

ECEN 325 – Electronics

Fall 2020

Lab 3: Report



Submitted by:

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Date Performed: Sept 15st, 2020

I. Objective

The objective of this lab is to have a better understanding of how op amps works by designing and building op amp circuits.

II. Procedure

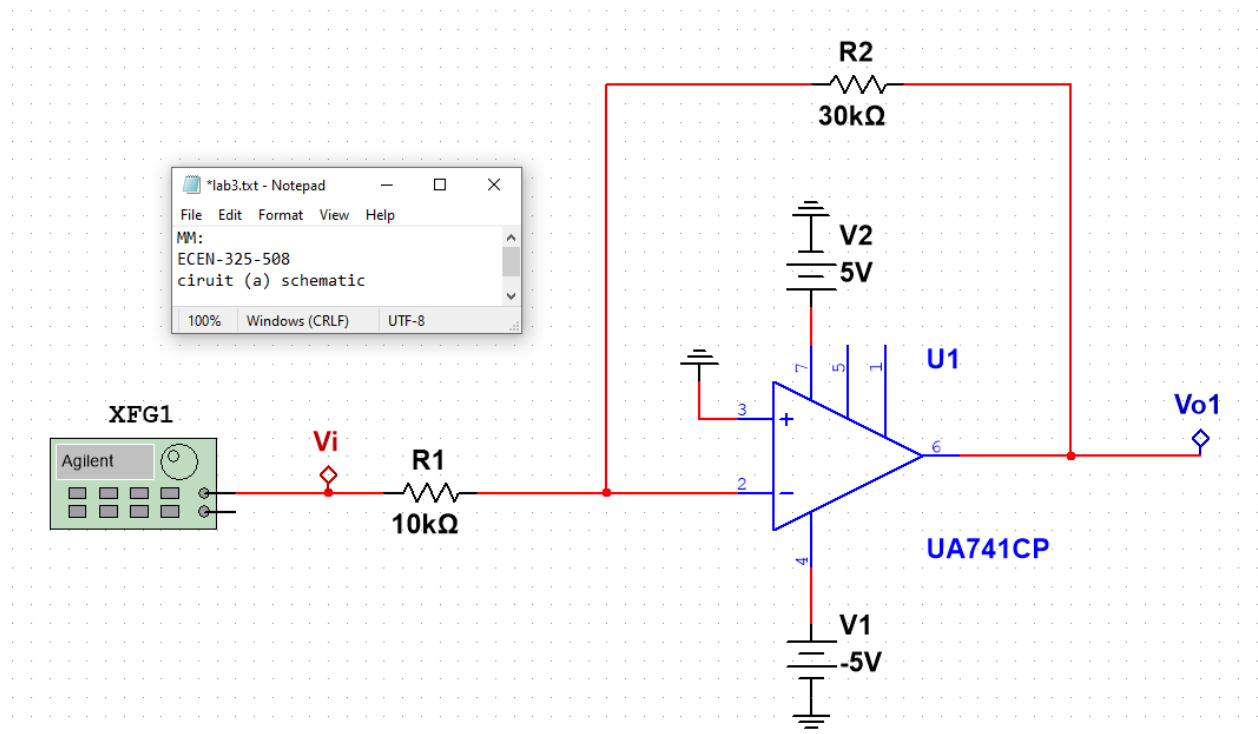
For the procedure I first had to calculate the values of unknown resistors for 3 op amp circuits. Then I created a schematic of the three circuits and built a breadboard design for each of them. After that, I measured the bode plots, time domains, and the total harmonic distortion of the circuits and then built a 4th op amp circuit and measured the values of the resistors to find the input current of the circuit.

III. Difficulties

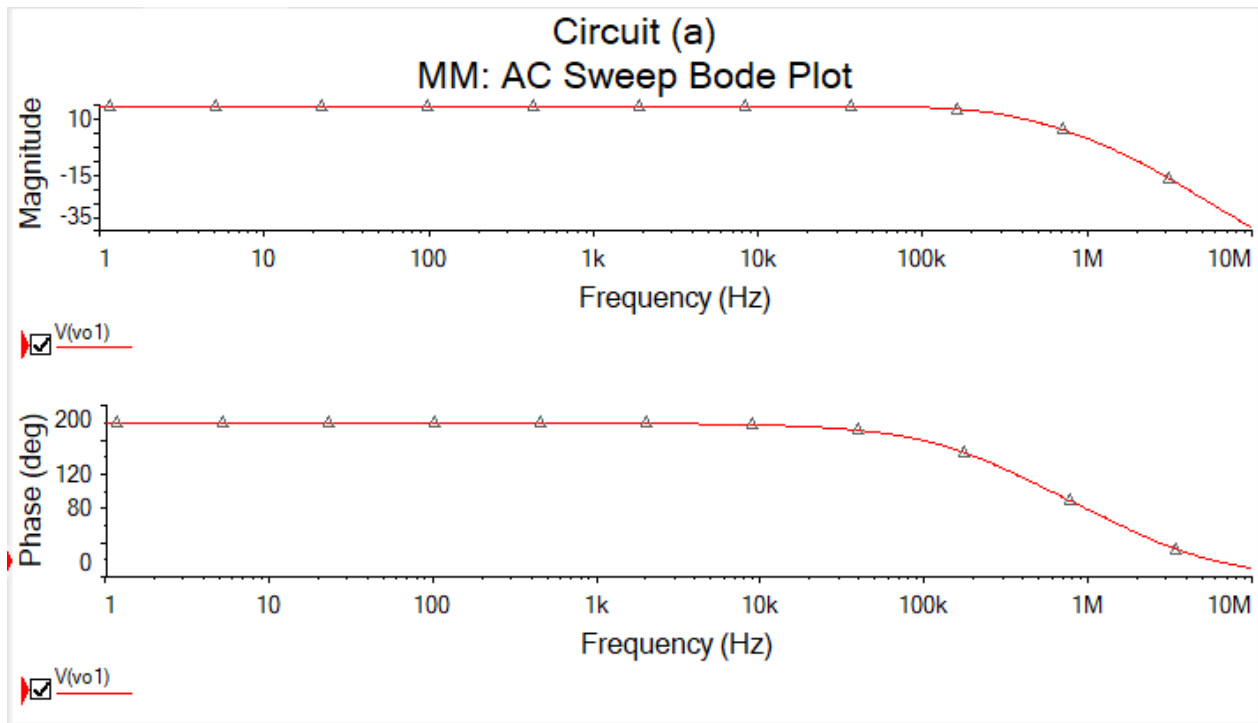
There were no difficulties during the lab.

