Contents

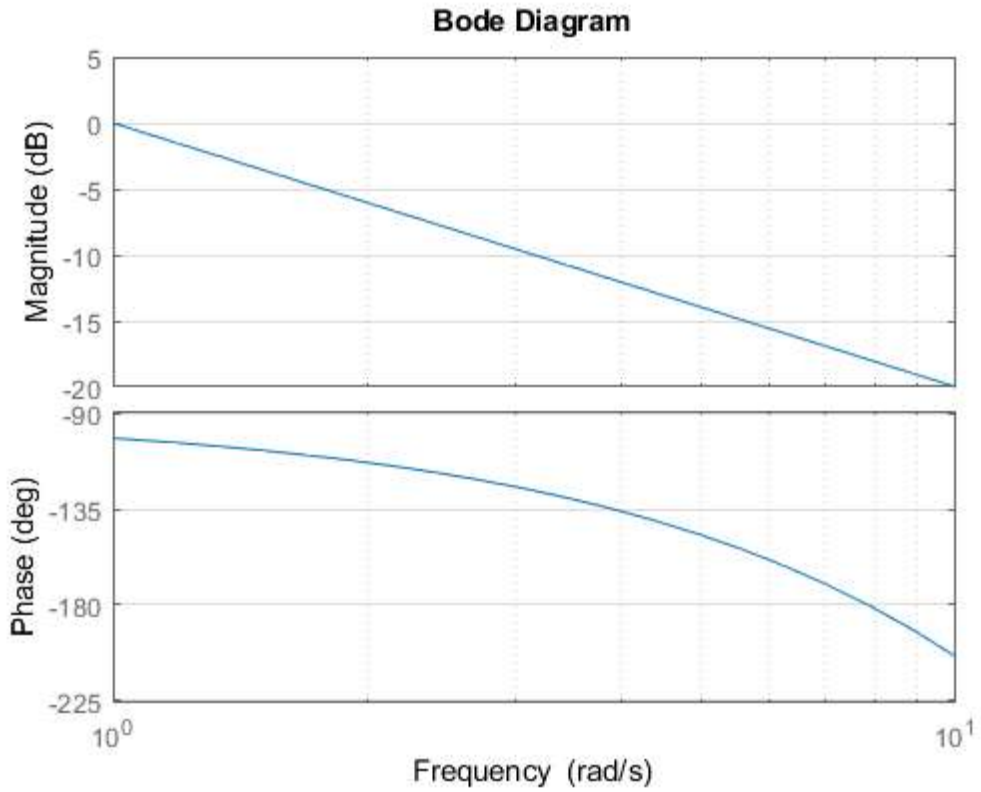
declaring the open-loop TF

```
Hol = tf(1, [1 0], 'IOdelay', 0.2)
```

```
Hol =

                1
  exp(-0.2*s) * -
                s

Continuous-time transfer function.
```

