Feedback Control Systems

Complex Engineering Problem (Project)

Phase 2 Report

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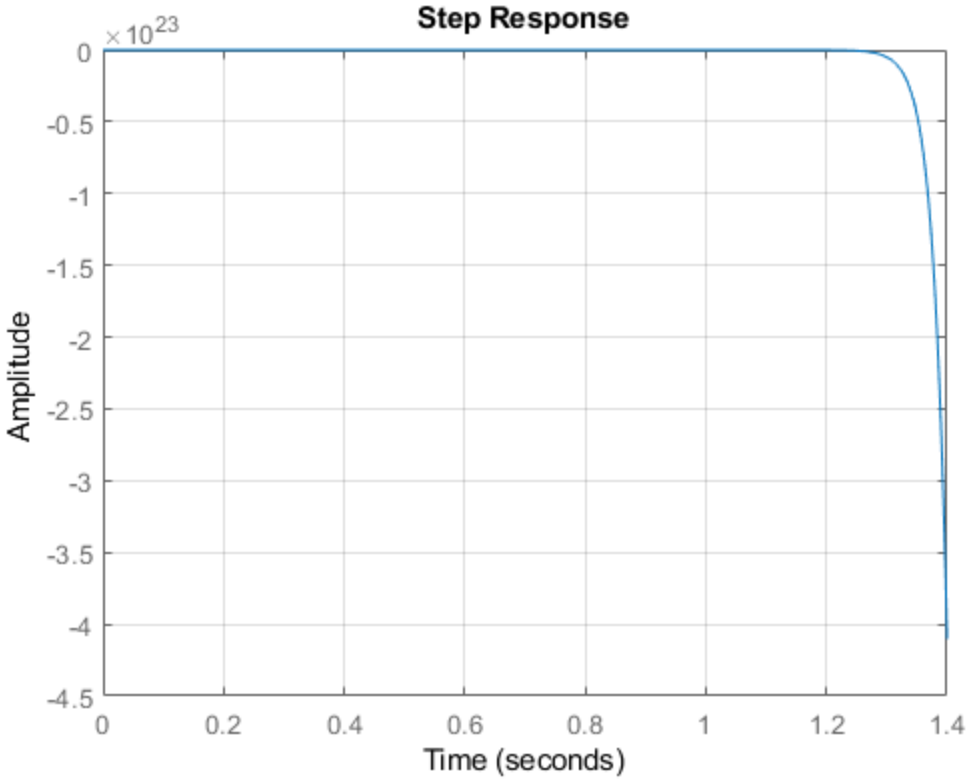
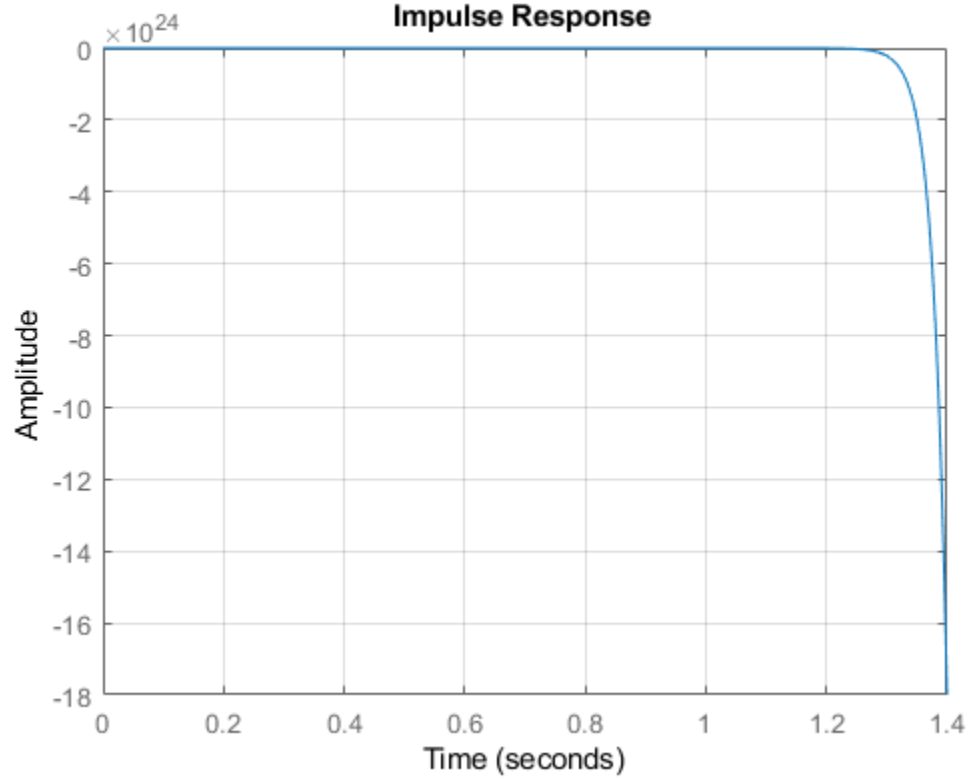
Section: A