IV. Results

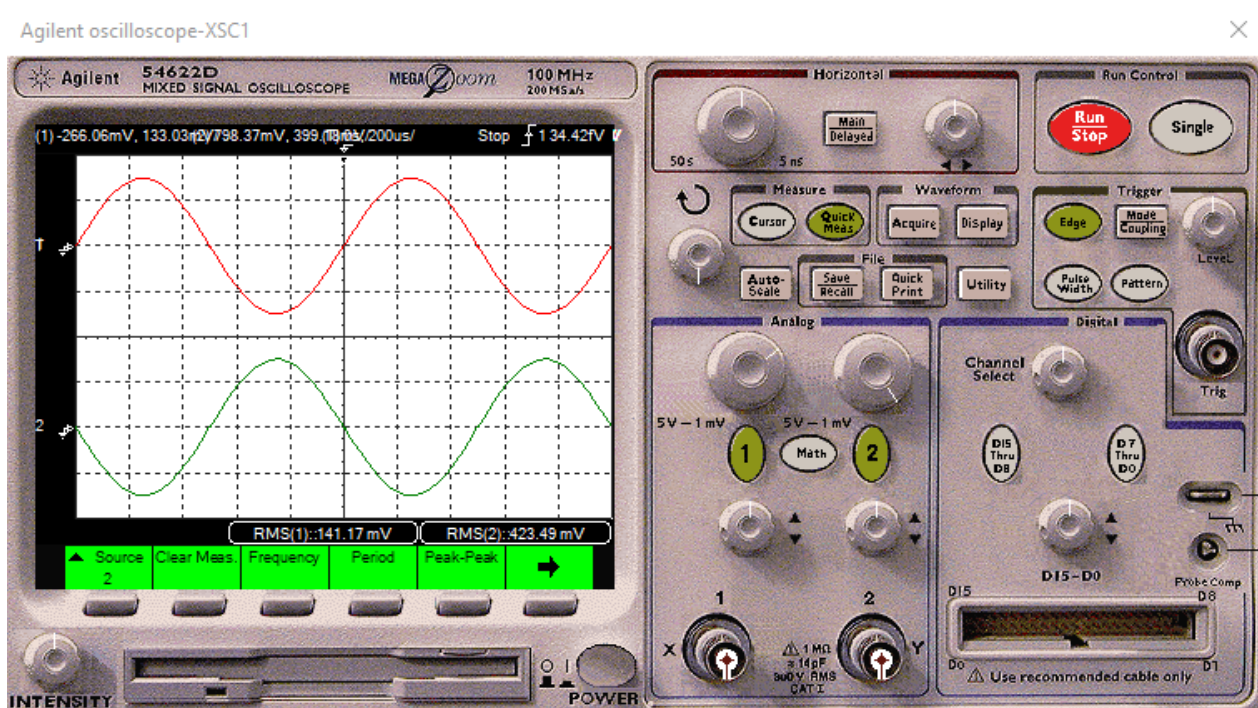
Circuit (a) schematic



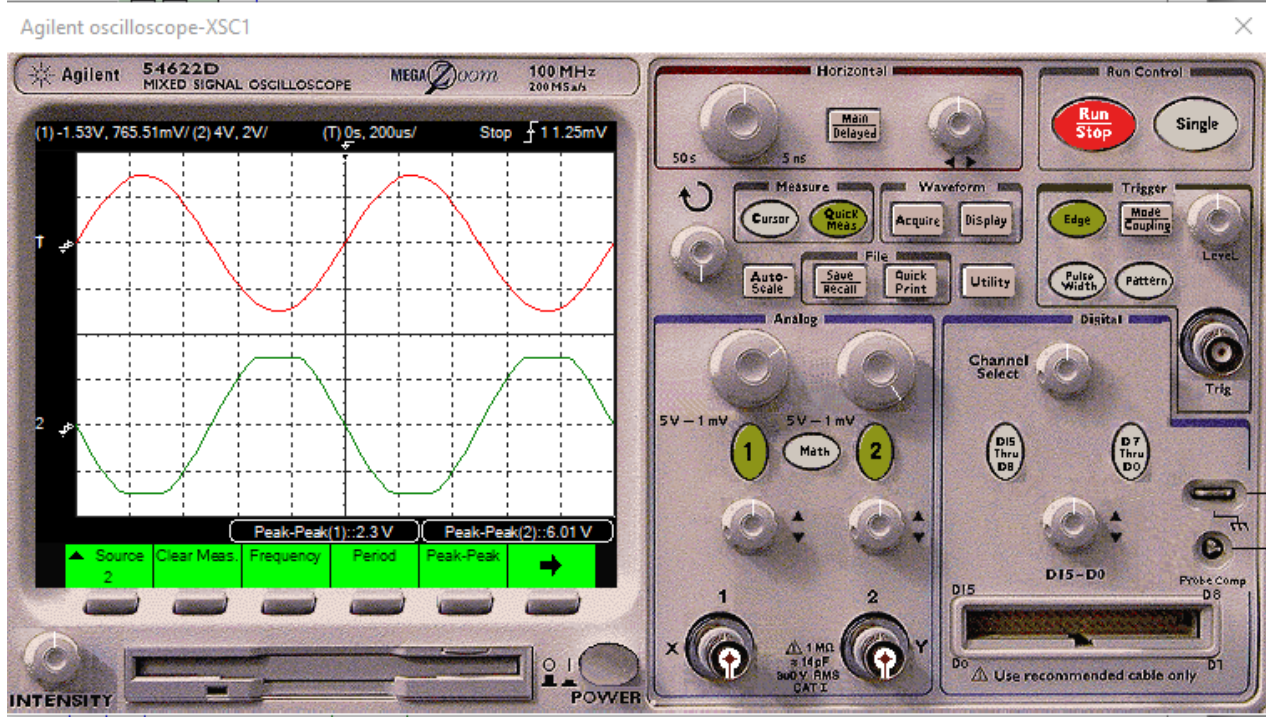
Circuit (a) Bode Plot



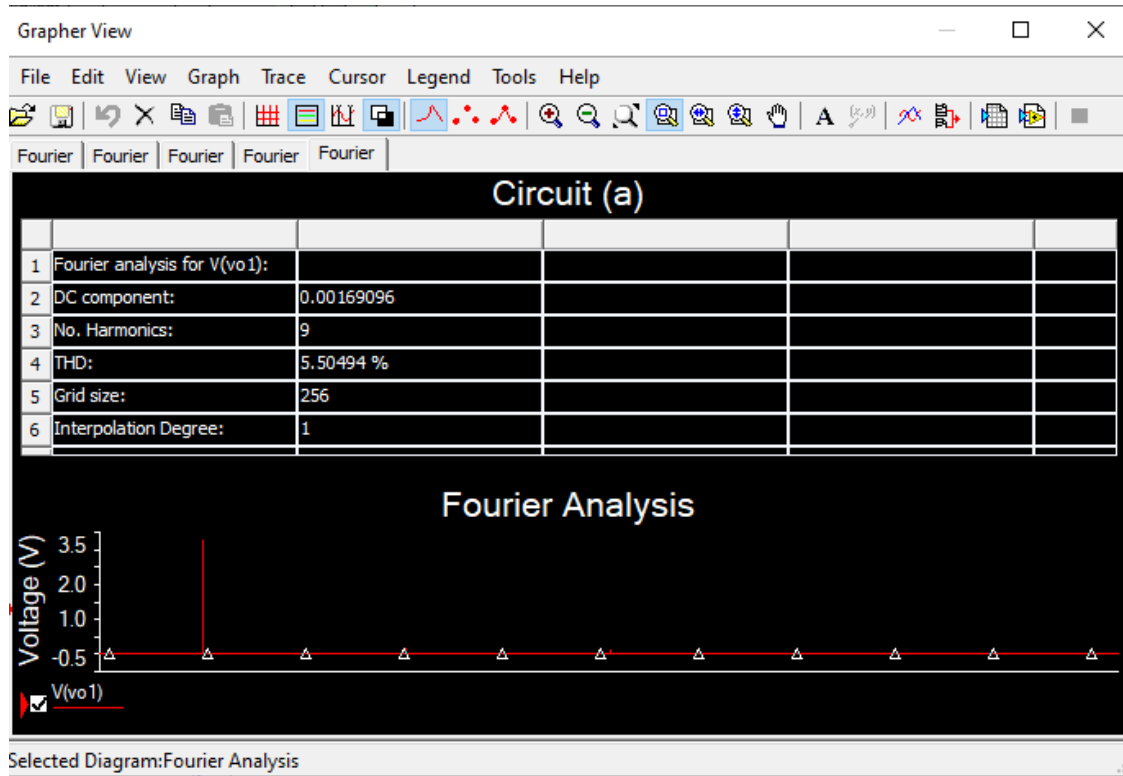
