

Operational Amplifiers

Circuits & Signals

EECE2150

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0 Introduction

The purpose of this laboratory experimentation is to familiarize oneself with the concept of operational amplifiers, as well as supporting circuit construction. By applying the idea of operational amplifiers in real-world scenarios, a more thorough understanding is developed.

1 Building and Testing

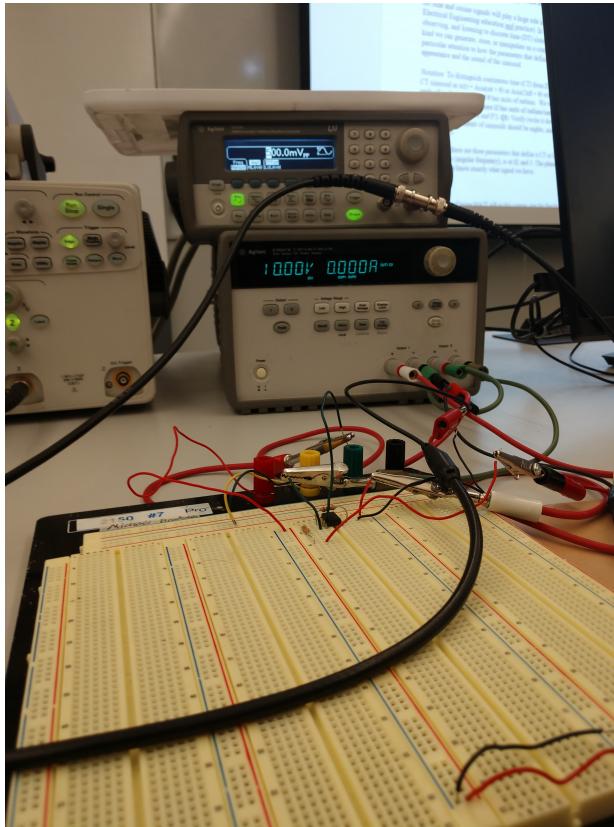


Figure 1: Operational Amplifier Circuit

1.1 Q1

According to the oscilloscope readings, the gain of the system is approximately $V_o/V_{in} = \mp 10/\pm 1 = -10$

1.2 Q2

This does agree with the predicted value, as it should be nearly 10 due to the ratio of the feedback resistor to the initial resistor.

1.3 Q3

It is evident that the gain is negative because the output voltage is a sine wave mirrored about the x -axis, as shown in Figure 2. Thus, due to the phase difference, it is the negative equivalent of the input voltage.

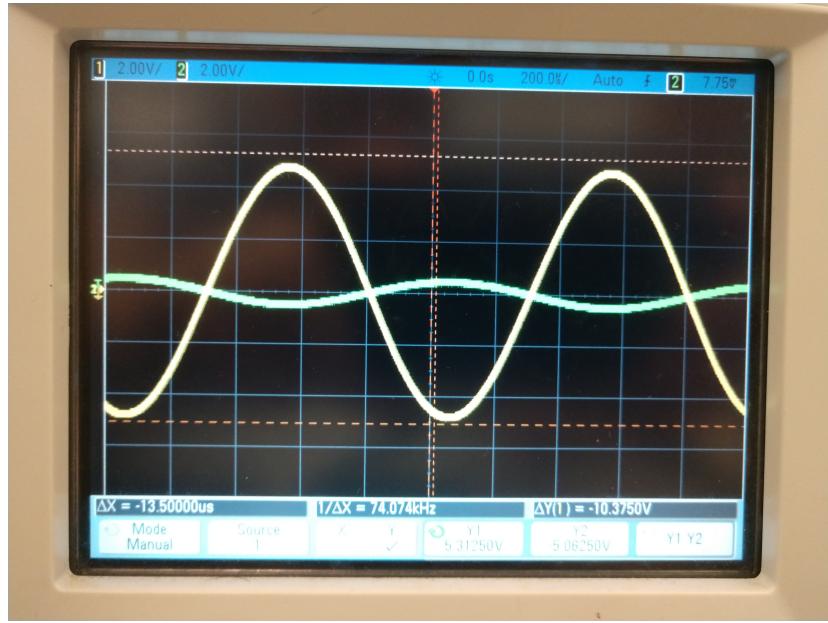


Figure 2: Oscilloscope Reading¹

1.4 Q4

Upon increasing the peak-to-peak voltage, the amplitude of both waves increased. The input voltage now had an amplitude of 1.2[V], and the second wave had an amplitude of $-10(1.2) = -12[V]$. One thing to note, however, is that the output voltage wave hit the oscilloscope display threshold, effectively limiting it to only 10[V] peaks.

1.5 Q5

This was accomplished by constructing a simple voltage divider to achieve the desired voltage output. Two resistors, one of $9[k\Omega]$ and another of $1[k\Omega]$ were daisy-chained together and placed in the circuit (connected to the DC generator) as if it was a single resistor with 1[V] across it.

1.6 Q6

The circuit output is shifted up by 1[V], as all alternating current values are increased by the 1[V] constant direct current voltage.

1.7 Q7

This is the expected result, as, due to the constant value of the DC output, as compared to the AC, 1 volt would be added to the AC value at every point.

2 Conclusion

Overall, this laboratory experiment allowed us to develop a fully-working operational amplifier circuit; in doing so, the concepts became much clearer than they were in in-class presentations. As such, a solid foundation for this concept was fabricated.