Simulation Assignment 2

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I. Method

A. Phase A

Initialization.

ass2.m ass2.mlx +

```
%Assignment 2 Rami Wail Shoula
```

phase A - Initialize

```
clc
close all
clear
s=tf('s'); % initialize Transfer Function TF in s domain
```

B. Phase B

Eqn 1.

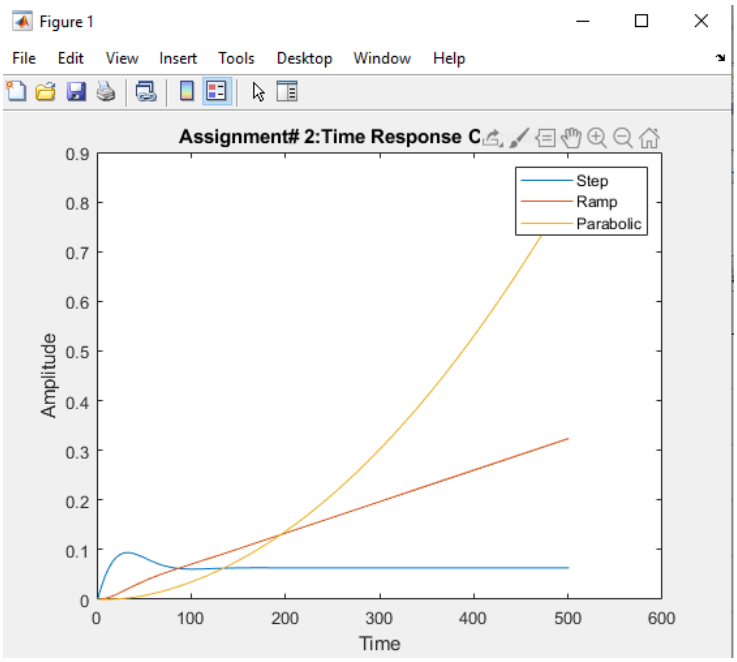
phase B - Eqn 1

```
6   TF=5*(s+3)/(7*s^2+56*s+252);
7   Gain=TF/(1-TF); %closed loop gain
8   Gain=minreal(Gain);
9   ess_step = 1/(1+dcgain(Gain))   %steady-state error step
10  ess_ramp = 1/dcgain(s*Gain)     %steady-state error ramp
11  ess_para = 1/dcgain((s^2)*Gain) %steady-state error parabolic
12
13
14  figure %initialize figure
15  t = 0:0.01:5; %small time for plot
16  plot(step(Gain, t)); %step
17  hold on
18  plot(step(Gain/s, t)); %ramp
19  hold on
20  plot(step(Gain/s^2, t)); %parabolic
21  title('Assignment# 2:Time Response Comparison')
22  legend('Step','Ramp','Parabolic')
23  xlabel('Time')
24  ylabel('Amplitude')
25
26  stepinfo(Gain)
27  damp(Gain)
```

Output from run:

```
ess_step =

    0.9405


ess_ramp =

   Inf


ess_para =

   Inf
```

```
        RiseTime: 0.0927
    SettlingTime: 1.2389
     SettlingMin: 0.0608
     SettlingMax: 0.0940
       Overshoot: 48.4559
      Undershoot: 0
            Peak: 0.0940
        PeakTime: 0.3160
```



damping frequency, natural frequency, and damping ratio

```
          Pole              Damping       Frequency       Time Constant
                                        (rad/seconds)      (seconds)

-3.64e+00 + 4.54e+00i      6.26e-01       5.82e+00         2.75e-01
-3.64e+00 - 4.54e+00i      6.26e-01       5.82e+00         2.75e-01
```

C. Phase C

Eqn 2.

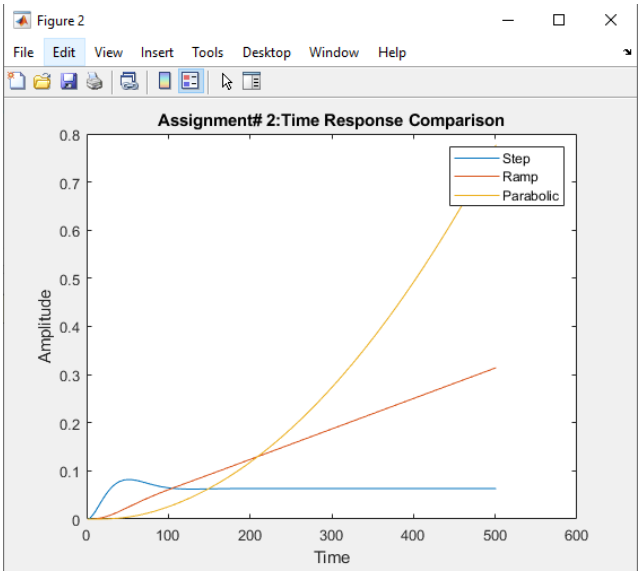
phase C - Eqn 2

```
28  TF2=5*(s+3)/((s+7)*(s^2+8*s+36));
29  G2=TF2/(1-TF2);
30  G2=minreal(G2);
31  ess_step2 = 1/(1+dcgain(G2))
32  ess_ramp2 = 1/dcgain(s*G2)
33  ess_para2 = 1/dcgain((s^2)*G2)
34
35  figure
36  t = 0:0.01:5;
37  plot(step(G2, t));
38  hold on
39  plot(step(G2/s, t));
40  hold on
41  plot(step(G2/s^2, t));
42  title('Assignment# 2:Time Response Comparison')
43  legend('Step','Ramp','Parabolic')
44  xlabel('Time')
45  ylabel('Amplitude')
46
47  stepinfo(G2)
48  damp(G2)
```

Output from run:

```
ess_step2 =

    0.9405


ess_ramp2 =

   Inf


ess_para2 =

   Inf
```

```
          RiseTime: 0.1953
      SettlingTime: 1.0042
       SettlingMin: 0.0595
       SettlingMax: 0.0820
         Overshoot: 29.4886
        Undershoot: 0
              Peak: 0.0820
          PeakTime: 0.5025
```



damping frequency, natural frequency, and damping ratio

Pole	Damping	Frequency (rad/seconds)	Time Constant (seconds)
-3.65e+00 + 4.18e+00i	6.58e-01	5.55e+00	2.74e-01
-3.65e+00 - 4.18e+00i	6.58e-01	5.55e+00	2.74e-01
-7.70e+00	1.00e+00	7.70e+00	1.30e-01