Bode Plot Building Blocks Summary

Constant Terms: $H(s) = K$ *Note:* Magnitude and Phase are constants

Integrators and Differentiators: $H(s) = s^n$

Magnitude: 20 n dB/decade, *Phase:* $n90^o$

Note: the point $(\omega = 1, 0\text{ dB})$ is on the Bode plot

Simple Poles and Zeros: $H(s) = (\tau s + 1)^n$

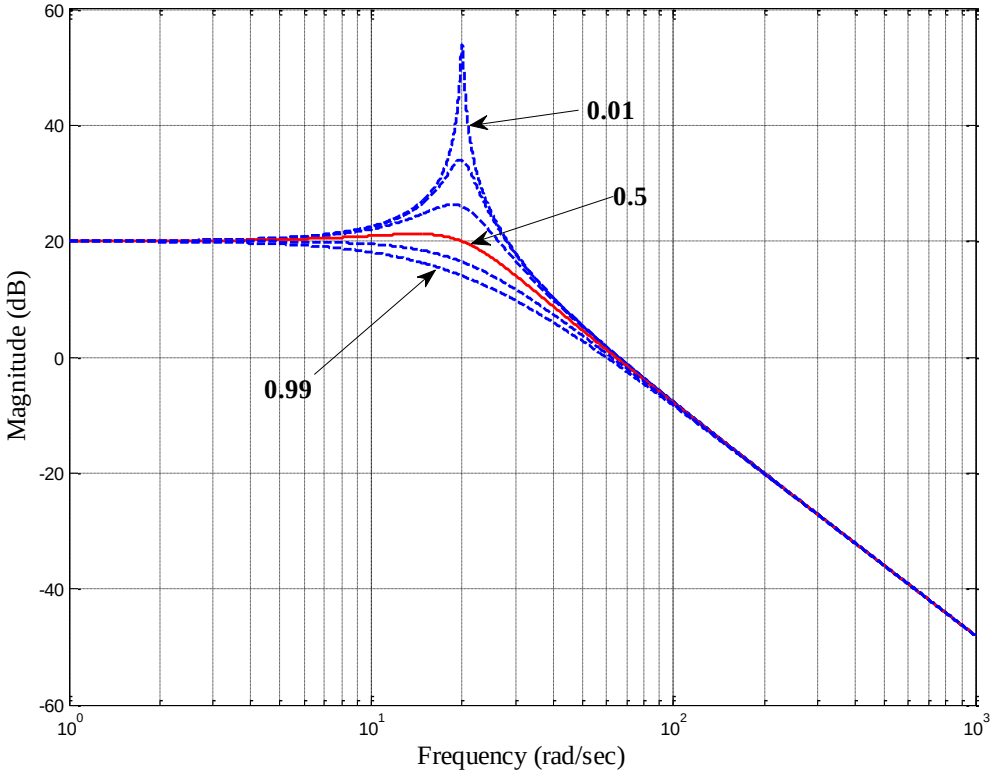
	Magnitude	*Phase*
$\omega \approx 0$	$0\ dB$	$\measuredangle H(j\omega) \approx 0^o$ *for* $\omega \le \frac{0.1}{\tau}\left(\textit{one decade before}\ \frac{1}{\tau}\right)$
$\omega = \frac{1}{\tau}$	$3n\ dB$	$\measuredangle H(j\omega) \approx n45^o$
$\omega \approx \infty$	$\textit{slope} \approx 20n\ dB/\textit{decade}$	$\measuredangle H(j\omega) \approx n90^o$ *for* $\omega \ge \frac{10}{\tau}\left(\textit{one decade after}\ \frac{1}{\tau}\right)$

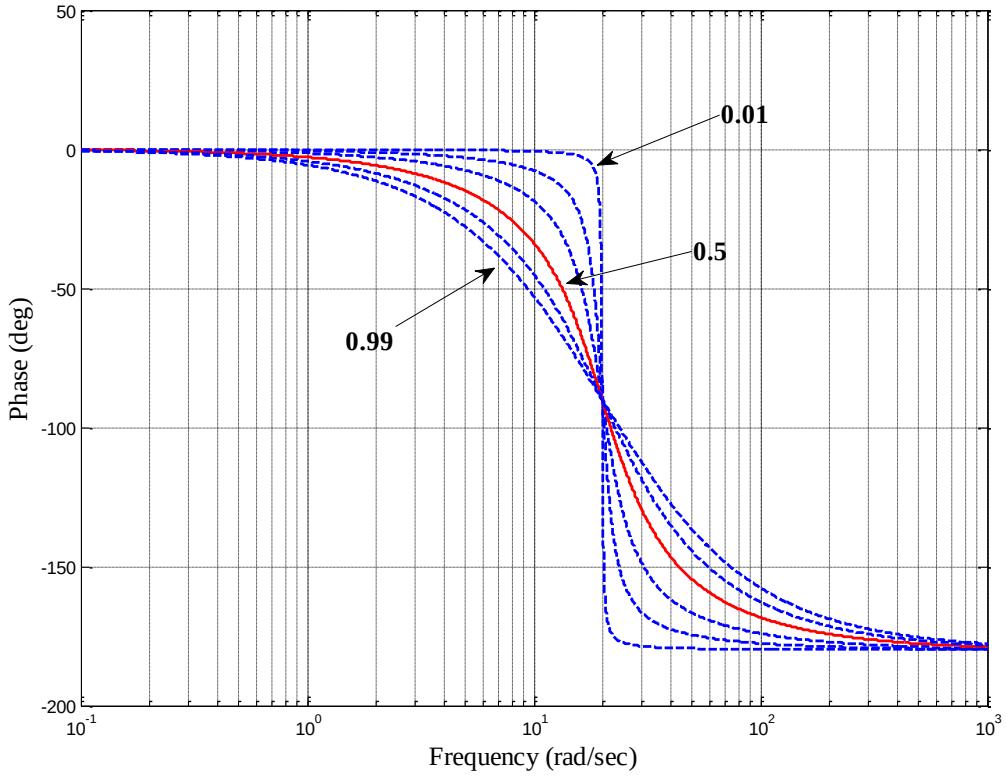
Complex Conjugate Poles and Zeros: $H(s) = \left(\frac{1}{\omega_n^2}s^2 + \frac{2\zeta}{\omega_n}s + 1\right)^n$

	Magnitude	*Phase*
$\omega \approx 0$	$0\ dB$	$\measuredangle H(j\omega) \approx 0^o$ *for* $\omega \le \frac{\omega_n}{10}\left(\textit{one decade before}\ \omega_n\right)$
$\omega = \omega_n$	*depends on* ζ	$\measuredangle H(j\omega) \approx n45^o$
$\omega \approx \infty$	$\textit{slope} \approx 40n\ dB/\textit{decade}$	$\measuredangle H(j\omega) \approx n180^o$ *for* $\omega \ge 10\omega_n\left(\textit{one decade after}\ \omega_n\right)$

(Next page) Magnitude and phase of the frequency response for the transfer function

$G(s) = \frac{K\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}$ for $K = 10, \omega_n = 20,$ and $\zeta = 0.01, 0.1, 0.250.5, 0.75, 0.99$


60
40
20
0
-20
-40
-60
Magnitude (dB)
0.01
0.5
0.99
10^0
10^1
10^2
10^3
Frequency (rad/sec)


50
0
-50
-100
-150
-200
Phase (deg)
0.01
0.5
0.99
10^{-1}
10^0
10^1
10^2
10^3
Frequency (rad/sec)