Practical Lab: First-Order System Analysis

1. Modeling a First-Order System:

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

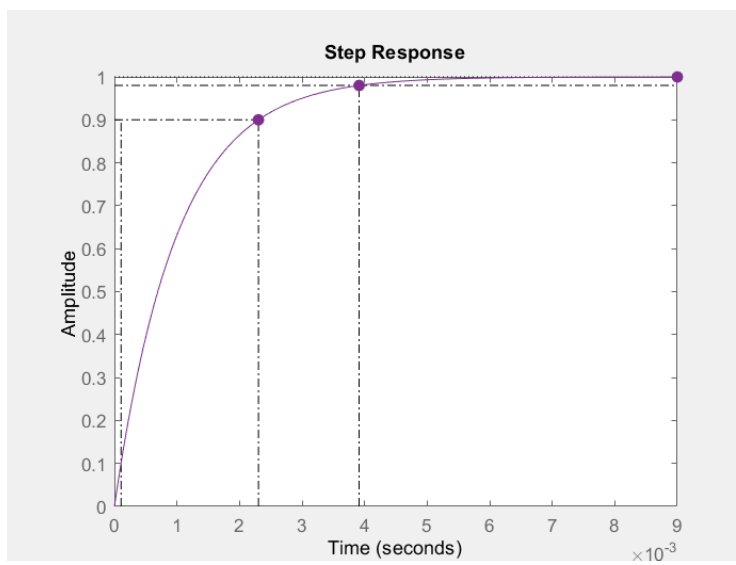
$$G(s) = \frac{K}{Ts + 1}$$

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

Editor - E:\mbd\Tasks pid\Lab1PID.m

Lab1PID.m

```
K = 1;

R = 10e3;
C = 1e-7;

T = R * C;

num = [0 K];
den = [T 1];

G = tf(num,den);
hold on
step(G)

stepinfo (G)

```



2. Analyzing the System Response:

- Using the stepinfo function:

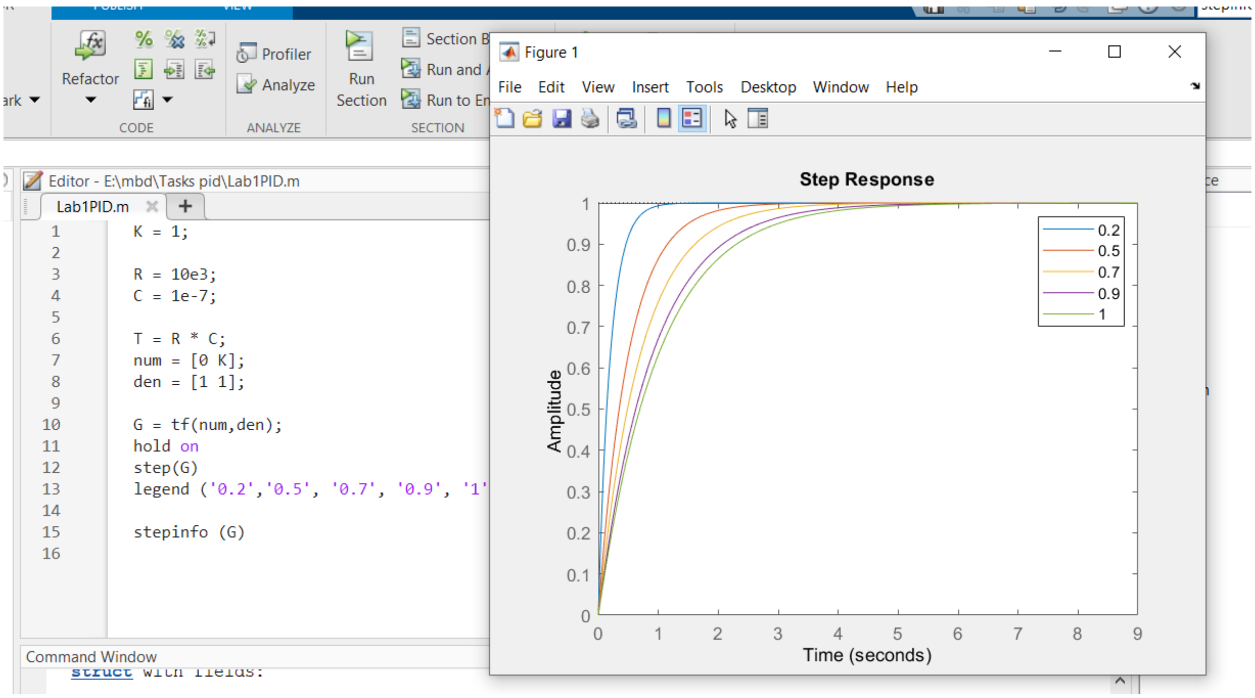
```
Command Window

>> 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

fx >>
```

3. Exploring Different Scenarios:

Different values of T:

