Justin Hsu
EEC 100 Lab 3
10/21/24

(1) Objective: Learn how to calculate, build, and simulate a summing amplifier circuit by using three different input waveforms and input voltages.

(2) Prelab:

1)

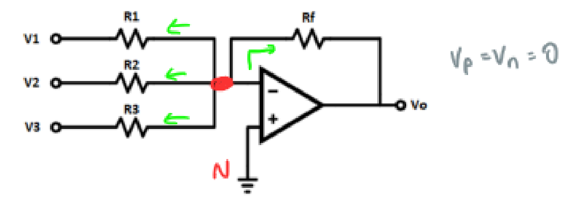


Figure 1: Summing Op Amp Schematic.

1. Given circuit shown in Figure 1 with Rf = 47kΩ, design values for R1, R2, R3 so then the output Vo satisfies the following relationship:

$$\mathbf{Vo} = -(2.14\mathbf{V1} + 1.00\mathbf{V2} + 0.47\mathbf{V3}) \qquad (1)$$

N|
$$\frac{-V_1}{R_1} + \frac{-V_2}{R_2} + \frac{-V_3}{R_3} + \frac{-V_o}{R_f} = 0$$

$$-\frac{V_1}{R_1} - \frac{V_2}{R_2} - \frac{V_3}{R_3} = \frac{V_o}{47k}$$

$$\frac{47k}{R_1} = 2.14 \qquad R_1 = 21962.62$$

$$\frac{47k}{R_2} = 1 \qquad R_2 = 47k$$

$$\frac{47k}{R_3} = 0.47 \qquad R_3 = 100k$$

2)

2. Draw the output waveform **Vo** for the input waveforms **V1** and **V2** shown Figure 2 with V3 = 5V.

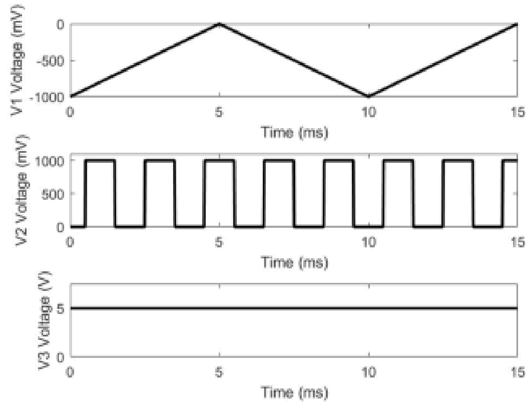


Figure 2: Input waveforms.

Vo (V)

$V_o = -(2.14V_1 + 1V_2 + 0.47V_3)$

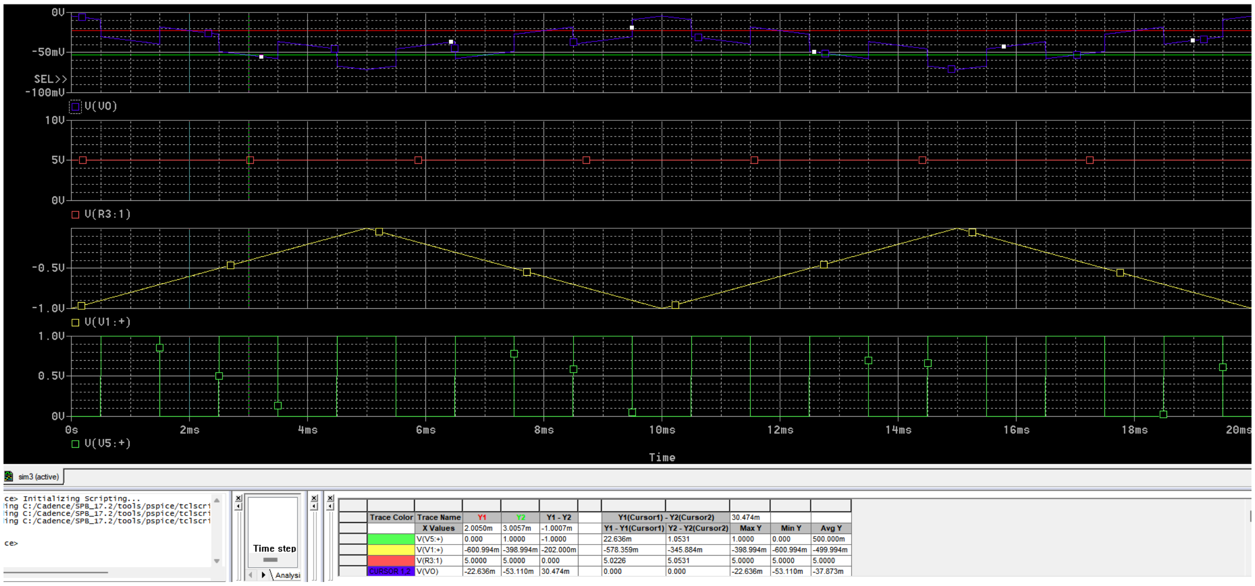
3)

