

Introductory Control Systems

Summary of Terms for Bode Diagrams

Term	Low Frequency Asymptote for M and φ (dB and deg)	High Frequency Asymptote for M and φ (dB and deg)	Corner Frequency (rad/s)
Constant, K $K > 0$ $K < 0$	$M = +20 \log(K)$ $\varphi = 0$ (deg) $\varphi = 180$ (deg)	same	none
Poles at Origin (Order N)	$M = -20 N \log(\omega)$ $\varphi = -90 N$ (deg)	same	none
Zeros at Origin (Order N)	$M = +20 N \log(\omega)$ $\varphi = +90 N$ (deg)	same	none
Real Pole $s = -p$ $s = +p$	$M = -20 \log(p)$ $\varphi = 0$ (deg) $\varphi = -180$ (deg)	$M = -20 \log(\omega)$ $\varphi = -90$ (deg) $\varphi = -90$ (deg)	$\omega = p$
Real Zero $s = -z$ $s = +z$	$M = +20 \log(z)$ $\varphi = 0$ (deg) $\varphi = +180$ (deg)	$M = +20 \log(\omega)$ $\varphi = +90$ (deg) $\varphi = +90$ (deg)	$\omega = z$
Complex Conjugate Poles (ζ, ω_n) Left-Half Plane Right-Half Plane	$M = -40 \log(\omega_n)$ $\varphi = 0$ (deg) $\varphi = -360$ (deg)	$M = -40 \log(\omega)$ $\varphi = -180$ (deg) $\varphi = -180$ (deg)	$\omega = \omega_n$
Complex Conjugate Zeros (ζ, ω_n) Left-Half Plane Right-Half Plane	$M = +40 \log(\omega_n)$ $\varphi = 0$ (deg) $\varphi = 360$ (deg)	$M = +40 \log(\omega)$ $\varphi = +180$ (deg) $\varphi = +180$ (deg)	$\omega = \omega_n$