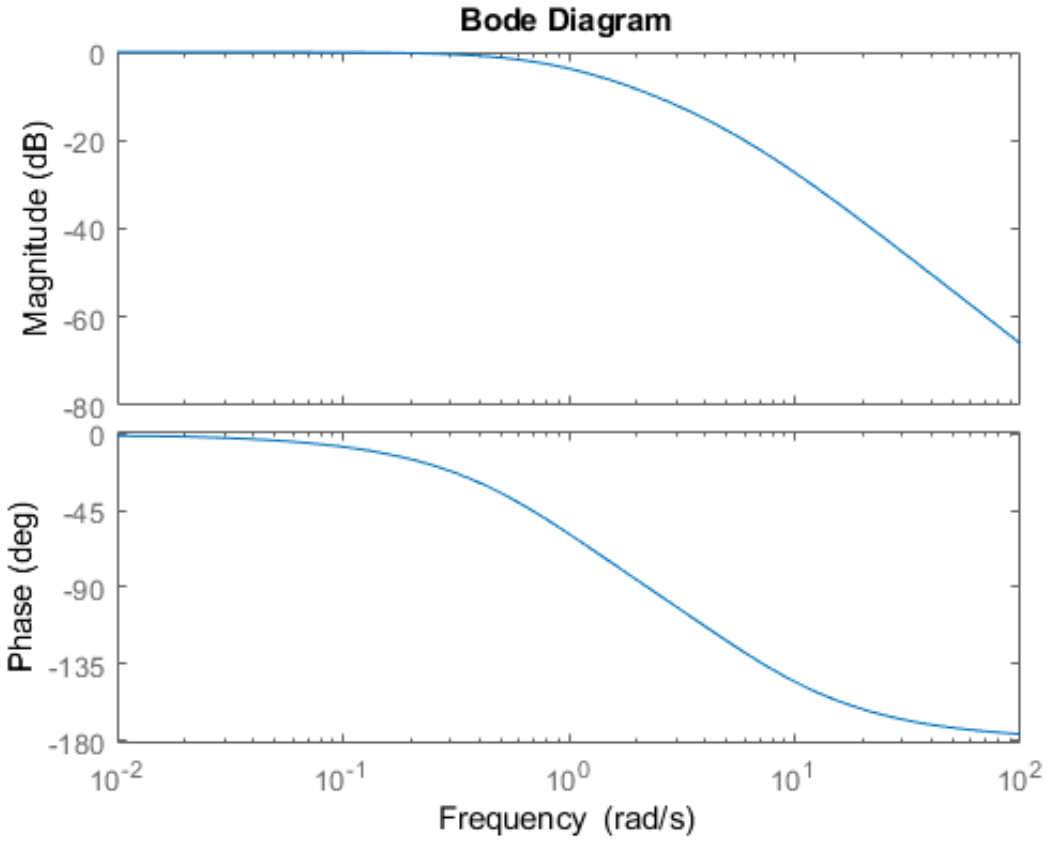
```
clc; clear; close all;
s = tf('s');
den_G = s*(s+6.54);
```

```
%10-2)
%a)
K_a = 5;
G_a = K_a / den_G;
CL_a = G_a/(1+G_a);
BW_a = bandwidth(CL_a)
```

```
BW_a = 0.8616
```

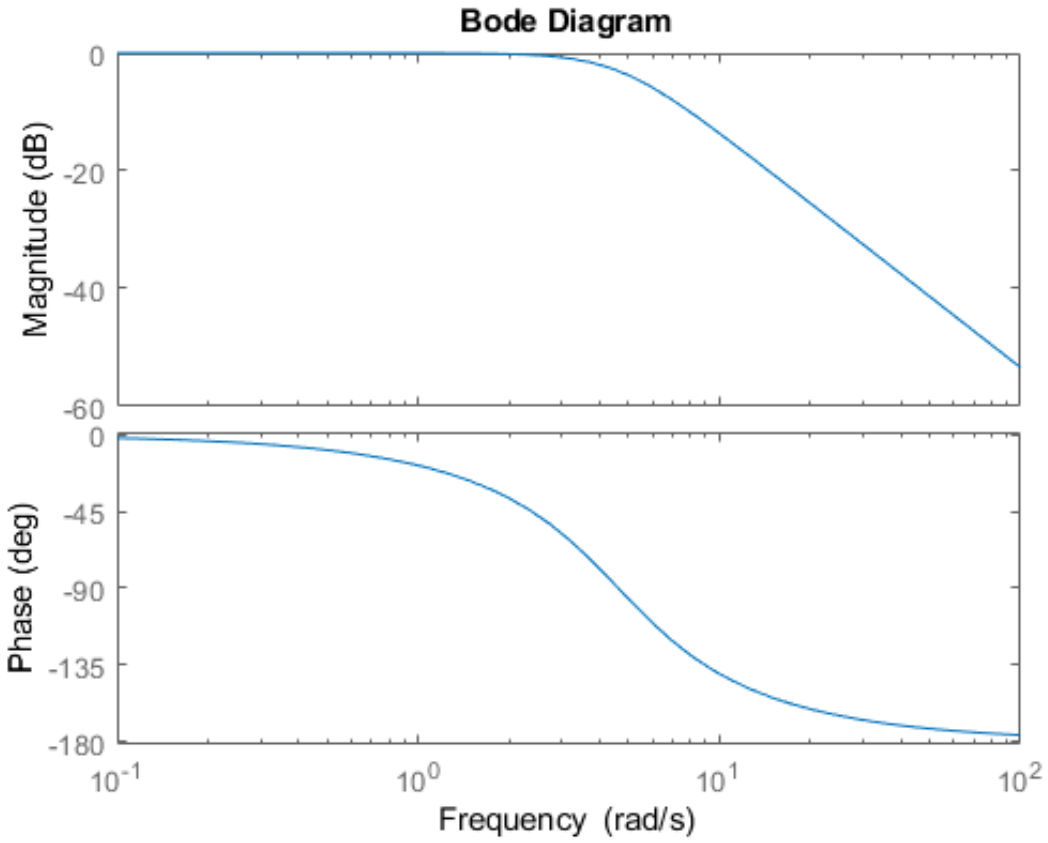
```
bode(CL_a);
```




```
%b)
K_b = 21.36;
G_b = K_b / den_G;
CL_b = G_b/(1+G_b);
