Linear Control - HW2

Problem 1

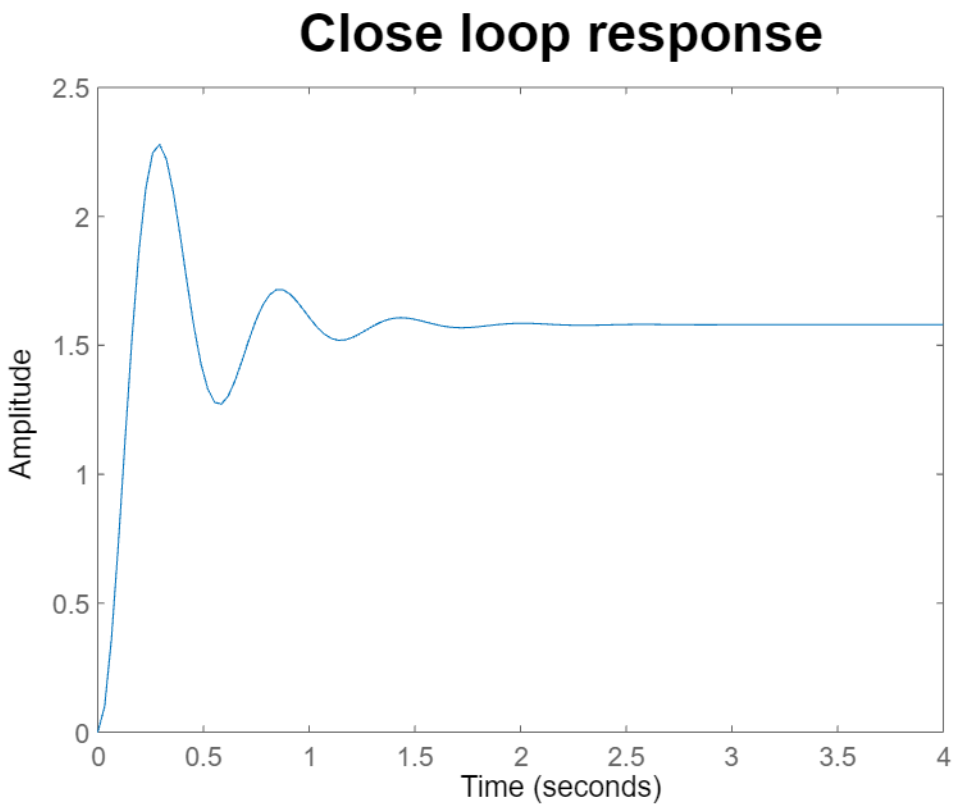
```
clear;clc
s = tf('s');
% zeta = 0.25 , ω_n = 11.347
format long
T = tf ([202.1432],[1 5.6736 127.9387])
```

```
T =

          202.1
  ---------------------
  s^2 + 5.674 s + 127.9

Continuous-time transfer function.
Model Properties
```

```
stepinfo(T)
```

```
ans = struct with fields:
         RiseTime: 0.112243410275209
    TransientTime: 1.247560512912281
     SettlingTime: 1.247560512912281
      SettlingMin: 1.270407081741653
      SettlingMax: 2.278882221361836
        Overshoot: 44.233013454890170
       Undershoot: 0
             Peak: 2.278882221361836
         PeakTime: 0.292206230075364
```

