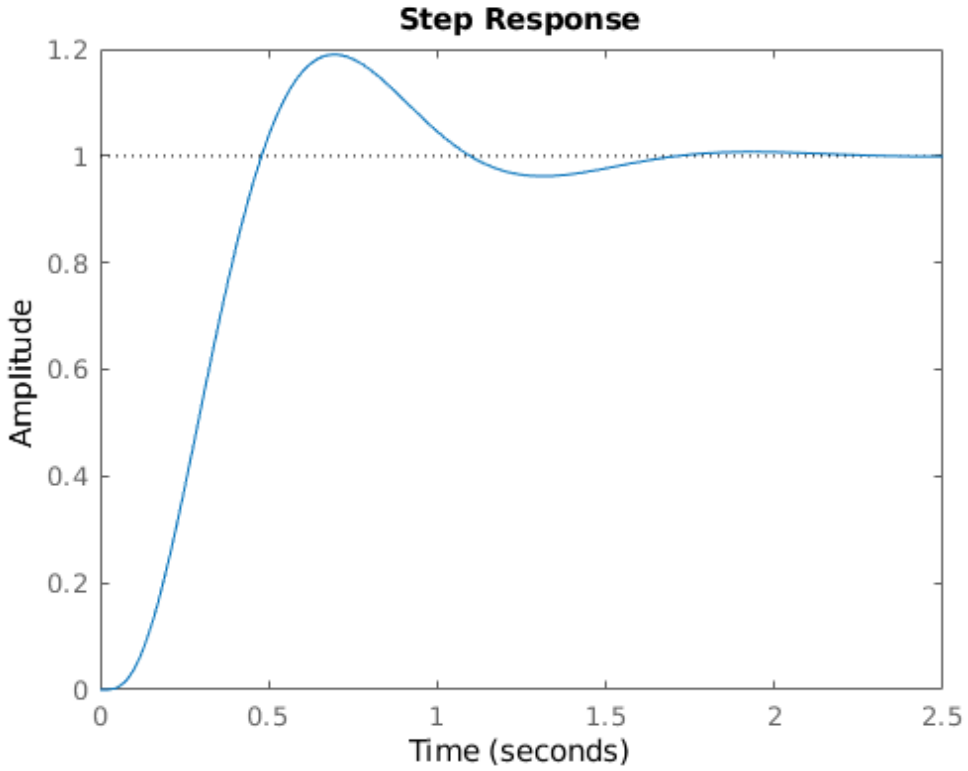
```
clear
clc
```

Controls Homework 11 Problem 1

```
Gs1 = zpk([],[0 -10 -15 -50],200);

X1 = evalfr(Gs1, -2.6 + 5.08j)
K1 = -1/X1

Gcl1 = minreal(Gs1*abs(K1) / (1 + Gs1*abs(K1)))

T = .05;

s1 = [roots([1 4.656 27.64])', roots([1 45.34 536.3])'];
z1 = exp(s1*T);

Gz1p = zpk([],z1,1,T)
Gs1 = zpk([],s1,14823)
kz1 = evalfr(Gz1p, 1);
ks1 = evalfr(Gs1, 0);
k1 = ks1/kz1
Gz1 = zpk([0 0],z1,k1,T);

Kz1 = zpk([0.8187 0.6065],[1 0.0834],34.7201,.1)
Kz1 = tf(Kz1)

step(Gcl1)
```

```
X1 =

  -0.0061 - 0.0000i


K1 =

   1.6361e+02 - 9.1505e-02i


Gcl1 =

                    32721
  -----------------------------------------
  (s+49.52) (s+20.28) (s^2 + 5.204s + 32.58)

Continuous-time zero/pole/gain model.


Gz1p =

                         1
```