BW_b = bandwidth(CL_b)
```

```
BW_b = 4.6134
```

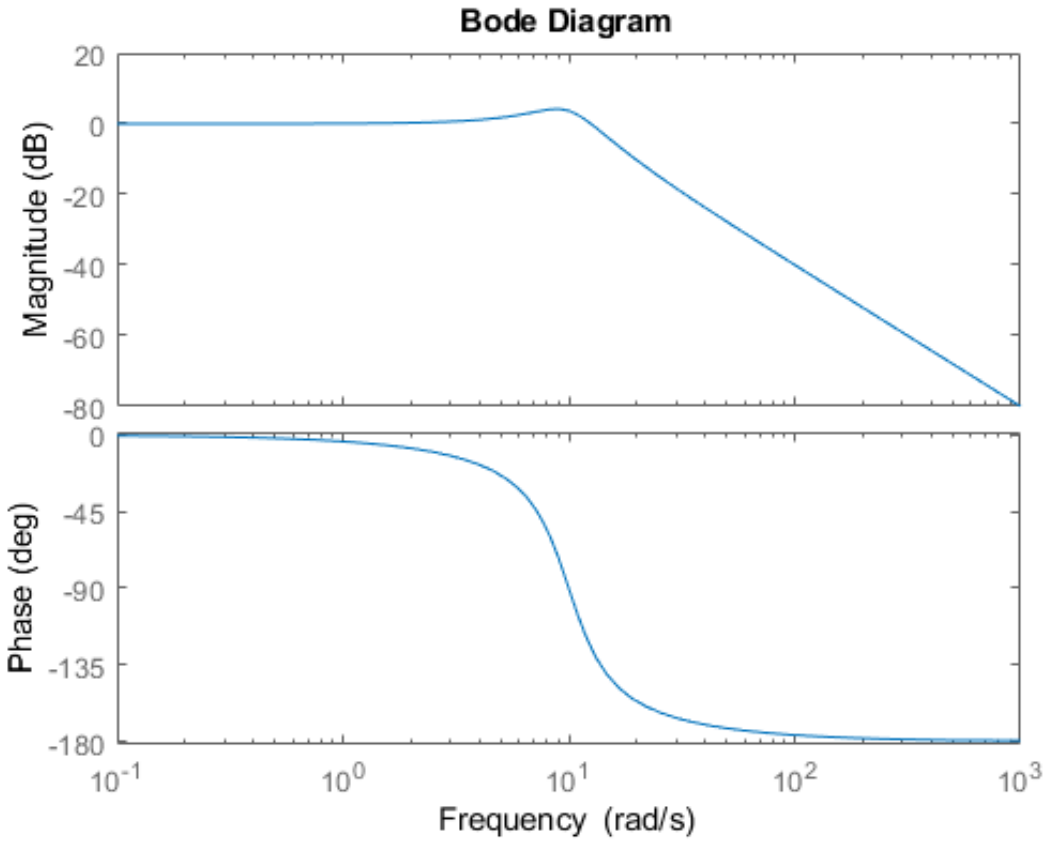
```
bode(CL_b);
```




```
%c)
K_c = 100;
G_c = K_c / den_G;
CL_c = G_c/(1+G_c);
BW_c = bandwidth(CL_c)
```

```
BW_c = 14.3398
```

```
bode(CL_c);
```



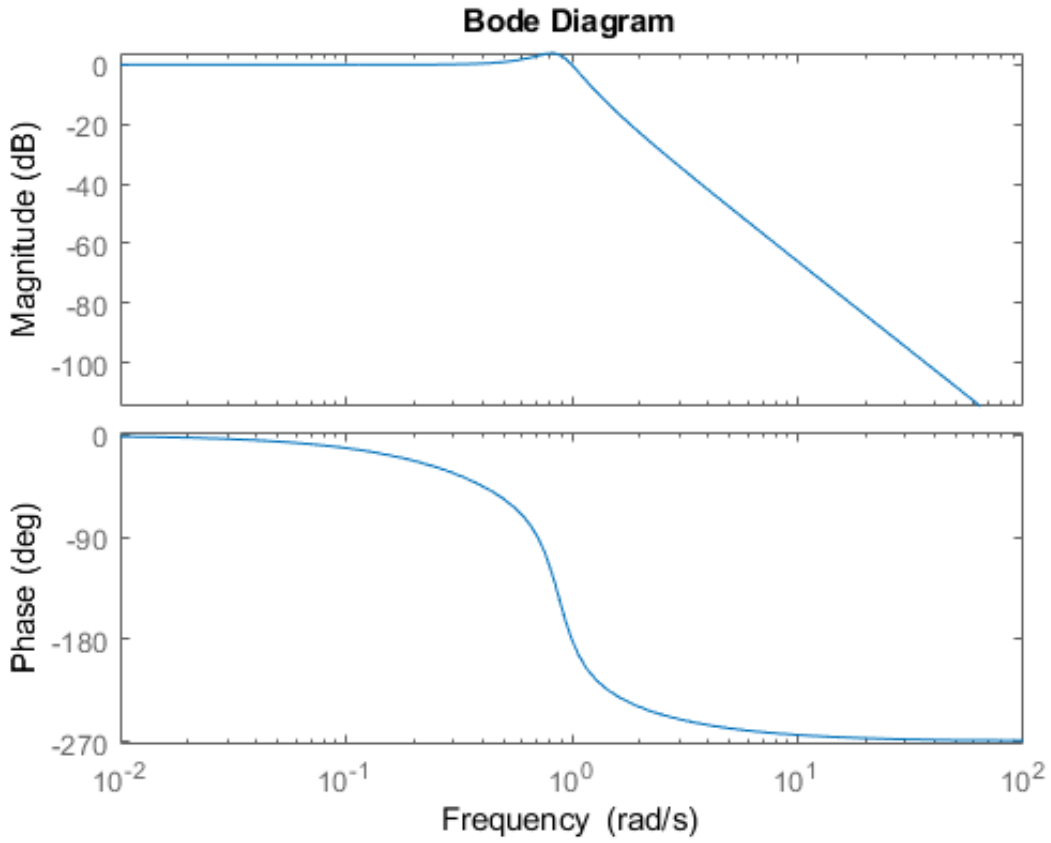

```
%10-4
% e)
num_10_4_e = 0.5;
den_10_4_e = s*(s^2+s+1);
