

# **ECEN 325 – Electronics**

**Fall 2020**

## **Lab 4: Report**



**Submitted by:**

<b>Student Name</b>	<b>UIN:</b>	<b>Section #</b>
Michael Mengistu	12500724	<b>508</b>

**Date Performed: Sept 22<sup>st</sup>, 2020**

## I. Objective

The objective of this lab is to understand different types of op amps by designing a summing, differential, and an instrumentation amplifier.

## II. Procedure

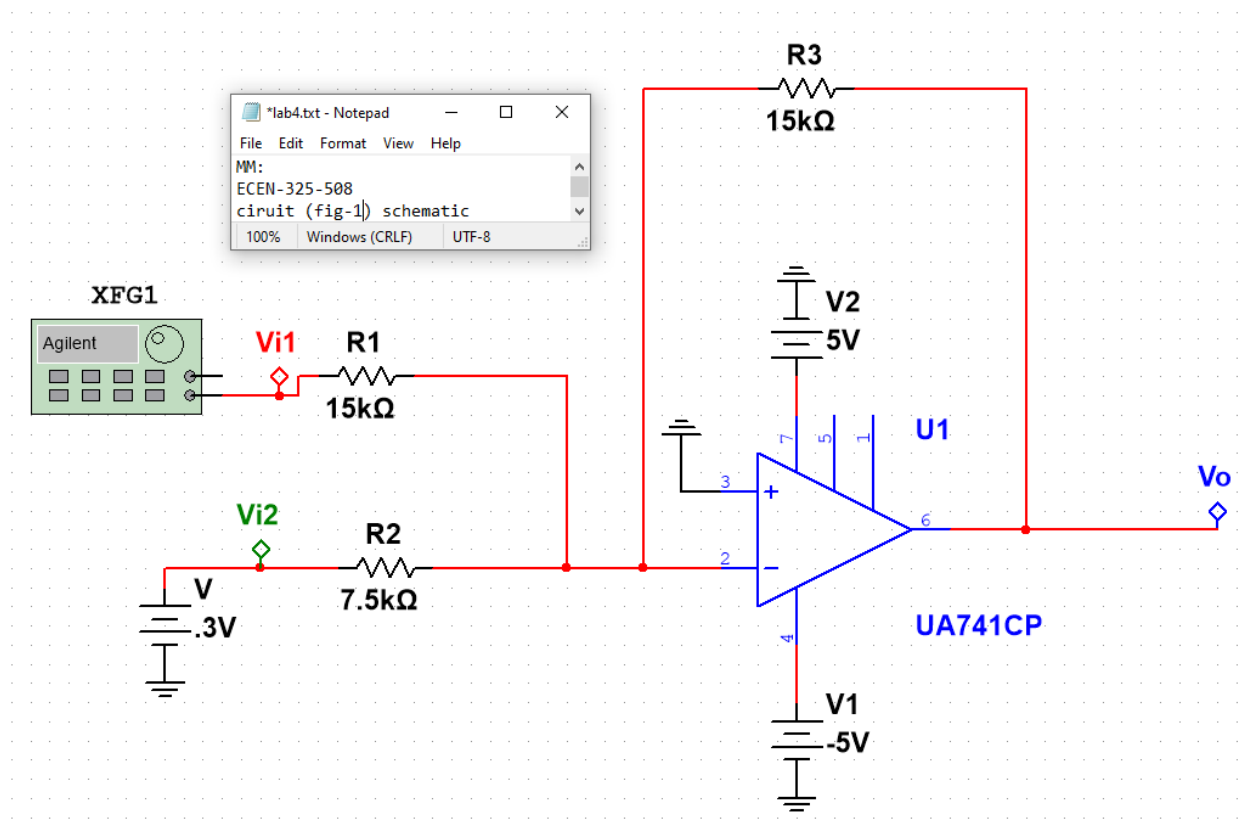
For the procedure I first had to calculate the values of unknown resistors for the summing, differential, and instrumentation op amp circuits. Then I created a schematic of the three circuits and built a breadboard design for each of them. After that, I took measurements of the time domains of the input and output voltage.