3. State the minimum and maximum values of **Vo**.

$V_{o\,max} = -0.21\,v$

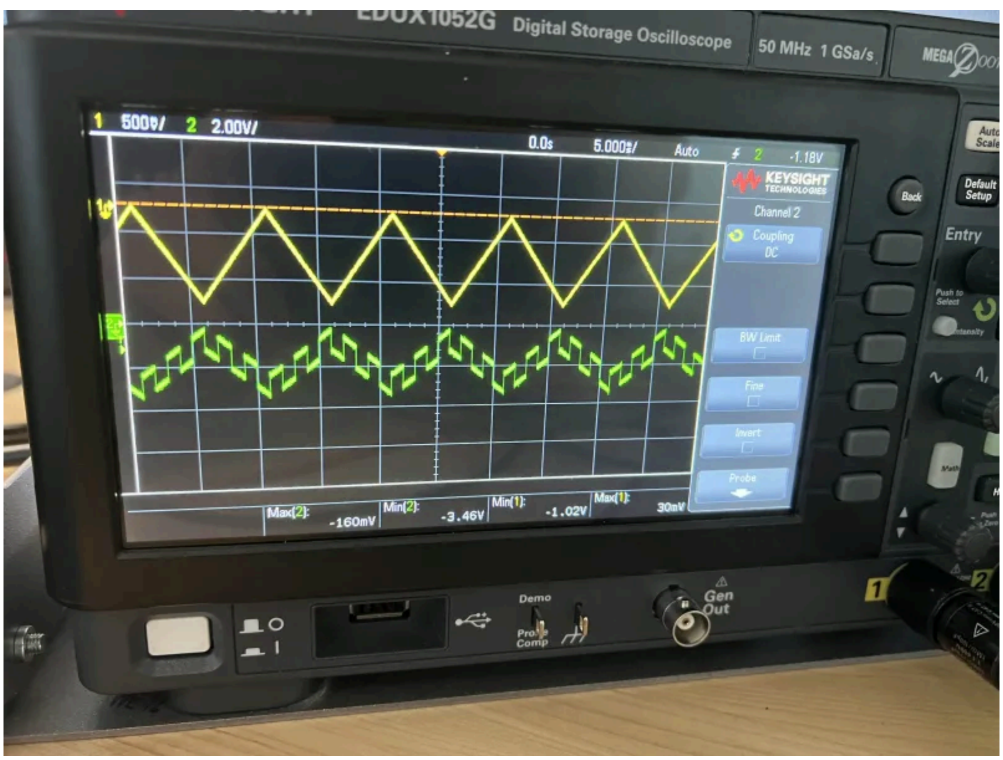
$V_{o\,min} = -3.35\,v$

(3) Simulation:

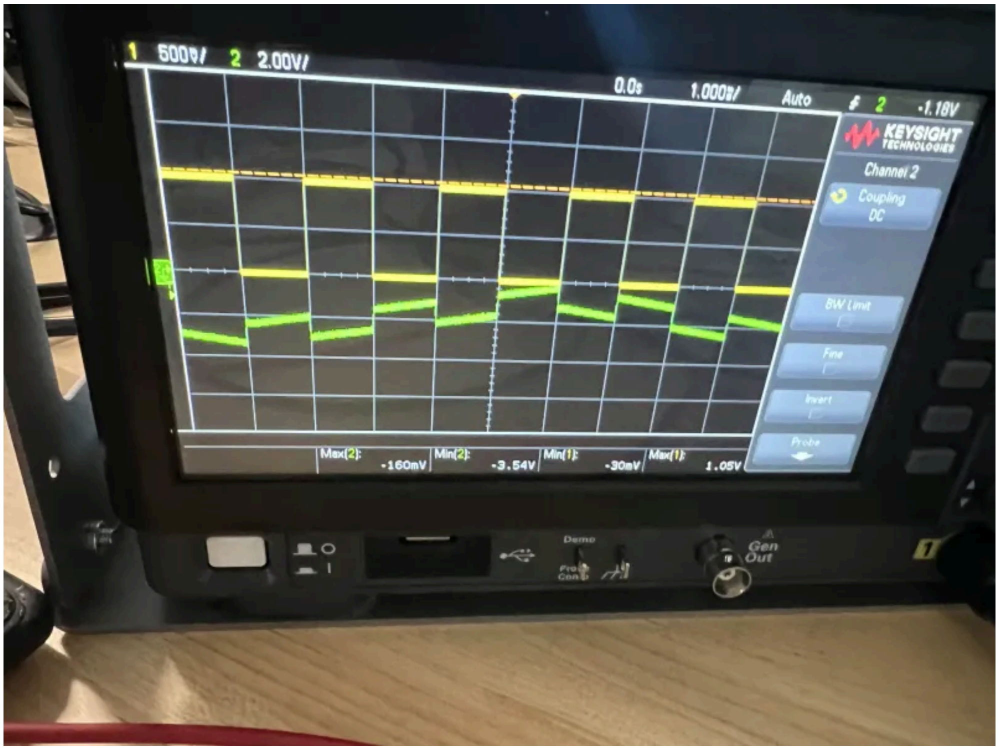


(4) Experiment:

