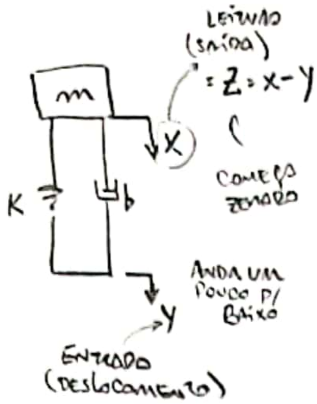
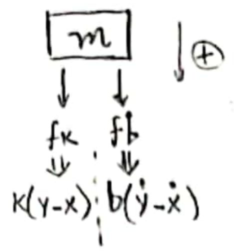
EX1 SISMÓGRAFO — WILSON SIOU KAN CHOW 10769938

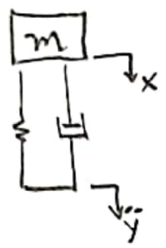




$$m(\ddot{x}+\ddot{y}) = fk + fb$$

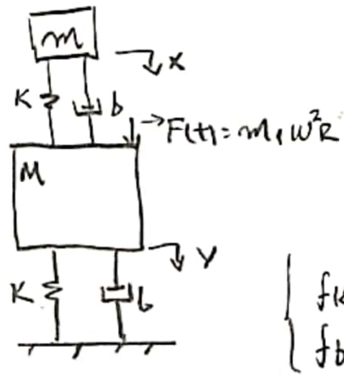
$$\boxed{m(\ddot{x}+\ddot{y}) = Ky - Kx + b\dot{y} - b\dot{x}}$$

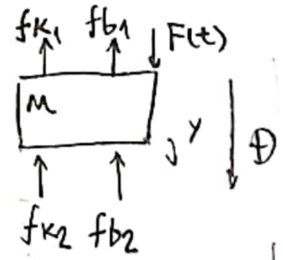
EX1b ACELERÔMETRO

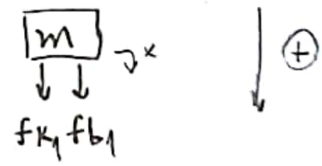


SERIA A MESMA COISA, A DIFERENÇA É QUE EM VEZ DE COMEÇAR COM A LEITURA y, IRIA COMEÇAR COM A LEITURA $\ddot{y}$.

EX2







$$\begin{cases} fk_2 = K \cdot y \\ fb_2 = b \cdot \dot{y} \end{cases}$$

$$\begin{cases} fk_1 = K_a(y-x) \\ fb_1 = b_a(\dot{y}-\dot{x}) \end{cases}$$

2ª LEI NA MASSA m:

$$m(\ddot{x}+\ddot{y}) = fk_1 + fb_1 = K_a(y-x) + b_a(\dot{y}-\dot{x}) \Rightarrow m(\ddot{x}+\ddot{y}) - b_a(\dot{y}-\dot{x}) - K_a(y-x) = 0$$

$$\Rightarrow \boxed{m(\ddot{x}+\ddot{y}) + b_a\dot{x} + K_a x = +b_a\dot{y} + K_a y}$$

2ª LEI NA MASSA M:

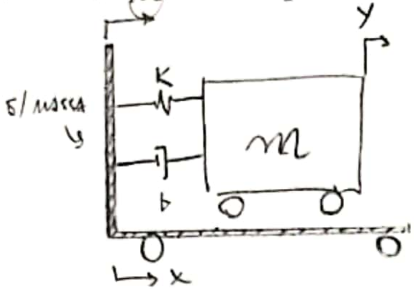
$$M\ddot{y} = -f_{K2} - fb_2 - fk_1 - fb_1 - F(t)$$

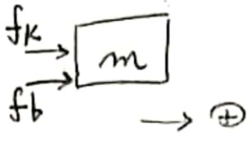
$$M\ddot{y} = -Ky - b\dot{y} - K_a y + K_a x - b_a\dot{y} + b_a\dot{x} + m_1 w^2 R\,\text{sen}(wt)$$

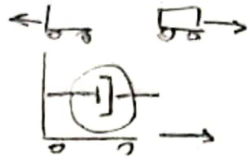
$$M\ddot{y} = -\dot{y}(b+b_a) - y(K+K_a) + K_a x + b_a\dot{x} + m_1 w^2 R\,\text{sen}(wt)$$

$$\boxed{M\ddot{y} + \dot{y}(b+b_a) + y(K+K_a) = K_a x + b_a\dot{x} + m_1 w^2 R\,\text{sen}(wt)}$$

EX 3.1: $u \rightarrow$ É FORÇA







$u - y > 0$

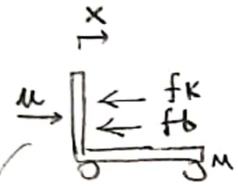
$$f_K = K \cdot (x - y)$$

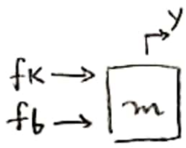
$$f_b = b \cdot (\dot{x} - \dot{y})$$

2º lei no m:

$$m\ddot{y} = f_K + f_b \Rightarrow m\ddot{y} = Kx - Ky + b\dot{x} - b\dot{y} \Rightarrow \underline{m\ddot{y} + b\dot{y} + Ky} = \underline{Kx + b\dot{x}}$$

