ELE 504 Lab Report 3

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Introduction

Op-Amps often have different qualities depending on how they were manufactured and how much they cost. When designing an Op-Amp circuit in a practical situation, it is important to find the most cost effective design for the desired specification and characteristics such as Slew-Rate and open-loop bandwidth need to be considered in order to make design decisions. This lab will take a look at two different Op-Amps and how they can both be used to meet design specifications through smart design decisions.

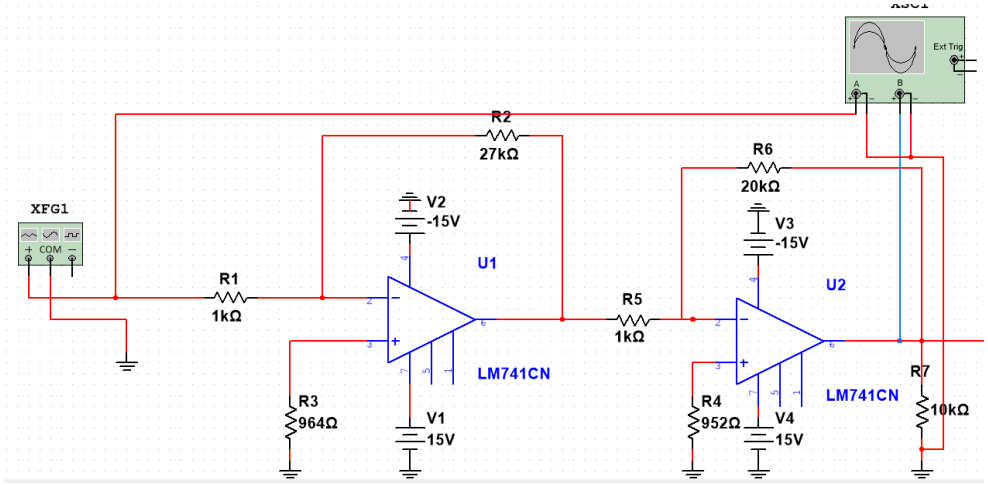
Objective

The objective of this lab is to understand the bandwidth limitations of an inverted amplifier circuit produced by the Slew-Rate and finite open loop bandwidth. From the conclusions drawn, we are to design a practical audio amplifier and choose the most appropriate values for resistors and minimize the effect of bandwidth constraints.

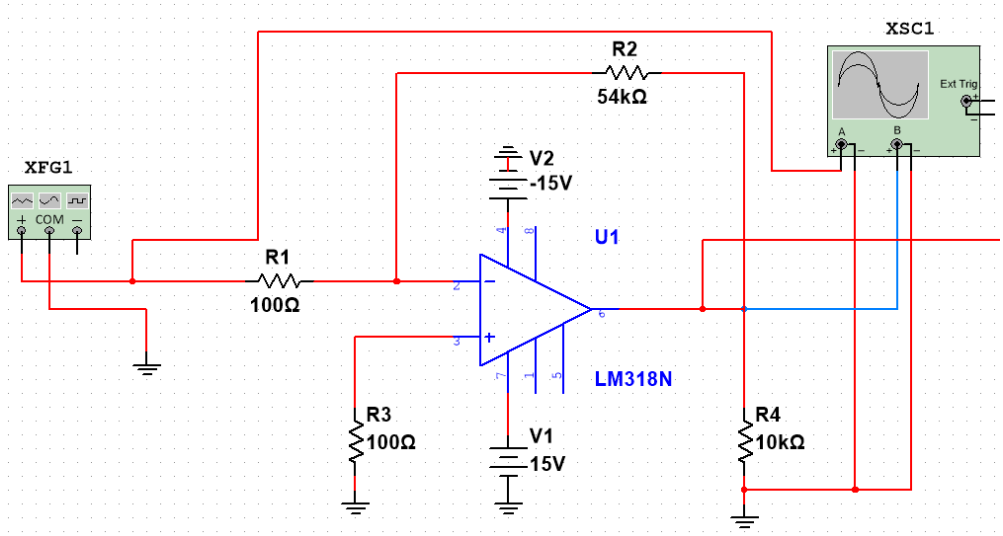
- *Note that K = 540 and v(i-peak) = 5mV was used to derive the designs.*

