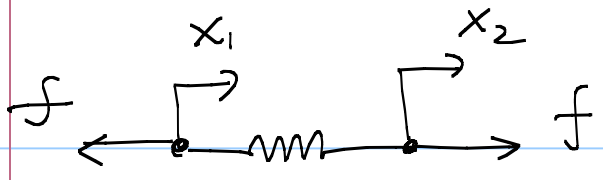
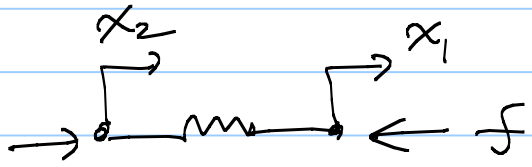


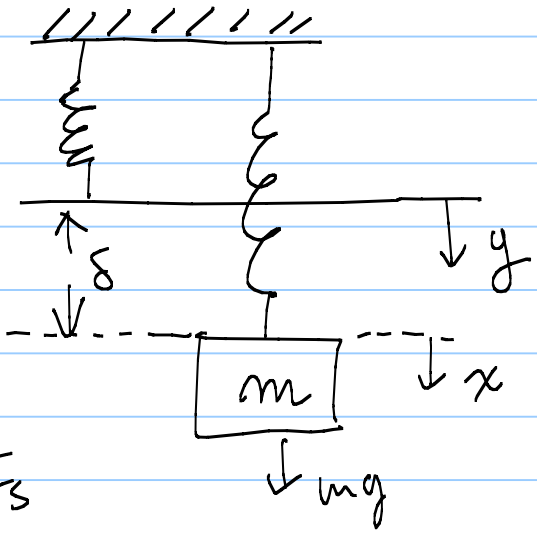
$$f = k(x_2 - x_1)$$

$x_2 - x_1 > 0$



$$f = k(x_2 - x_1)$$

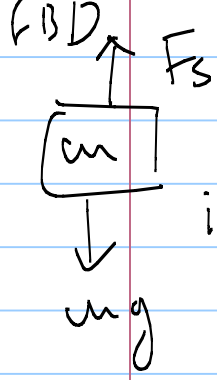
$x_2 - x_1 > 0$



$$mg = k\delta$$

$\Sigma F_z = ma$

$y = x + \delta$, $\dot{y} = \dot{x}$, $\ddot{y} = \ddot{x}$



in y

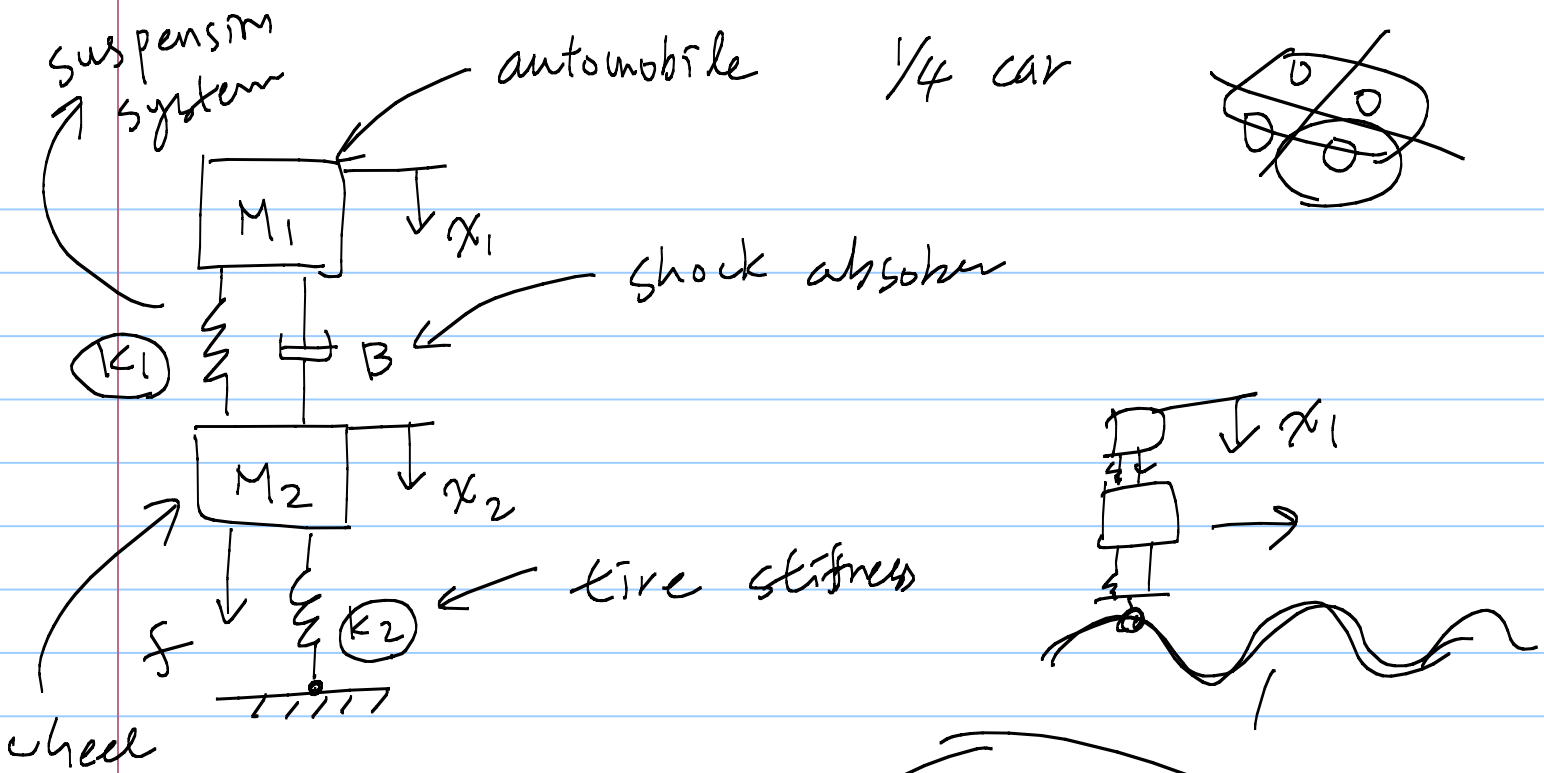
$$m\ddot{y} = mg - ky$$

in (x)

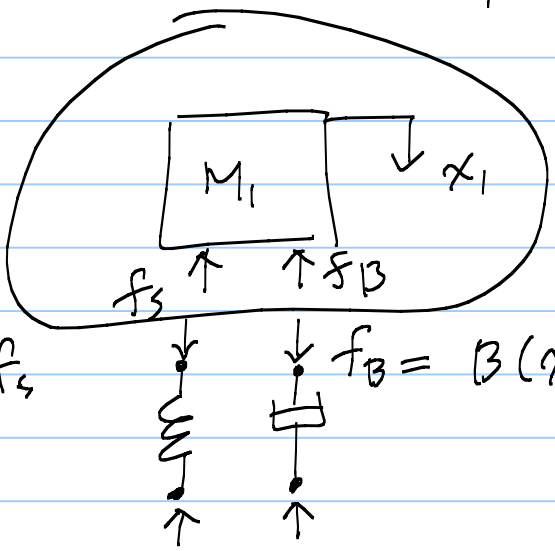
$$m\ddot{x} = mg - k(x + \delta)$$

$$= \cancel{mg} - kx - \cancel{k\delta}$$

$$\hookrightarrow m\ddot{x} = -kx$$



FBD



$\sum F_i = ma$

$K_1(x_1 - x_2) = f_s$

$m_1 \ddot{x}_1 = -B(\dot{x}_1 - \dot{x}_2) - K(x_1 - x_2)$

$m_1 \ddot{x}_1 + B\dot{x}_1 + Kx_1 = B\dot{x}_2 + Kx_2$

$\mathcal{L}$

$(m_1 s^2 + Bs + K) X_1(s) = (Bs + k) \cdot X_2(s)$

$$\frac{X_1(s)}{X_2(s)} = \frac{Bs + k_1}{m_1 s^2 + Bs + k_1} \quad \text{---} \quad (1)$$