plot the OL bode diagram

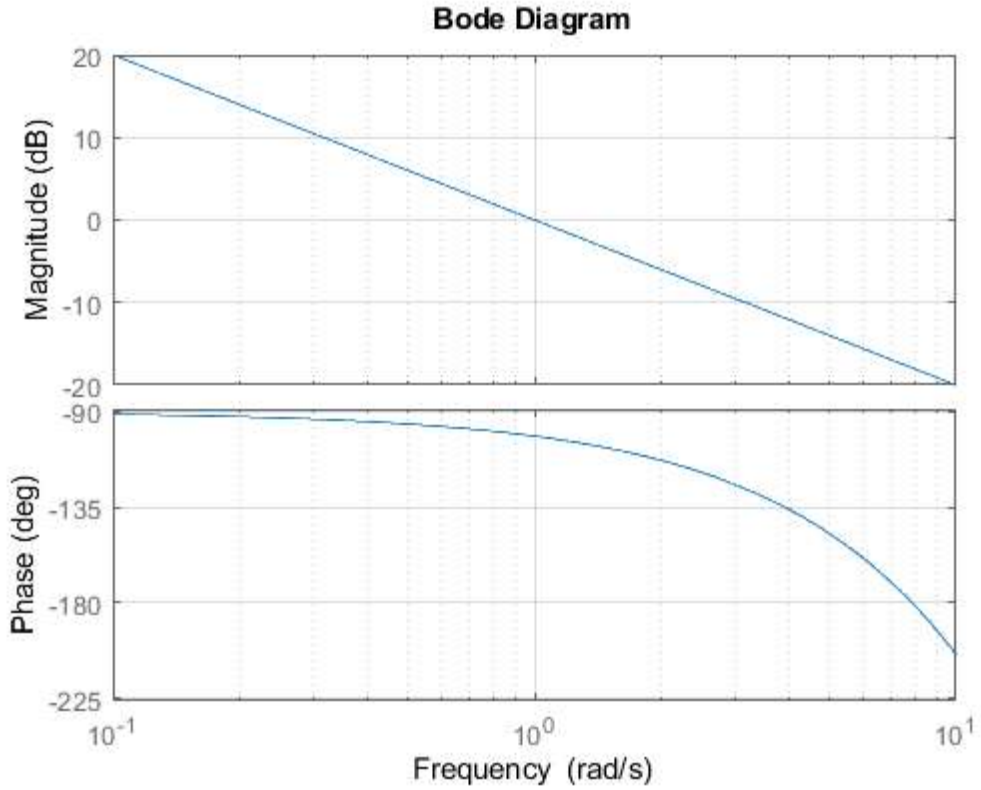
```
bode(Hol); grid; shg;
```



the cuto ff freq. is the freq. where the magnitude is 0dB

```
bode(Hol, logspace(-1,1,500)); grid; shg; hold
```

```
Current plot held
```

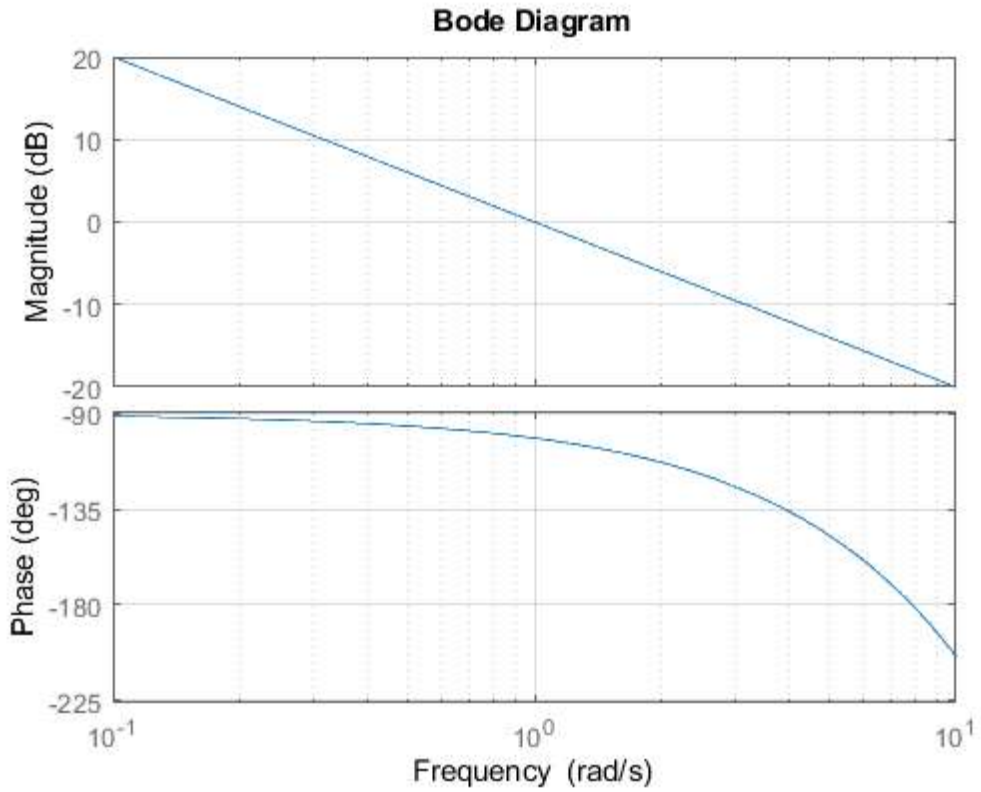


Now you can read and stroe the value of the cut off frequency

```
wc = 1;
```

place a dot in the cut off freq.

