EGE UNIVERSITY
ELECTRICAL AND ELECTRONICS ENGINEERING

CONTROL SYSTEMS 1

LAB-10

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Control Lab-10

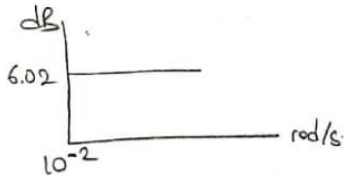
1- $G(s) = \frac{2000(s+0.5)}{s(s+10)(s+50)}$

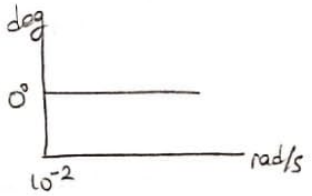
$$= \frac{2000 \cdot 0.5}{10 \cdot 50} \cdot \frac{\left(\frac{s}{0.5}+1\right)}{s\left(\frac{s}{10}+1\right)\left(\frac{s}{50}+1\right)} = 2 \cdot \frac{\left(\frac{s}{0.5}+1\right)}{s\left(\frac{s}{10}+1\right)\left(\frac{s}{50}+1\right)}$$

$s = jw$

$$G(jw) = 2 \frac{\left(\frac{jw}{0.5}+1\right)}{jw\left(\frac{jw}{10}+1\right)\left(\frac{jw}{50}+1\right)}$$

$20 \log 2 = 6.02 \angle 0°$





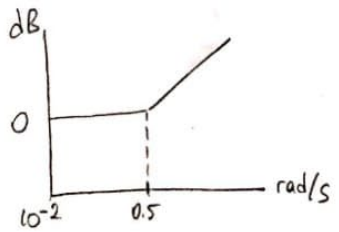
$20 \log \sqrt{1+\left(\frac{w}{0.5}\right)^2}$

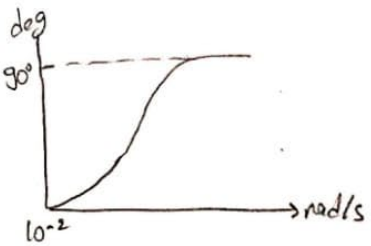
$w \angle 0.5 \longrightarrow 20 \log 1 = 0$ dB

$w > 0.5 \longrightarrow 20 \log \frac{w}{0.5}$ dB

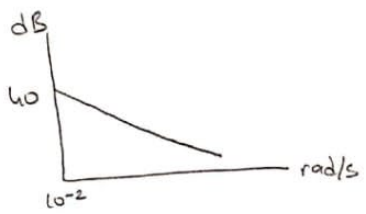
$w \ll 0.5 \longrightarrow \tan^{-1}\left(\frac{0}{1}\right) = 0°$

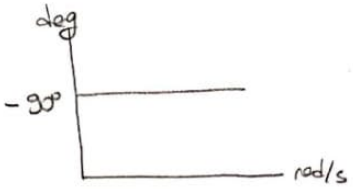
$w \gg 0.5 \longrightarrow \tan^{-1}\left(\frac{w}{0.5}\right) = 90°$





$20\log\frac{1}{\omega}$, $\tan^{-1}\left(\frac{\omega}{0}\right) \longrightarrow \frac{1}{j\omega}$ için





$20\log 10^2 = 40\,dB$

$-\tan^{-1}\left(\frac{10^{-2}}{0}\right) = -90°$

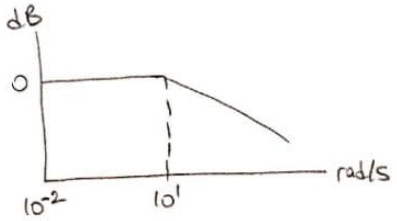
$\longrightarrow \left(\frac{1}{\frac{j\omega}{10}+1}\right)$ için

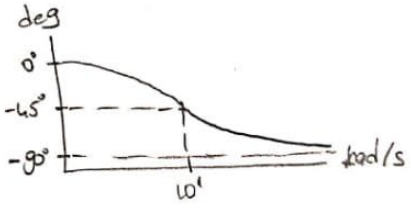
$\omega < 10 \quad 20\log 1 = 0\,dB$

$\omega > 10 \quad 20\log\left(\frac{\omega}{10}\right)^{-1}\,dB$

$-\tan^{-1}\left(\frac{\omega}{10}\right) = 0° \longrightarrow$ küçük değerler için

