ELEC ENG – 2CJ4

Laboratory Experiments (Set 4)

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03/25/2024

1.

$$V_{th1} = \frac{R_1}{R_1+R_2} \cdot V_{out+} = \frac{1K\Omega}{(1K\Omega+22K\Omega)} \cdot 5V = 0.217\,V$$

$$V_{th2} = \frac{R_1}{R_1+R_2} \cdot V_{out-} = \frac{1K\Omega}{(1K\Omega+22K\Omega)} \cdot -5V = -0.217\,V$$

$$T_{TOTAL} = RC\left(\ln\left(\frac{V_{out+}-V_{th2}}{V_{out+}-V_{th1}}\right) + \ln\left(\frac{V_{out-}-V_{th1}}{V_{out-}-V_{th2}}\right)\right)$$

$$= (100nF \times 50K\Omega)\left[\ln\left(\frac{5-(-0.217)}{5-(0.217)}\right) + \ln\left(\frac{-5-(0.217)}{-5-(-0.217)}\right)\right]$$

$$= 8.69 \times 10^{-4}\,s = 0.869\,ms$$

$$Frequency = \frac{1}{T_{Total}} = \frac{1}{0.869ms} = \frac{1}{8.69 \times 10^{-4}\,s} = 1151\,Hz$$

2.

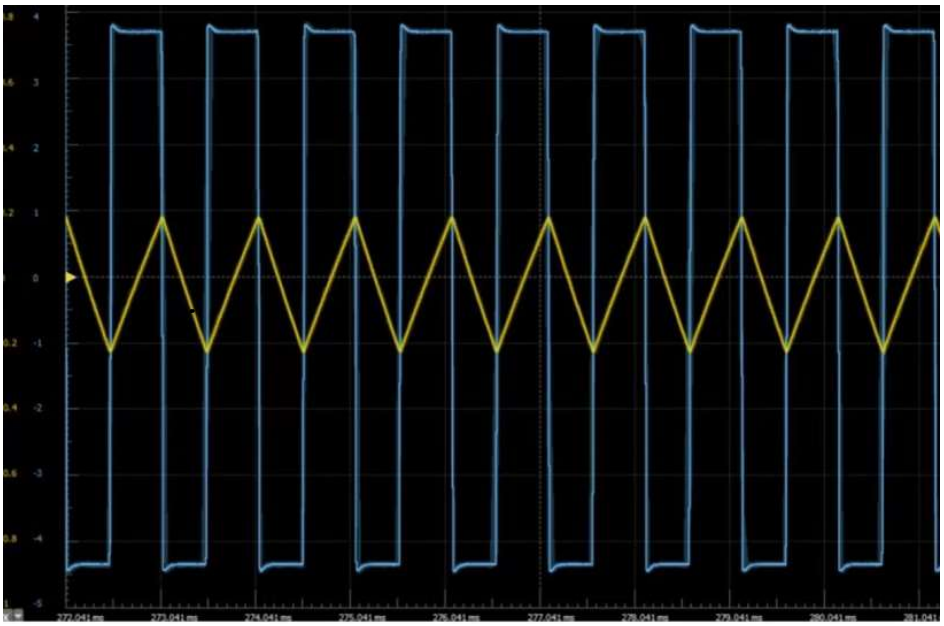

Figure 1: Capacitor Voltage (Yellow Waveform) and Op-Amp Output (Blue Waveform)

From the data, we can notice that the values generated from the Analog Discovery 2 are very similar to those calculated in the theoretical calculations. In the theoretical calculations, a frequency of 1151 Hz was calculated. From the measurements, we obtained roughly a frequency of 1030 Hz. This results in a percent difference of 11.18% which is determined through the formula: |V1 – V2| / [(V1 + V2) / 2]. The discrepancies that arise may occur due to the usage of a 49.9 Kohm resistor rather than the 50 Kohm resistor and issues with wires.

3. Yes. We can utilize the LM358 Op-Amp to generate a triangular output. In Lab 3, an integrator circuit was utilized to generate a triangular output wave from a square input wave. By feeding the outputted waveform from Lab 4 into the input of the integrator circuit from Lab 3, we will be able to generate a triangular wave output. The graph shown below demonstrates the functionality of Lab 3.

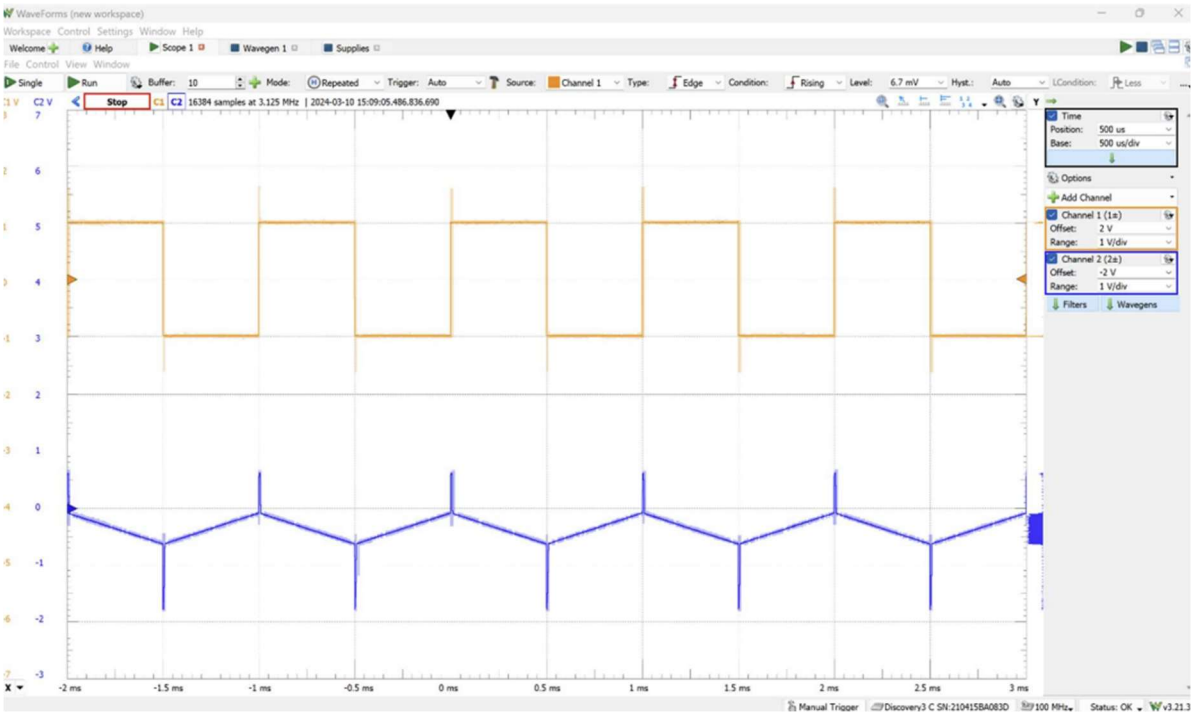

Figure 2: Square Wave Input into Triangular Wave Output