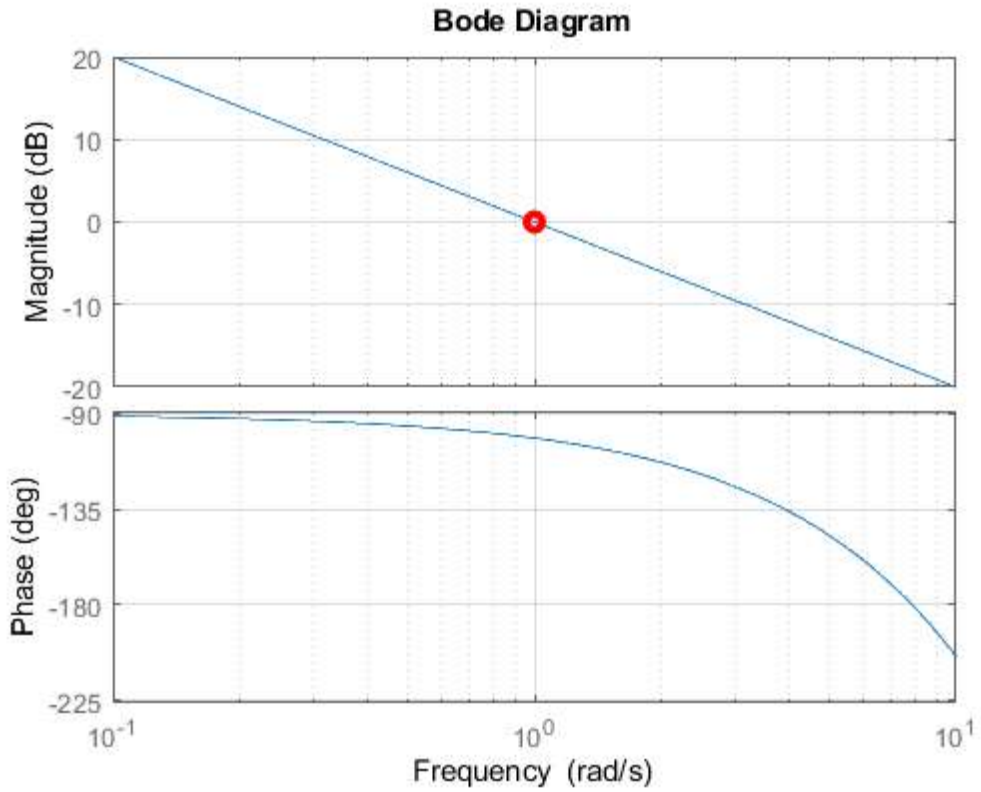
```
semilogx(wc,0,'ro', LineWidth=3)
```



the last command is not working

set the active plot the one with the magnitude characteristic

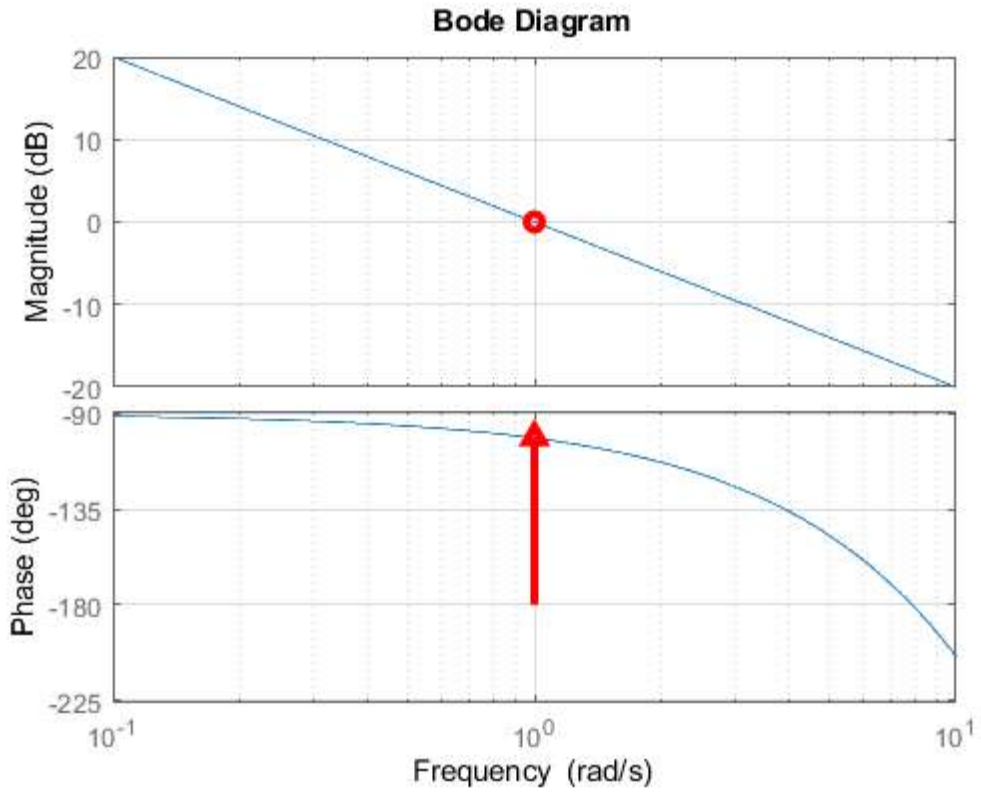
```
handles = findobj(gcf, 'Type', 'axes');
axes(handles(2))
semilogx(wc,0,'ro', LineWidth=3)
```