$V_i(t) = 2\sin(2\pi 1000)$ Time-domain waveforms for Circuit (a)



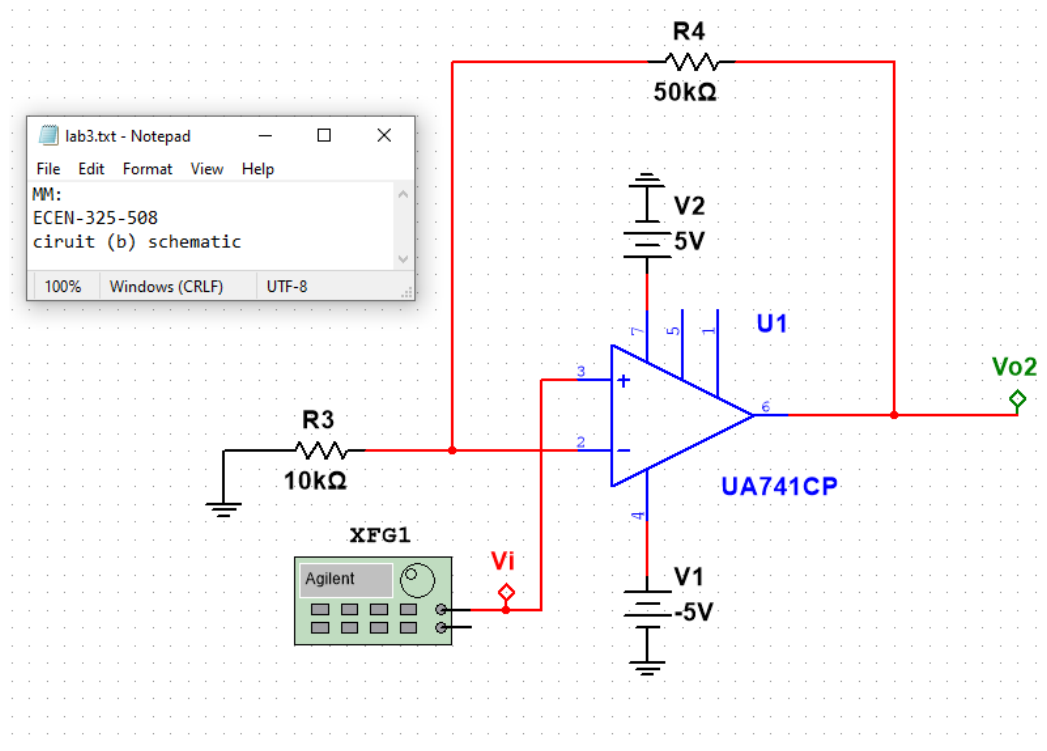
$V_{i,max}$ at 1kHz Time-domain waveforms for Circuit (a)



