EE230: Analog Circuits Lab
Lab 2

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1 OpAmp based Negative feedback circuits

Aim of the experiment

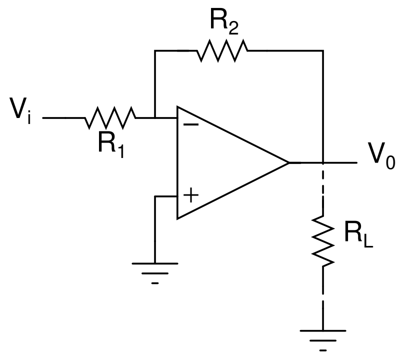
- To familiarize ourselves with Operational Amplifier (OpAmp) based Negative feedback circuits.
- Understanding how OpAmps can be used to implement various mathematical operations.

1.1 Inverting Amplifier circuit

1.1.1 Design

- $R_1 = 1k\Omega$
- $R_2 = 10k\Omega$
- Frequency = 1kHz
- $V_i = 0.1sin(\omega t)$

$$V_o = \frac{R_2}{R_1}V_i = 10V_i = sin(\omega t) \tag{1}$$



1.1.2 Experimental results

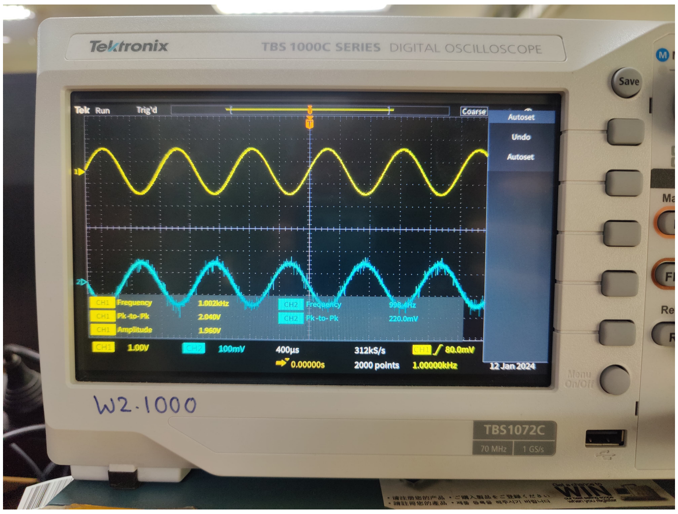


Figure 1: Enter Caption

1.1.3 Conclusion and Inference

- The output signal is ten times the input signal in magnitude.
- Thus, we have demonstrated that we can use an OpAmp based inverting amplifier circuit for signal amplification.

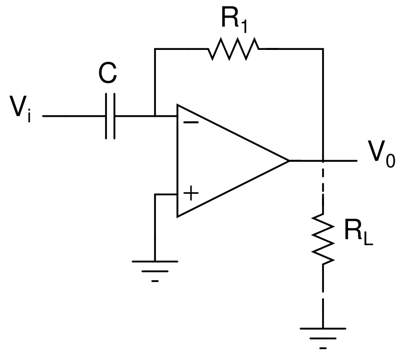
1.2 Differentiator

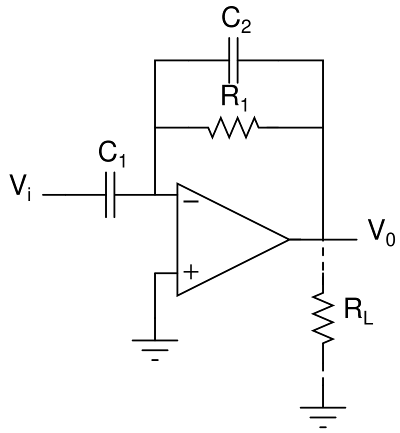
1.2.1 Design

- $R_1 = 1k\Omega$

- $C = 0.01\mu F$
- V_i = Triangular wave input (2 V, 2.5 kHz)