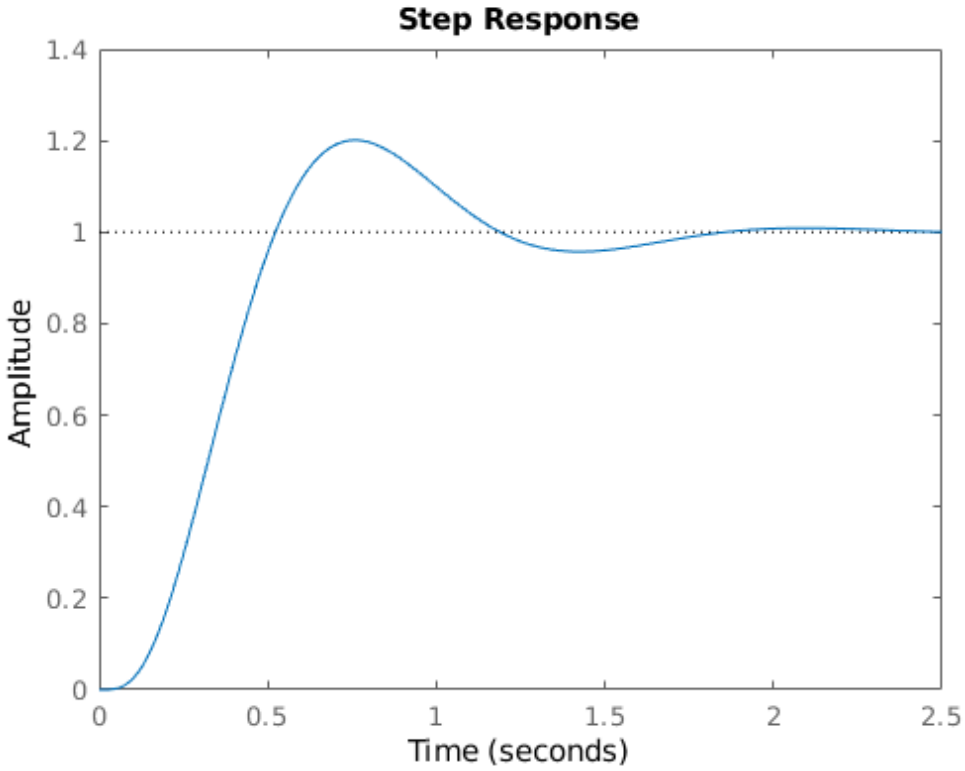
```
  -----------------------------------------------
  (z^2 - 0.6259z + 0.1036) (z^2 - 1.731z + 0.7923)

Sample time: 0.05 seconds
Discrete-time zero/pole/gain model.


Gs1 =

                       14823
  ---------------------------------------------
  (s^2 + 4.656s + 27.64) (s^2 + 45.34s + 536.3)

Continuous-time zero/pole/gain model.


k1 =

    0.0293


Kz1 =

  34.72 (z-0.8187) (z-0.6065)
  ---------------------------
       (z-1) (z-0.0834)

Sample time: 0.1 seconds
Discrete-time zero/pole/gain model.


Kz1 =

  34.72 z^2 - 49.48 z + 17.24
  ---------------------------
    z^2 - 1.083 z + 0.0834

Sample time: 0.1 seconds
Discrete-time transfer function.
```



Controls Homework 11 Problem 2

```
T2 = .250;

s2 = [roots([1 4.656 27.64])', roots([1 45.34 536.3])'];
z2 = exp(s2*T2);

Gz2p = zpk([],z2,1,T2);
Gs2 = zpk([],s2,14823);
kz2 = evalfr(Gz2p, 1);
ks2 = evalfr(Gs2, 0);
k2 = ks2/kz2
Gz2 = zpk([0 0],z2,k2,T2)

Kz2 = zpk([0.2865 0.6065],[1 -0.7287],31.5021,.25)
Kz2 = tf(Kz2)

figure;
step(Gs2)


k2 =

    0.8826
```

```
Gz2 =

                        0.88262 z^2
  ------------------------------------------------------
  (z^2 - 0.002618z + 1.195e-05) (z^2 - 0.4273z + 0.3122)

Sample time: 0.25 seconds
Discrete-time zero/pole/gain model.


Kz2 =

  31.502 (z-0.2865) (z-0.6065)
  ----------------------------
        (z-1) (z+0.7287)

Sample time: 0.25 seconds
Discrete-time zero/pole/gain model.


Kz2 =

  31.5 z^2 - 28.13 z + 5.474
  --------------------------
   z^2 - 0.2713 z - 0.7287

Sample time: 0.25 seconds
Discrete-time transfer function.
```



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