Introduction to RC Circuits
Circuits & Signals
EECE2150

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March 12, 2023

Date Performed:	March 2, 2023
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0 Introduction

The purpose of this laboratory experimentation is to familiarize oneself with circuits involving resistors, capacitors, and an operational amplifier. A circuit with a resistor, capacitor, and alternating current function generator are constructed to observe RC circuits behaving under alternating current.

0.1 Which Frequency to Use

According to RC circuit rules, the best frequency to use would be $RC = 20000(.1 \cdot 10^{-6}) = 2 \cdot 10^{-3}[\text{s}] \rightarrow \frac{1}{10 \cdot 2 \cdot 10^{-3}} = 50[\text{Hz}]$

1 Part I

1.1 Q1

From the waveform, τ would be:

$$V(t) = V_o e^{-\frac{t}{\tau}} \rightarrow \tau = \frac{1.45}{\ln(1.94375)} = 2.18[\text{ms}]$$

The value of 2.18[ms] is close to the above value of 2[ms]

2 Part 2

2.1 Q2

The magnitude of the signal generator is 2[V], with a cap of 1.3625[V]

2.2 Q3

The following formula was used to convert between magnitude and phase:

$$\frac{2\pi}{t_1} = \frac{x}{t_2}$$

Where t_1 is the period for a full cycle, t_2 is the period for the newly-generated waveform, and x is the phase. As an example, for 50[Hz], the value was obtained as follows:

$$\frac{2\pi}{12.5} = \frac{x}{1.7} = .272\pi[\text{rad}]$$

Frequency (Hz)	Δ Magnitude (V)	Δ Phase (π-rad)
.1	2.125	.02
1	2.125	.02
10	2.3	.04
100	1.15	.318
1000	.16625	.47
10000	.0305	5

2.3 Q4

As frequency is increased, the change in magnitude decreases, and the change in phase increases, and vice versa.

3 Conclusion

Overall, this laboratory experiment introduced us to the concept of RC circuits with alternating current. In such a manner, real-world examples were tested with theoretical formula applications.