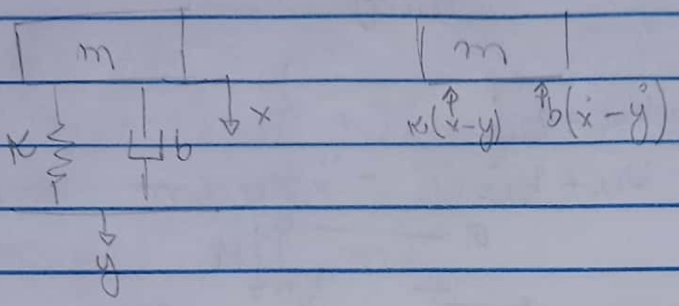
Alessandra da Cruz Nunes de Moraes - 10337209

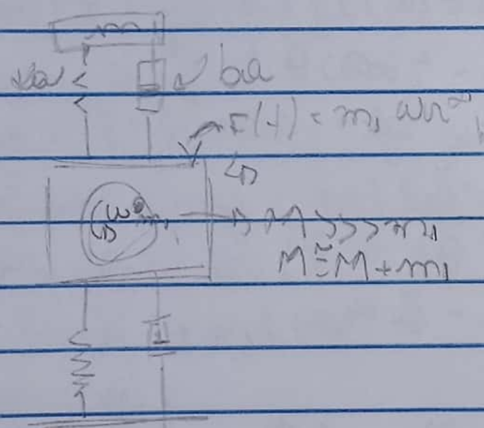
Exercícios Aula 27/08

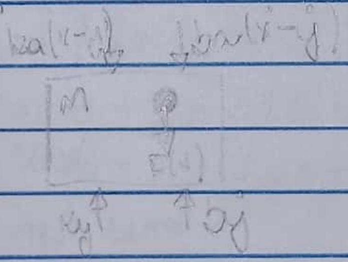
a) Sismógrafo / b) Acelerômetro

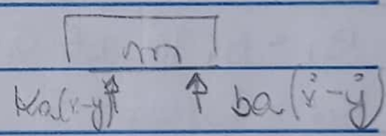


TMB: $m(\ddot{x}-\ddot{y}) = -k(x-y) - b(\dot{x}-\dot{y}) \Leftrightarrow m\ddot{x} + b\dot{x} + kx = m\ddot{y} + b\dot{y} + ky$

② máquina rotativa com absorvedor de vibração







$m\ddot{x} + k_a x + b_a\dot{x} = k_a y + b_a\dot{y}$

$M\ddot{y} + y(k + k_a) + \dot{y}(b + b_a) = m_1 \omega^2 R + k_a x + b_a\dot{x}$

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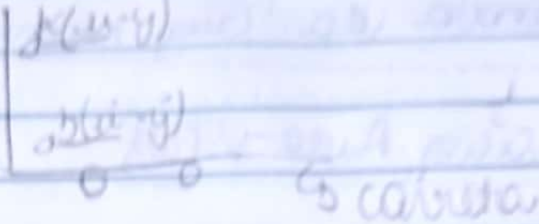
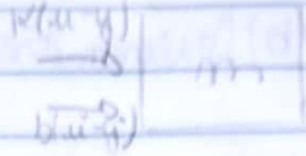
③ Carrinho de transporte



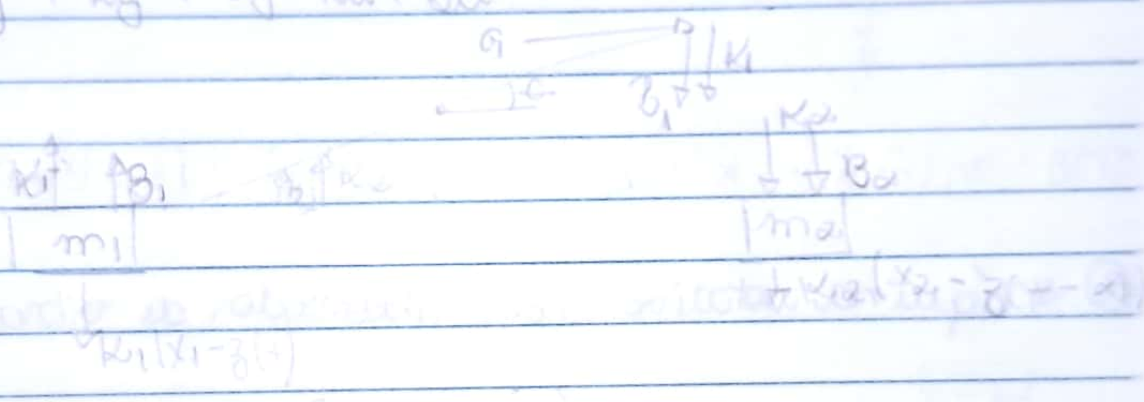
a) $m\ddot{y} + ky + b\dot{y} = ku + b\dot{u}$



b) $M\ddot{u} + ku + b\dot{u} = ky + b\dot{y}$

$m\ddot{y} + ky + b\dot{y} = ku + b\dot{u}$

④ a)



$B_2 = b_2(\dot{\theta}\cos\theta[l - G] + \dot{x}_2 - \dot{x}_G)$

$K_2 = k_2(\operatorname{sen}\theta[l - G] + x_2 - x_G)$

$B_1 = b_1(\dot{\theta}\cos\theta\, G - \dot{x}_1 + \dot{x}_G)$

$K_1 = k(\operatorname{sen}\theta\, G - x_1 + x_G)$

$M\ddot{x}_G + K_1 + B_1 - K_2 - B_2 = 0$

$J_G\ddot{\theta} + (K_1 + B_1)\cos\theta\, G + (K_2 + B_2)\cos\theta(l - G) = 0$