$$V_o = R_1 C \frac{dV_i}{dt} \tag{2}$$





1.2.2 Experimental results

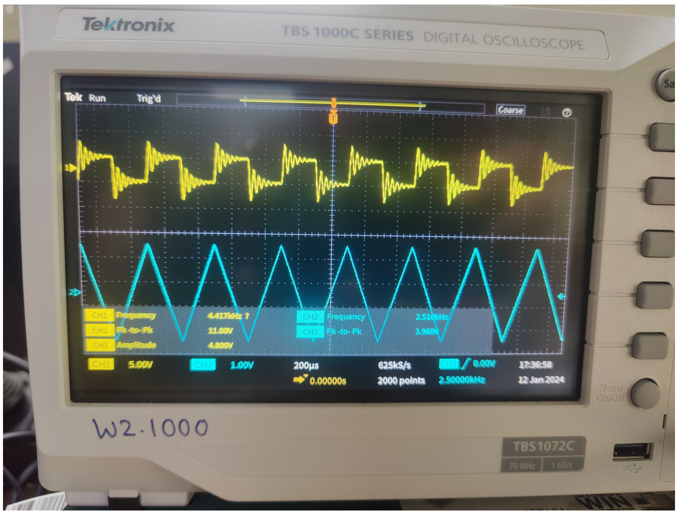


Figure 2: Enter Caption

Figure 3: Enter Caption

1.2.3 Conclusion and Inference

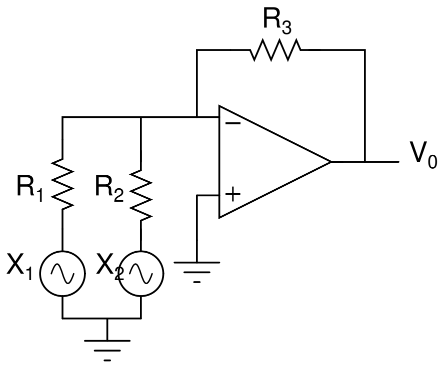
- The output signal in the first case is noisy, and does not follow the expected output completely.
- However, on adding the second capacitor, we get the expected output as the second capacitor aids in denoising.

1.3 Summer Amplifier Circuit

1.3.1 Design

- $R_1 = 10k\Omega$
- $R_2 = 5k\Omega$
- $R_3 = 10k\Omega$
- $X_1 = 4V_{pp}sin(\omega t)$
- $X_2 = 2V_{pp}sin(\omega t)$

$$V_o = \frac{R_3}{R_1}X_1 + \frac{R_3}{R_2}X_2 \tag{3}$$



1.3.2 Experimental results

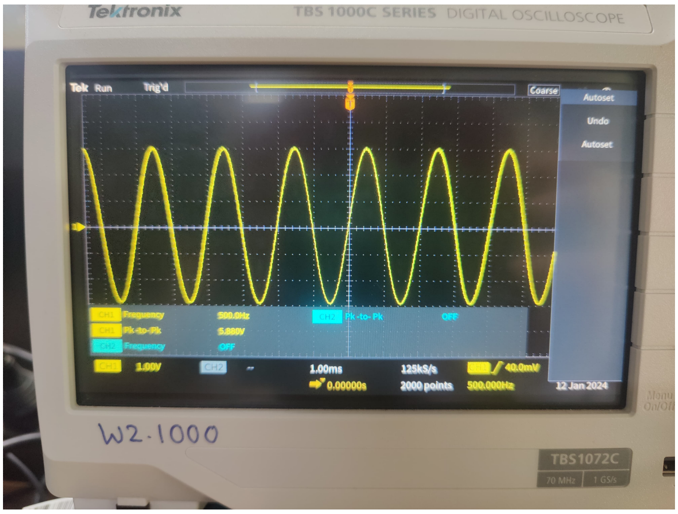


Figure 4: Enter Caption

1.3.3 Conclusion and Inference

- The output signal is the sum of the input signals multiplied by their respective gain factors.

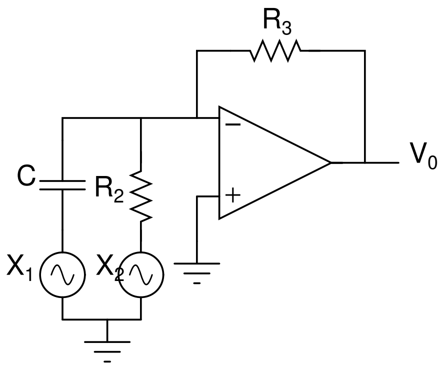
1.4 Equation Solver

1.4.1 Design

- $C = 0.01\mu F$
- $R_2 = 5k\Omega$
- $R_3 = 10k\Omega$
- $X_1 = 10sin(2\pi * 500 * t)$
- $X_2 = 2.5sin(2\pi * 500 * t)$

$$V_o = -(0.0001\frac{dX_1}{dt} + 2X_2)$$

(4)