## III. Difficulties

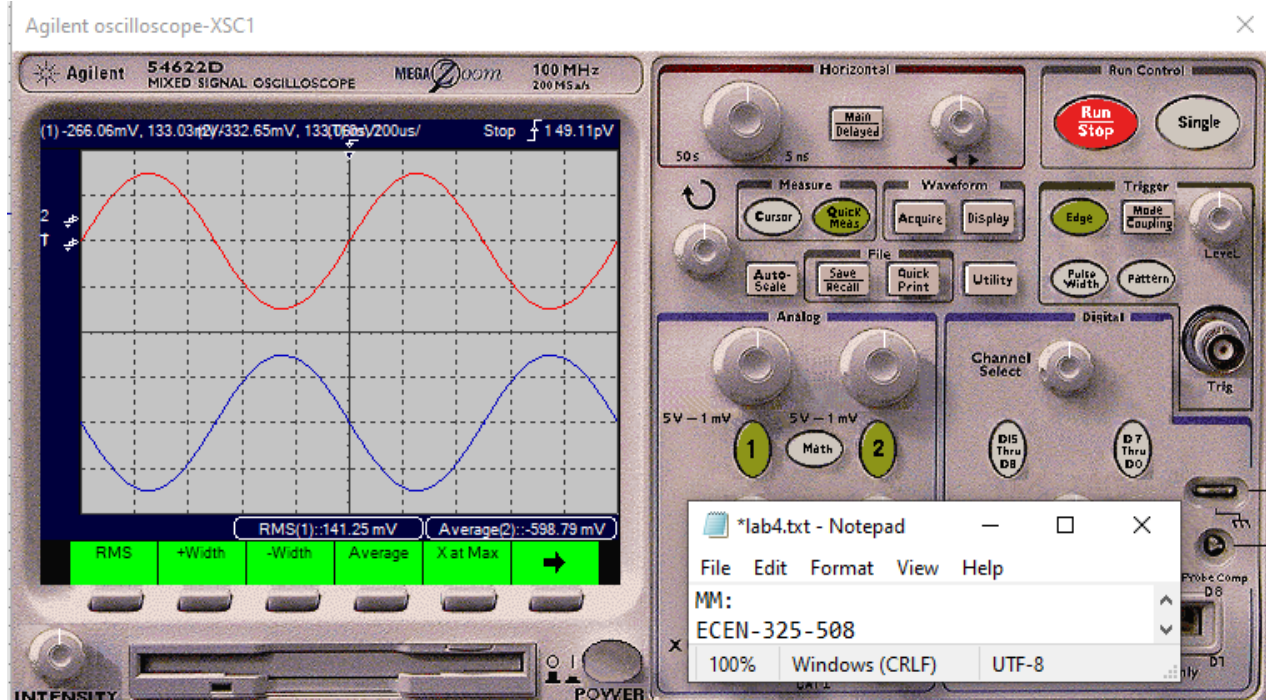
There were no difficulties during the lab.