drawing the phase margin

switch to phase characteristic plot

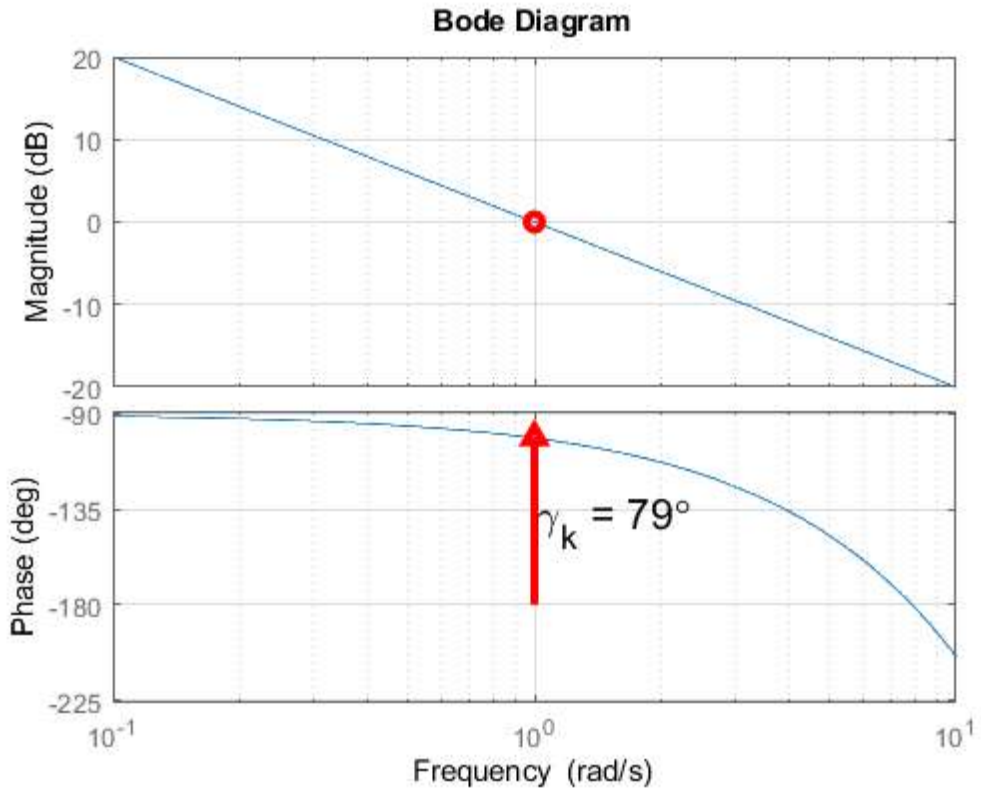
```
axes(handles(1))
% read from the bode the phase at wc
pwc = -101;
gamma_k = (180 + pwc); % the phase margin

% place an arrow in (wc,pwc)
semilogx(wc, pwc,'r^', LineWidth=3);
% drawing a straight line for the phase margin
semilogx([wc wc], [-180 pwc],'r-', LineWidth= 3);
```



place a text near a phase margin PM(gamma_k)

in order to make visible the value of the PM

```
text(wc*1.01,pwc-gamma_k/2, "\gamma_k = " + num2str(gamma_k) + "\circ", 'FontSize', 16)
```