Circuit Screenshots

Part a



Part b



Results and Tables

The input voltage used has a peak to peak of 10mV, so all calculations for voltage gain were made using an input peak voltage of 5 mV. All output voltage peak values were taken from oscilloscope readings using the built in cursors.

Table 1 for Part a

	Frequency data points =>	100Hz	1KHz	20KHz	100KHZ
Circuit Design #1	Measured peak output voltage, Vo_{peak}	2.7V	2.6985V	2.25V	1.027V
	Computed voltage gain, (Vo_{peak}/ Vi_{peak})	540	539.7	450	205.4

Table 2 for Part b

	Frequency data points =>	100Hz	1KHz	20KHz	100KHZ
Circuit Design #2	Measured peak output voltage, Vo_{peak}	1.925V	1.925V	1.925V	1.6125
	Computed voltage gain, (Vo_{peak}/ Vi_{peak})	385	385	385	322.5

Figure 1 for Part a

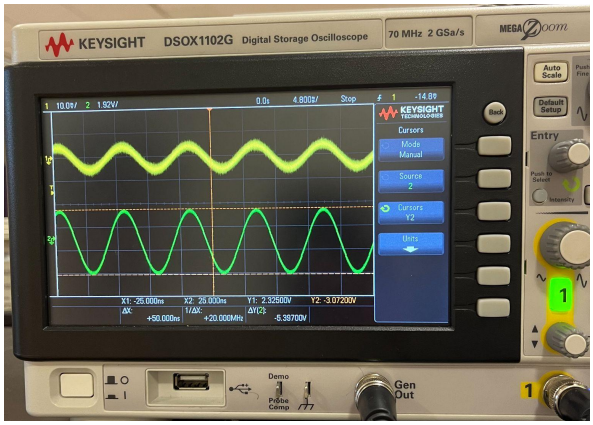