## IV. Results

(fig-1) Circuit schematic



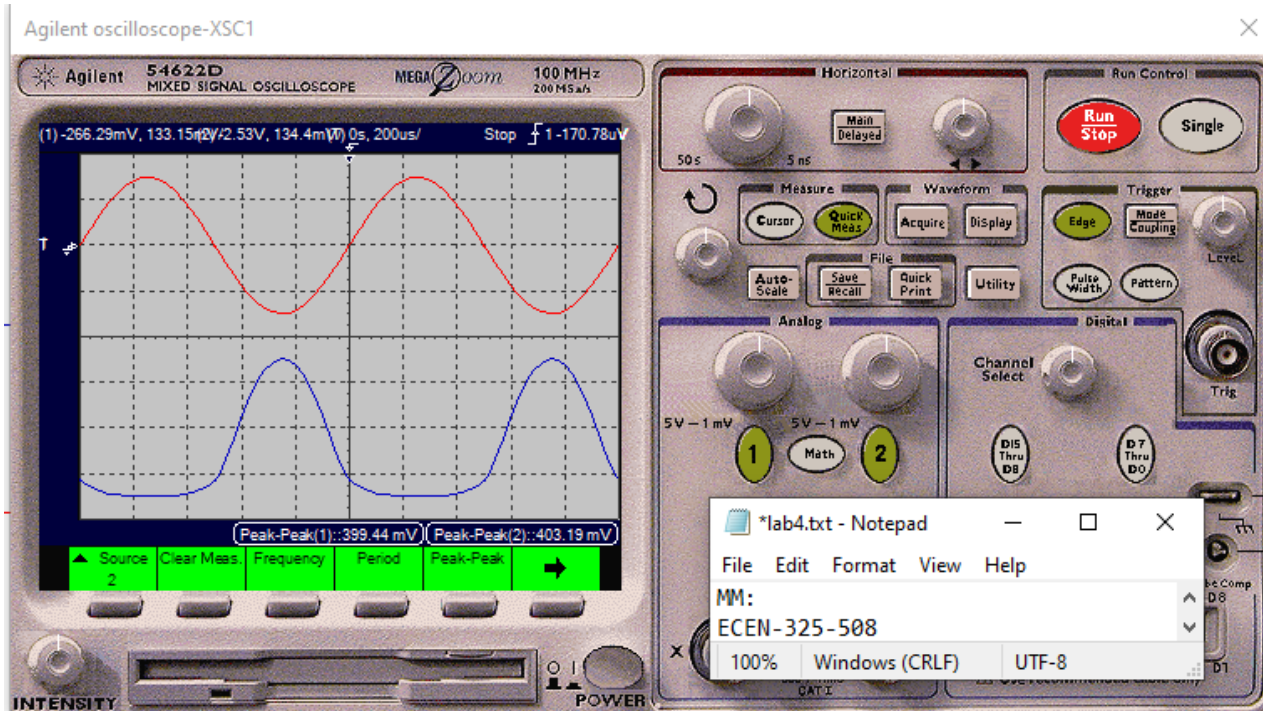
(fig-1) Time-domain waveforms at  $V_{i1}(t) = 2\sin(2\pi 1000)$ ,  $V_{i2}(t) = 0.3$



### Measured and calculated results:

Circuit:	$V_{i2}$ (V)	$V_{i1}$ RMS (V)	$V_o$ Avg (V)	Calculated $V_o$ (V)
(fig-1)	0.3	0.141	-0.589	-0.8

