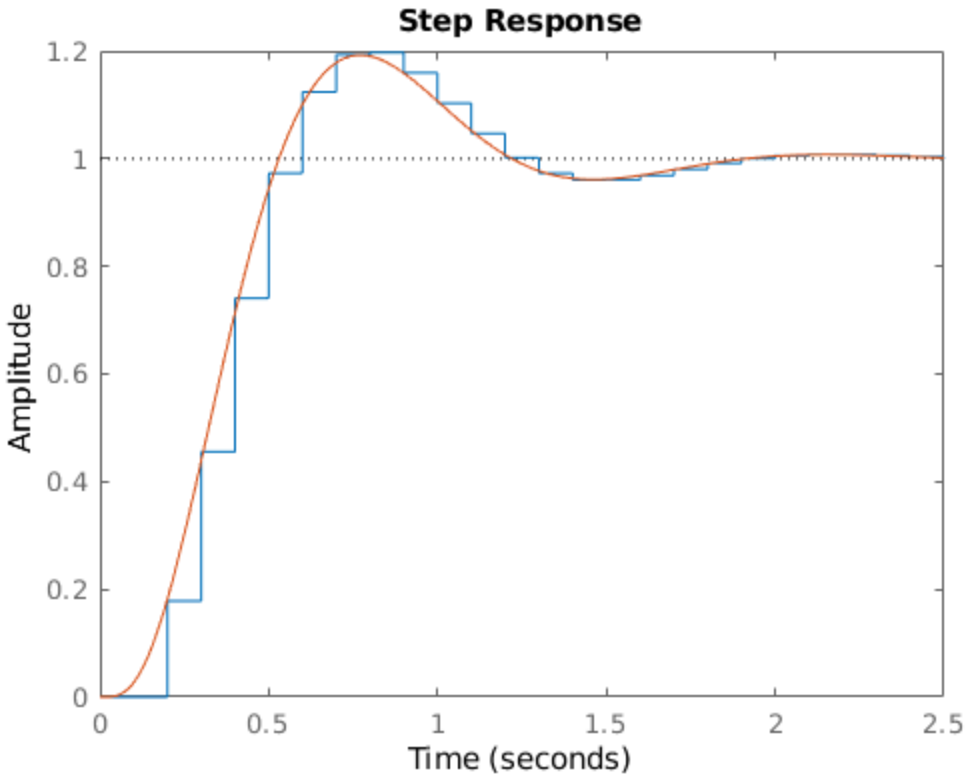
Controls Homework 11 Problem 1

```
Gs1 = zpk([],[2 -10 -15 -30],[200]);

X1 = evalfr(Gs1, -2)
K1 = -1/X1

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

Gs1_2 = zpk([],[0 -8 -20.24 -28.46],[11648]);

X1_2 = evalfr(Gs1_2, -2.3302 + 4.5505i)
K1_2 = -1/X1_2

Gcl1_2 = minreal(Gs1_2*abs(K1_2) / (1 + Gs1_2*abs(K1_2)))

T = .1;

s1 = [roots([1 52.04 697])', roots([1 4.66 26.14])'];
z1 = exp(s1*T);

Gz1 = zpk([],z1,1);
Gs1 = zpk([],s1,18216);
kz1 = evalfr(Gz1, 1);
ks1 = evalfr(Gs1, 0);
k1 = ks1/kz1
Gz1 = zpk([0 0],z1,k1,T)
Gz1tf = tf(Gz1)

step(Gz1)
hold on
step(Gs1)
hold off


X1 =

   -0.0172


K1 =

   58.2400


Gcl1 =

                11648
  ----------------------------------
  (s+28.46) (s+20.24) (s+2.298) (s+2)

Continuous-time zero/pole/gain model.
```