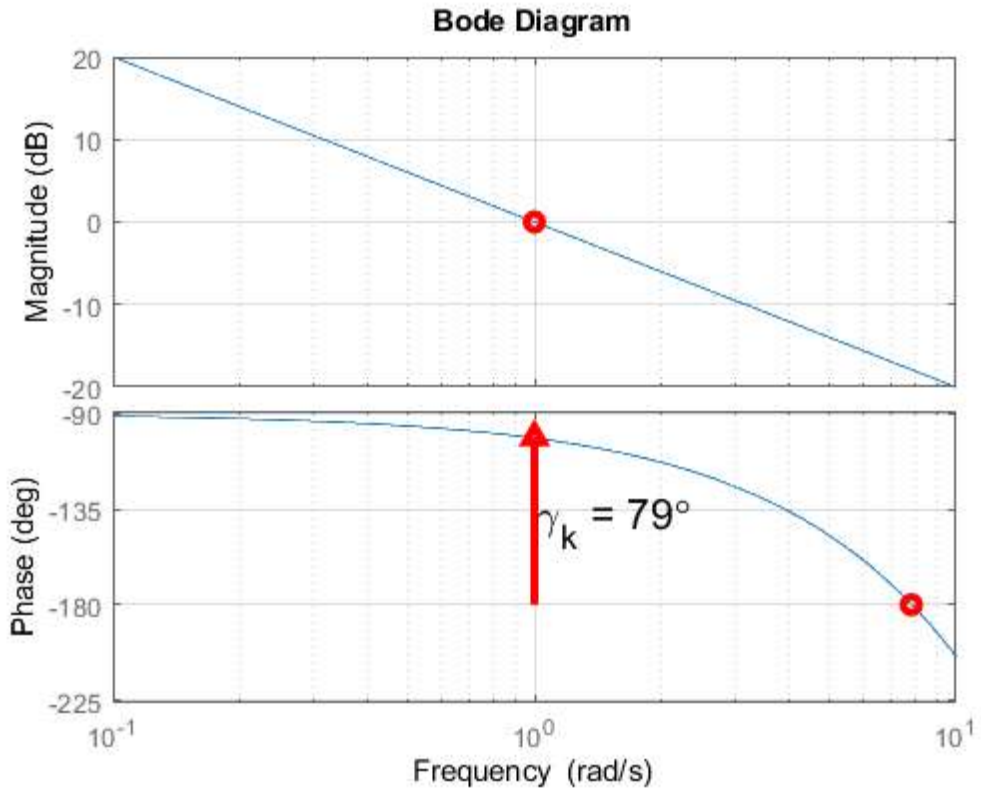


now we can read w_pi from the phase characteristics

```
w_pi = 7.83;
```

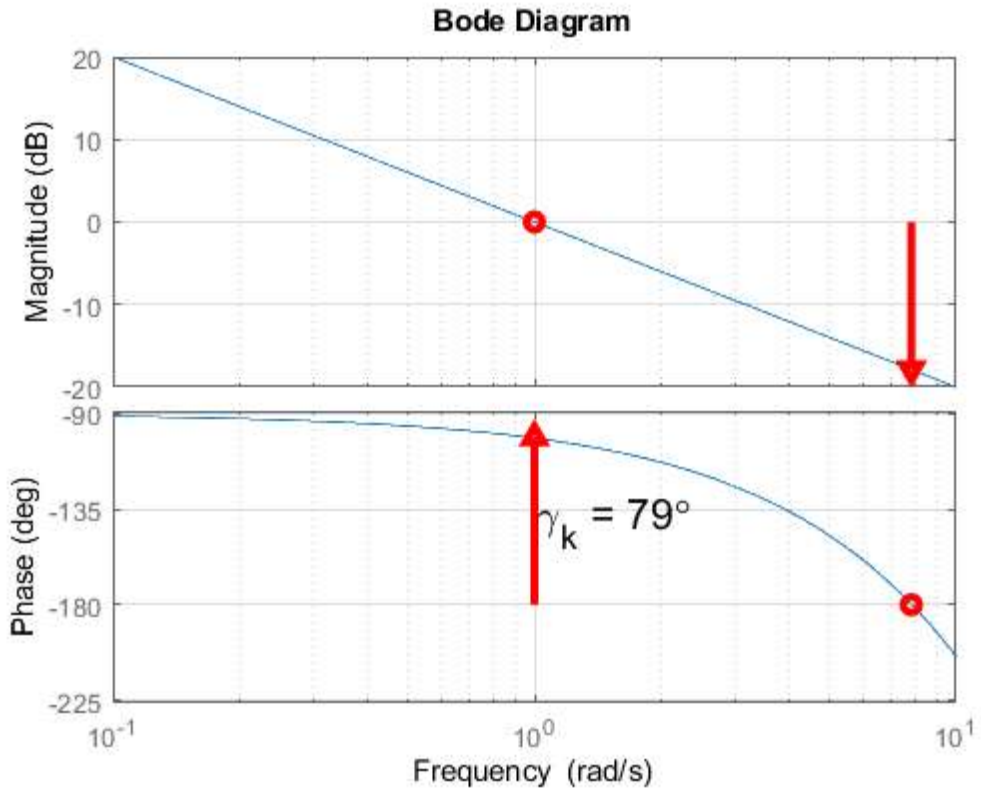
place a point on the w_pi

```
semilogx(w_pi,-180,'ro', LineWidth=3)
```



drawing the gain margin

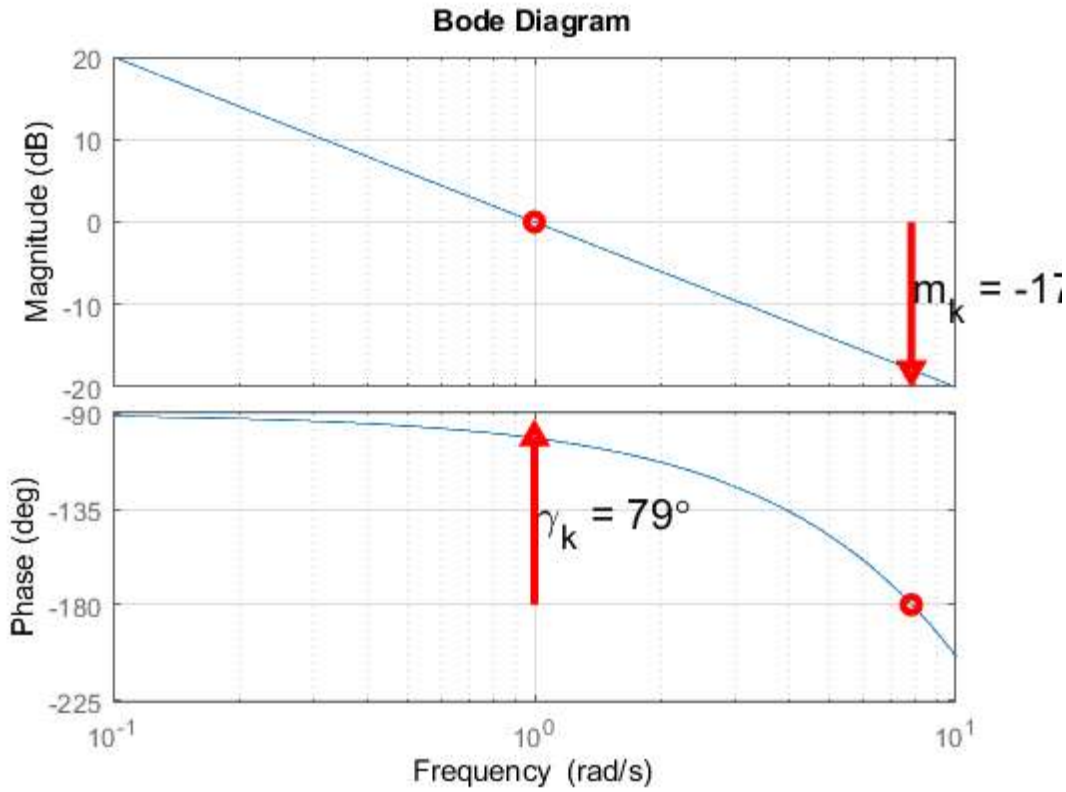
```
%switching to the magnitude characteristics plot
axes(handles(2));

%read the magnitude at w_pi
m_k = -17.9;

% place an arrow in (w_pi, m_k)
semilogx(w_pi,m_k,'rv', LineWidth=3);

% drawing a straight line for the magnitude margin
semilogx([w_pi w_pi], [m_k 0],'r-', LineWidth= 3);
```



