

```
clc;
```

```
%% Q1.1.
```

```
p = tf(1,[0.1 1 0])*tf(1,[1 1]);
```

```
fig1 = figure ("Name","Q1.1 - Bode",'Position',[100 350 900✓  
500]);
```

```
bode(p)
```

```
grid on
```

```
grid minor
```

```
title("Bode Diagram | Almog Dobrescu 214254252")
```

```
% legend({'p_gal*C_ld'},'FontSize',11 ,'Location','northeast')
```

```
%exportgraphics(fig1, 'Q1.1graph1.png','Resolution',1200);
```

```
%% Q1.3.
```

```
format long
```

```
numerator = 16*tf([233.0874 1],1);
```

```
denominator = tf([1 0],1)*tf([6057.92 1],1)*tf([0.01 1],1)*tf✓  
([1 1],1);
```

```
final = numerator - denominator;
```

```
zero(final);
```

```
atan2(15.2672,1)*180/pi
```

```
atan2(77.95,1)*180/pi
```

```
w = 3.16;
```

```
s = i*w;
```

```
magnitude = 4*abs((15.2672*s+1)/(77.9482*s+1))
```

```
%% Q1.4.
```

```
p = tf(1,[0.1 1 0])*tf(1,[1 1]);
```

```
c_lg = 4*tf([15.2672 1],[77.9482 1])
```

```
fig2 = figure ("Name","Q1.4 - Bode",'Position',[250 350 900✓  
500]);  
  
bode(minreal(p*c_lg,1e-6))  
  
grid on  
grid minor  
title("Bode Diagram | Almog Dobrescu 214254252")  
% legend({'p_gal*C_ld'},'FontSize',11 ,'Location','northeast')  
%exportgraphics(fig2, 'Q1.4graph1.png','Resolution',1200);  
  
G_with_c = minreal(c_lg*p/(1+c_lg*p),1e-6);  
G_without_c = minreal(4*p/(1+4*p),1e-6);  
  
time = 0:0.01:40;  
ramp = 1*time;  
y_ramp_with = lsim(G_with_c,ramp,time);  
y_ramp_without = lsim(G_without_c,ramp,time);  
  
[y_with, x_with] = step(G_with_c,time);  
[y_without, x_without] = step(G_without_c,time);  
  
fig3 = figure ("Name","Q1.4 - Response of System With and✓  
Without Lag Compensaor",'Position',[400 350 900 500]);  
  
subplot(1,2,1)  
  
hold all  
plot(x_with, y_with,'LineWidth',2,'Color','#0072BD')  
plot(x_without, y_without,'LineWidth',2,'Color','#D95319')  
  
grid on  
grid minor  
ylabel("Amplitude")  
xlabel("t [sec]")
```

```
title("Q1.4 - Step Response of System With and Without Lag✓  
Compenstaor")  
subtitle("Almog Dobrescu 214254252")  
legend({'with','without'}, 'FontSize', 11✓  
, 'Location', 'southeast')  
  
subplot(1,2,2)  
  
hold all  
plot(time, y_ramp_with, 'LineWidth', 2, 'Color', "#0072BD")  
plot(time, y_ramp_without, 'LineWidth', 2, 'Color', "#D95319")  
  
grid on  
grid minor  
ylabel("Amplitude")  
xlabel("t [sec]")  
title("Q1.4 - Ramp Response of System With and Without Lag✓  
Compenstaor")  
subtitle("Almog Dobrescu 214254252")  
legend({'with','without'}, 'FontSize', 11✓  
, 'Location', 'southeast')  
%exportgraphics(fig3, '1.4grap2.png', 'Resolution', 1200);  
  
fig4 = figure ("Name", "Q1.4 - Pole-Zero Map of System With and✓  
Without Lag Compenstaor", 'Position', [550 350 900 500]);  
  
hold all  
pzmap(G_with_c, 'b')  
pzmap(G_without_c, 'r')  
  
grid on  
grid minor  
% ylabel("Im")
```

```

% xlabel("Re")
title("Q1.4 - Pole-Zero Map of System With and Without Lag✓
Compenstaor | Almog Dobrescu 214254252")
% subtitle("Almog Dobrescu 214254252")
legend({'with','without'},'FontSize',11✓
,'Location','southwest')
%exportgraphics(fig4, '1.4grap3.png','Resolution',1200);

bandwidth(G_without_c)
bandwidth(G_with_c)

%% Q2.

p = 20*tf(1,[1 5])*tf(1,[1 2]);
p_gal = minreal(25*tf(1,[1 0])*p,1e-6);

w_gco = 2.1;
s = j*w_gco;
[GM, PM] = margin(p_gal);
wanted_PM = 75;
curren_PM = 180 + atan2(imag(freqresp(p_gal,s)), real(freqresp✓
(p_gal,s)))*180/pi;
delta_PM = 1.156157*(wanted_PM-curren_PM);
alpha_ld = double((1-sin(deg2rad(delta_PM)))/(1+sin(deg2rad✓
(delta_PM))));

w_bar = 0.5*w_gco;

tao_ld = 1/(w_bar*sqrt(alpha_ld));

C_ld = tf([tao_ld 1],[tao_ld*alpha_ld 1])

alpha_lg = abs(freqresp(p_gal,s))*abs(freqresp(C_ld,s));

tao_lg = 10/w_bar;

```

```
C_lg = tf([tao_lg 1],[tao_lg*alpha_lg 1])

[new_GM, new_PM] = margin(minreal(C_ld*p_gal*C_lg,1e-6))

C = minreal(C_ld*C_lg*25*tf(1,[1 0]),1e-6);

fig5 = figure ("Name","Q2 - Bode",'Position',[700 350 900✓
500]);

bode(minreal(C_ld*p_gal*C_lg,1e-6))

grid on
grid minor
title("Bode Diagram | Almog Dobrescu 214254252")
% legend({'p_gal*C_ld'},'FontSize',11 ,'Location','northeast')
%exportgraphics(fig5, 'Q2graph1.png','Resolution',1200);

time = 0:0.01:100;
ramp = 1*time;
y_ramp = lsim(minreal(C_ld*p_gal*C_lg/(1+C_ld*p_gal*C_lg),1e-✓
6),ramp,time);
for i = 1:length(time)
    error_y(i) = y_ramp(i) - ramp(i);
    i;
end

fig6 = figure ("Name","Q2 - Error of Ramp Input",'Position',✓
[100 200 900 500]);

hold all
plot(time, error_y,'LineWidth',2,'Color',"#0072BD")

grid on
grid minor
```

```
ylabel("Amplitude")
xlabel("t [sec]")
title("Q2 - Error of Ramp Input")
subtitle("Almog Dobrescu 214254252")
legend({'C_l_d*p_g_a_l*C_l_g'}, 'FontSize', 11,
, 'Location', 'southeast')
%exportgraphics(fig6, '2grap2.png', 'Resolution', 1200);
```