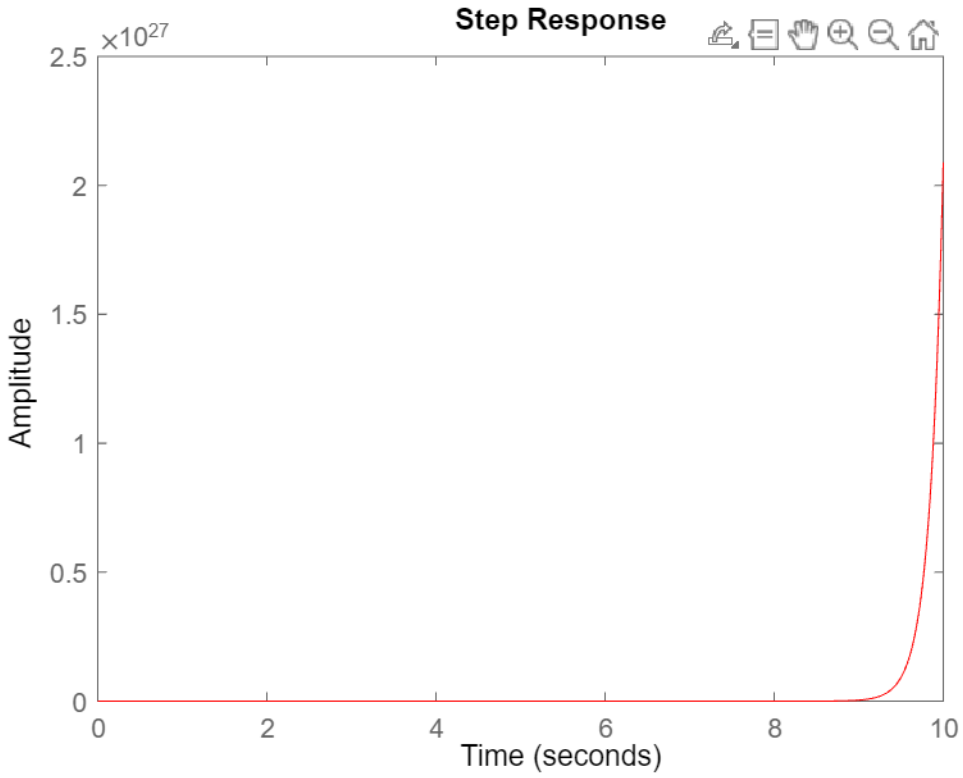
```
step (T,4);
title('Close loop response','FontSize',20);
```




```
G = feedback(T,-1)
```

```
G =

        202.1
  --------------------
  s^2 + 5.674 s - 74.2

Continuous-time transfer function.
Model Properties
```

```
step(G,'r')
```



Problem 2

```
clc;clear
s = tf('s') ;
Ka = 1 ;
Km = 0.8 ;
Ra = 2 ;
Kb = 0.5 ;
Kt = 1 ;
G = ((1)/(s+0.2)) ;
Gop = series(feedback(series(Km/Ra,G),Kb),Ka)
```

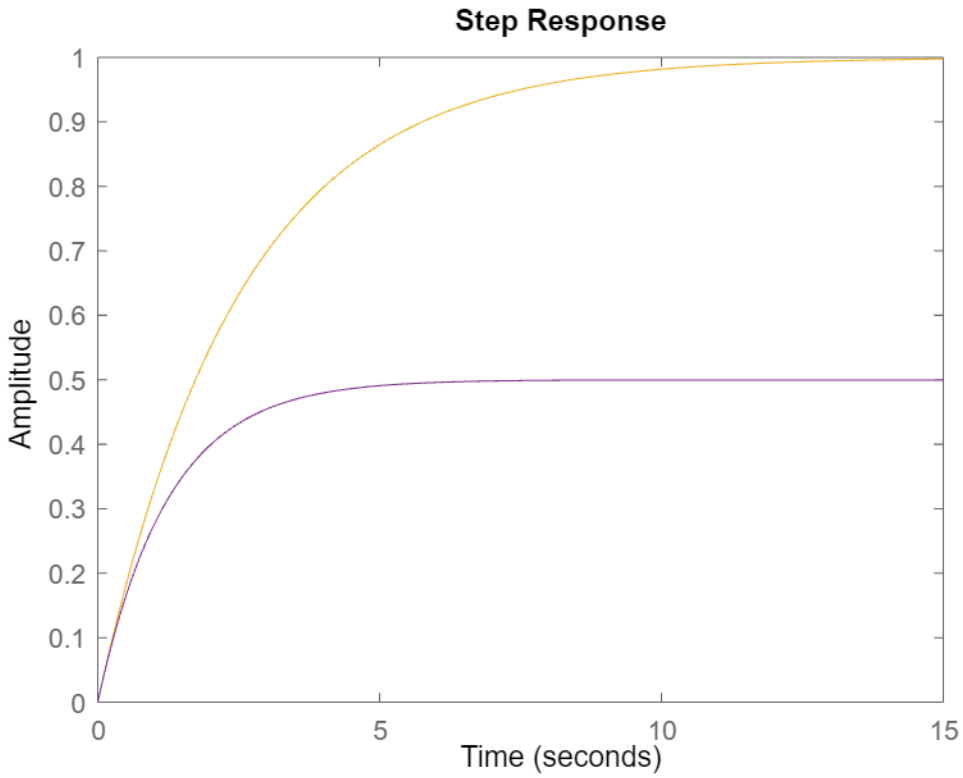
```
Gop =

    0.4
  -------
  s + 0.4

Continuous-time transfer function.
Model Properties
```

```
Gcl = feedback(series(feedback(series(Km/Ra,G),Kb),Ka),Kt)
```

```
Gcl =

    0.4
  -------
  s + 0.8
```

```
Continuous-time transfer function.
Model Properties
```

```
step(Gop)
hold on
step (Gcl)
hold off
```




```
stepinfo(Gop)
```

```
ans = struct with fields:
         RiseTime: 5.492516241579684
    TransientTime: 9.780186113349385
     SettlingTime: 9.780186113349385
      SettlingMin: 0.904500741397731
      SettlingMax: 0.999339306551989
        Overshoot: 0
       Undershoot: 0
             Peak: 0.999339306551989
         PeakTime: 18.305551489292501
```

```
stepinfo(Gcl)
```

```
ans = struct with fields:
         RiseTime: 2.746258120789819
    TransientTime: 4.890093056674668
     SettlingTime: 4.890093056674668
      SettlingMin: 0.452250370698897
      SettlingMax: 0.499669653275996
        Overshoot: 0
       Undershoot: 0
```