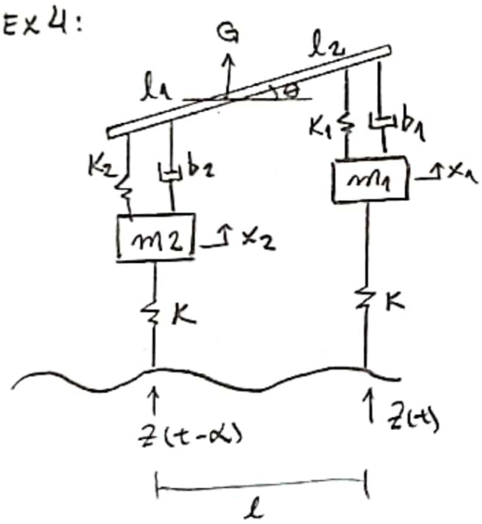
EX 3.2:





$$M(\ddot{x}) = -f_K - f_b + u \Rightarrow M\ddot{x} = Ky - Kx + b\dot{y} + b\dot{x} + u$$

EX 4:



ESTILO LAGRANGE:

$$\frac{\partial}{\partial t}\left[\frac{\partial L}{\partial \dot{q}_i}\right] - \frac{\partial L}{\partial q_i} + \frac{\partial R}{\partial \dot{q}_i} = F_{EXT}$$

$$T = \frac{m_1 \dot{x}_1^2}{2} + \frac{m_2 \dot{x}_2^2}{2} + \underbrace{T_{BARRA}}$$

$$T_{BAR}: \frac{1}{2} M \cdot \dot{x}_G^2 + M\vec{\dot{x}}_G \cdot (\vec{\omega} \wedge (G - G)) + \frac{1}{2}[\omega]^t I_{Gxyz}[\omega]$$

$$= \frac{1}{2} M\dot{x}_G^2 + \frac{1}{2} J_G \dot{\theta}^2$$

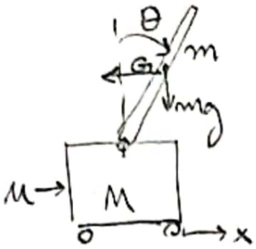
$$V = \frac{1}{2}K\left[z(t-\alpha) - x_2\right]^2 + \frac{1}{2}K\left[z(t-\alpha) - x_1\right]^2 + \frac{1}{2}K_1\left[x_G + l_2 \operatorname{sen}\theta - x_1\right]^2 +$$

$$\frac{1}{2}K_2\left[x_G - l_1 \operatorname{sen}\theta - x_2\right]^2$$

$$R_1 = \frac{1}{2}b_1(\dot{x}_G + l_2 \cdot \dot{\theta} \cdot \cos\theta - \dot{x}_1)^2 + \frac{1}{2}b_2(\dot{x}_G - l_1 \cdot \dot{\theta}\cos\theta - \dot{x}_2)^2$$

$F_{EXT} = \emptyset$

Ex 5:



$$T_{BARRA} = \frac{1}{2} m \dot{x}^2 + m(\dot{x}\vec{i})\left[(-\dot{\theta}\vec{k}) \times \ell(\cos\theta\,\vec{j} + \operatorname{sen}\theta\,\vec{i})\right] + \frac{1}{2}(\dot{\theta})^2 \frac{4}{3} m\ell^2$$

$$= \frac{1}{2}(M+m)\dot{x}^2 + m\dot{x}\dot{\theta}\,\ell\cos\theta + \frac{2}{3} m\ell^2(\dot{\theta})^2$$

$$V_{BARRA} = mg\ell\cos\theta$$

$$\frac{\partial}{\partial t}\left[\frac{\partial L}{\partial \dot{q}_i}\right] - \frac{\partial L}{\partial q_i} + \cancelto{0}{\frac{\partial R}{\partial \dot{q}_i}} = F_{EXT}$$

Para x:

$$\frac{\partial L}{\partial \dot{x}} = (M+m)\dot{x} + m\dot{\theta}\ell\cos\theta$$

$$\frac{d}{dt}\left[\frac{\partial L}{\partial \dot{x}}\right] = (M+m)\ddot{x} + m\ell\cos\theta\,\ddot{\theta} + m(\dot{\theta})^2\ell(-\operatorname{sen}\theta)$$

$$\frac{\partial L}{\partial x} = 0$$

$$\boxed{(M+m)\ddot{x} + m\ell\cos\theta\cdot\ddot{\theta} - m\ell(\dot{\theta})^2\operatorname{sen}\theta = u}$$

Para θ:

$$\frac{\partial L}{\partial \dot{x}} = m\dot{x}\ell\cos\theta + \frac{4}{3}m\ell^2\dot{\theta} \Rightarrow \frac{d}{dt}\left[\frac{\partial L}{\partial \dot{\theta}}\right] = m\ell\cos\theta\,\ddot{x} + m\dot{x}\ell\dot{\theta}(-\operatorname{sen}\theta) + \frac{4}{3}m\ell^2\ddot{\theta}$$

$$\frac{\partial L}{\partial \theta} = -m\dot{x}\dot{\theta}\ell\operatorname{sen}\theta - mg\ell\operatorname{sen}\theta$$

$$\boxed{m\ell\cos\theta\cdot\ddot{x} + \frac{4}{3}m\ell^2\ddot{\theta} + mg\ell\operatorname{sen}\theta = 0}$$