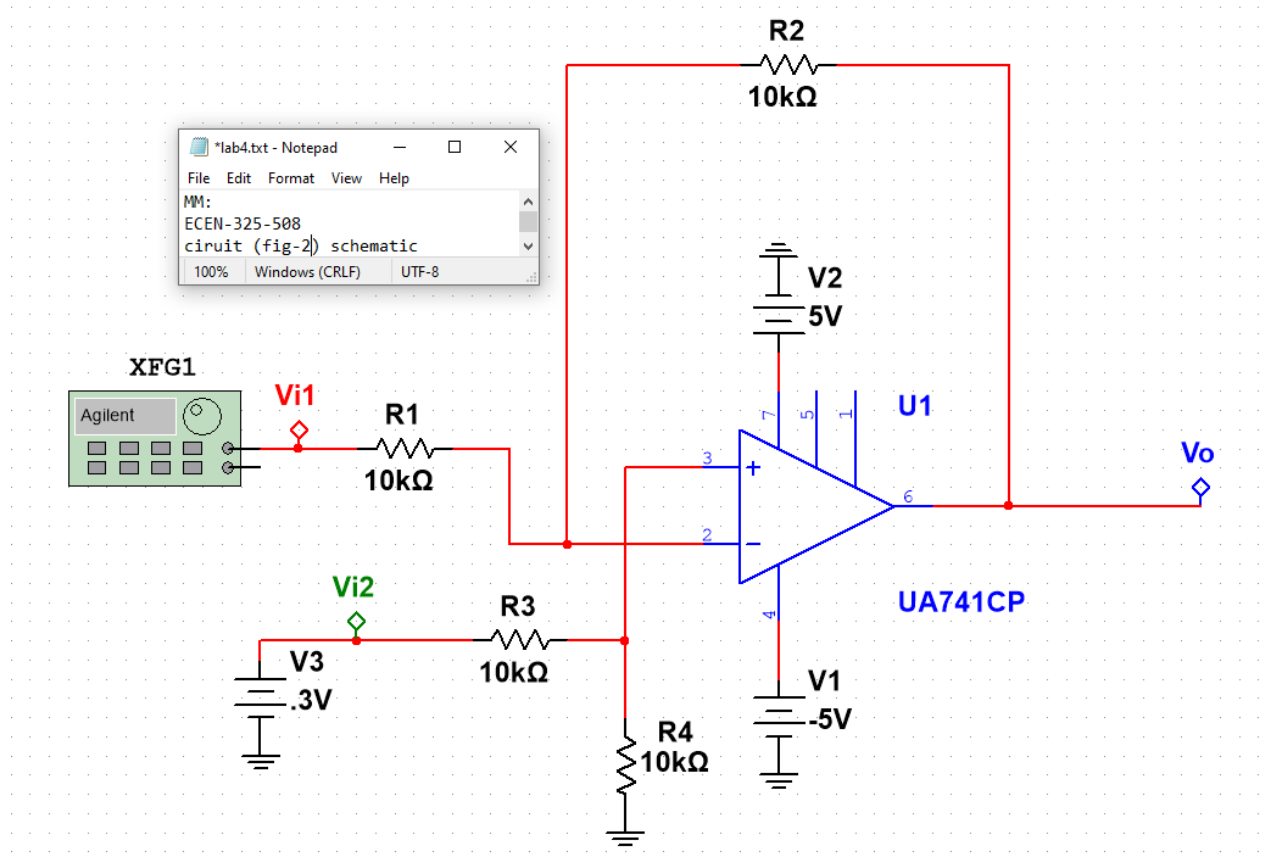
(fig-1) Time-domain waveforms at clipping output



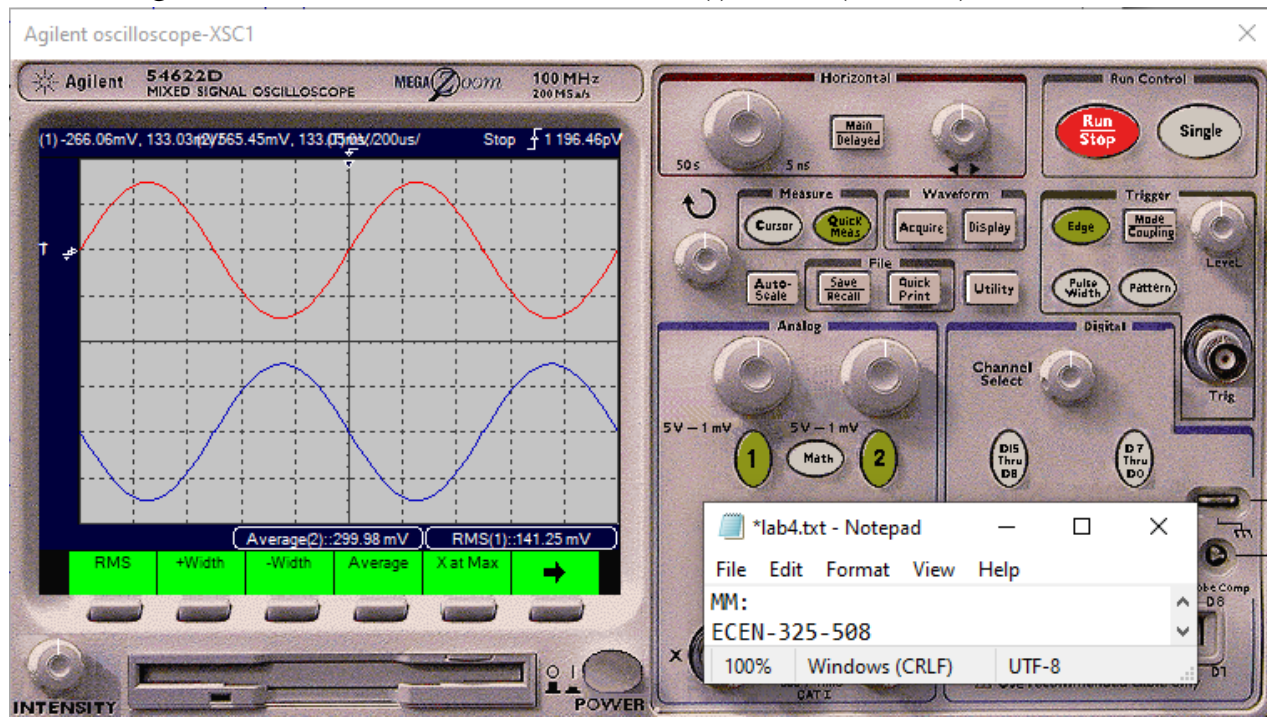
**Measured  $V_{i2}$  result at clipping:**