$$m_2\ddot{x}_2 = +B(\dot{x}_1 - \dot{x}_2) + K_1(x_1 - x_2) + f - K_2x_2$$

f_2

$$m_2\ddot{x}_2 + B\dot{x}_2 + (K_1+K_2)x_2 = B\dot{x}_1 + K_1x_1 + f$$

$\mathcal{L}\{\}$

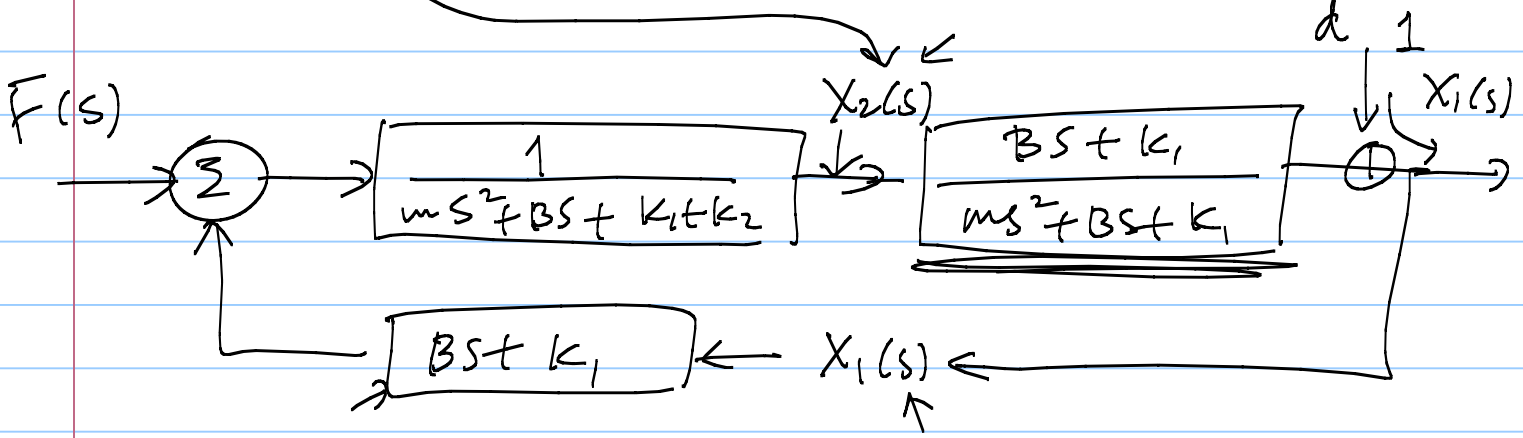
$$(ms^2 + Bs + (K_1+K_2))X_2(s) = (Bs + K_1)X_1(s) + F(s) \quad \text{— (2)}$$

(1) →

$$\rightarrow X_2(s) \rightarrow \boxed{\frac{Bs+K_1}{ms^2+Bs+K_1}} \rightarrow X_1(s)$$

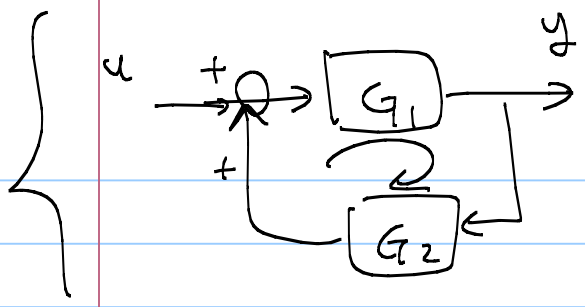
(2) →

$$X_2(s) = \frac{(Bs+K_1)}{ms^2+Bs+(K_1+K_2)}X_1(s) + \frac{F(s)}{ms^2+Bs+(K_1+K_2)}$$



$$\frac{X_1(s)}{F(s)} = \frac{Bs+K_1}{(ms^2+Bs+K_1)(ms^2+Bs+K_1+K_2) - (Bs+K_1)^2}$$

$$1 - L(s) = 1 - \frac{(Bs+K_1)^2}{(\quad //\quad)(\quad //\quad)}$$

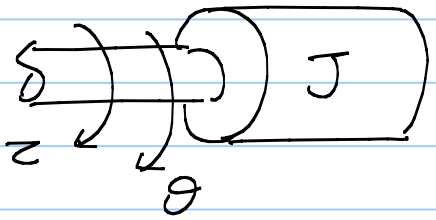


$$\frac{Y(s)}{u(s)} = \frac{G_1}{1 - G_2 G_1}$$

$$\frac{X_1(s)}{d(s)} = \left\{ \frac{1}{1 - L(s)} \right\}$$

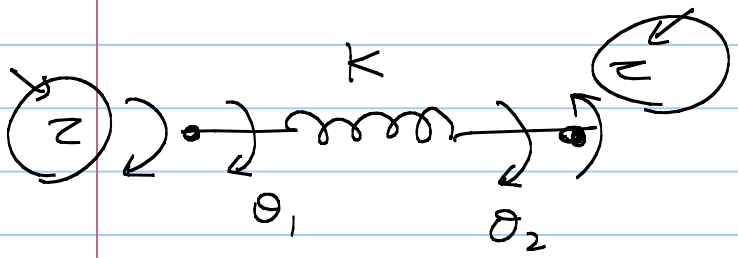
$$\frac{X_1(s)}{X_2(s)} = \frac{\boxed{Bs + K_1}}{1 - L(s)}$$

