Experiment No. 1

Modeling of R-C Circuit (SISO Open Loop)

Objectives

- Understand system modeling.
- Understand system transfer function and governing equation.
- Observe response of system.

Circuit Diagram

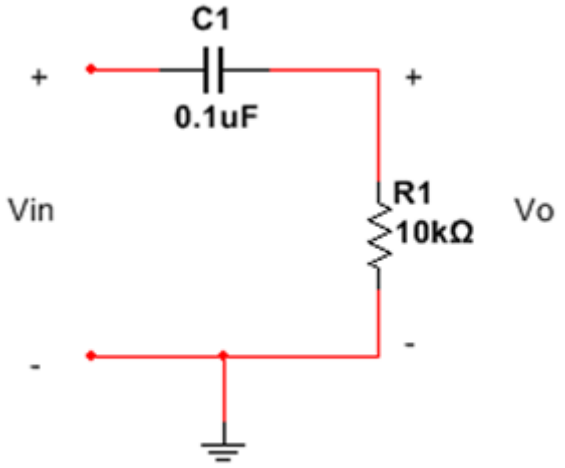

FIGURE 1.1: RC Circuit

Section 1.1: Theoretical Calculations

- Find transfer function of system shown in Figure 1.1
- Find zero, pole and gain from Transfer function.
- Find governing equation of system.
- Find unit step response of system.
- Fill table below.

Observation Set:

No.	Time	V_o (dc)
1	1ms	
2	2ms	
3	3ms	
4	4ms	
5	5ms	
6	6ms	
7	7ms	
8	8ms	

Section 1.2: Simulation

- Define transfer function of system in Matlab.
- Find zero, pole and gain from Transfer function.
- Find unit step response of system.
- Fill table below.

Observation Set:

No.	Time	V_o (dc)
1	1ms	
2	2ms	
3	3ms	
4	4ms	
5	5ms	
6	6ms	
7	7ms	
8	8ms	

Matlab Functions:

No.	Code
1	tf
2	ilaplace
3	zpkdata
4	zero
5	pole
6	step

Section 1.3: Hardware Results

- Patch circuit on breadboard.
- Generate 50 Hz Square wave with Vp-p 1V and offset 0.5V and use as input.
- Observe output using oscilloscope.
- Fill table below.

Observation Set:

No.	Time	V_o (dc)
1	1ms	
2	2ms	
3	3ms	
4	4ms	
5	5ms	
6	6ms	
7	7ms	
8	8ms	

Point to ponder:

- Product of system transfer function H(s) and unit step (1/s) IS EQUAL to convolution of system time domain h(t) and unit step u(t) and it IS EQUAL to solution of governing equation.
- System have multiple state space representations but single unique transfer function.
- Number of poles is equal to number of zeros.
- Poles in left plane of pole-zero plot make system stable while poles in right plane makes system unstable.
- System becomes marginally stable if there is at least one pole on imaginary axis in pole-zero plot.
- Two poles on origin make system unstable.
- Transfer Function us Unique while state space representation is infinitely many.