Circuit:	$V_{i2}$ (V)
(fig-1)	3

(fig-2) Circuit schematic



(fig-2) Time-domain waveforms at  $V_{i1}(t) = 2\sin(2\pi 1000)$ ,  $V_{i2}(t) = 0.3$

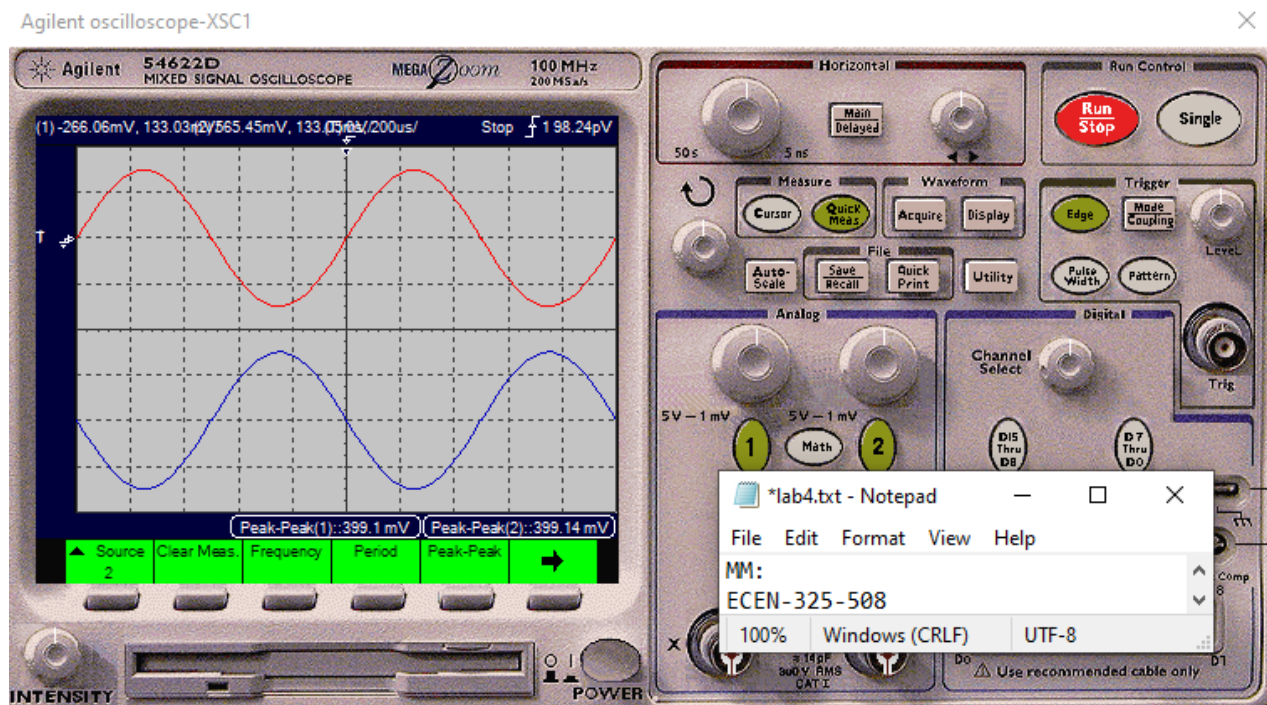


### Measured and calculated results:

Circuit:	$V_{i2}$ (V)	$V_{i1}$ RMS (V)	$V_o$ Avg (V)	Calculated $V_o$ (V)