Figure 2 for Part a

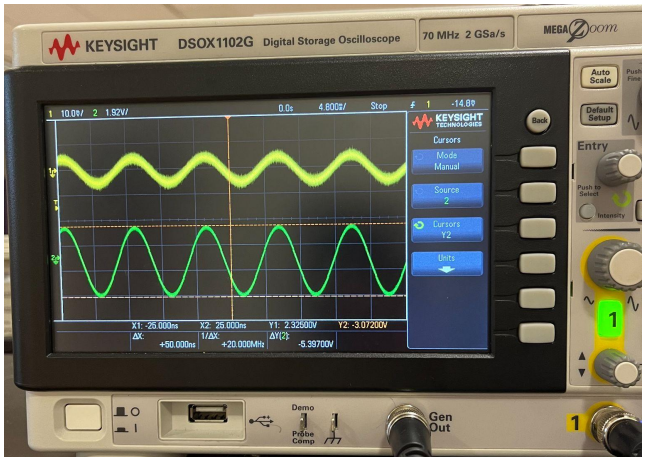


Figure 3 for Part a

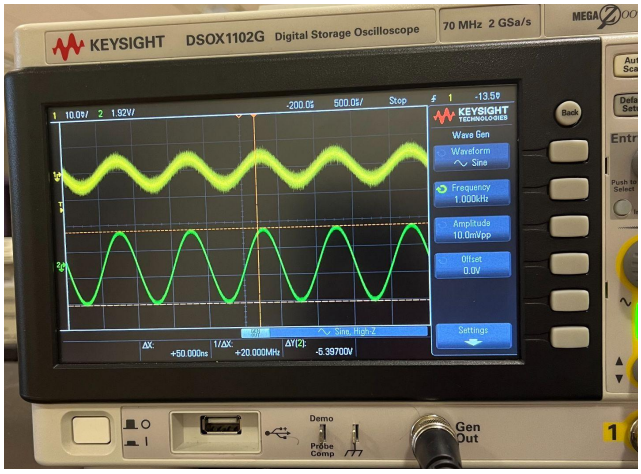


Figure 4 for Part a

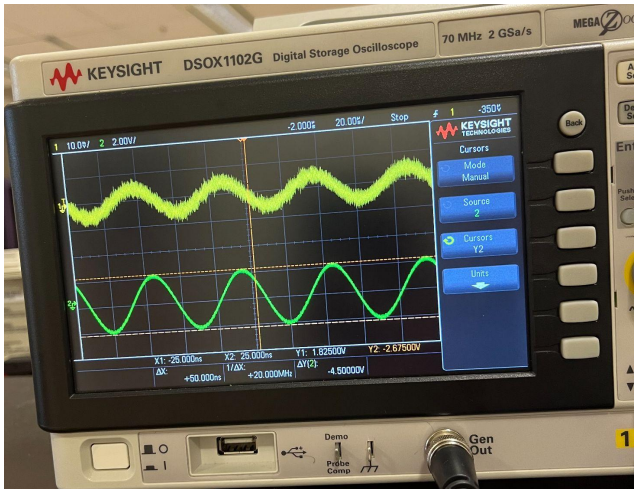


Figure 5 for Part a

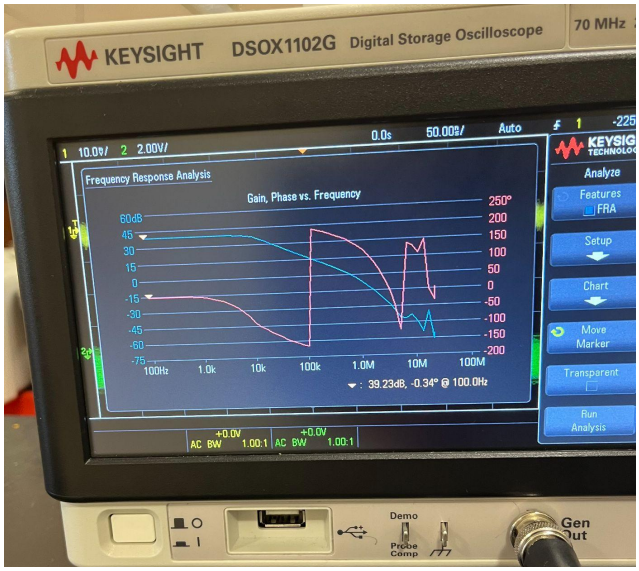


Figure 1 for Part b

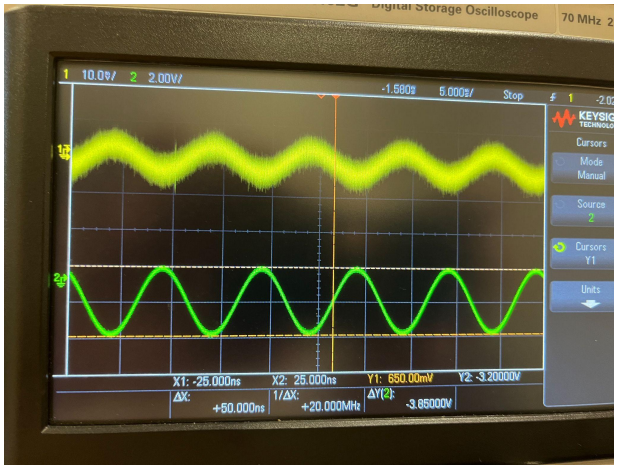


Figure 2 for Part b

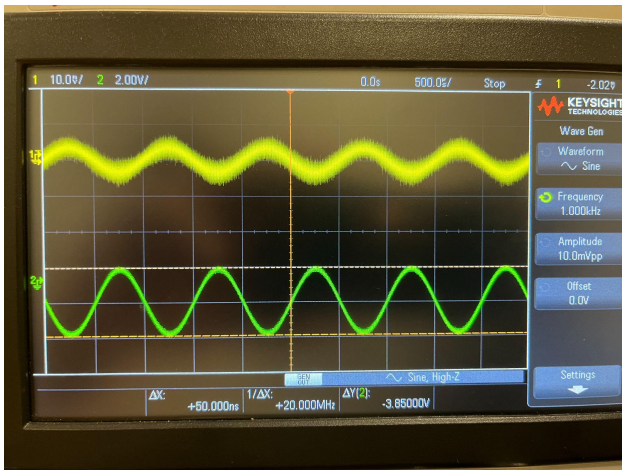


Figure 3 for Part b

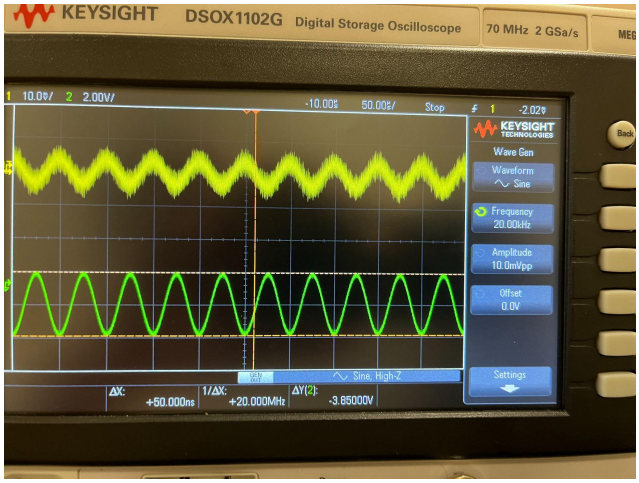


Figure 4 for Part b

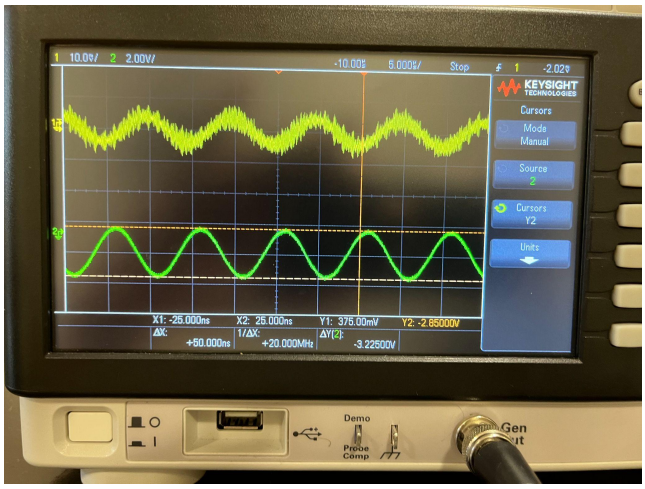


Figure 5 for Part b

Conclusion

After conducting the experiment, certain conclusions can be drawn. When looking at the first design, it was able to meet the requirements by splitting the circuit into two stages with two LM741CN op-amps. This was helpful as dividing the gain into two parts helped minimize the effect of the open-loop bandwidth on the effective bandwidth frequency. Although there was a small drop in the output voltage at 20kHz, it still met the design requirements, which aligned well with the prelab calculations. In the second design, one LM318N op-amp stage was used to meet the design requirements because the open-loop bandwidth for this specific amplifier was high enough to withstand the large voltage gain at frequencies well above 20kHz according to the prelab calculations. This was also observed in the lab as there was little to no drop off in the output voltage at 20kHz, however the gain was observed to be less than expected overall. In, general, both designs were able to meet the design specifications and both designs aligned quite well with the analysis conducted in the prelab.