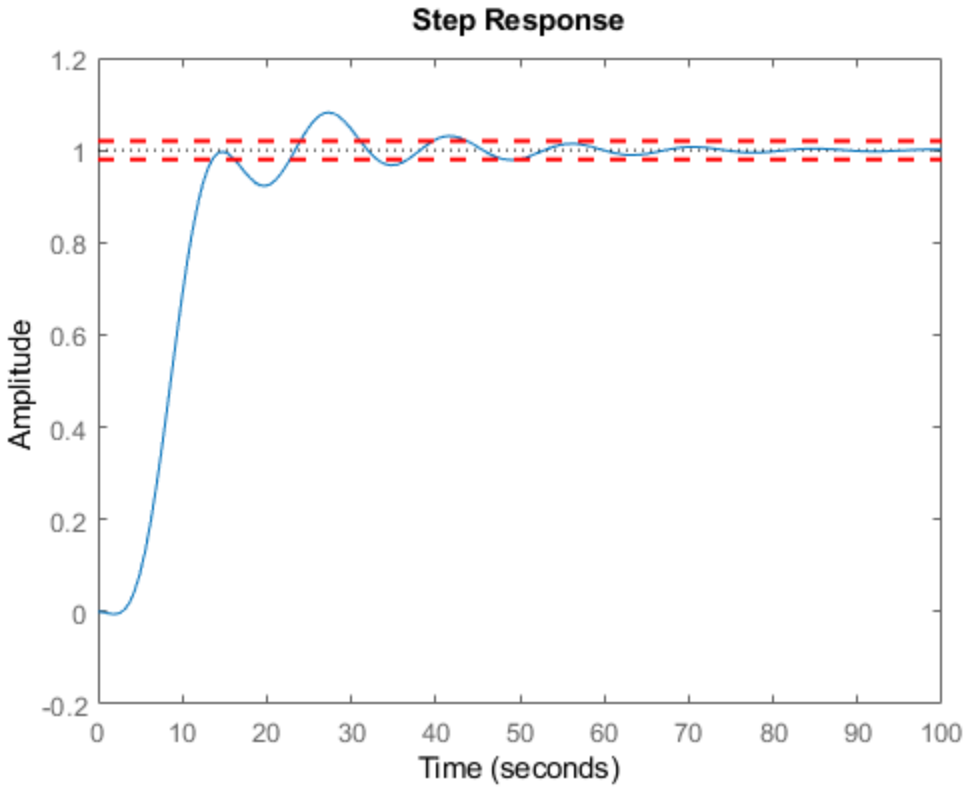
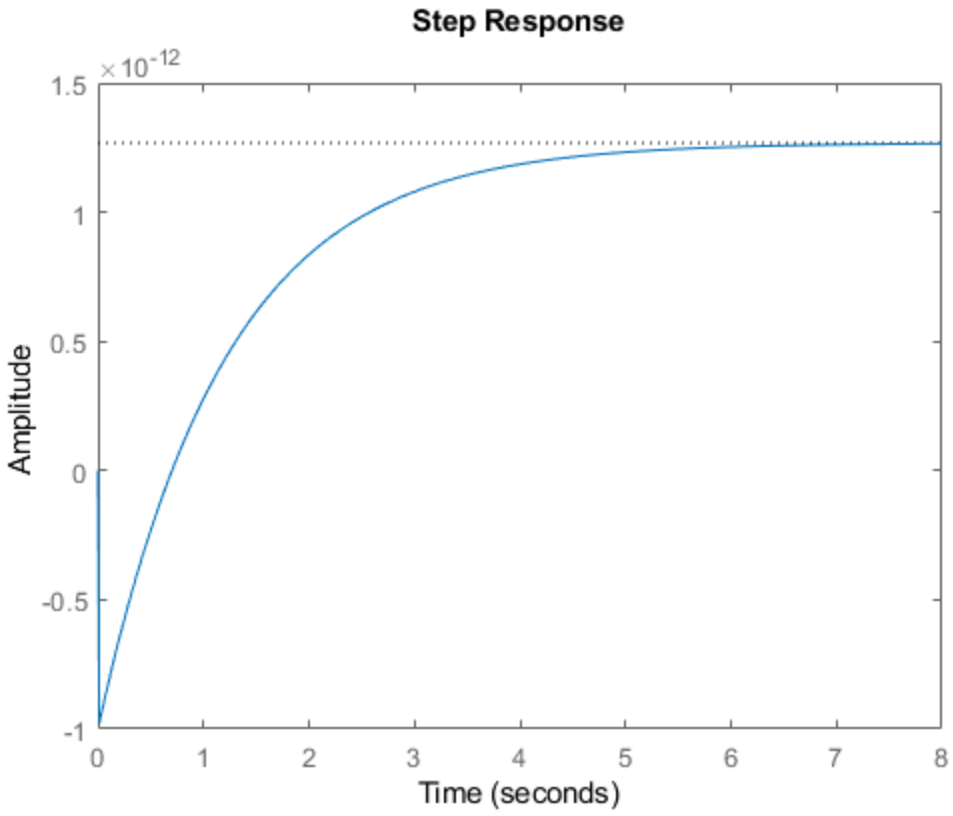
```
clc
clear
close all

A = [0 0 1 0; 0 0 0 1; -1/11 1/11 -0.1/11 0.1/11; 1/11 -1/11 0.1/11 -0.1/11];
B = [0; 0; 12/143; -1/143];
C = [0 1 0 0];
D = 0;
Q = C'*C;
R = 1;
[K,S,P] = lqr(A,B,Q,R);
[num, den] = ss2tf(A-B*K, B, C, D);
sys = tf(num, den);
damp(sys)
[wn, zeta, poles] = damp(sys);
Ts = (-log(0.02))/(zeta(1)*wn(1))
figure(1)
hold on
step(sys)
stepinfo(sys)
plot([0, 100], [1.02, 1.02], '--r', 'LineWidth', 1.5);
plot([0, 100], [0.98, 0.98], '--r', 'LineWidth', 1.5);
```

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

 -1.48e-01 + 1.19e-01i     7.80e-01       1.90e-01          6.76e+00
 -1.48e-01 - 1.19e-01i     7.80e-01       1.90e-01          6.76e+00
 -4.89e-02 + 4.38e-01i     1.11e-01       4.41e-01          2.05e+01
 -4.89e-02 - 4.38e-01i     1.11e-01       4.41e-01          2.05e+01

Ts =

   26.4313


ans =

  struct with fields:

         RiseTime: 6.8520
    TransientTime: 49.6229
     SettlingTime: 49.6774
      SettlingMin: 0.9230
      SettlingMax: 1.0820
        Overshoot: 8.1991
       Undershoot: 0.5349
             Peak: 1.0820
         PeakTime: 27.3807
```




```
figure(2)
R = 1e-24;
[K,S,P] = lqr(A,B,Q,R);
[num, den] = ss2tf(A-B*K, B, C, D);
sys = tf(num, den);
step(sys)
stepinfo(sys)
```

```
ans =

  struct with fields:

        RiseTime: 2.6504
    TransientTime: 4.7299
     SettlingTime: 5.4202
      SettlingMin: 1.1423e-12
      SettlingMax: 1.2665e-12
        Overshoot: 0
       Undershoot: 77.2239
             Peak: 1.2665e-12
         PeakTime: 8.7657
```



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