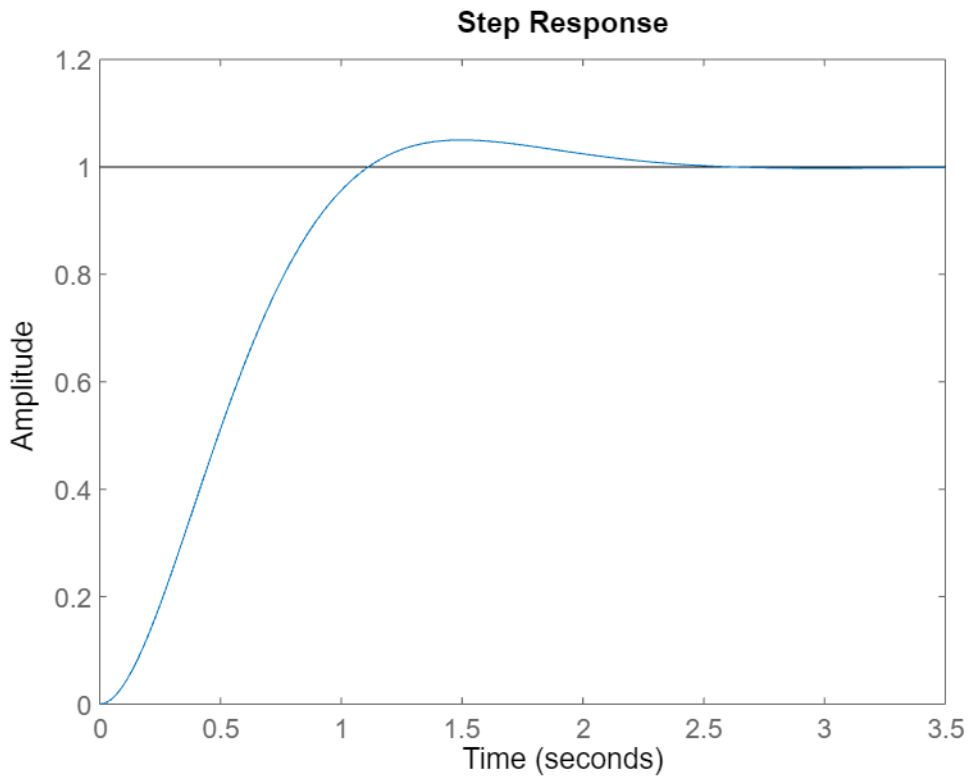
```
          Peak: 0.499669653275996
      PeakTime: 9.152775744648791
```

Problem 3

```
clc;
clear;
s = tf('s') ;
G = ((1)/(s^2+4*s)) ;
K = 8.399 ;
Gcl = feedback(series(G,K),1)
```

```
Gcl =

        8.399
  -----------------
  s^2 + 4 s + 8.399

Continuous-time transfer function.
Model Properties
```

```
step(Gcl)
```

