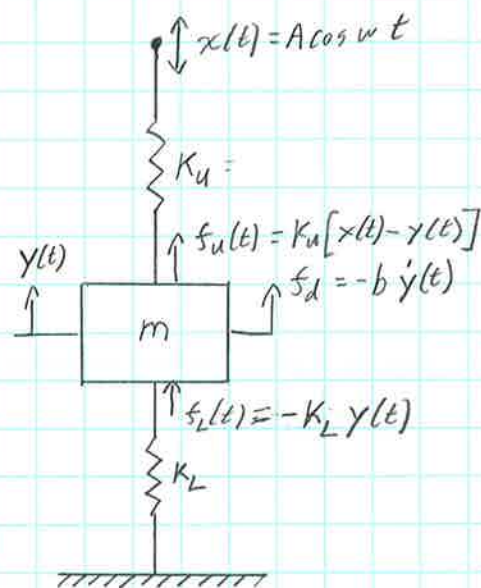


FREQ DOMAIN RESPONSE OF MASS BETWEEN TWO SPRINGS



$$x(t) = \text{Re}[X e^{j\omega t}] = X^R \cos \omega t + X^I \sin \omega t$$

$$\rightarrow X = X^R + jX^I : X^R = A, X^I = 0$$

$$y(t) = \text{Re}[Y e^{j\omega t}] = Y^R \cos \omega t + Y^I \sin \omega t$$

$$\dot{y}(t) = \text{Re}[j\omega Y e^{j\omega t}] \quad \ddot{y}(t) = \text{Re}[-\omega^2 Y e^{j\omega t}]$$

$$f_u(t) = K_u[x(t) - y(t)] = \text{Re}[F_u e^{j\omega t}]$$

$$F_u = K_u[X - Y]$$

$$f_l(t) = -K_L y(t) = \text{Re}[F_L e^{j\omega t}]$$

$$F_L = -K_L Y$$

$$f_d(t) = -b \dot{y}(t) = \text{Re}[F_D e^{j\omega t}]$$

$$F_D = -j\omega b Y$$

$$m \ddot{y}(t) = F_u(t) + F_L(t) + F_D(t)$$

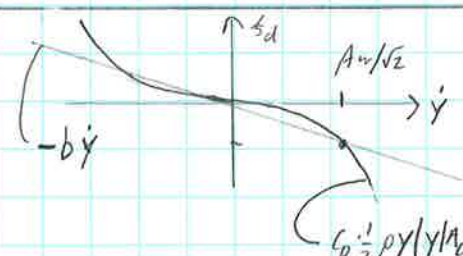
$$\text{Re}[-m\omega^2 Y e^{j\omega t}] = \text{Re}[(K_u(X - Y) - K_L Y - j\omega b Y) e^{j\omega t}]$$

$$0 = m\omega^2 Y + K_u X - (K_u + K_L) Y - j\omega b Y$$

$$-K_u X = [m\omega^2 - (K_u + K_L) - j\omega b] Y$$

$$Y = \frac{-K_u X}{[m\omega^2 - (K_u + K_L) - j\omega b]}$$

$$\text{RAO} = \left| \frac{Y}{X} \right| = \left| \frac{-K_u}{m\omega^2 - (K_u + K_L) - j\omega b} \right| = \frac{K_u}{[(m\omega^2 - (K_u + K_L))^2 + \omega^2 b^2]^{1/2}}$$



$$b = \frac{C_D^{1/2} \rho A_c \left[\frac{A\omega}{\sqrt{2}} \right]^2}{A\omega/\sqrt{2}}$$

$$b = C_D^{1/2} \rho A_c \frac{A\omega}{\sqrt{2}}$$

LINEARIZED RELATIVE TO RMS EXCITATION VEL.

UNDAMPED RESONANCE PT:

$$\omega_R = \sqrt{\frac{K_u + K_L}{m}}$$

DAMPED RESONANCE PT:

$$\omega_R = \sqrt{\frac{(K_u + K_L) - b^2}{m}}$$

SUFFICIENTLY UNDER DAMPED, WHEN $\zeta = \frac{b}{2\sqrt{m(K_u + K_L)}} < 1/\sqrt{2}$