MATLAB Code

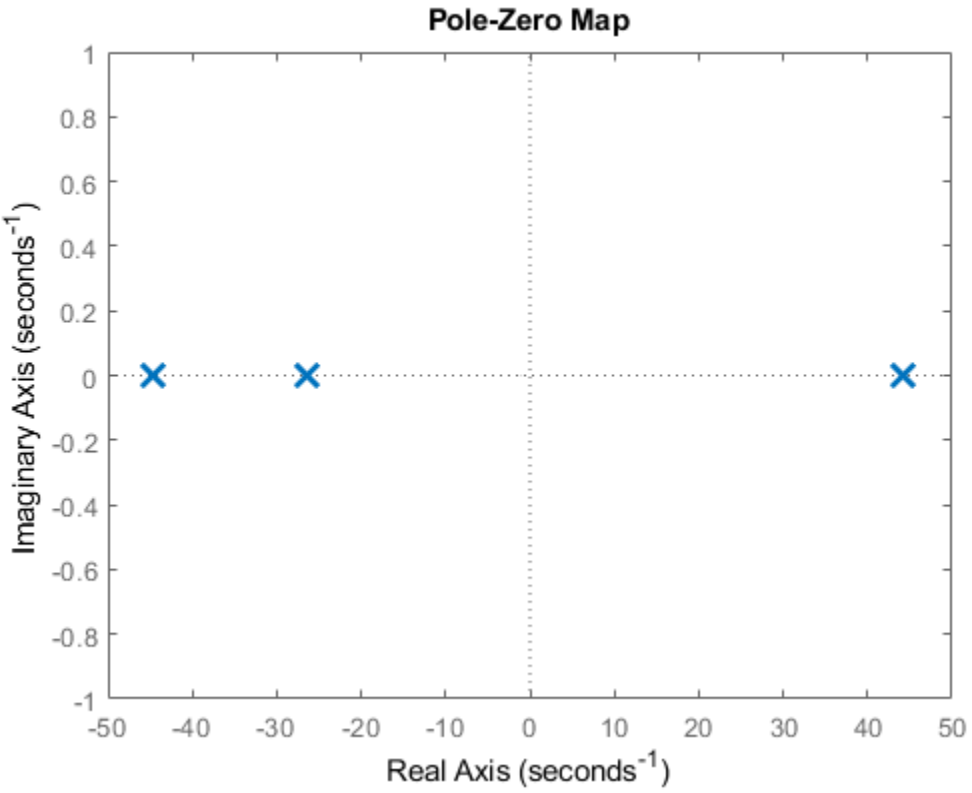
```
clear all; close all;
s = tf('s');
G = (-153)/(s^3+27*s^2-1962*s-52320); % transfer function
figure(1)
step(G) % plotting the bode step response of G(s)
stepinfo(G)
grid on;
figure(2)
impulse(G) % plotting the impulse response of G(s)
grid on;
figure(3)
pzmap(G) % plotting the pole-zero map of G(s)
a = findobj(gca,'type','line'); % findobj locates graphics objects with specific properties
for i = 1:length(a)
    set(a(i),'markersize',12)
    set(a(i), 'linewidth',2)
end
figure(4)
rlocus(G)
set(findall(gcf,'type','line'),'linewidth',2); % findall returns the objects that have the
specified
                                                % properties and sets them to the specified values
figure(5)
bode(G) % plotting the bode plot of G(s)
margin(G)
sisotool(G)
```

