Analog Electronics

Laboratory exercise 1

Fall 2016

1 Abstract

The purpose of this laboratory exercise is to refresh skills learned from both circuits 1 and 2. Through the use of Multi-Sim and our lab bench equipment we will calculate and graph the cutoff frequency of a low-pass filter.

2 Theory

Figure 1 shows the circuit that will be constructed during this experimentation. Through the use of the function generator we will be able input an AC voltage at V_i. Using the oscilloscope we can measure the output voltage across the capacitor. From that we can derive our amplitude measurements.

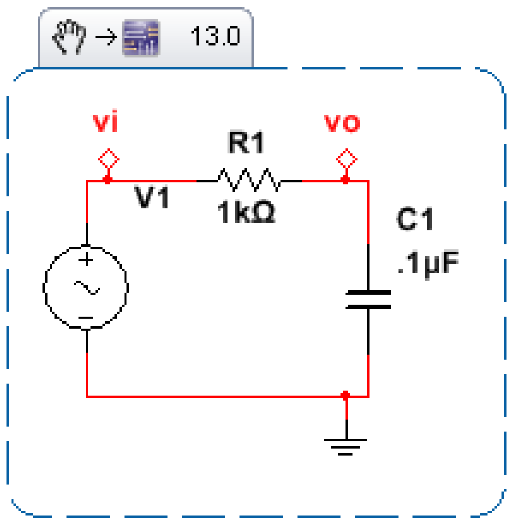

Figure 1: A simple low-pass filter

Table 1: My caption

Amplitude mV	Amplitude	Pk-Pk
700	11	22
650	10.25	20.5
600	9.5	19
550	8.65	17.3
500	7.9	15.8
450	6.95	13.9
400	6.2	12.4
350	5.4	10.8
300	4.69	9.38
250	3.875	7.75
200	3.115	6.23
150	2.37	4.74
100	1.56	3.12
50	0.81	1.62
0	0	0
2000	0.4575	0.915

3 Experiment

3.1 Experimental setup and procedure

Using Figure1 as our reference for the circuit design we begin the experimentation

1. First we construct the circuit ensuring to have all values correct.
2. By varying the frequency by intervals of 100hz and taking the amplitude at each point, construct a table of all values to model frequency response

4 Measurements

4.1 Measurement Table

From the data gathered in 3.1.2 we can construct a table.

4.2 Graph of Measurements

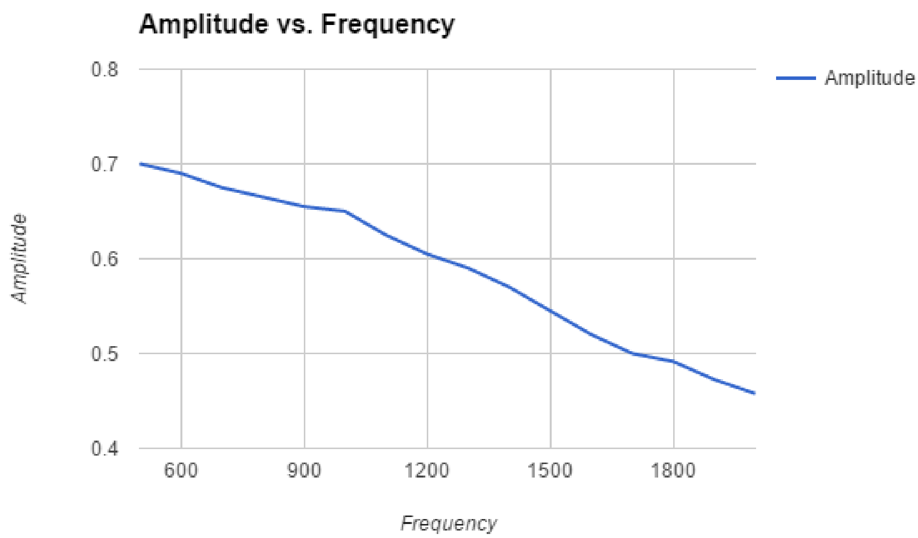

Figure 2: Graph

4.3 Calculating cutoff frequency

To calculate our cutoff frequency we will use the equation

$$\frac{1}{2\pi RC} = f_c$$

Using our Resistor Value of $1k$ and our Capacitance value of $.1uF$ we can solve for f_c

$$f_c = \frac{1}{2\pi(1k)(.1uF)} \approx 1600Hz$$

4.4 Measuring Cut-off frequency

For measuring cut-off frequency my graph of the data is inconclusive. The data I collected could have be corrupted in a number of ways including user error. From collaboration with other students I can say that a response of $1600Hz$ is reasonably accurate.

4.5 Calculating time constant s

To calculate s we will use the equation

$$\tau = RC = \frac{1}{2\pi F_c}$$

By inputing the values that are given we can calculate τ

$$\tau = (1k)(.1uF) = \frac{1}{2\pi 1600Hz} = \frac{1}{10000}$$

5 Conclusion

In this experimentation, we used a capacitor and resistor to construct a simple low pass filter. Using this filter setup we calculated f_c,τ, and we where able to graph the response(albeit incorrect). The function generator in combination with the oscilloscope is a powerful combination of tools for creating and mapping various filters that was essential to brush up on for this experimentation.