$m_1\ddot{x}_1 + k_1(x_1 - z(t)) - K_1 - B_1 = 0$

$m_2\ddot{x}_2 + k_2(x_2 - z(t - \alpha)) + K_2 + B_2 = 0$

b) Não soube resolver

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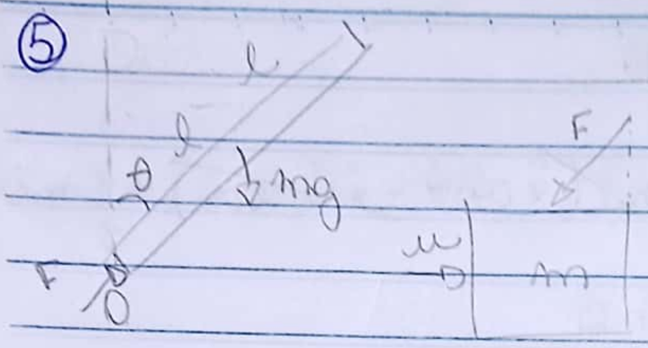

$\vec{\omega} = -\dot{\theta}\vec{k}$

$\vec{M}_{ext} = m(G-O)\wedge\ddot{\vec{r}} + J[\dot{\omega}] = -mgl\,\text{sen}\,\theta\,\vec{k}$

$-mgl\,\text{sen}\,\theta = -ml\cos\theta\,\ddot{x} - J_z\ddot{\theta}$

$J_z = \frac{m(2l)^2}{3} = \frac{4}{3}ml^2$

$ml\cos\theta\,\ddot{x} + \frac{4}{3}ml^2\ddot{\theta} - mgl\,\text{sen}\,\theta = 0$

$\vec{a}_{cm} = \vec{a}_0 + \dot{\vec{\omega}}\wedge(G-O) + \vec{\omega}\wedge(\vec{\omega}\wedge(G-O))$

$\vec{a}_{cm} = \ddot{x}\vec{i} - \ddot{\theta}\vec{k}\wedge[l(\cos\theta\,\vec{i} + \text{sen}\,\theta\,\vec{j})] + \dot{\theta}\vec{k}\wedge(\dot{\theta}\vec{k}\wedge l(\text{sen}\,\theta\,\vec{i} + \cos\theta\,\vec{j}))$

$\vec{a}_{cm} = \ddot{x}\vec{i} + l\ddot{\theta}\cos\theta\,\vec{i} - l\ddot{\theta}\,\text{sen}\,\theta\,\vec{j} + l\dot{\theta}^2\cos\theta\,\vec{j} - l\dot{\theta}^2\,\text{sen}\,\theta\,\vec{i}$

$\vec{a}_{cm} = (\ddot{x} + l\ddot{\theta}\cos\theta + l\dot{\theta}^2\,\text{sen}\,\theta)\vec{i} - l\ddot{\theta}\,\text{sen}\,\theta - l\dot{\theta}^2\cos\theta)\vec{j}$

$R\cos\theta - mg = m(l\ddot{\theta}\,\text{sen}\,\theta + l\dot{\theta}^2\cos\theta)$ com $R = \frac{U - M\ddot{x}}{\text{sen}\,\theta}$

$R\,\text{sen}\,\theta = m(\ddot{x} + l\ddot{\theta}\cos\theta - l\dot{\theta}^2\,\text{sen}\,\theta)$

$(M+m)\ddot{x} + ml\cos\theta\,\ddot{\theta} - ml\,\text{sen}\,\theta\,\dot{\theta}^2 = U$

Lagrange:

$T_1 = \frac{m\vec{v}_0^2}{2} + m\vec{v}_0(\omega\wedge(G-O)) + \frac{J_0\omega^2}{2} = \frac{m\dot{x}^2}{2} + ml\dot{x}\dot{\theta}\cos\theta + \frac{2}{3}ml^2\dot{\theta}^2$

$T_2 = \frac{M\dot{x}^2}{2}$

$T = \frac{(m+M)\dot{x}^2}{2} + ml\dot{x}\dot{\theta}\cos\theta + \frac{2}{3}ml^2\dot{\theta}^2$

$V = mgl\cos\theta$

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$$\frac{\partial L}{\partial \theta} = -\cancel{ml}\,\dot{x}\dot{\theta}\,sen\theta + \cancel{m}gl\,sen\theta$$

$$\frac{d}{dt}\left(ml\dot{x}\cos\theta + \frac{1}{3}ml^2\dot{\theta}\right) = \cancel{ml}\left(\ddot{x}\cos\theta - \cancel{\dot{x}\dot{\theta}\,sen\theta}\right) + \frac{1}{3}ml^2\ddot{\theta}$$

$$Q=0 \Rightarrow \frac{1}{3}l\ddot{\theta} + \ddot{x}\cos\theta - g\,sen\theta = 0$$

$$\frac{\partial L}{\partial x} = 0 \qquad Q = U$$

$$\frac{d}{dt}\left((M+m)\dot{x} + ml\dot{\theta}\cos\theta\right) = (M+m)\ddot{x} + ml\ddot{\theta}\cos\theta - ml\dot{\theta}^2 sen\theta$$

$$(M+m)\ddot{x} + ml\ddot{\theta}\cos\theta - ml\dot{\theta}^2 sen\theta - 0 = U$$

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