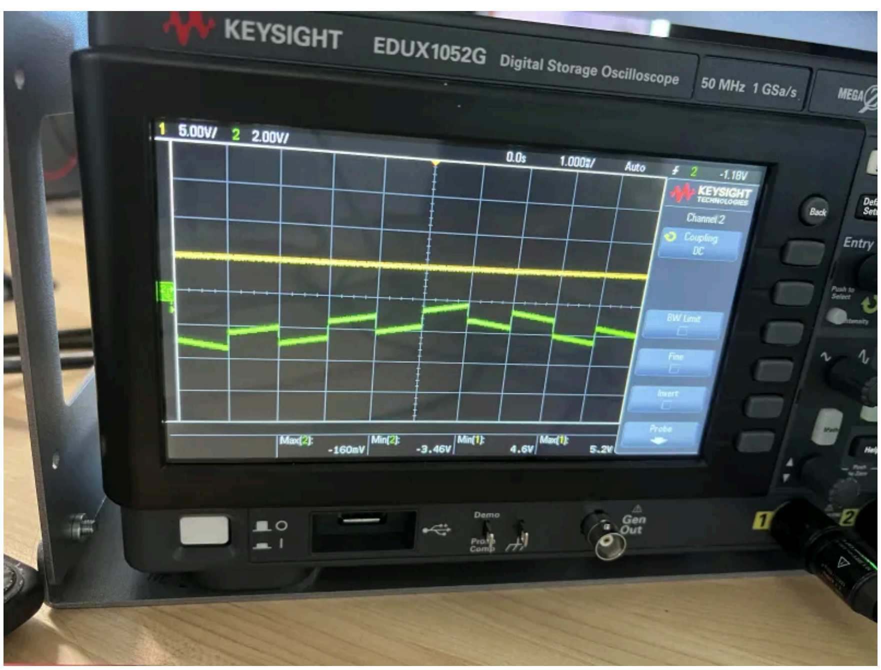
Probe R1:



Probe R2:



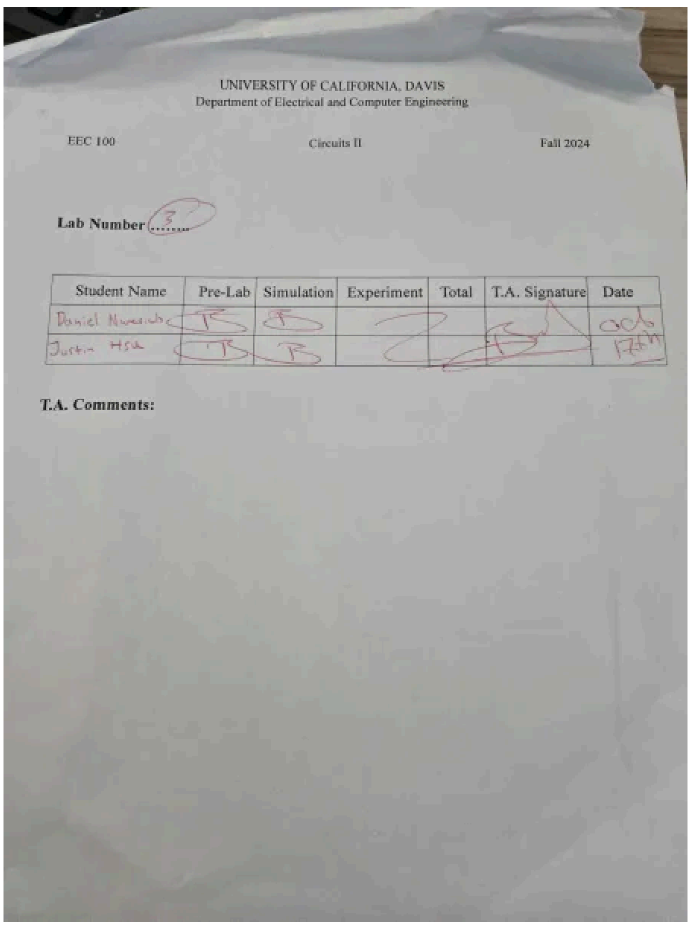
Probe R3:



(5) Conclusion:

The calculations I made as well as the PSpice simulation agreed with our experimental results. We can see that the output waveform makes sense because as the circuit name suggests, the output waveform is the overall sum of the 3 input waveforms, which explains its general triangular wave trend while having the rectangular increase and decrease in voltage as seen in a rectangular waveform. The experimental voltages are a little off from the PSpice and calculated voltages because real world resistors, op-amps, and wires are non ideal, and the resistance values do not match the nominal values. Additionally, the presence of noise due to an imperfect power supply, lack of decoupling, as well as poor wire quality also contribute to the experimental results not matching the simulated and calculated values.

(6) Checkoff:


UNIVERSITY OF CALIFORNIA, DAVIS
Department of Electrical and Computer Engineering

EEC 100 Circuits II Fall 2024

Lab Number 3

Student Name	Pre-Lab	Simulation	Experiment	Total	T.A. Signature	Date
Daniel [illegible]						Oct
Justin Hsu						17th

T.A. Comments: