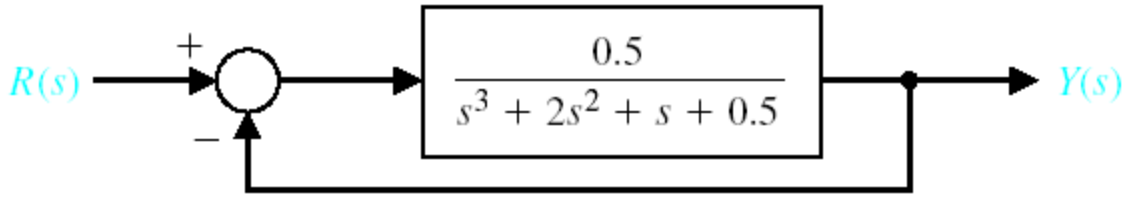
UNIT-5

(Lecture-10)

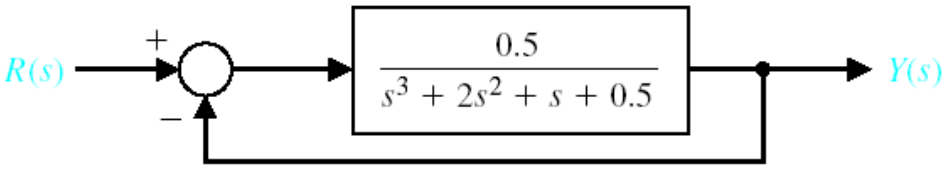
Examples

Examples – Bode and Nyquist



A closed-loop control system example for Nyquist and Bode with relative stability.

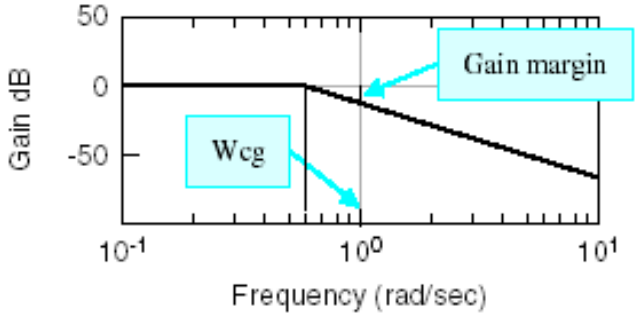
Examples - Bode




```
[mag,phase,w]=bode(sys);
[Gm,Pm,Wcg,Wcp]=margin(mag,phase,w);
```

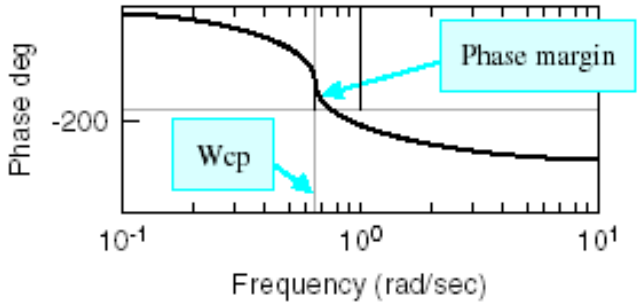
or

```
[Gm,Pm,Wcg,Wcp]=margin(sys);
```



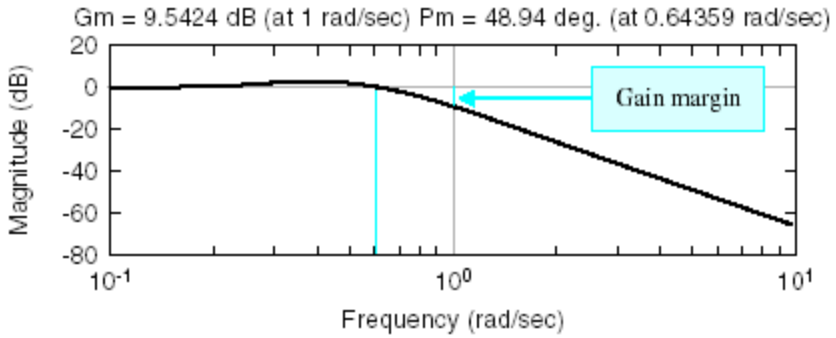
Example

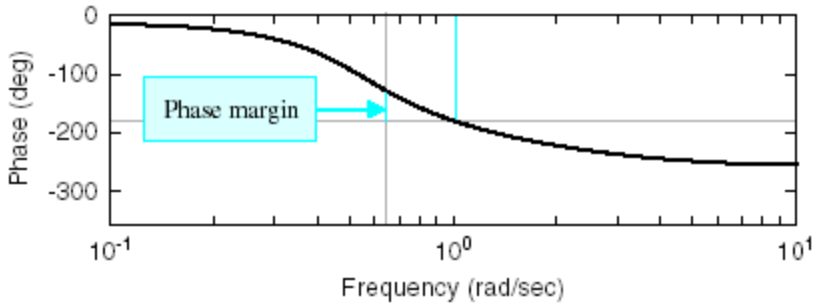
```
num=[0.5]; den=[1 2 1 0.5];
sys=tf(num,den);
margin(sys);
```



Gm = gain margin (dB)
Pm = phase margin (deg)
Wcg = freq. for phase = −180
Wcp = freq. for gain = 0 dB

Examples - Bode



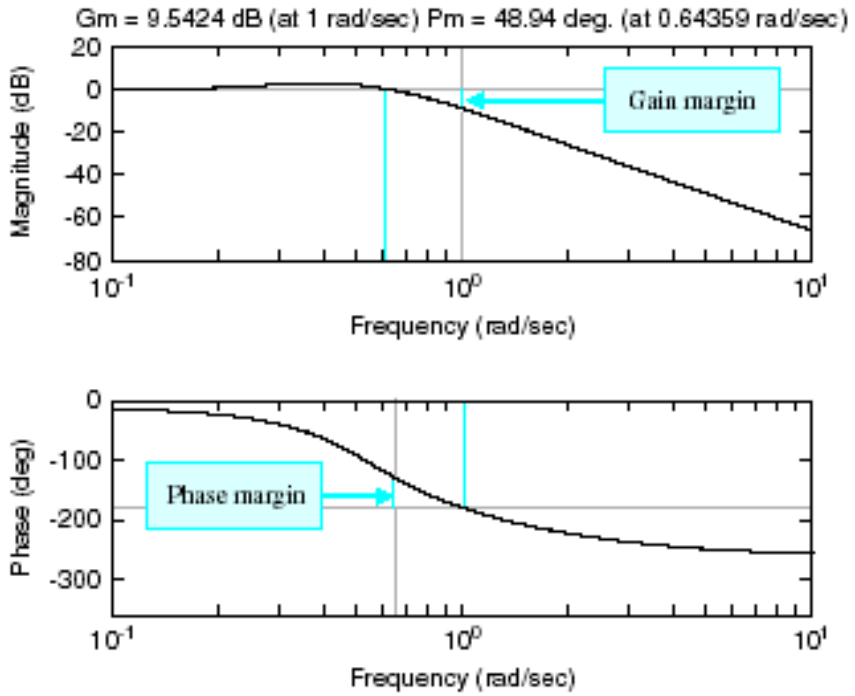


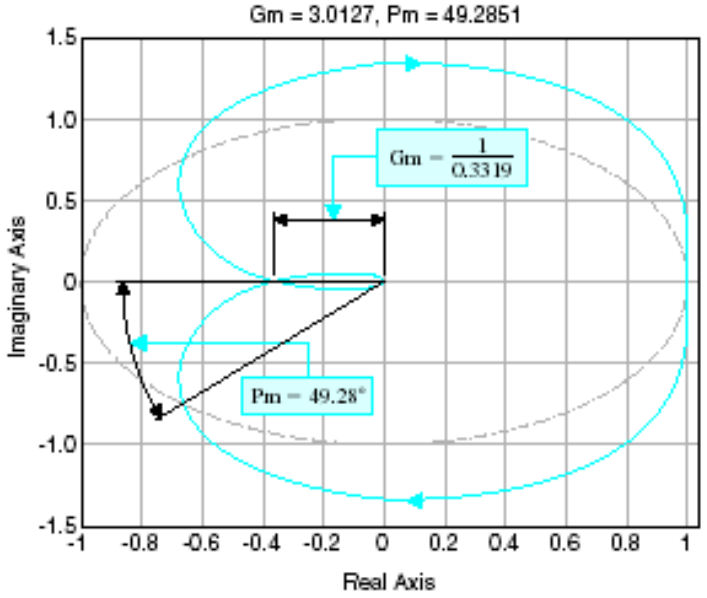

```
num=[0.5];
den=[1 2 1 0.5 ];
sys=tf(num,den);
%
w=logspace(-1,1,200);
%
[mag,phase,w]=bode(sys,w);
%
margin(mag,phase,w);
```

Open-loop system

Specify frequency range

Examples – Bode and Nyquist






```
num=[0.5];
den=[1 2 1 0.5 ];
sys=tf(num,den);
%
w=logspace(-1,1,200);
%
[mag,phase,w]=bode(sys,w);
%
margin(mag,phase,w);
```

Open-loop system

Specify frequency range

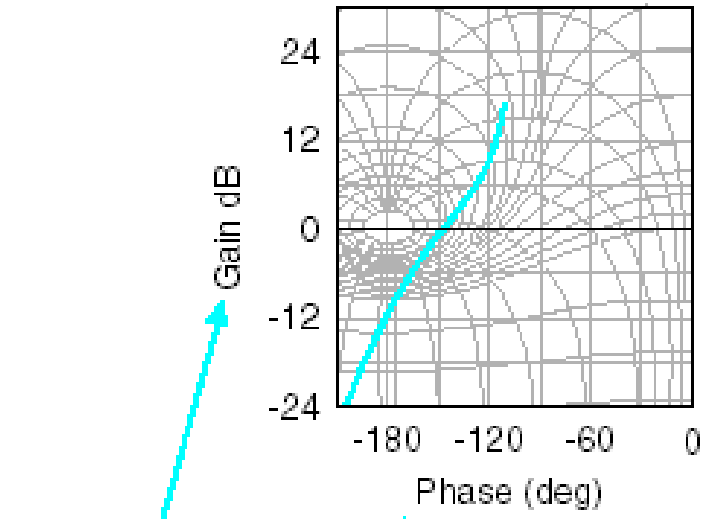
```
%  The Nyquist plot of
%
%                  0.5
%  G(s) = ------------------------------
%          s^3 + 2 s^2 + s + 0.5
%
%  with gain and phase margin calculation.
%
num=[0.5]; den=[1 2 1 0.5]; sys=tf(num,den);
%
[mag,phase,w]=bode(sys);
[Gm,Pm,Wcg,Wcp]=margin(mag,phase,w);
%
nyquist(sys);
title(['Gm = ',num2str(gm),' Pm = ',num2str(Pm)])
```

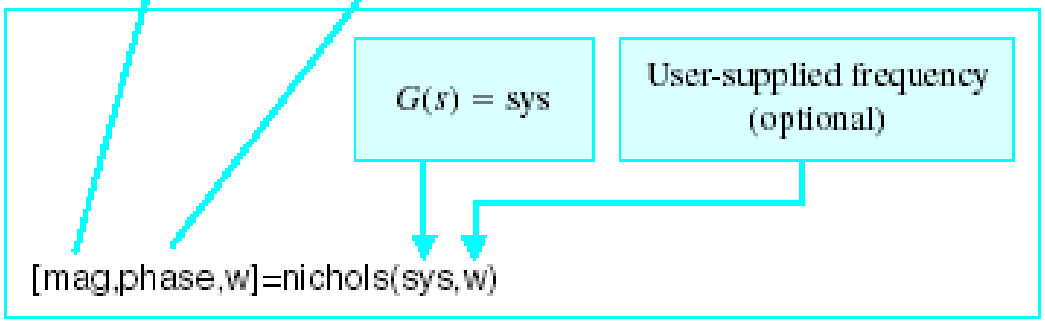
Compute gain and phase margins.

Nyquist plot

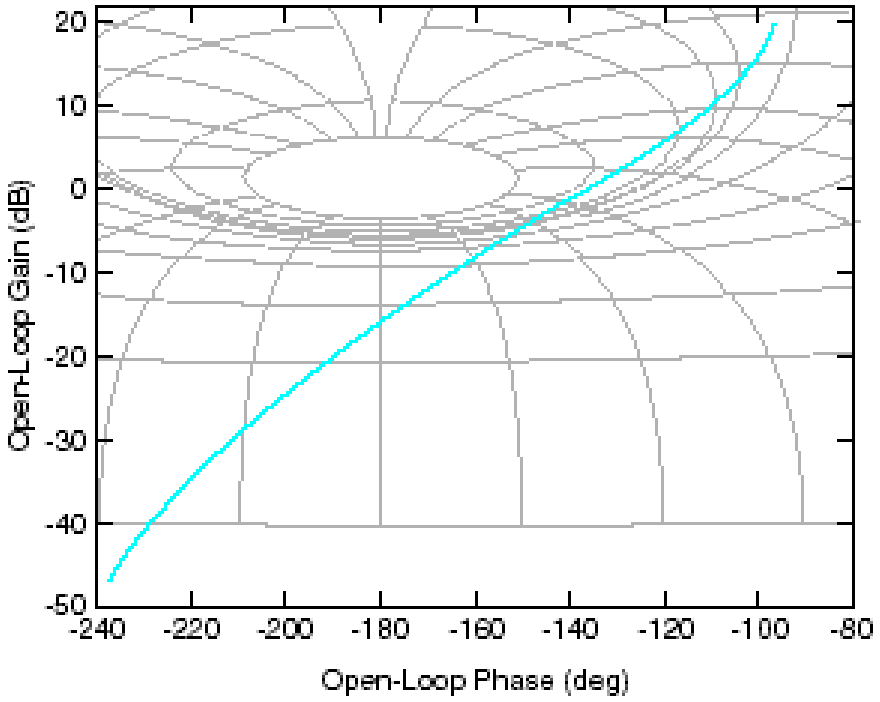
Label gain and phase margins on plot.

Examples - Nichols





Examples - Nichols




```
num=[1]; den=[0.2 1.2 1 0 ];
sys=tf(num,den);
w=logspace(-1,1,400);
nichols(sys,w);
ngrid
```

Set up to generate Fig. 9.27

Plot Nichols chart and add grid lines.