop across the green LED, so it doesn't light. When $V_0 = 1.5$ V, there is still enough voltage across the red LED for it to light, while there is still not enough voltage across the green LED for it to light. However, when $V_0 = 3$ V, there is not enough of a voltage drop across either LED for

them to light up, so both stay dim. When $V_0 = 9$ V, all the voltage drop is in the section with the green LED and its respective resistor, so the green LED lights up while the red stays dim. There were no values of V_0 that allowed both LEDs to light up.

Task 4

For task 4, the students are required to build their circuit based on either Figure 5.6 or 5.7. This is where we determined whether our op-amp should be inverting or non-inverting. Since our circuit from lab 4 had positive output, we chose to make the op-amp non-inverting, so the output of the present circuit would also be positive. This concludes that a positive input through a non-inverting op-amp will result in a positive output. When the IR beam is obstructed the red LED lights up and when it's unobstructed the green LED turns on, this is then demoed.