(fig-2)	0.3	0.141	0.29998	0.2



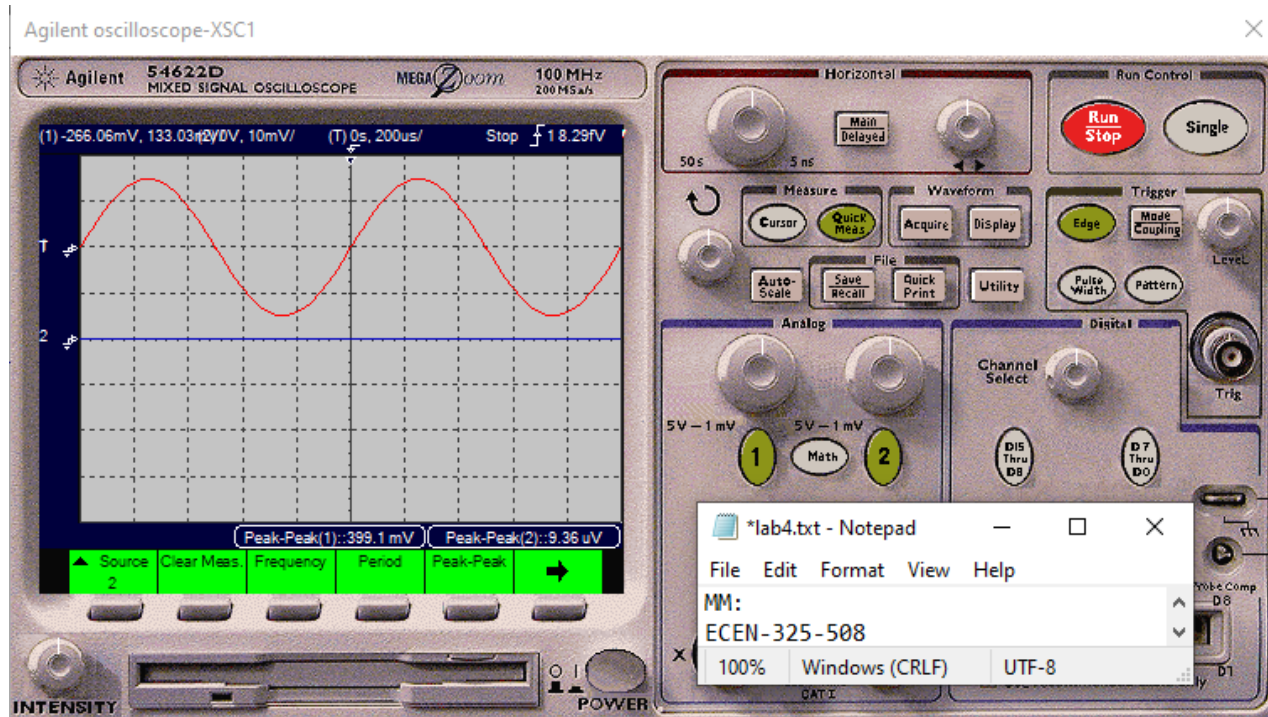
(fig-2) Time-domain waveforms at  $V_{i1}(t) = 2\sin(2\pi 1000)$ ,  $V_{i2}(t) = 0$



### Measured results when $V_{i2}(t)$ is grounded:

Circuit:	$V_{i2}$ (V)	$V_{i1}$ peak-peak (V)	$V_o$ peak-peak (V)	Adm
(fig-2)	0	0.3991	0.3991	1