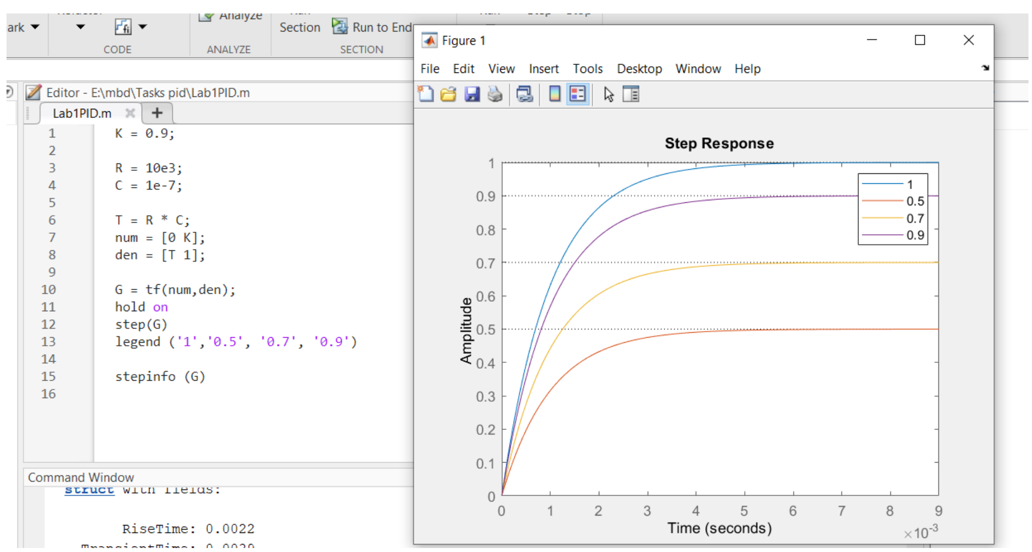
The step response for the different values of T:

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.

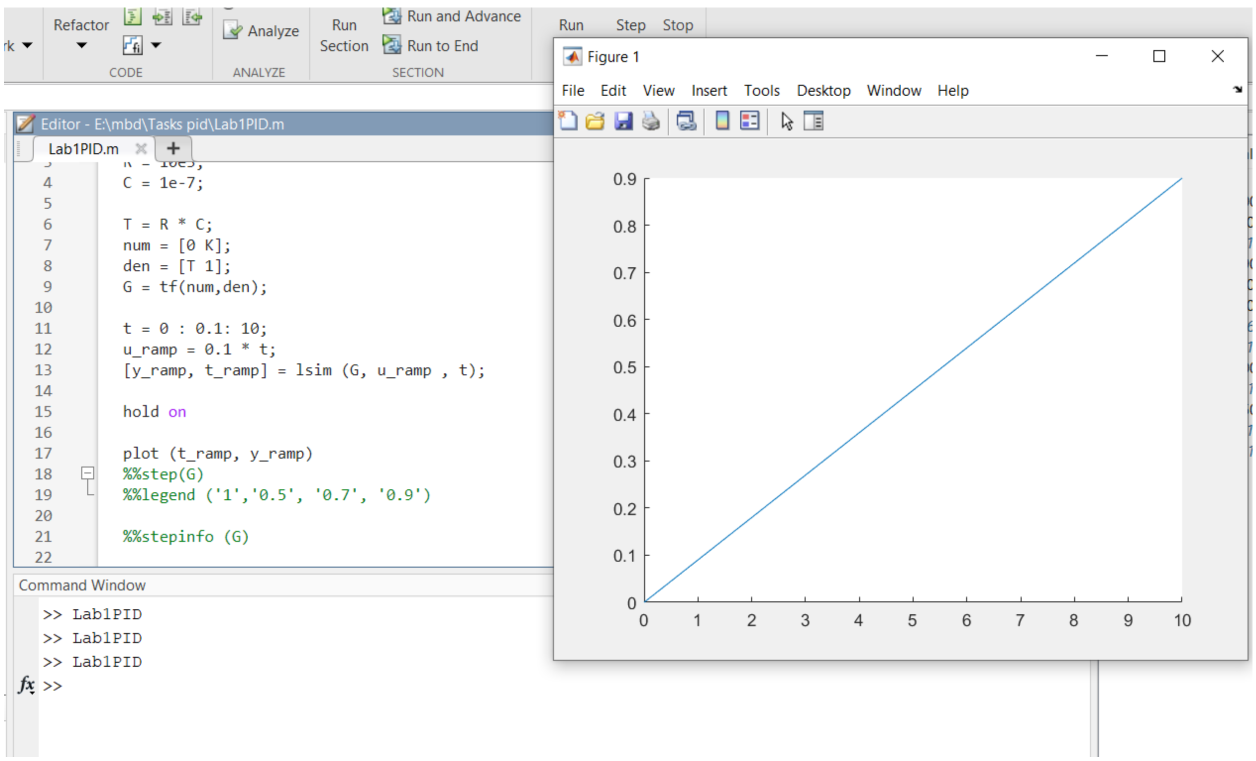


4. Ramp Input Response:

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

$$\boxed{e_{ss} = \frac{1}{K}}$$

- 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:

$$e_{ss} = \frac{1}{K_a}$$

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