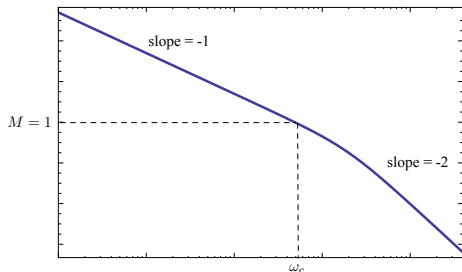


Example 2: Magnitude Plot

$$G(j\omega) = \frac{\omega_n^2}{(j\omega)^2 + 2\zeta\omega_n j\omega} = \frac{\omega_n}{2\zeta j\omega \left(\frac{j\omega}{2\zeta\omega_n} + 1 \right)}$$



It can be shown that, *for this system*,

$$\text{PM} \Big|_{K=1} = \tan^{-1} \left(\frac{2\zeta}{\sqrt{4\zeta^4 + 1} - 2\zeta^2} \right)$$

— for $\text{PM} < 70^\circ$, a good approximation is $\text{PM} \approx 100 \cdot \zeta$