$-\tan^{-1}\left(\frac{\omega}{10}\right) = -90° \longrightarrow$ büyük değerler için





MATLAB KODU

```
clc;clear;close all;

%1.SORU
G1=tf(2,1);
bode(G1)
hold on

G2=tf([1/0.5 1],1);
bode(G2)
hold on

G3=tf(1,[1 0]);
bode(G3)
hold on

G4=tf(1,[1/10 1]);
bode(G4)
hold on

G5=tf(1,[1/50 1]);
bode(G5)
hold on

G=G1*G2*G3*G4*G5;
bode(G)
legend('G1','G2','G3','G4','G5','G')

%2.SORU
%K=0.1
%K=1
%K=2
 K=10
num=1;
den=conv(conv([1 1],[1 1]),[1 0]);
GG=tf(num,den);
figure(1)
rlocus(GG)
figure(2)
bode(K*GG)
grid on
```

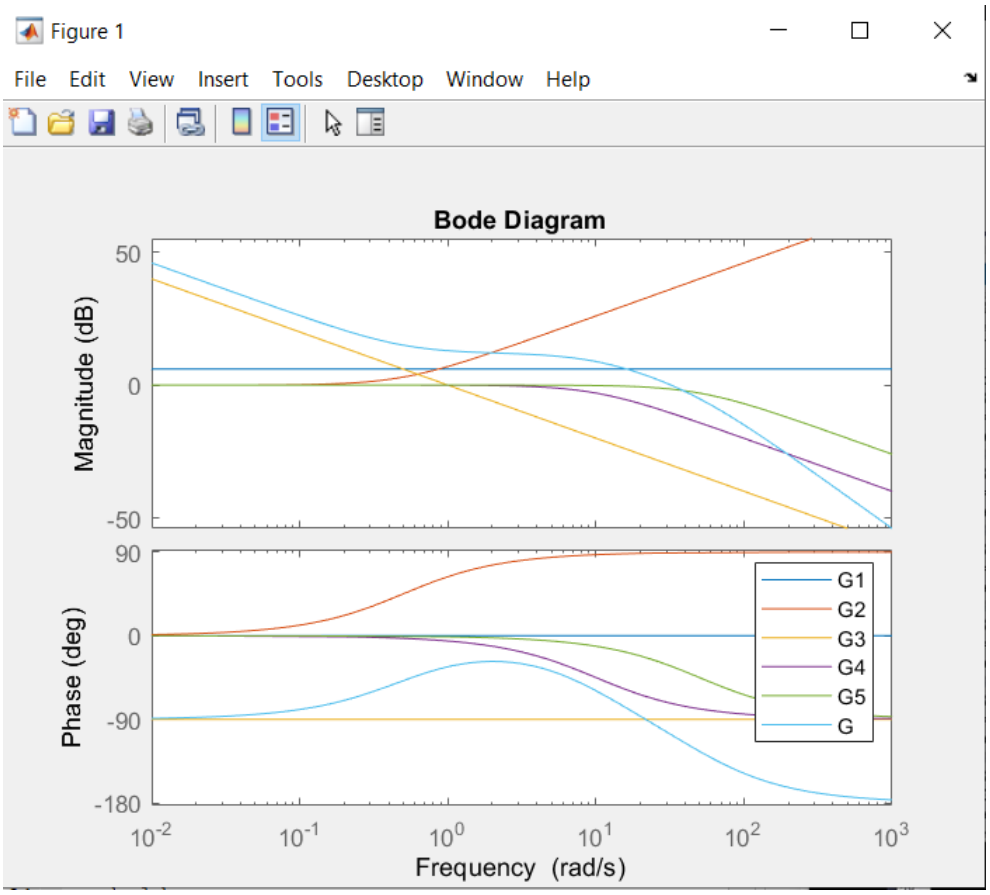


Figure 1 G1, G2, G3, G4, G5 ve G transfer fonksiyonları için bode grafiği

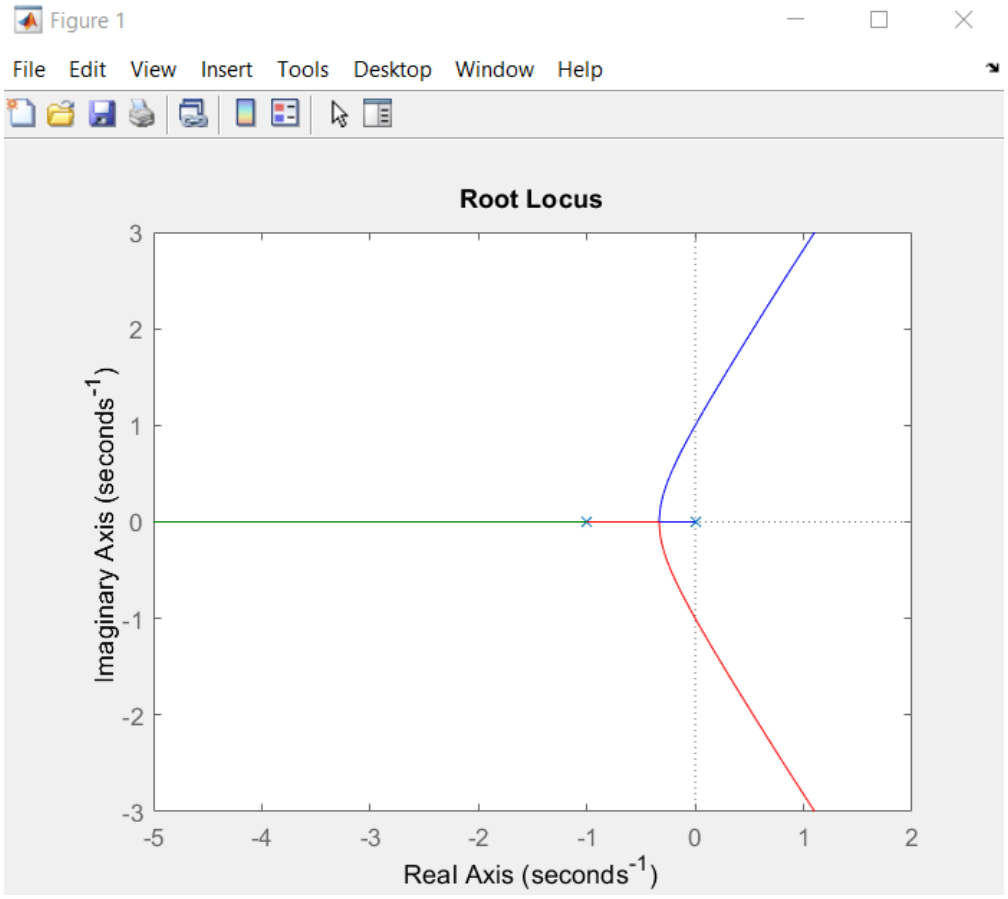


Figure 2 K=2 için GG transfer fonsiyonunun Root Locus grafiği

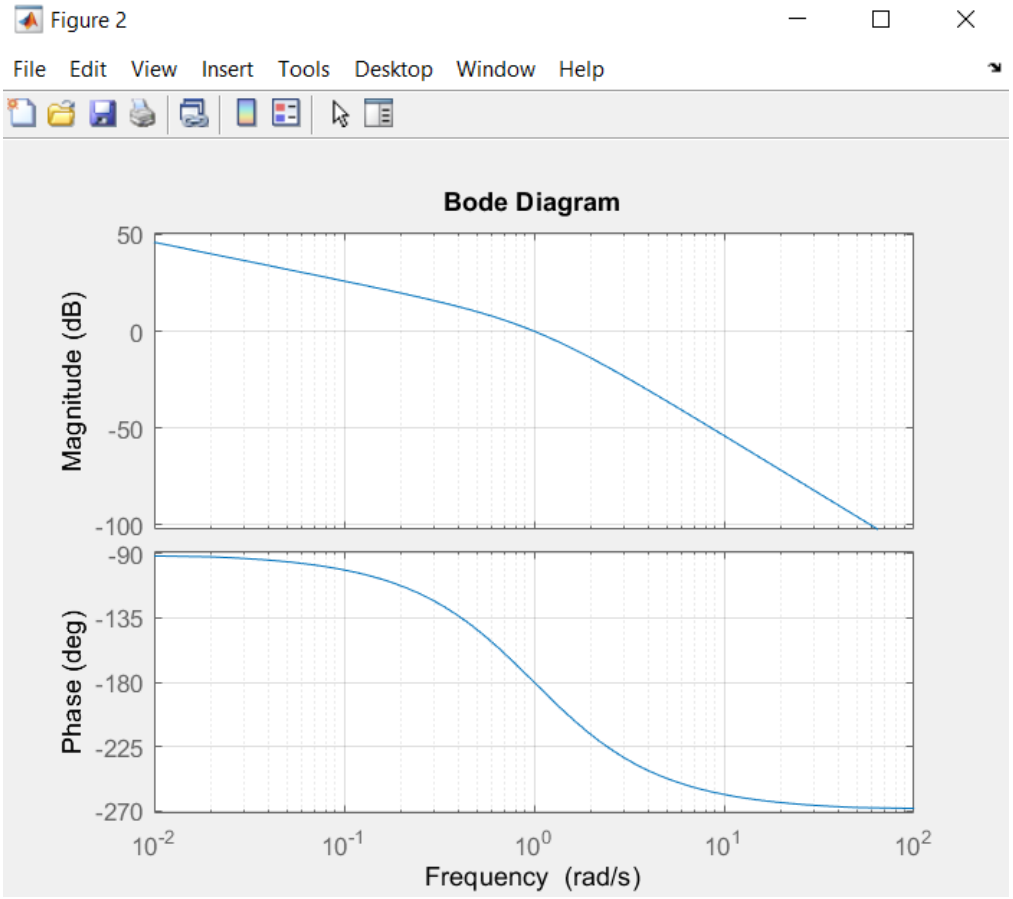