(fig-2) Time-domain waveforms at  $V_{i1}(t) = V_{i2}(t) = 2\sin(2\pi 1000)$



Measured results when  $V_{i1}(t) = V_{i2}(t)$ :

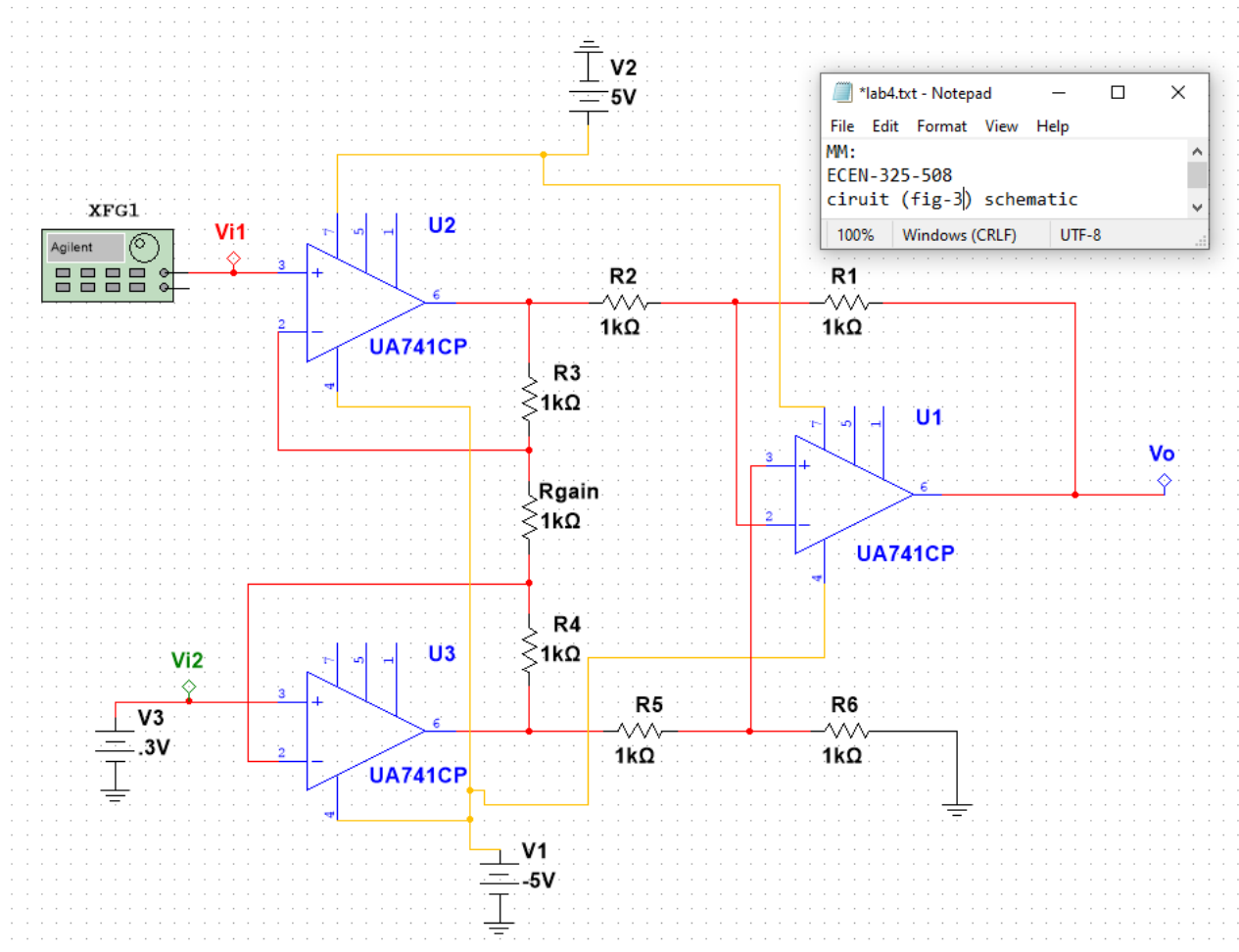
Circuit:	$V_{i2} = V_{i1}$ peak-peak (V)	$V_o$ peak-peak (V)	$A_{cm}$
(fig-2)	0.3991	0.3991	0.0000094

