

Second Order System Frequency Response

$$m := 15 \cdot \text{slug} \quad \text{mass}$$

$$k := 500 \cdot \frac{\text{lbf}}{\text{ft}} \quad \text{spring constant}$$

$$b := 20 \cdot \frac{\text{lbf} \cdot \text{sec}}{\text{ft}} \quad \text{damping coefficient}$$

$$\omega_n := \sqrt{\frac{k}{m}} \quad \omega_n = 5.774 \frac{\text{rad}}{\text{sec}} \quad \text{natural frequency}$$

$$\zeta := \frac{b}{2 \cdot \sqrt{k \cdot m}} \quad \zeta = 0.115 \quad \text{damping ratio}$$

$$\omega_r = \frac{\omega}{\omega_n} \quad \text{frequency ratio}$$

$$A(\omega_r) := \frac{1}{\sqrt{\left[(1 - \omega_r^2)^2 + 4\zeta^2 (\omega_r^2)^2 \right]}} \quad \text{amplitude ratio as a function of frequency ratio}$$

$$A(1) = 4.33 \quad \text{amplitude ratio at resonance}$$

$$\phi(\omega_r) := -\text{angle} \left(\frac{1}{\omega_r} - \omega_r, 2\zeta \right) \quad \text{phase angle as a function of frequency ratio}$$

$$\phi(1) = -90 \text{ deg} \quad \text{phase angle at resonance}$$

$\omega_r := 0.01, 0.05 \dots 2$