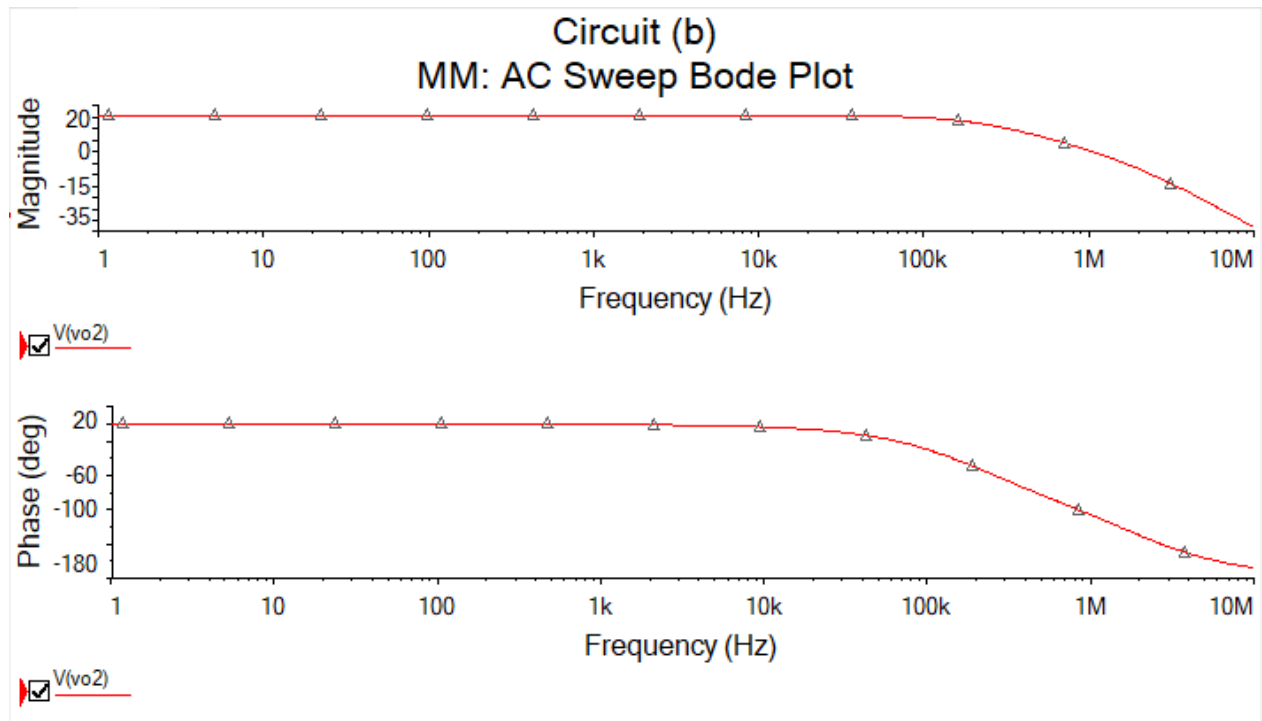
Total harmonic distortion for Circuit (a)



