# **Practical Lab: First-Order System Analysis**

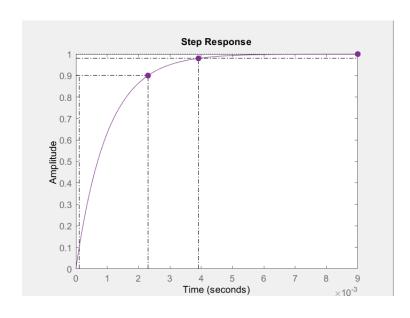
### 1. Modeling a First-Order System:

- The equation of First order system in s-domain is:

$$G(s) = rac{K}{Ts+1}$$

- Defining the system parameters, creating transfer function, and plotting the step response:

```
Editor - E:\mbd\Tasks pid\Lab1PID.m
 Lab1PID.m × +
 1
          K = 1;
 2
          R = 10e3;
          C = 1e-7;
          T = R * C;
 7
 8
          num = [0 K];
 9
          den = [T 1];
10
11
          G = tf(num,den);
          hold on
12
13
          step(G)
14
          stepinfo (G)
15
16
```



### 2. Analyzing the System Response:

- Using the stepinfo function:

```
Command Window

>>> Lab1PID

ans =

struct with fields:

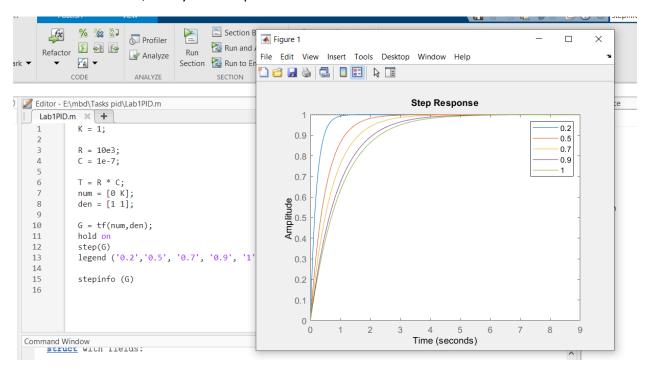
    RiseTime: 0.0022
    TransientTime: 0.0039
    SettlingTime: 0.0039
    SettlingMin: 0.9000
    SettlingMax: 1.0000
    Overshoot: 0
        Undershoot: 0
        Peak: 1.0000
        PeakTime: 0.0105
```

# 3. Exploring Different Scenarios:

#### Different values of T:

The step response for the different values of T:

When we increase T, the system response becomes slower.



#### **Different values of Gain:**

When we decrease the gain, the final value of the output decreases and the steady state error increases.

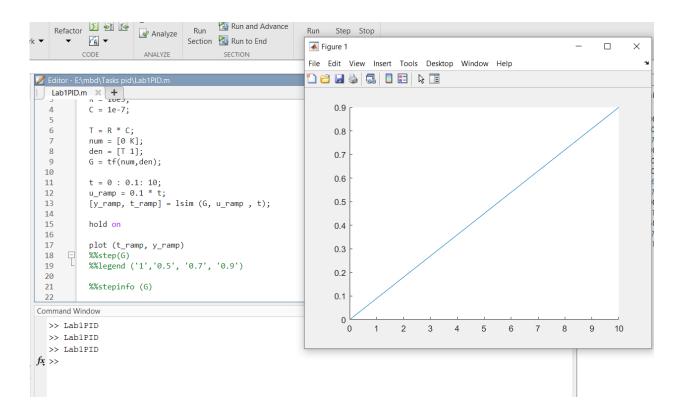
```
Section Run to End
        Figure 1
                                                       File Edit View Insert Tools Desktop Window Help
Editor - E:\mbd\Tasks pid\Lab1PID.m
                                                       Step Response
             R = 10e3;
C = 1e-7;
                                                              0.9
                                                                                                                        0.5
              T = R * C;
                                                              0.8
             num = [0 K];
den = [T 1];
                                                              0.7
              G = tf(num,den);
                                                            O.6
0.5
0.4
    11
12
              step(G)
              legend ('1','0.5', '0.7', '0.9')
    13
14
15
16
              stepinfo (G)
                                                              0.3
                                                              0.2
  Command Window struct with fletas:
               RiseTime: 0.0022
```

# 4. Ramp Input Response:

- The steady-state error equation of a first-order system with a ramp input is defined by the following equation:

$$e_{ss}=rac{1}{K}$$

- so, it depends on the gain of the system.



### 5. Parabolic Input Response:

- The steady-state error equation of a first-order system with a parabolic input is defined by the following equation:

$$e_{ss}=rac{1}{K_a}$$

- Ka=0, so the steady-state error is infinite..