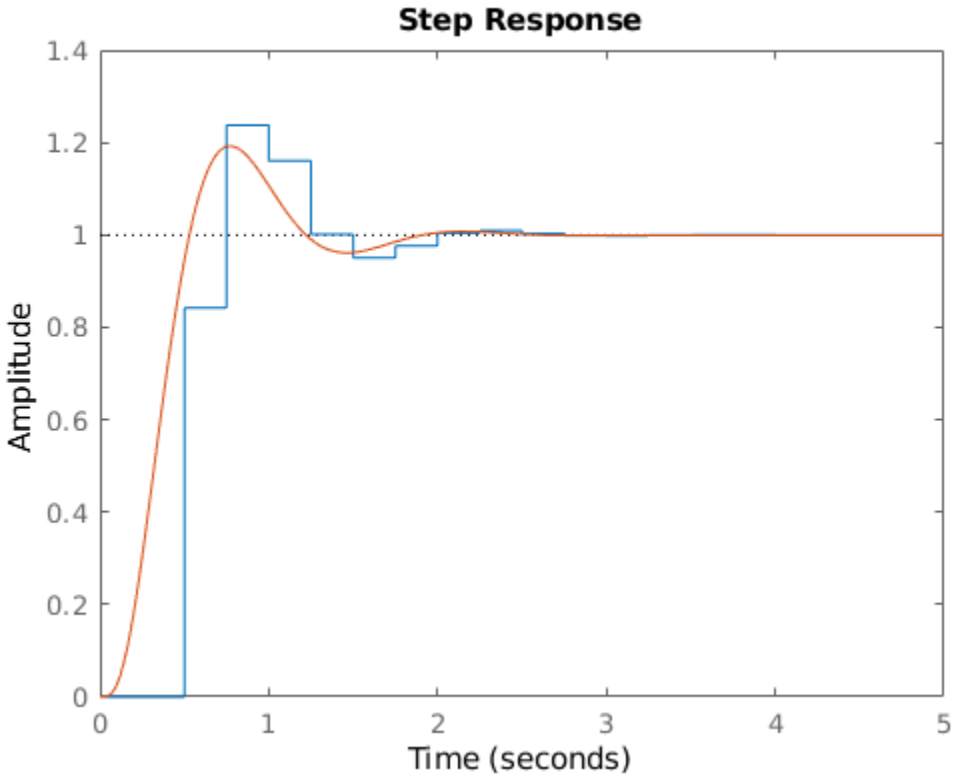
```
X1_2 =

  -0.6394 + 0.0000i


K1_2 =

   1.5639 + 0.0000i


Gcl1_2 =

                    18216
  ----------------------------------------
  (s^2 + 52.04s + 697) (s^2 + 4.66s + 26.14)

Continuous-time zero/pole/gain model.


k1 =

    0.1782


Gz1 =

                      0.1782 z^2
  -------------------------------------------------
  (z^2 - 0.1337z + 0.005495) (z^2 - 1.423z + 0.6275)

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


Gz1tf =

                      0.1782 z^2
  -----------------------------------------------------
  z^4 - 1.557 z^3 + 0.8233 z^2 - 0.09172 z + 0.003448

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



Controls Homework 11 Problem 2

```
T2 = .250;

s1 = [roots([1 52.04 697])', roots([1 4.66 26.14])'];
z1 = exp(s1*T2);

Gz1 = zpk([],z1,1);
Gs1 = zpk([],s1,18216);
kz1 = evalfr(Gz1, 1);
ks1 = evalfr(Gs1, 0);
k1 = ks1/kz1
Gz1 = zpk([0 0],z1,k1,T2)
Gz1tf = tf(Gz1)

figure;
step(Gz1)
hold on
step(Gs1)
hold off


k1 =

    0.8419
```

```
Gz1 =

                        0.8419 z^2
  ------------------------------------------------------
  (z^2 - 0.001312z + 2.238e-06) (z^2 - 0.4687z + 0.3119)

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


Gz1tf =

                        0.8419 z^2
  ------------------------------------------------------
  z^4 - 0.4701 z^3 + 0.3125 z^2 - 0.0004102 z + 6.98e-07

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



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