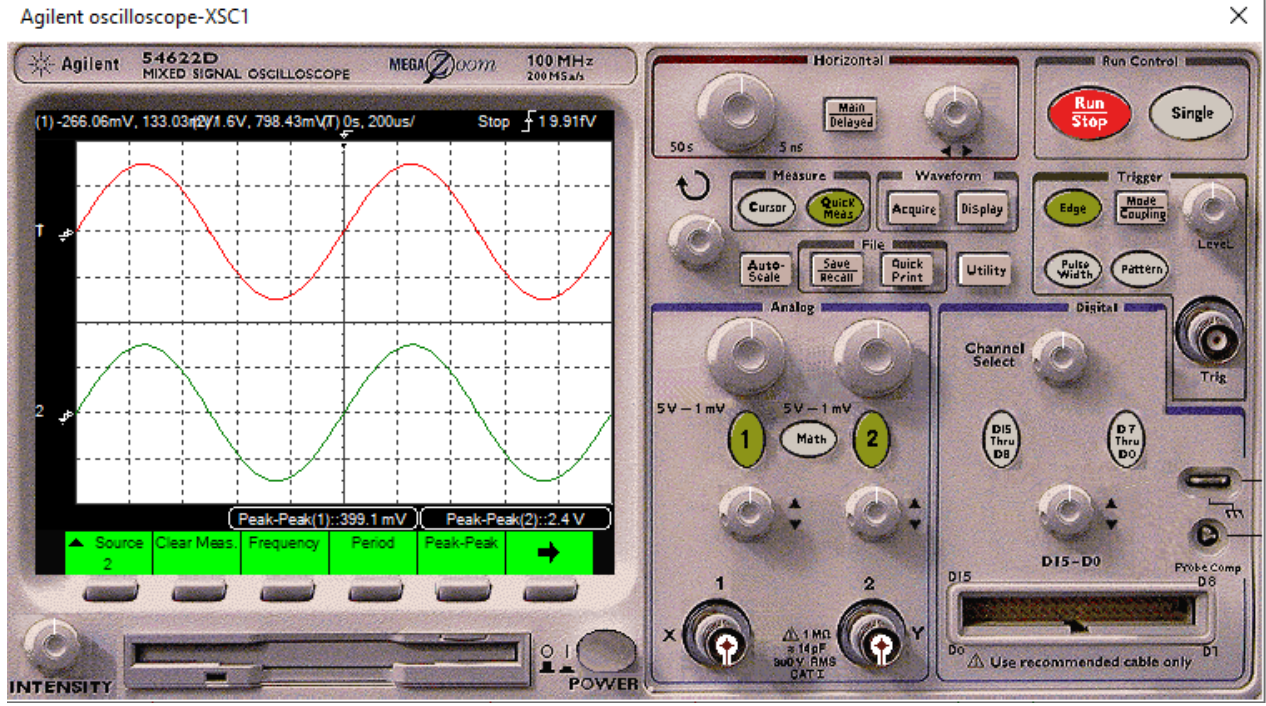
Circuit (b) schematic



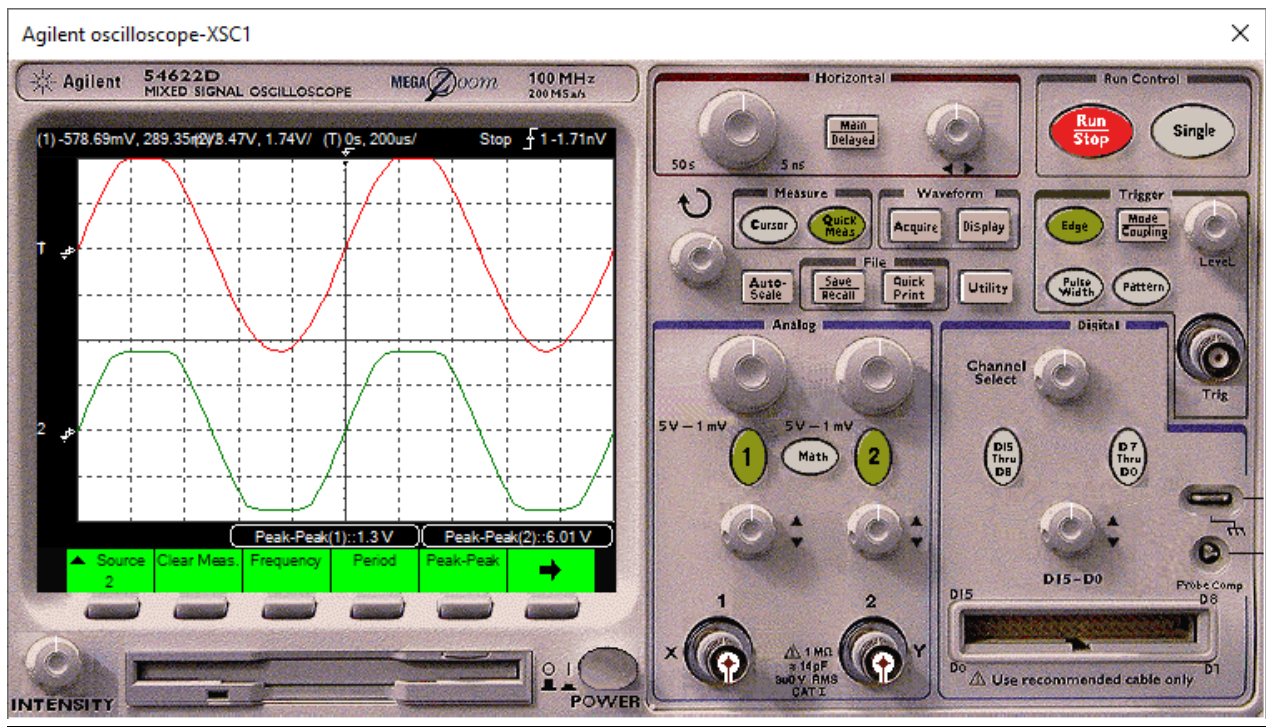
Circuit (b) Bode Plot



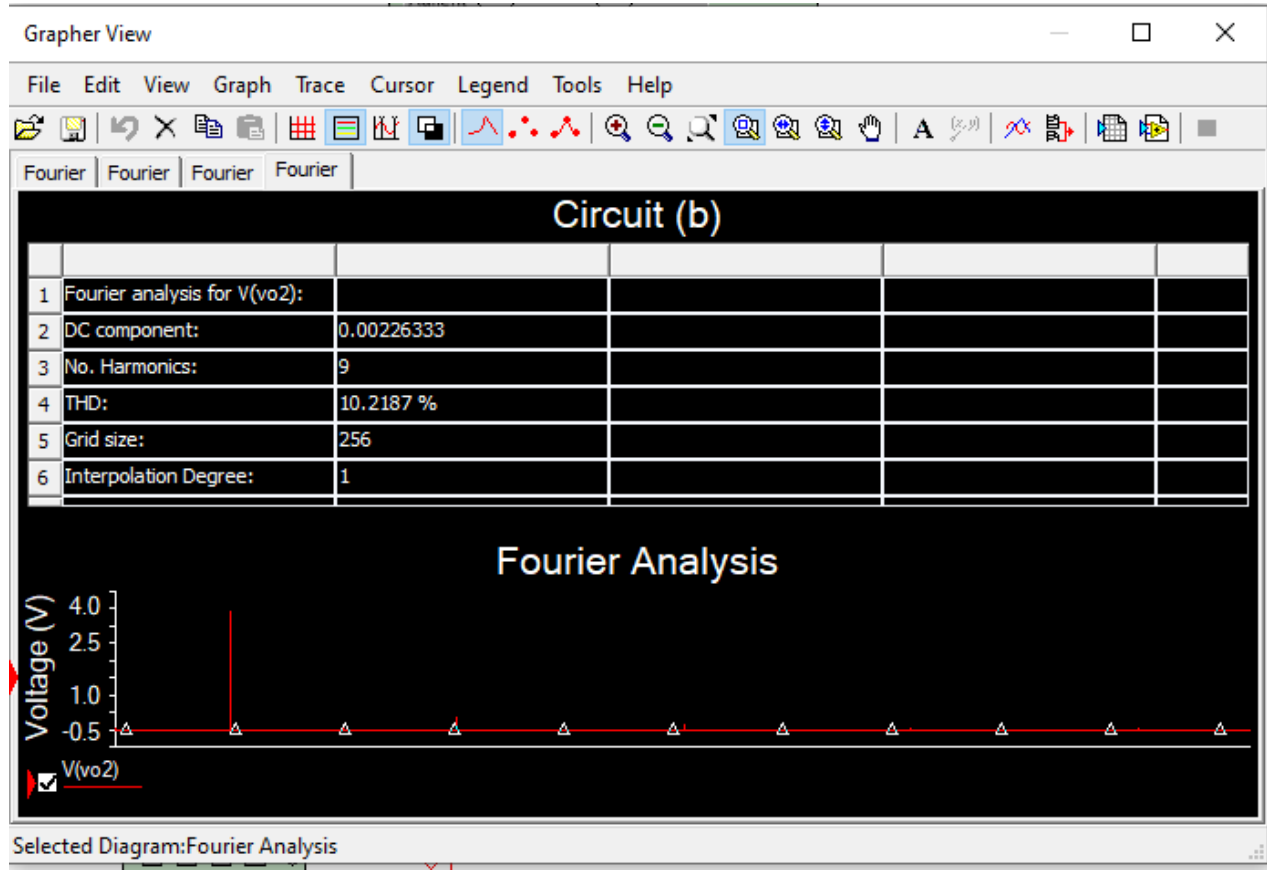
$V_i(t) = 2\sin(2\pi 1000)$ Time-domain waveforms for Circuit (b)



