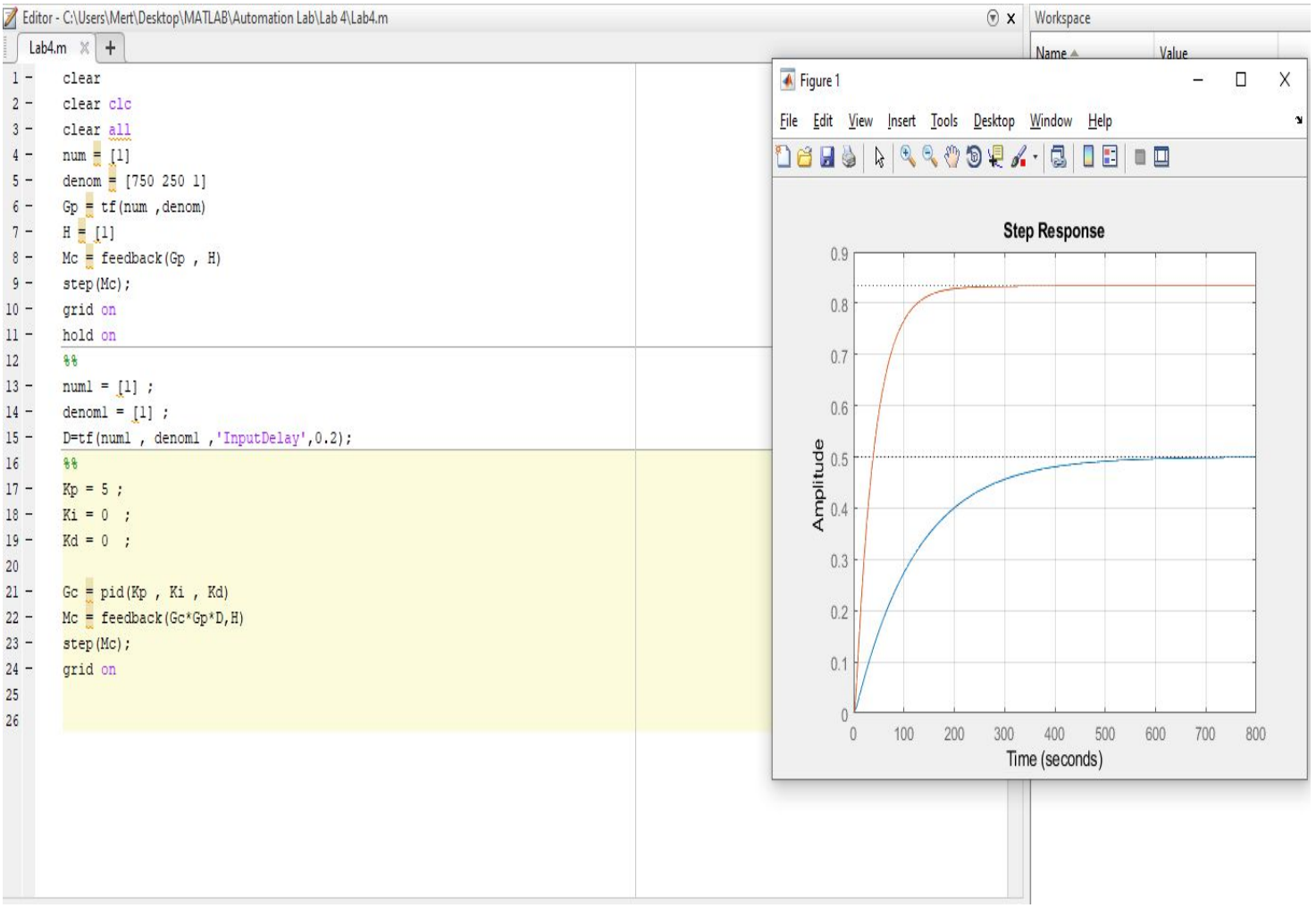
Simulation:

At the first step I added delay transfer function to my PID controller setup :

```
%%
numl = [1] ;
denoml = [1] ;
D=tf(numl , denoml ,'InputDelay',0.2);

Gc = pid(Kp , Ki , Kd)
Mc = feedback(Gc*Gp*D,H)
step(Mc);
grid on
```