Rotational Systems — applied Torque

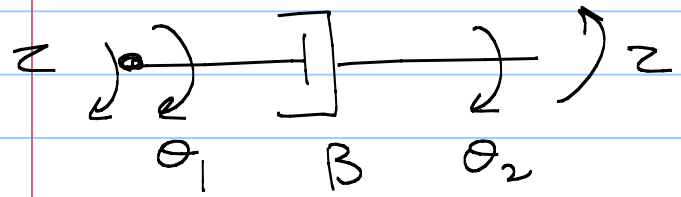


$$\tau = J \frac{d^2\theta}{dt^2}$$

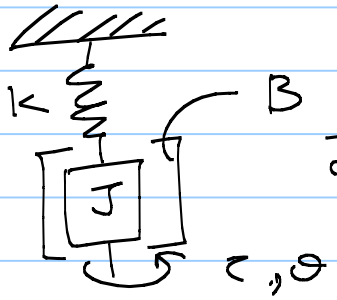
↑ moment of Inertia



$$\tau = K(\theta_1 - \theta_2)$$



$$\tau = B(\dot{\theta}_1 - \dot{\theta}_2)$$

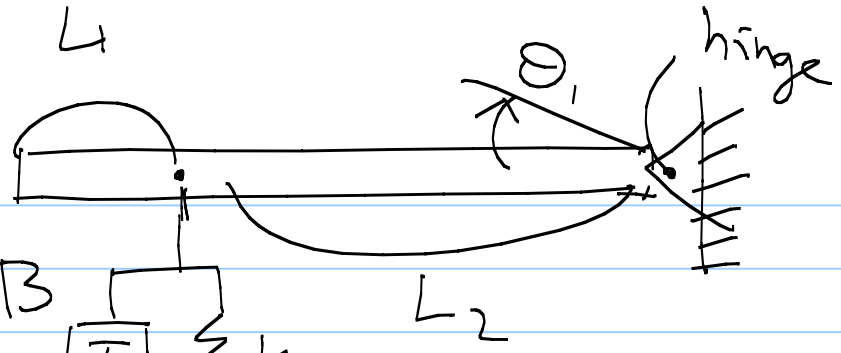


$$J\ddot{\theta} = -K\theta - B\dot{\theta} + \tau$$

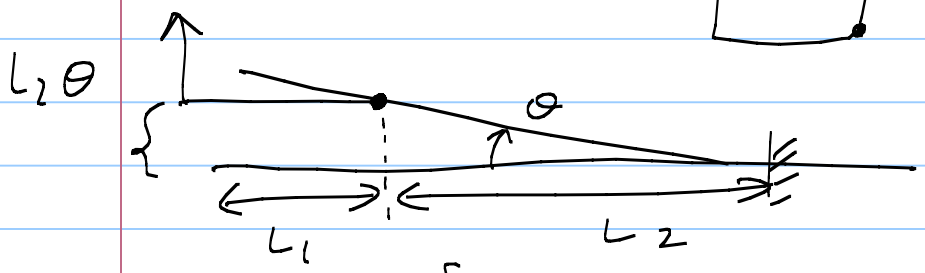
$$(Js^2 + Bs + K)\,\theta(s) = \tau(s)$$

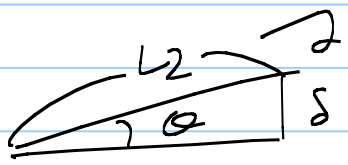
$$\frac{\theta(s)}{\tau(s)} = \frac{1}{Js^2 + Bs + K}$$

Hw prob 3



Assume
θ is small.





$$\frac{\delta}{L_2} = \sin\theta$$

$\sin\theta \approx \theta$ $\approx\theta$

$$\frac{\sin\theta}{\cos\theta} = \tan\theta = \frac{\delta}{L_2}$$

$\cos\theta \approx 1$