place a text near the gain margin GM(m_k)

in order to make visible the value of the GM

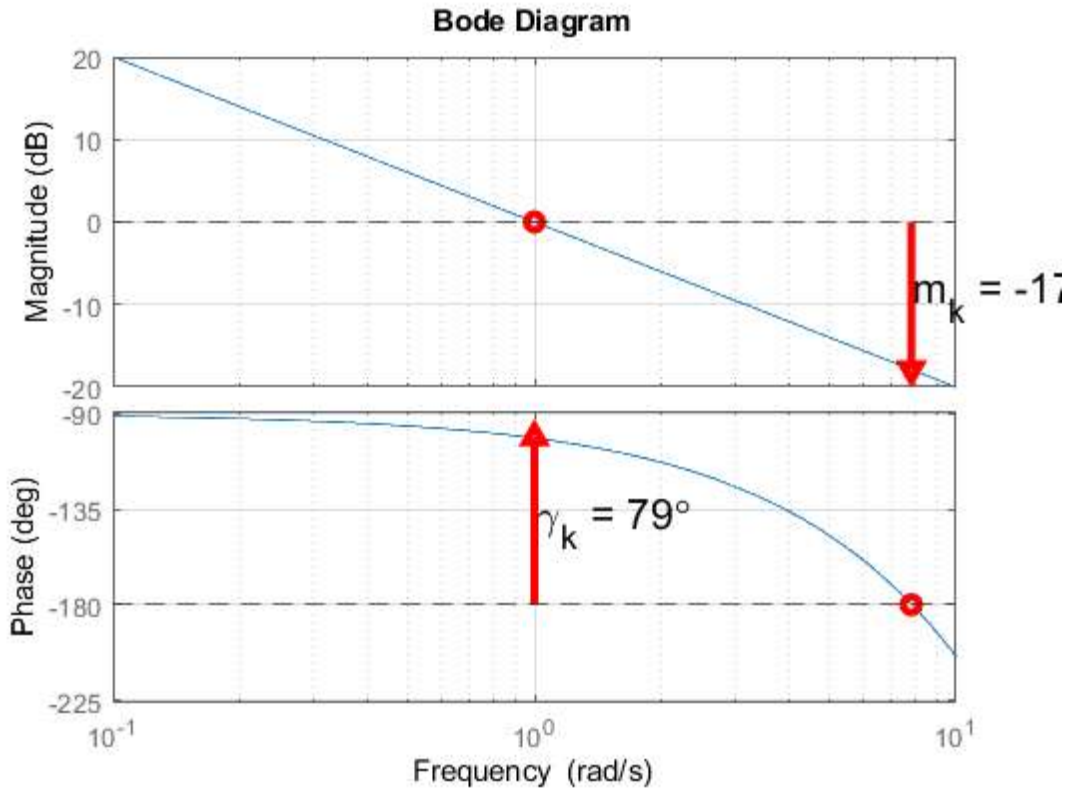
```
text(w_pi*1.01, m_k/2, "m_k = " + num2str(m_k) + "dB", 'FontSize', 16);
```



drawing horizontal lines at 0 magnitude and -180 degrees on the bode

diagrams for better represent the obvious:

```
yline(0,'--');
axes(handles(1));
yline(-180, '--');
```



checking for stability:

```
if (m_k < 0) && (gamma_k) > 0
    msg = "The system is closed loop stable.";
else
    msg = "The system is NOT closed loop stable.";
end

disp(msg)
```

```
The system is closed loop stable.
```

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