

General Transfer Function of 2nd Order ODEs:

$$G(s) = \frac{X(s)}{U(s)} = \frac{\omega_n^2}{(s^2 + 2\zeta\omega_n s + \omega_n^2)}$$

Substituting Our Equation:

$$\frac{\Theta_L}{\Theta_0} = \frac{\left(\frac{K_p K_g K_m}{J R_m}\right)}{s^2 + s \left(\frac{K_g^2 K_m^2}{J R_m} + \frac{K_d K_g K_m}{J R_m}\right) + \left(\frac{K_p K_g K_m}{J R_m}\right)}$$

We see that: $\boxed{\omega_n^2 = \frac{K_p K_g K_m}{J R_m}}$

$$\text{And } 2\zeta\omega_n = \frac{K_g^2 K_m^2 + K_d K_g K_m}{J R_m}$$

$$\zeta = \frac{K_g^2 K_m^2 + K_d K_g K_m}{2 J R_m} \cdot \sqrt{\frac{J R_m}{K_p K_g K_m}}$$

$$\boxed{\zeta = \frac{K_g^2 K_m^2 + K_d K_g K_m}{2 \sqrt{K_p K_g K_m J R_m}}}$$