Figure 3 K=2 için GG transfer fonsiyonunun bode grafiği

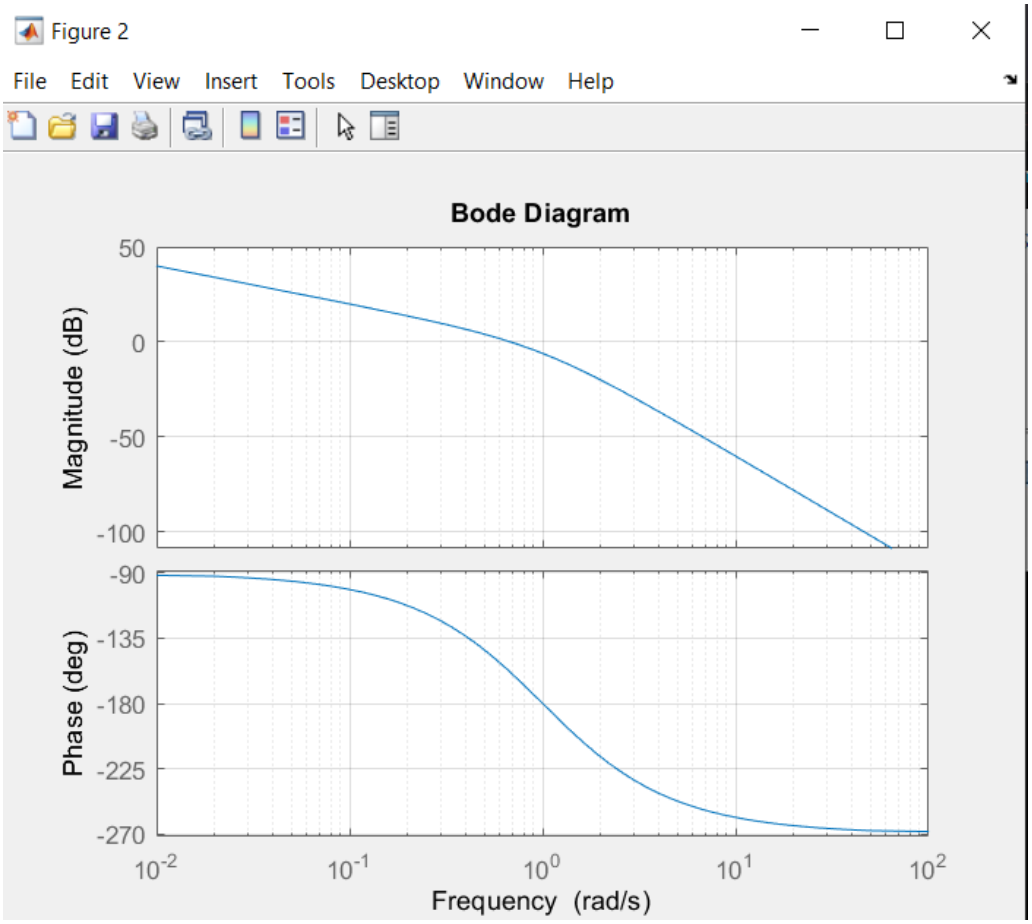


Figure 4 K=1 için GG transfer fonsiyonunun bode grafiği

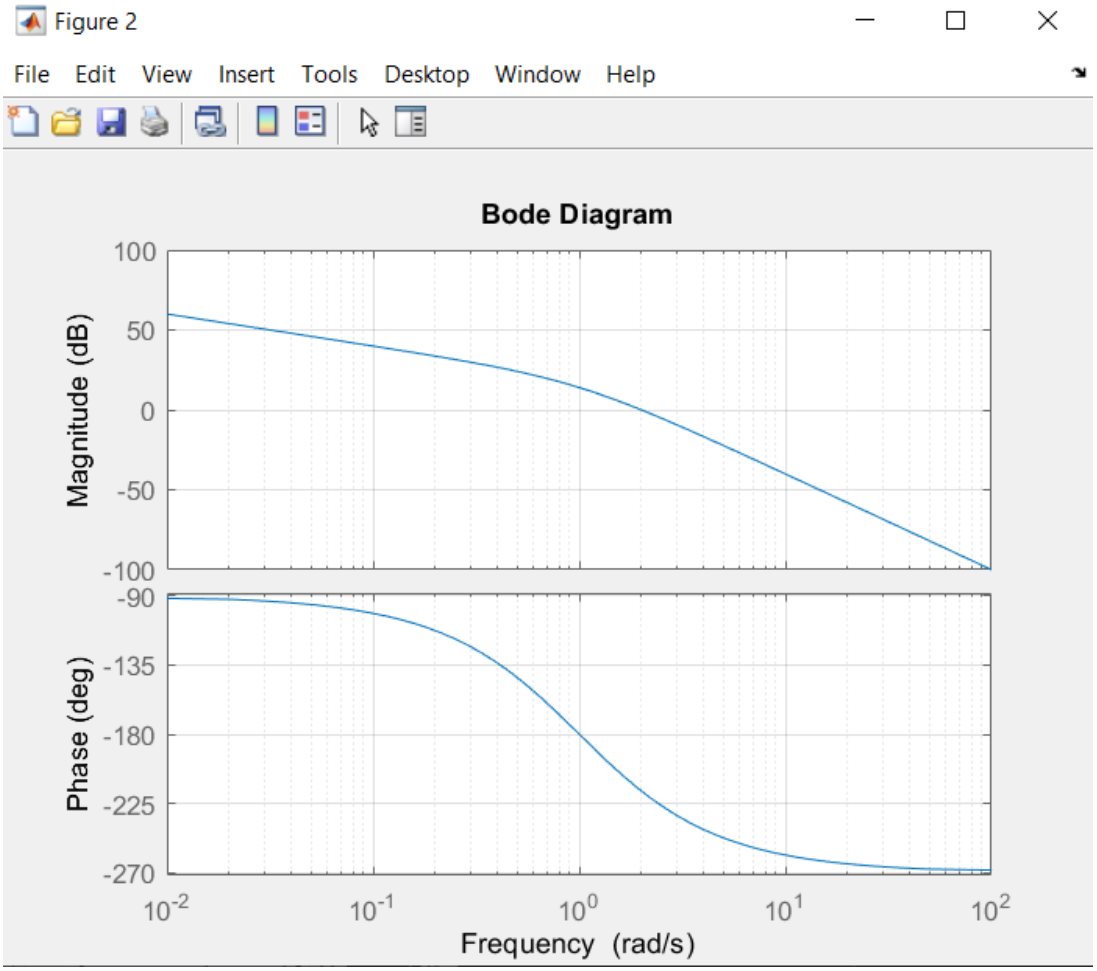


Figure 5 K=10 için GG transfer fonsiyonunun bode grafiği