1.4.2 Experimental results

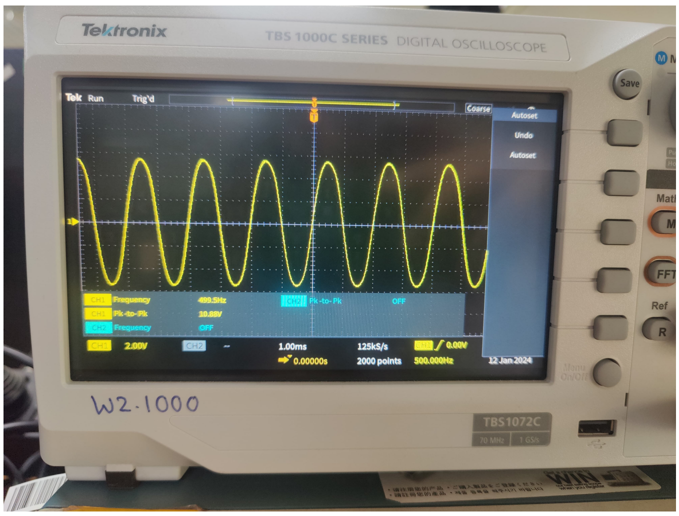


Figure 5: Enter Caption

1.4.3 Conclusion and Inference

- The output waveform, as expected, is close to the value of the intended equation for X_1 and X_2.

2 OpAmp Based Positive Feedback Circuit

2.1 Schmitt Trigger Circuit

2.1.1 Design

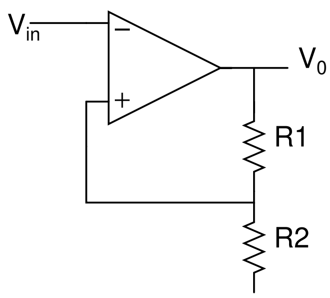
1.

- $V_T H = 2.5V$
- $V_T L = -2.5V$
- $V_a = 0V$
- $V_{in} = 10V_{pp} sin(2\pi * 1000 * t)$
- $R_1 = 1k\Omega$
- $R_2 = 5k\Omega$

$$V_o = \frac{R_2}{R_1} V_i = 10V_i = sin(\omega t) \tag{5}$$

2.

- $V_T H = 4.5V$
- $V_T L = -0.5V$
- $V_a = 2V$
- $V_{in} = 10V_{pp} sin(2\pi * 1000 * t)$



2.1.2 Experimental results

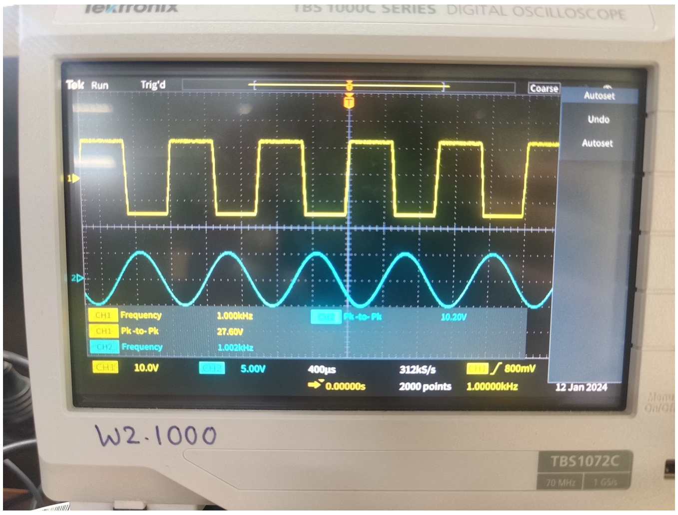


Figure 6: Enter Caption

2.1.3 Conclusion and Inference

Conclusion and Inference of the experiment should be added here.

- Completed experiments 1 and 2.1
- We were not able to complete experiment 3 because one of our OpAmps was faulty, and we spent more than one and a half hours trying to figure out why we were not getting the expected results.