Plots of Step and Impulse responses


Step Response
×10^23
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
Amplitude
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Time (seconds)

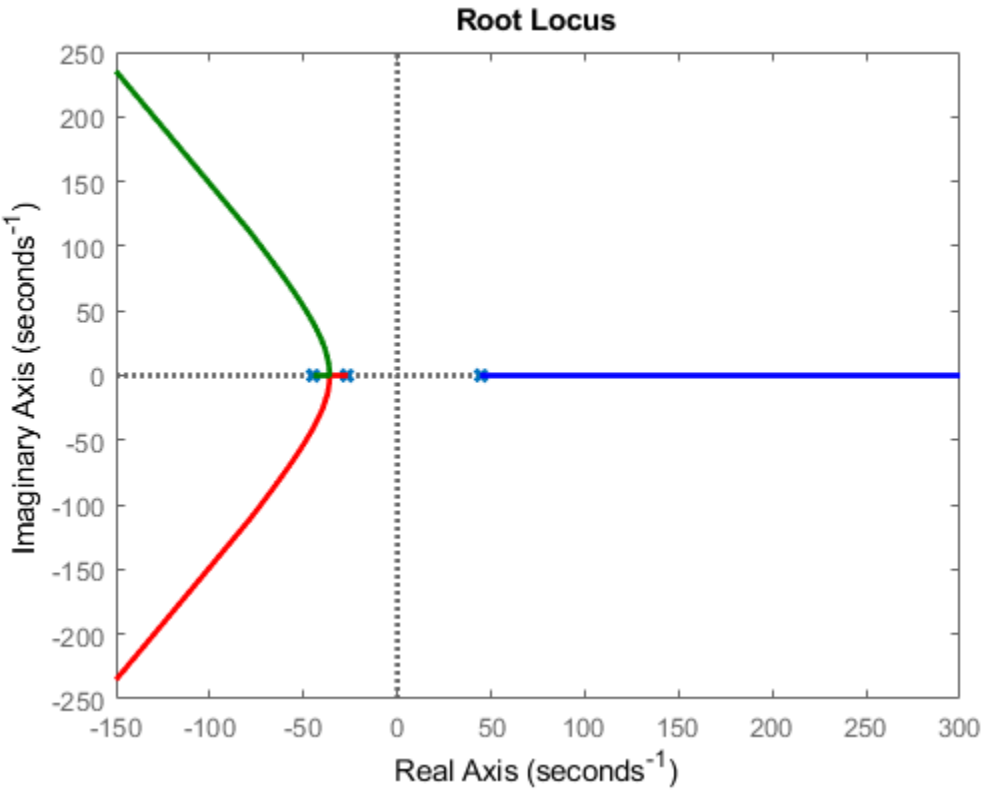

Impulse Response
×10^24
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
Amplitude
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Time (seconds)