G_10_4_e = num_10_4_e/den_10_4_e;
CL_10_4_e = G_10_4_e/(1+G_10_4_e);
BW_10_4_e = bandwidth(CL_10_4_e)
```

```
BW_10_4_e = 1.0858
```

```
[Mr,wr] = getPeakGain(CL_10_4_e)
```

```
Mr = 1.5655
wr = 0.8086
```

```
bode(CL_10_4_e);
```




```
%11.22
Kp = 6;
Ki = 1;
num_GH= 24*(Kp+Ki/s);
den_GH=s*(s+1)*(s+6);
GH=num_GH/den_GH;
%lead design
PL=55
```

```
PL = 55
```

```
CRover=15
```

```
CRover = 15
```

```
alpha=(1+sin(PL/180*pi))/(1-sin(PL/180*pi))
```

```
alpha = 10.0590
```

```
T=1/alpha^0.5/CRover
```

```
T = 0.0210
```

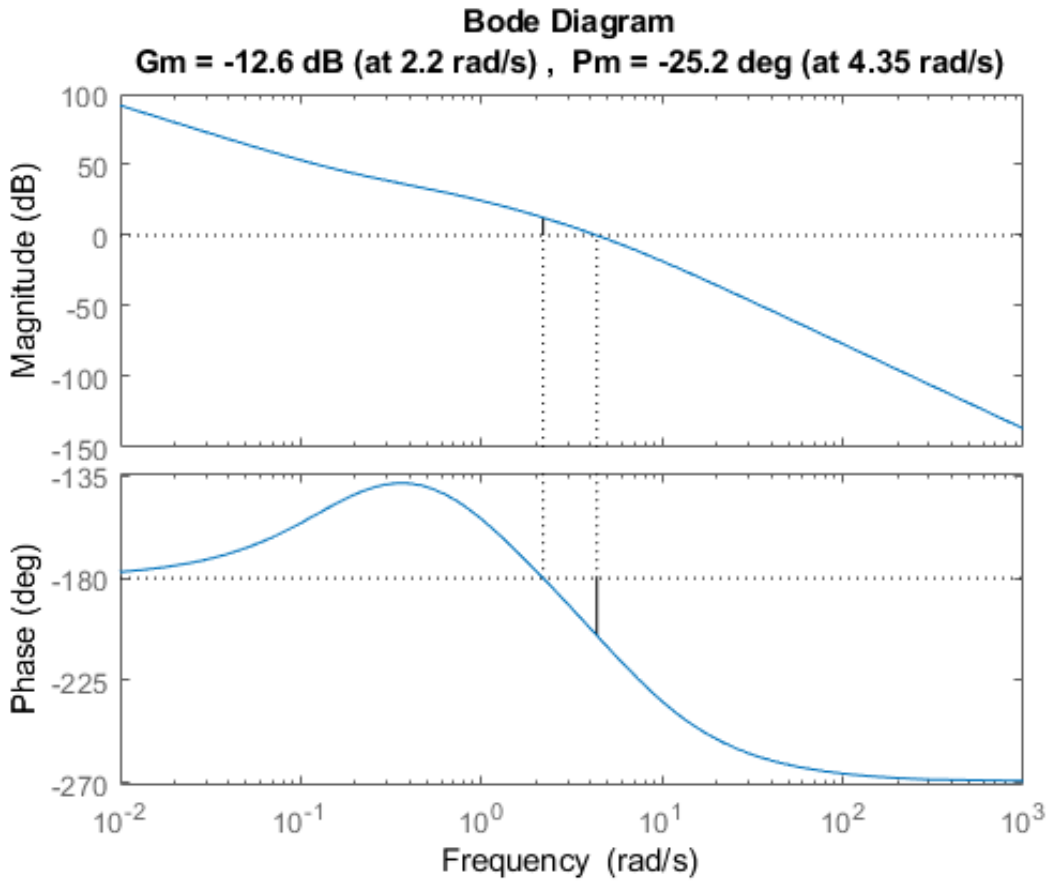
```
lead=(1+T*alpha*s)/(1+T*s)
```

```
lead =

  0.2114 s + 1
  ------------
  0.02102 s + 1

Continuous-time transfer function.