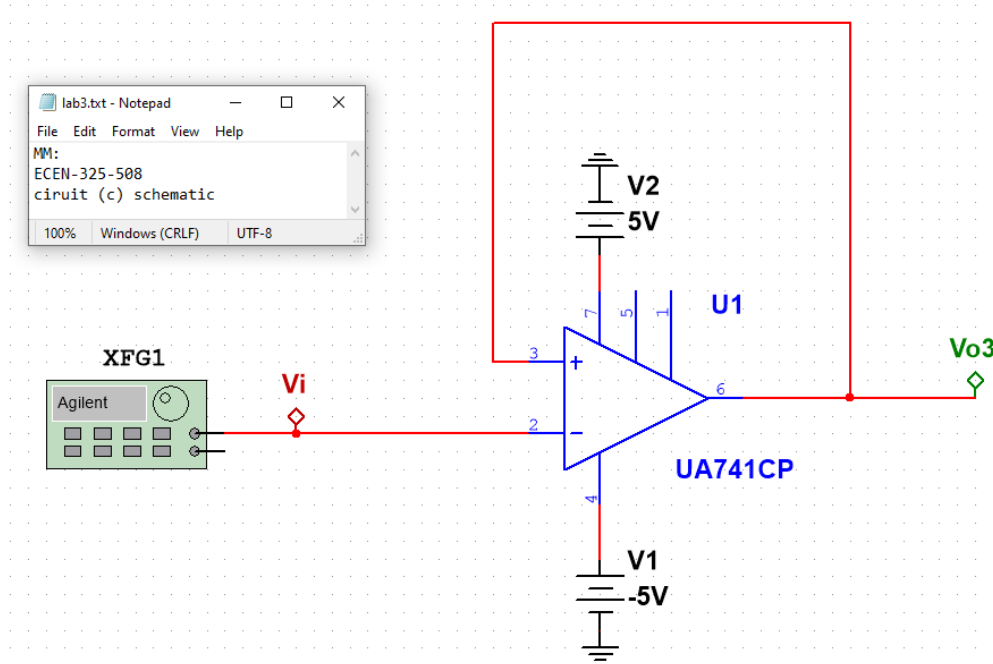
$V_{i,max}$ at 1kHz Time-domain waveforms for Circuit (b)



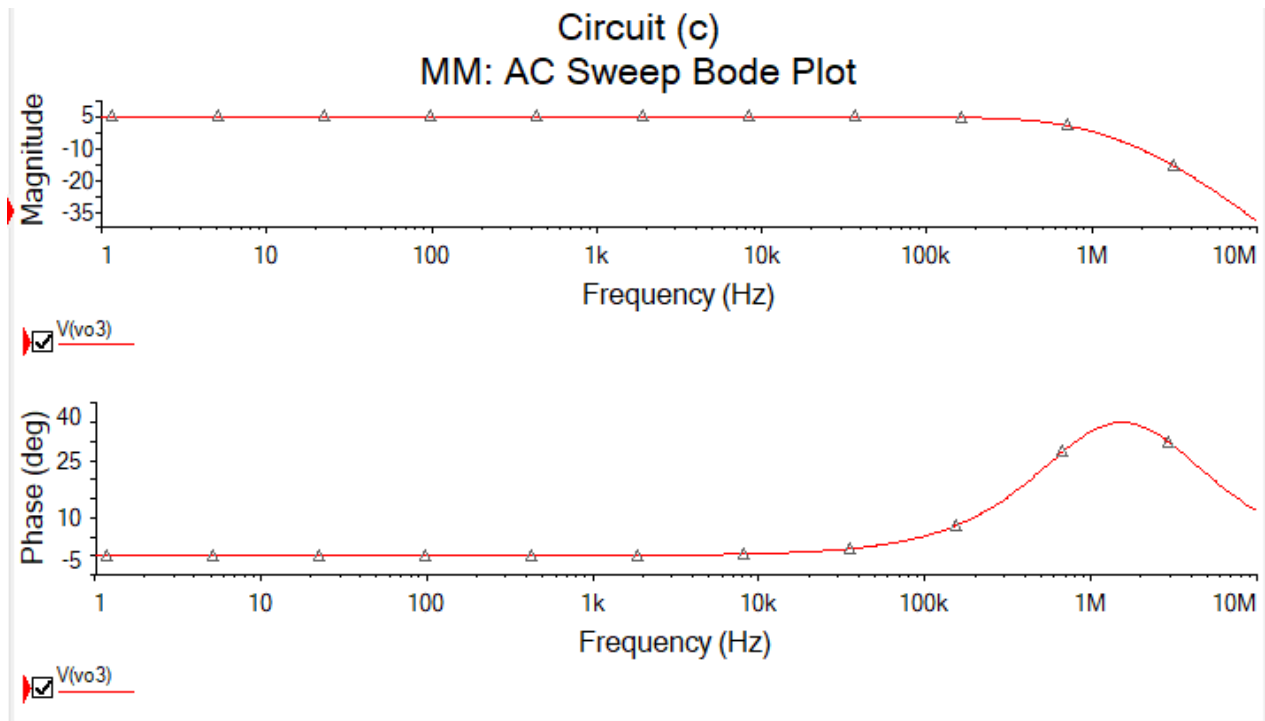
Total harmonic distortion for Circuit (b)