Pzmaps and time domain specifications and errors

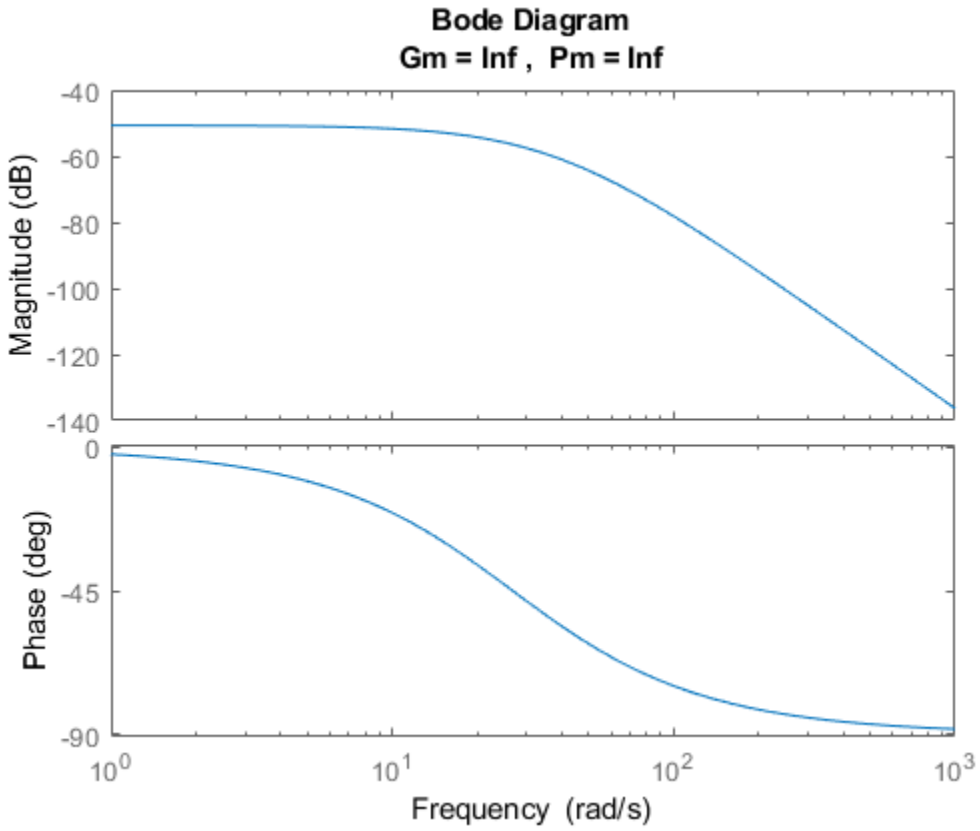


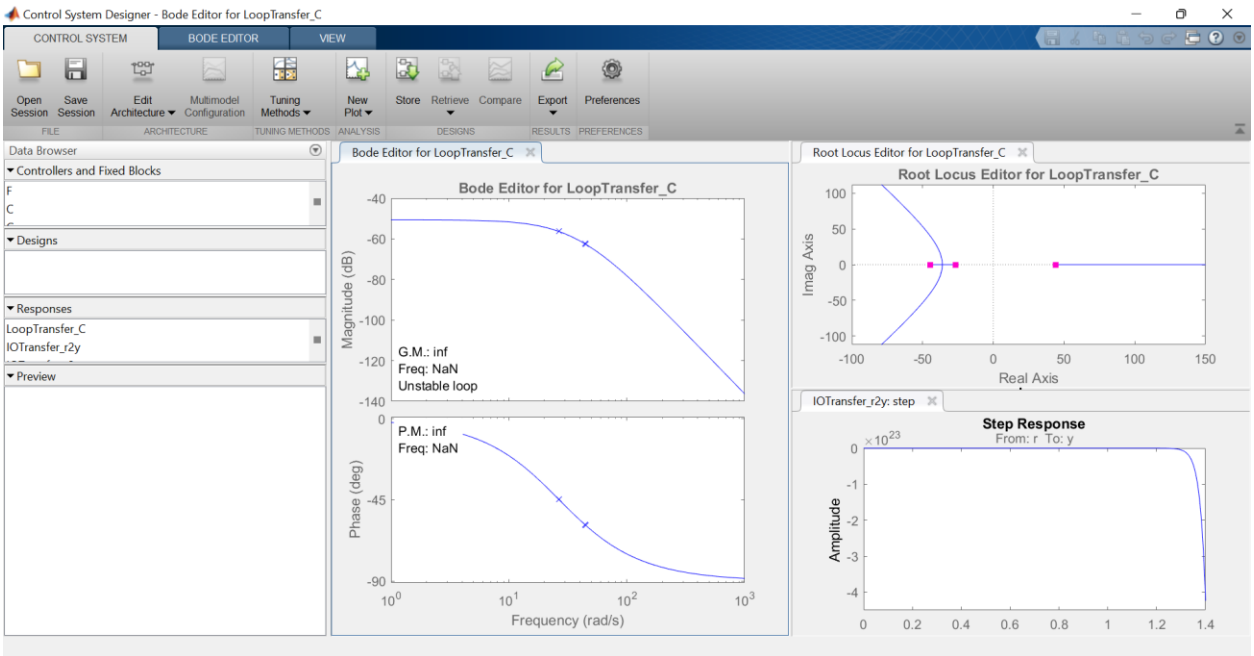

```
    RiseTime: NaN
SettlingTime: NaN
 SettlingMin: NaN
 SettlingMax: NaN
   Overshoot: NaN
  Undershoot: NaN
        Peak: Inf
    PeakTime: Inf
```