```

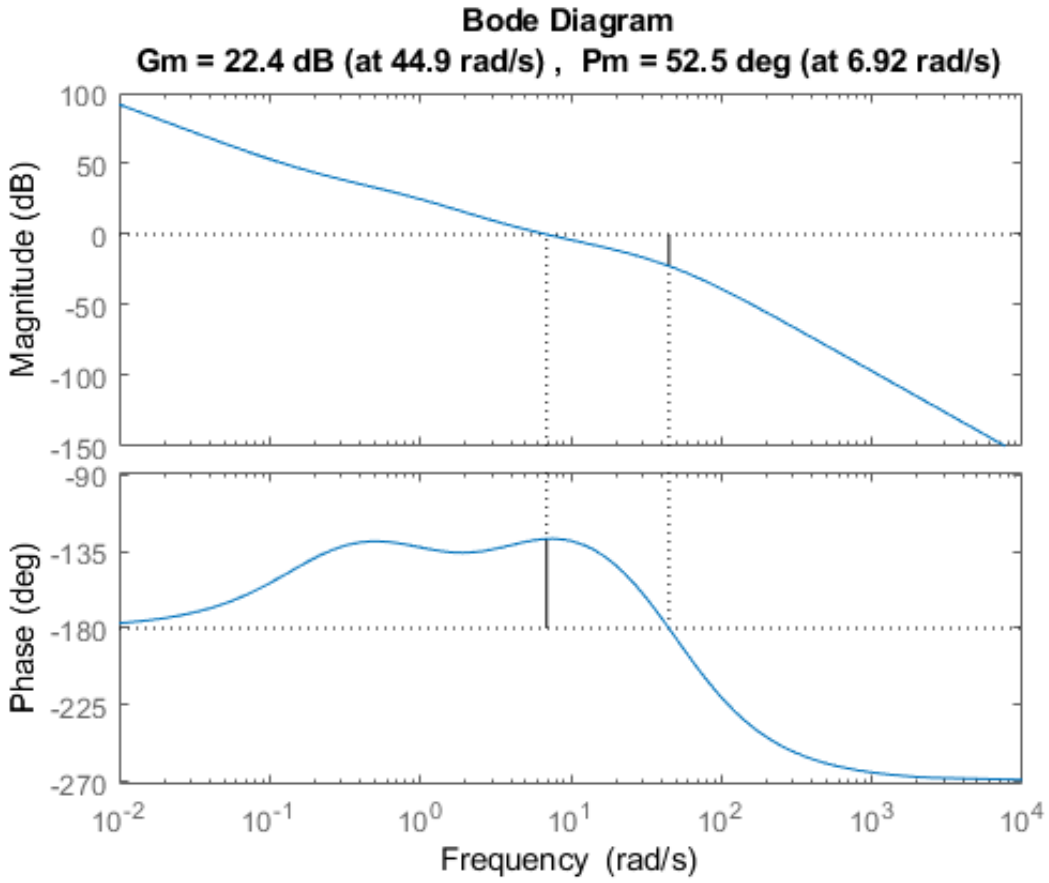
```
LT=GH*lead*lead %double lead compensation
```

```
LT =

              6.438 s^3 + 61.97 s^2 + 154.1 s + 24
  ---------------------------------------------------------
  0.0004418 s^6 + 0.04513 s^5 + 1.297 s^4 + 7.252 s^3 + 6 s^2

Continuous-time transfer function.