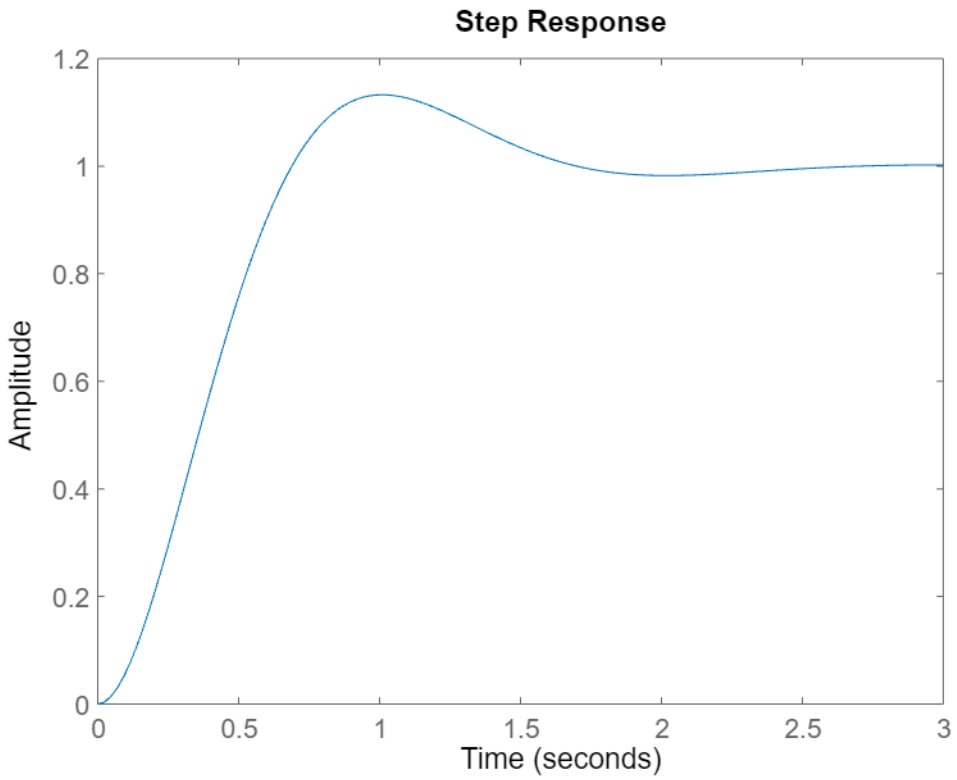



```
G = ((1)/(s^2+4*s)) ;
K = 13.675 ;
Gcl2 = feedback(series(G,K),1)
```

```
Gcl2 =
```

```
       13.68
  -----------------
  s^2 + 4 s + 13.68

Continuous-time transfer function.
Model Properties
```

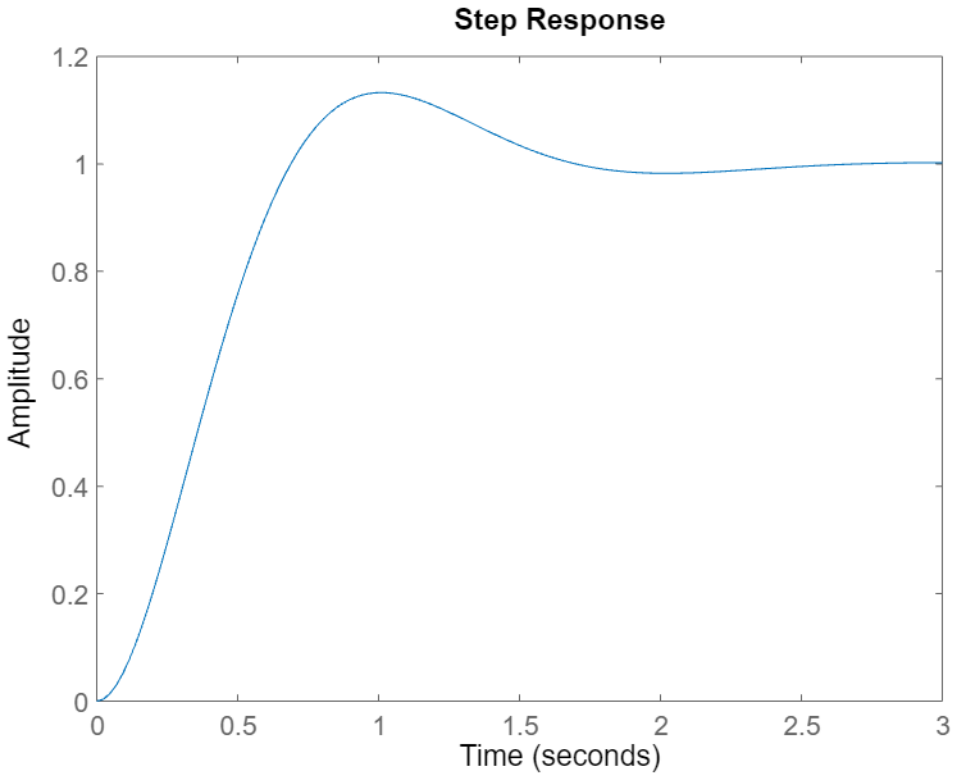
```
step(Gcl2)
```




```
G = ((1)/(s^2+4*s)) ;
K = 11.037 ;
Gcl3 = feedback(series(G,K),1)
```

```
Gcl3 =

       11.04
  -----------------
  s^2 + 4 s + 11.04

Continuous-time transfer function.
Model Properties
```

```
step(Gcl2)
```


Step Response
Amplitude
Time (seconds)
0
0.2
0.4
0.6
0.8
1
1.2
0
0.5
1
1.5
2
2.5
3