Root Locus

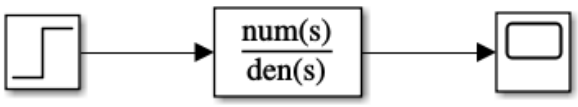

Root Locus
Imaginary Axis (seconds^{-1})
Real Axis (seconds^{-1})
250
200
150
100
50
0
-50
-100
-150
-200
-250
-150
-100
-50
0
50
100
150
200
250
300

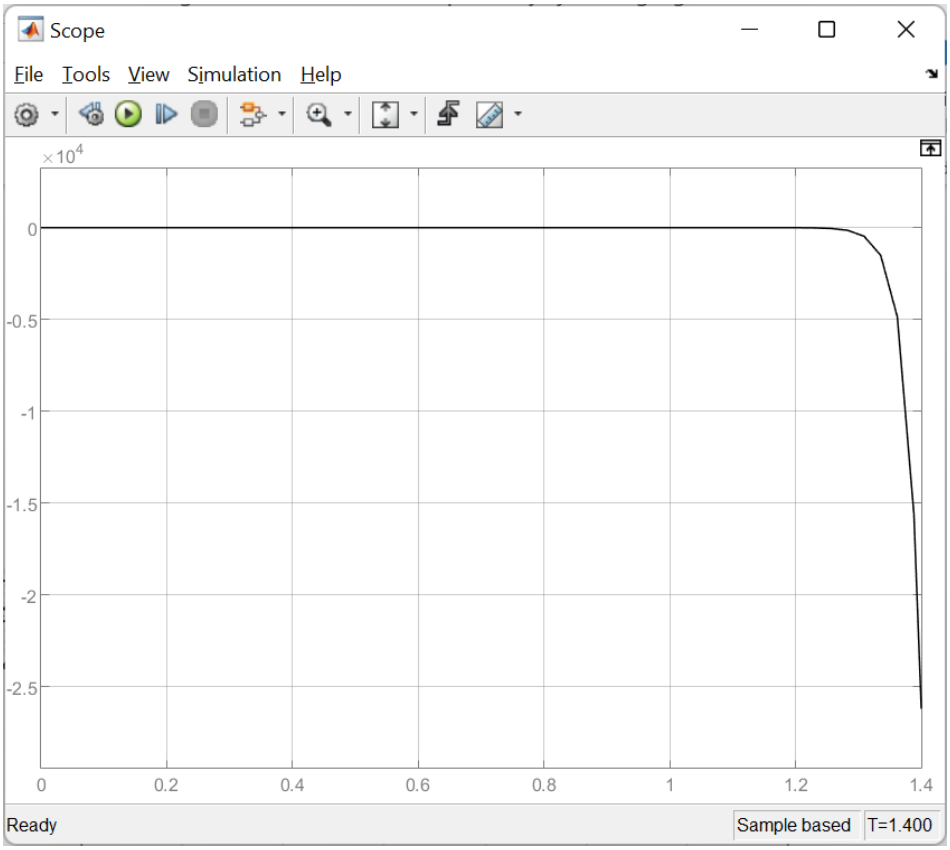
Bode Diagram with its subsequent specifications