```

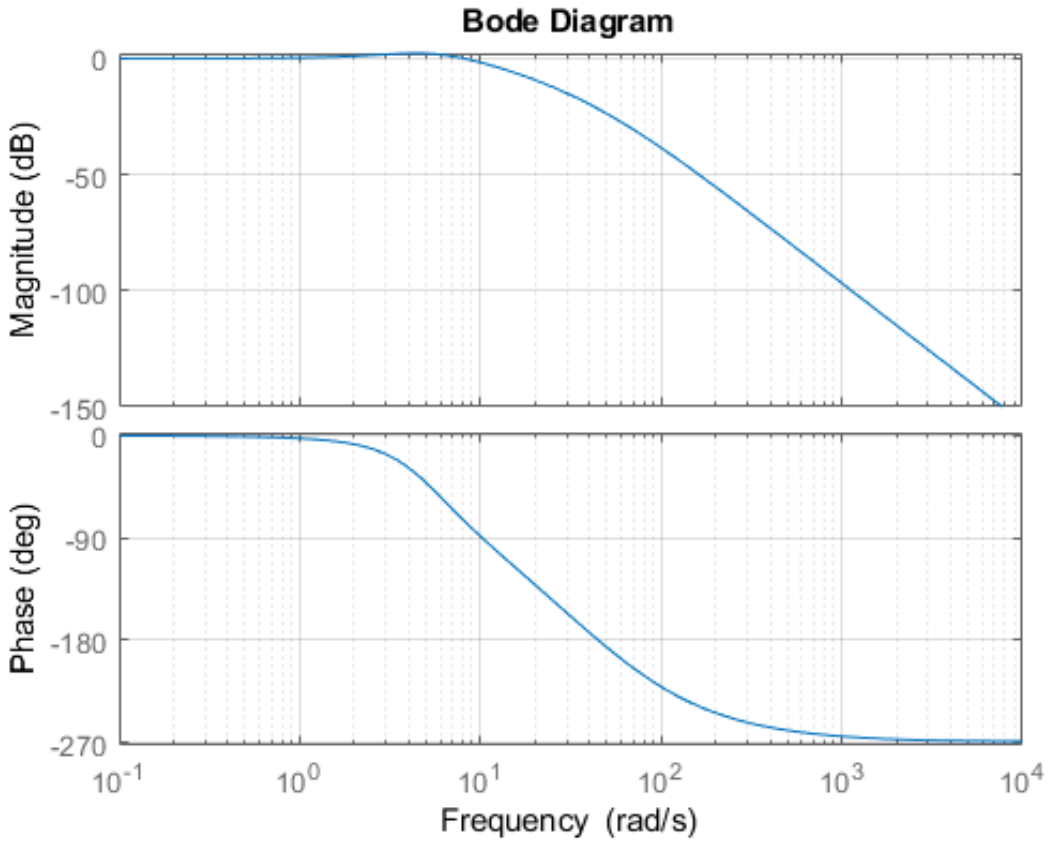
```
CL = LT/(1+LT);
figure(1)
margin(GH)
```




```
figure(2)
margin(LT)
```




```
figure(3)
bode(CL)
grid on;
```


Bode Diagram
Magnitude (dB)
0
-50
-100
-150
Phase (deg)
0
-90
-180
-270
10^-1
10^0
10^1
10^2
10^3
10^4
Frequency (rad/s)