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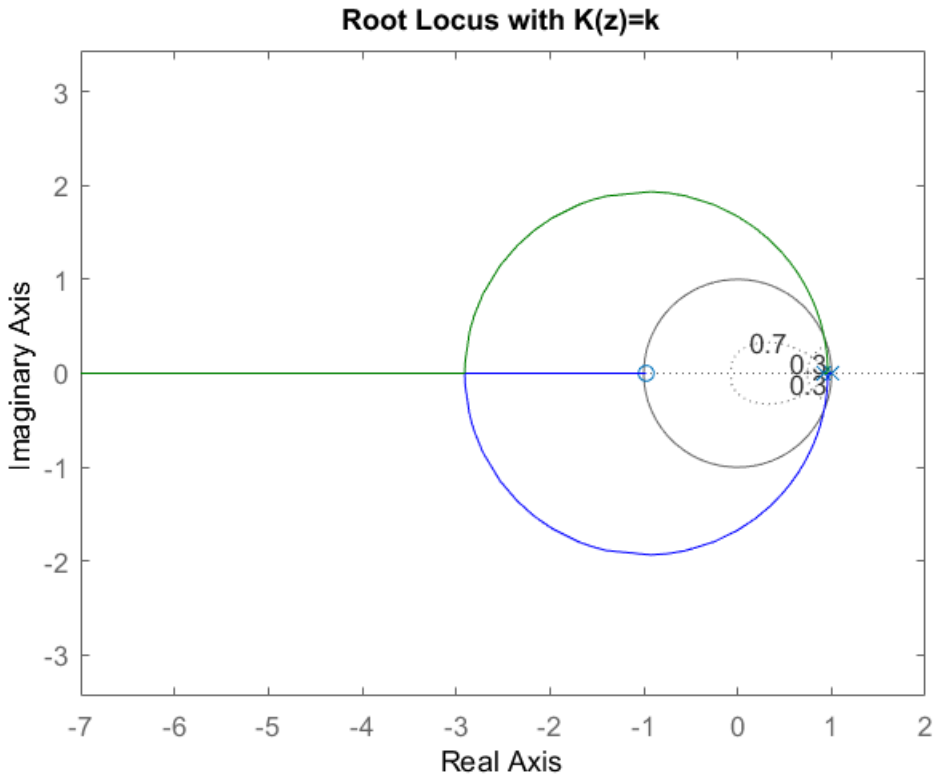
Discrete Design of Yaw Controller

```
%Continuous-time plant
G=tf(7.461,[1 0.2701 0]);
% Desired closed-loop poles info
zeta=0.7;
wn=1;
% ZOH Discrete equivalent of G(s)
Ts=0.3;
G0=c2d(G,Ts)
pole(G0)
zero(G0)
```

```
G0 =

    0.3269 z + 0.3181
  ----------------------
  z^2 - 1.922 z + 0.9222

Sample time: 0.3 seconds
Discrete-time transfer function.


ans =

    1.0000
    0.9222


ans =

   -0.9734
```

Discrete-time Controller K(z)=k

```
%Plot Root Locus
rlocus(G0);
title('Root Locus with K(z)=k')
zgrid(zeta ,wn*Ts);
axis equal
```