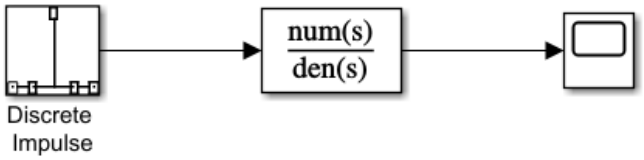


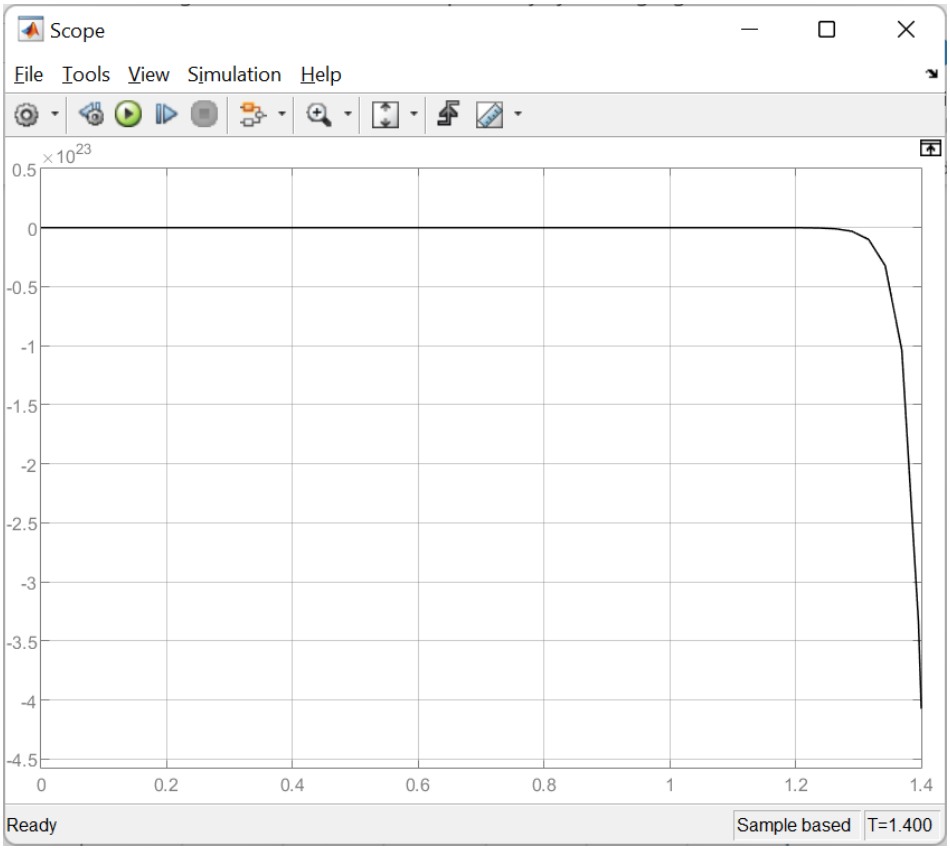


Simulink


num(s)
den(s)


Scope
File Tools View Simulation Help
×10^4
0
-0.5
-1
-1.5
-2
-2.5
0 0.2 0.4 0.6 0.8 1 1.2 1.4
Ready
Sample based
T=1.400





Stability of the system:

In the pole zero map, we can see that there is a pole in the RHP which indicates that the system response is unstable. The Bode plot also highlights that there is a pole in the RHP thus indicating an unstable system. This unstable system causes the phase to fall quickly, as seen in the Bode diagram.

The root locus also shows that the system is unstable as the pole remains in the RHP. This can also be observed for values of gain from zero to negative infinity. In either case, the system will remain unstable.

The same step response is obtained via Simulink, thus verifying the MATLAB response.