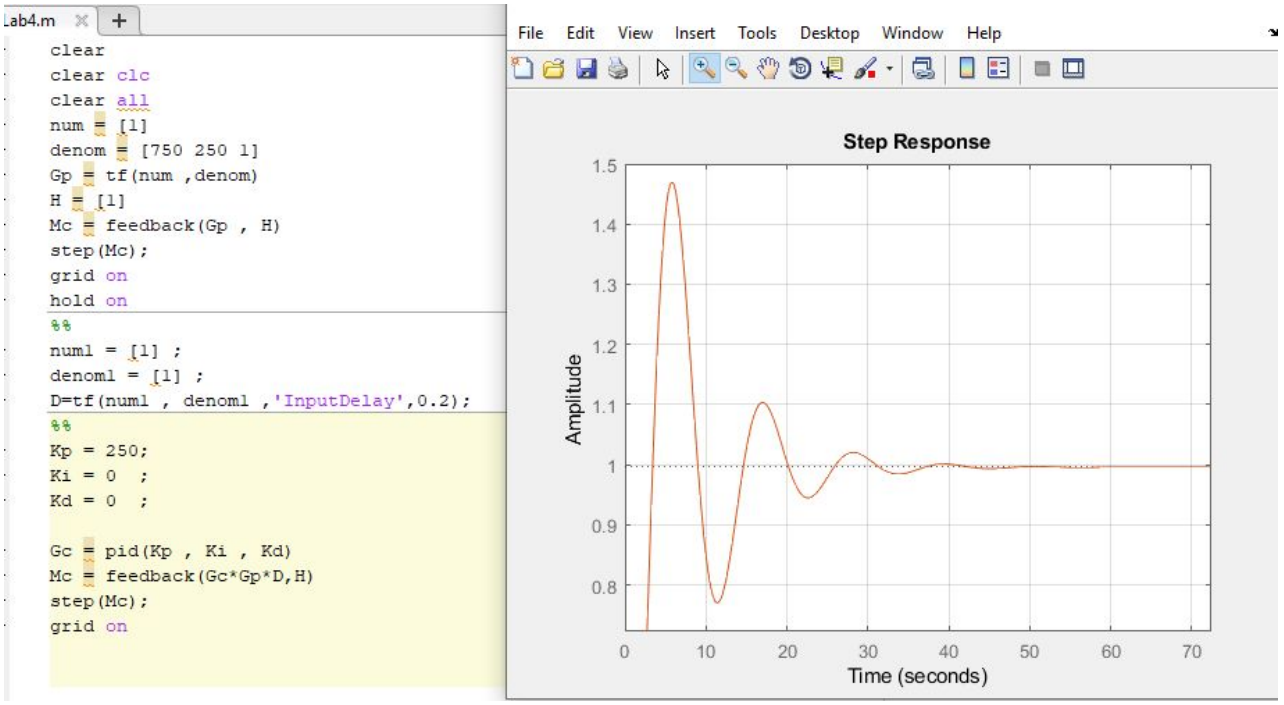
Then Ki and Kd values set to 0 and Kp value started to increase until reach the critical point:




```
clear
clear clc
clear all
num = [1]
denom = [750 250 1]
Gp = tf(num ,denom)
H = [1]
Mc = feedback(Gp , H)
step(Mc);
grid on
hold on
%%
numl = [1] ;
denoml = [1] ;
D=tf(numl , denoml ,'InputDelay',0.2);
%%
Kp = 5 ;
Ki = 0  ;
Kd = 0  ;

Gc = pid(Kp , Ki , Kd)
Mc = feedback(Gc*Gp*D,H)
step(Mc);
grid on
```

After short session for finding critical point I determined to set Kp value for 250:



```
clear
clear clc
clear all
num = [1]
denom = [750 250 1]
Gp = tf(num ,denom)
H = [1]
Mc = feedback(Gp , H)
step(Mc);
grid on
hold on
%%
num1 = [1] ;
denom1 = [1] ;
D=tf(num1 , denom1 ,'InputDelay',0.2);
%%
Kp = 250;
Ki = 0  ;
Kd = 0  ;

Gc = pid(Kp , Ki , Kd)
Mc = feedback(Gc*Gp*D,H)
step(Mc);
grid on
```


And determined Pcr to 5 seconds

Calculations :

Since we have Kcr and Pcr we can use Ziegler-Nichols Table :

Type of Controller	K_p	T_i	T_d
P	$0.5K_{cr}$	∞	0
PI	$0.45K_{cr}$	$\frac{1}{1.2}P_{cr}$	0
PID	$0.6K_{cr}$	$0.5P_{cr}$	$0.125P_{cr}$

Kp = 250 * 0.6 = 150

Ti = 0.5 * 5 = 2.5

Td = 0.125 * 5 = 0.625

According to data we find from table our final PID Controller will be like :