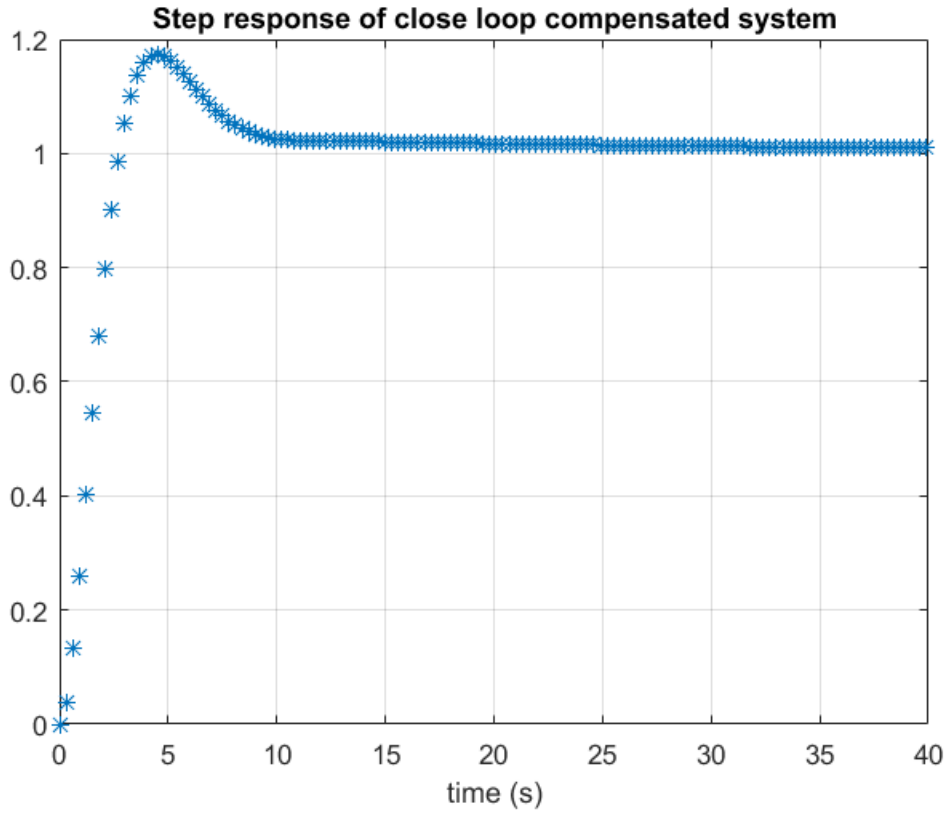


Discrete-time Controller

```
K1=tf([1 -0.89] ,[1 -0.6],Ts)
K2=tf([1 -0.991],[1 -0.999],Ts)
K=0.113*K1*K2;
Gol=series(K,G0);
%Plot Root Locus
rlocus(Gol);
title(' Root Locus with K(z)')
zgrid(zeta , wn*Ts); axis equal

Gcl=feedback(Gol,1);
tfinal=40;
[y,t]=step(Gcl,tfinal);
plot(t,y,'*')
grid
xlabel('time (s)')
title('Step response of close loop compensated system')
stepinfo(Gcl)
```

```
K1 =

  z - 0.89
  --------
  z - 0.6
```

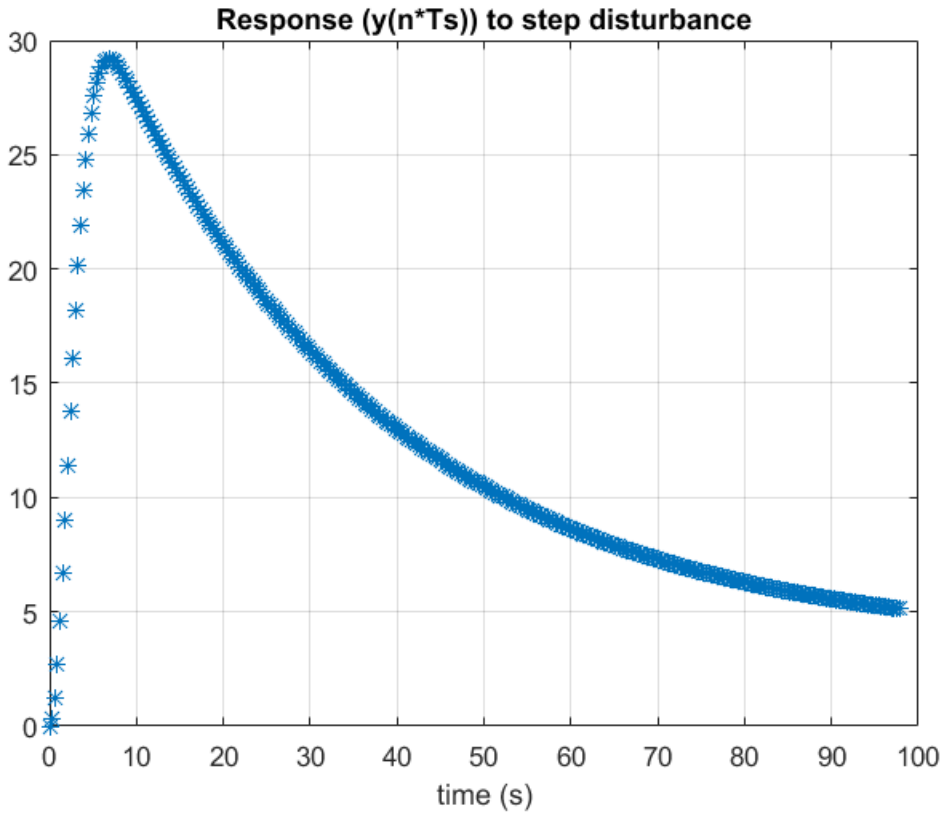
```
Sample time: 0.3 seconds
Discrete-time transfer function.


K2 =

  z - 0.991
  ---------
  z - 0.999

Sample time: 0.3 seconds
Discrete-time transfer function.


ans =

        RiseTime: 1.8000
    SettlingTime: 15.9000
     SettlingMin: 0.9013
     SettlingMax: 1.1737
       Overshoot: 17.3724
      Undershoot: 0
            Peak: 1.1737
        PeakTime: 4.5000
```



Disturbance

```
Gdy=feedback(G0,K)
tfinal=98;
[yd,t]=step(Gdy,tfinal);
plot(t,yd,'*')
grid
xlabel('time (s)')
title('Response (y(n*Ts)) to step disturbance')
resp_dist=stepinfo(Gdy)
```

```
Gdy =

   0.3269 z^3 - 0.2045 z^2 - 0.3128 z + 0.1907
  -------------------------------------------
  z^4 - 3.484 z^3 + 4.562 z^2 - 2.662 z + 0.5845

Sample time: 0.3 seconds
Discrete-time transfer function.


resp_dist =

        RiseTime: 0.6000
    SettlingTime: 133.8000
     SettlingMin: 3.6088
     SettlingMax: 29.1678
       Overshoot: 715.7493
      Undershoot: 0
            Peak: 29.1678
        PeakTime: 6.9000
```



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