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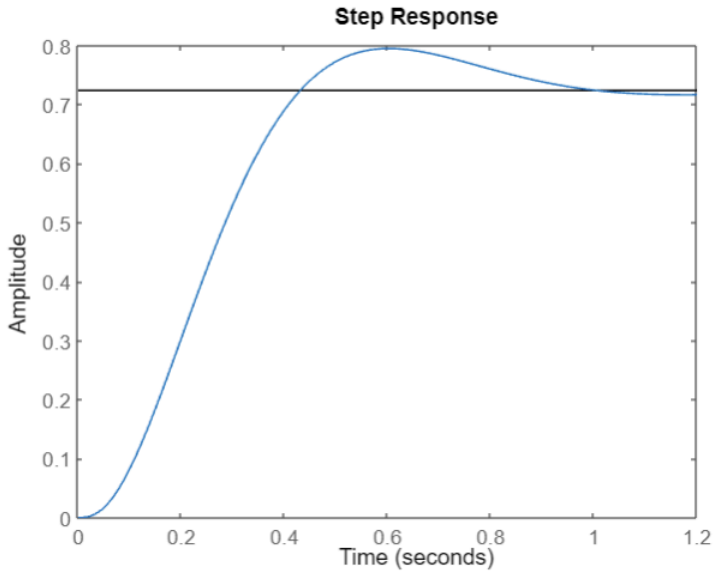
MAE 476, Sec 3

Project 4

untitled.mlx *

```
%% Step 1
Ts = 1;
pos = 10;
z = -log(pos/100)/sqrt(pi^2+(log(pos/100))^2);
alpha = acos(z);
re_comp = -4/Ts;
im_comp = re_comp*tan(alpha);
p1 = re_comp + j*im_comp
p2 = re_comp - j*im_comp
p3 = 10*real(p1) % multiply by 10 to place pole 10 times away from second-order dominant pair
Jc = [p1 p2 p3];
%% Step 2
A = [0 1 0; 0 0 1; 0 -171 -101.71];
B = [0 0 1]';
C = [1325 0 0];
D = 0;
K = acker(A,B, Jc);
An = A - B*K
[num, den] = ss2tf(An, B, C, D)
step(tf(num,den))
%% Step 3
Jo = 10*real(Jc)
%% Step 4
L = acker(A',C',Jo)'
```

- Designed controller with a 10% overshoot and a 1 second settling time
- Put third pole 10 times away from second-order dominant pair by multiplying the real part of pole 1 by 10




```
ans = struct with fields:
         RiseTime: 0.2761
    TransientTime: 0.9021
     SettlingTime: 0.9021
      SettlingMin: 0.6639
      SettlingMax: 0.7946
        Overshoot: 9.8339
       Undershoot: 0
             Peak: 0.7946
         PeakTime: 0.5987
```

- Verify that the design requirements are met with 10% overshoot and 1 second settling time

```
%% Step 3
Jo = 10*real(Jc)
%% Step 4
L = acker(A',C',Jo)'
```

- Designed observer with a natural frequency 10 times of the system response of the previous system