Calculated CRMM:

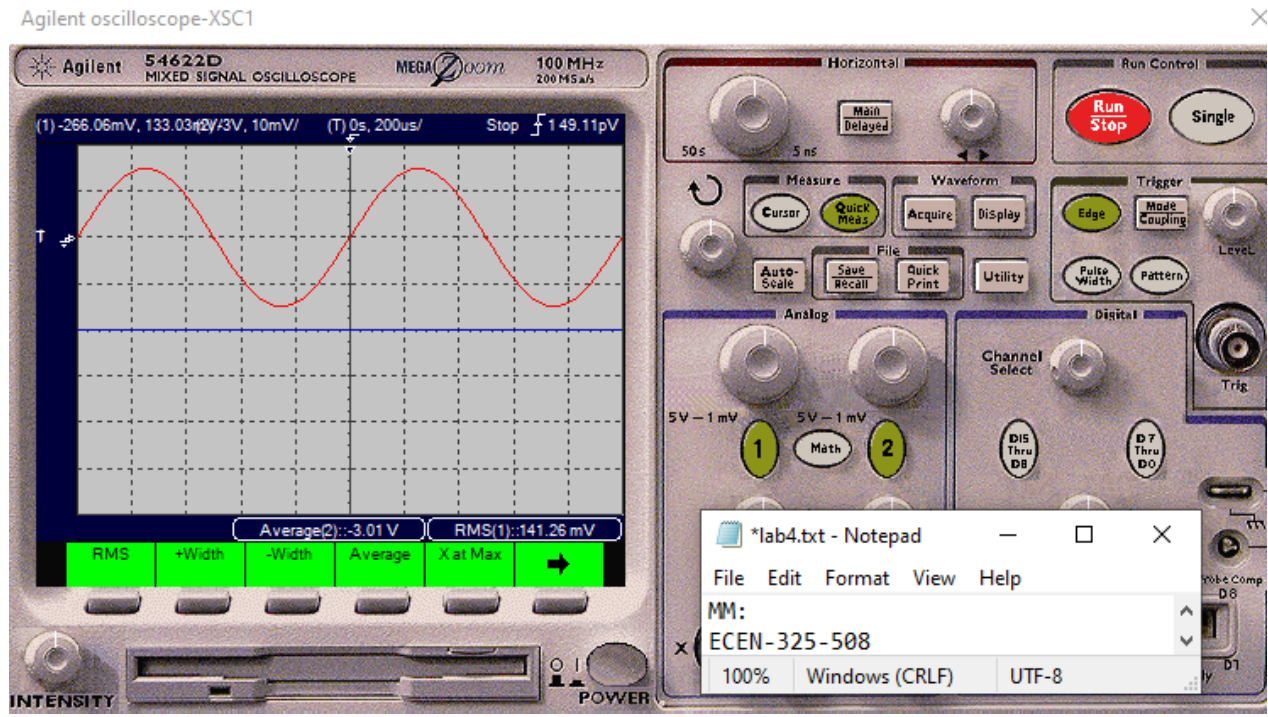
Circuit:	$CMRR = A_{dm} / A_{cm}$
(fig-2)	0



(fig-3) Circuit schematic



(fig-3) Time-domain waveforms at  $V_{i1}(t) = 2\sin(2\pi 1000)$ ,  $V_{i2}(t) = 0.3$



measured and calculated results:

Circuit:	$V_{i2}$ (V)	$V_{i1}$ RMS (V)	$V_o$ Avg (V)	Calculated $V_o$ (V)
(fig-3)	0.3	0.141	-3.01	-0.3

## V. Conclusion

In conclusion, when comparing my calculated with my measured results the avg output voltage is only slightly different between my calculated output voltage. This might be due to averaging output voltage only gives you a estimated look at the voltage that is being out putted.