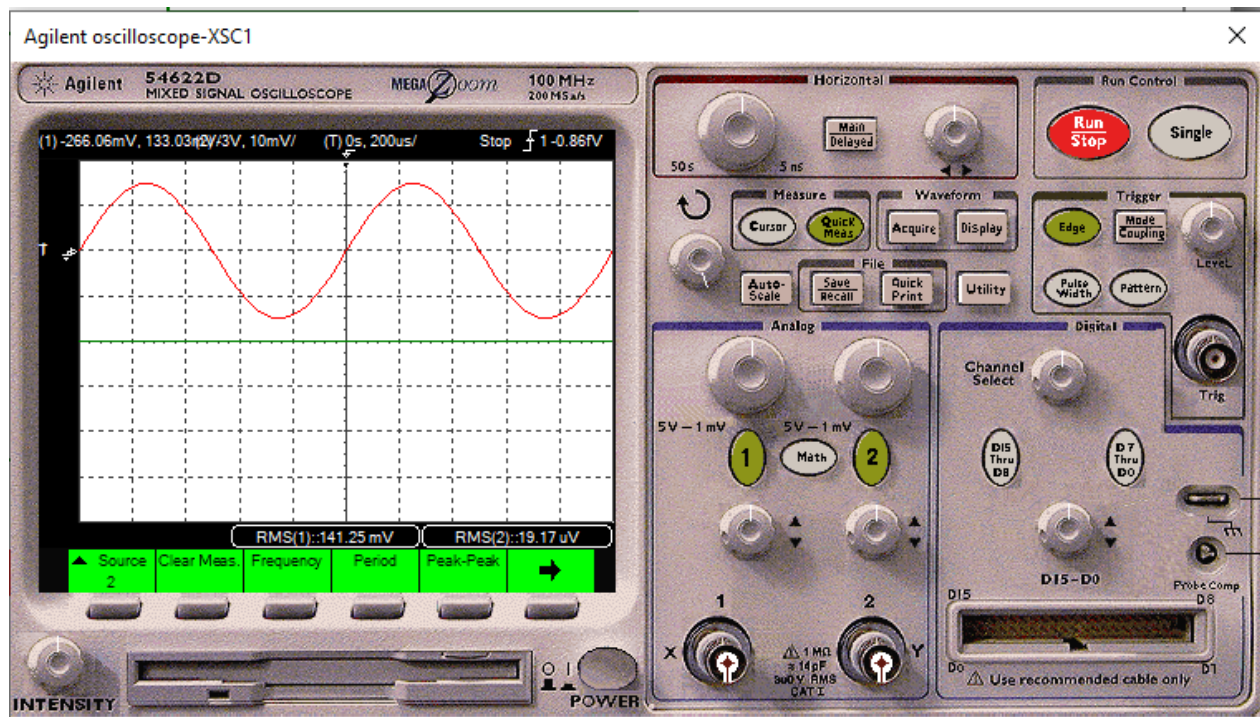
Circuit (c) schematic



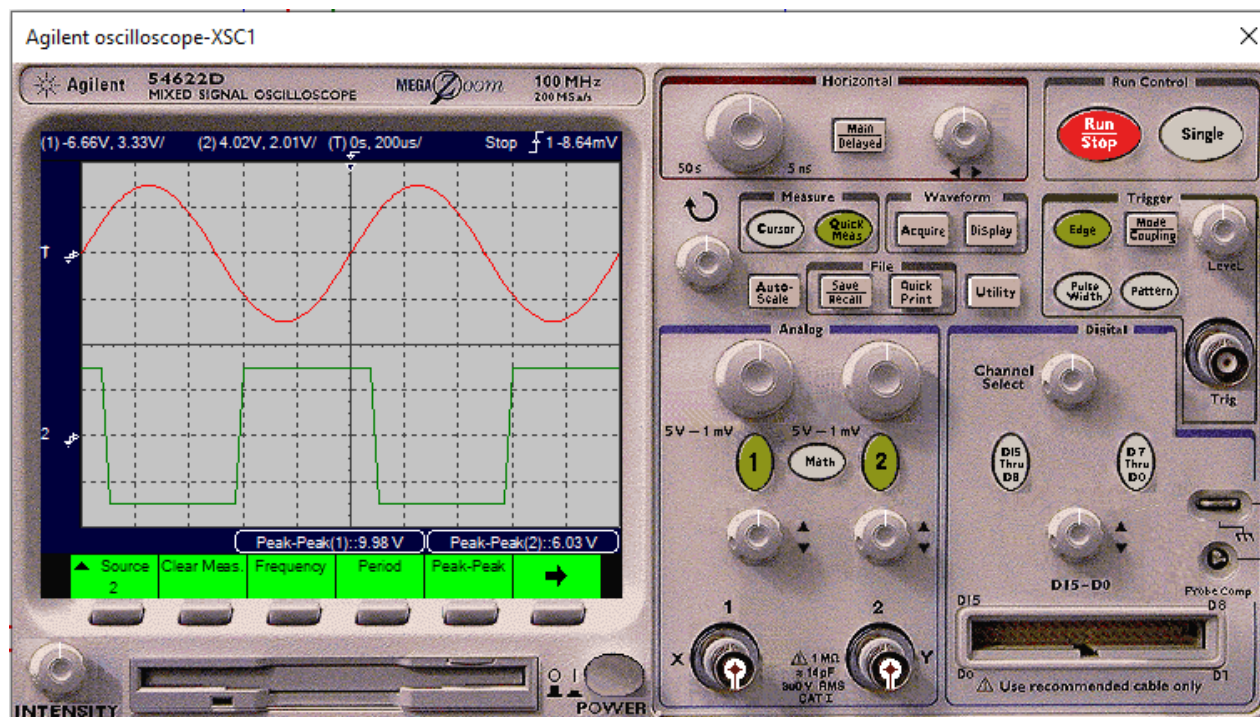
Circuit (c) Bode Plot



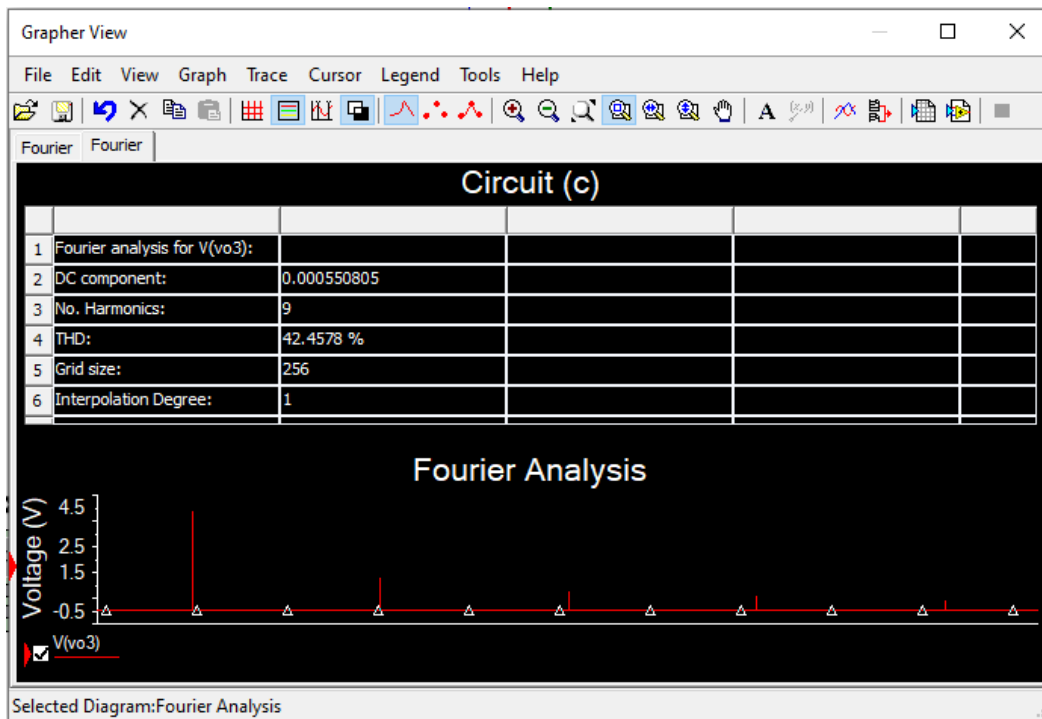
$V_i(t) = 2\sin(2\pi 1000)$ Time-domain waveforms for Circuit (c)



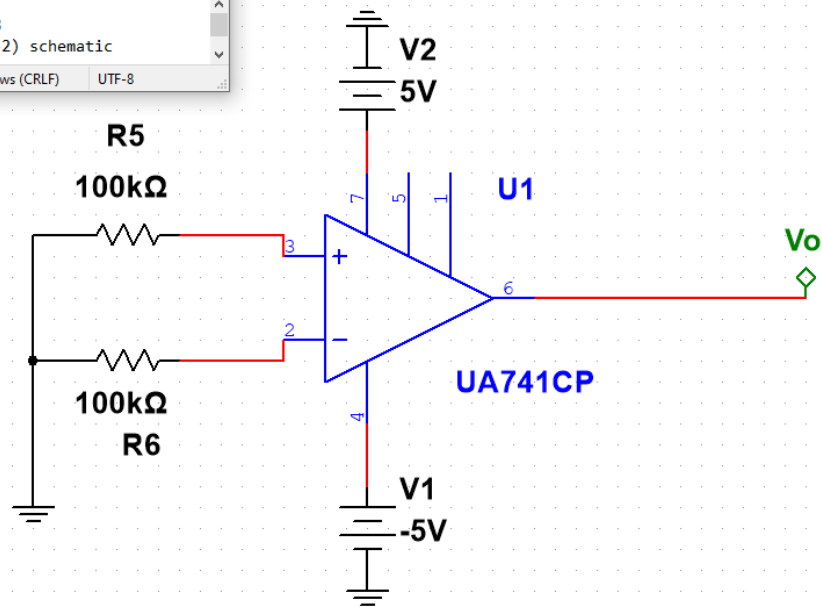
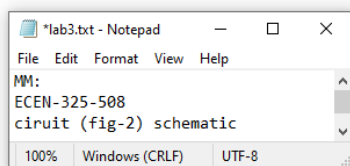
$V_{i,max}$ at 1kHz Time-domain waveforms for Circuit (c)



Total harmonic distortion for Circuit (c)



Circuit (fig.2) schematic



Circuit (fig.2) voltage at R5



Circuit (fig.2) voltage at R6



Measured results for bode plots:

Circuit:	gain at 1 kHz:
(a)	9.54 dB
(b)	15.6 dB
(c)	196 μ dB

Measured results for $V_i(t) = 2\sin(2\pi 1000)$ Time-domain waveforms:

- Found the gain by dividing V_{out}/V_i and looking at waveforms to see if it is negative or positive gain.

Circuit:	V_i RMS (V)	V_{out} RMS (V)	Gain
(a)	0.14117	0.42349	-2.99986
(b)	0.3991	2.4	6.01353
(c)	0.14125	0.00001917	-0.00014

Measured results for max Voltage amplitude at 1kHz:

- Found the amplitude by dividing my measured Peak to Peak voltage by 2

Circuit:	$V_{i,max}$ peak-peak (V)	$V_{i,max}$ amplitude (V)
(a)	2.3	1.15
(b)	1.3	0.65
(c)	10	5

Measured results of total harmonic distortion:

Circuit:	THD
(a)	5.51%
(b)	10.23%
(c)	42.46%

Measured results of fig.2:

- Found input offset using ohms law

Circuit:	Voltage of R5 (V)	Voltage of R5 (V)	input offset current (μ A)
(fig.2)	-0.797529	-0.797529	7.975

V. Conclusion

In conclusion, I found the voltage gains for each of the circuits by measuring the output voltage and then dividing it by the input voltage. Also, when comparing my results from my measurements the calculated and measured gain my calculations were correct for only certain levels of input voltages. This is mainly due to the saturation rate of the op amp's.