33.

SISEL - AR

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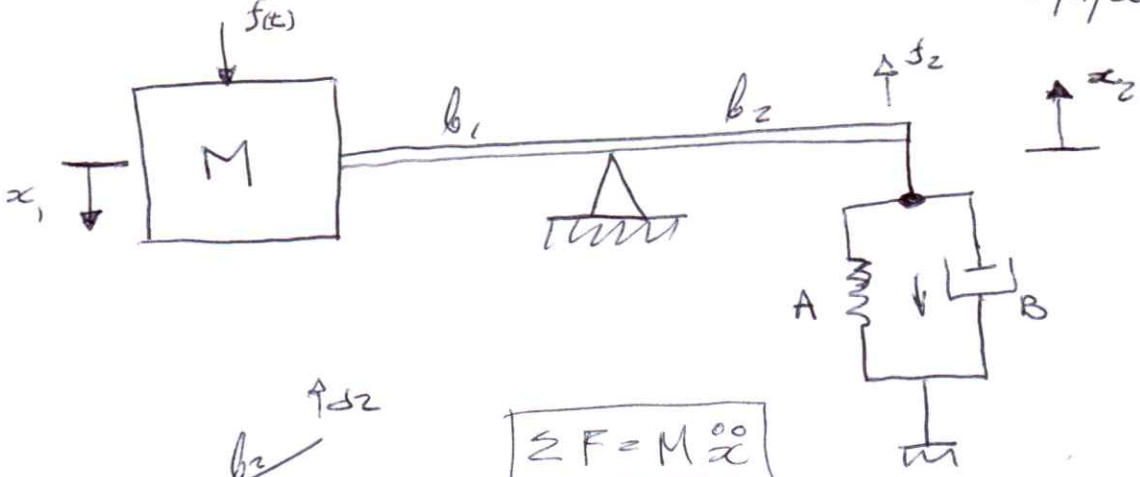
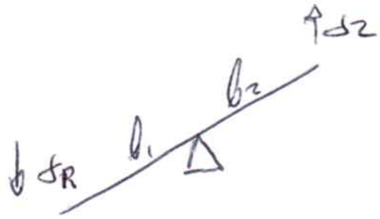
5/11/2009.





$$\boxed{\Sigma F = M\ddot{x}}$$

$$x_1: \quad M\ddot{x}_1 = f - \frac{b_2}{b_1} f_2$$

$$\frac{d_1}{d_2} = \frac{b_2}{b_1} = \frac{x_2}{x_1}$$

$$x_2: \quad 0 = f_2 - Kx_2 - B\dot{x}_2$$

$$f_2 = Kx_2 + B\dot{x}_2$$

$$\left(\frac{b_2}{b_1} x_1\right)$$

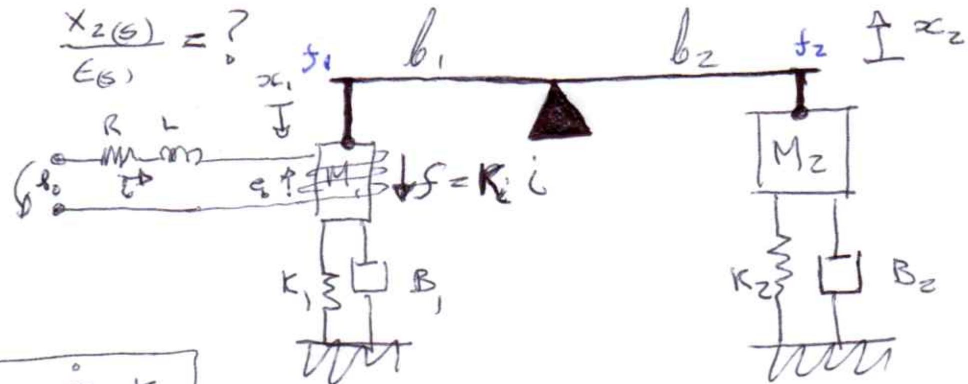
$$f = M\ddot{x}_1 + \frac{b_2}{b_1}(Kx_2 + B\dot{x}_2)$$

$$f = M\ddot{x}_1 + \left(\frac{b_2}{b_1}\right)^2 K x_1 + \left(\frac{b_2}{b_1}\right)^2 B \dot{x}_1$$

4.

—— // ——

$$\frac{X_2(s)}{E(s)} = ?$$



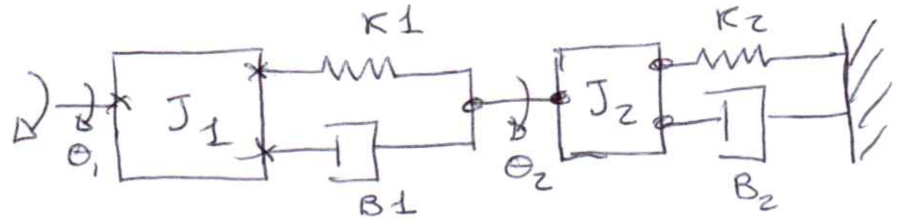
$$\boxed{e_b = \dot{x}_1 \cdot K_b}$$

$$\boxed{e_0 = \Sigma U}$$

$$e_0 - e_b = Ri + L\frac{di}{dt}$$

$$\Leftrightarrow \quad e_0 = Ri + L\frac{di}{dt} + e_b$$

exercicio 21) ~~[illegible]~~ sisel-AR 29/10/2009 19:40

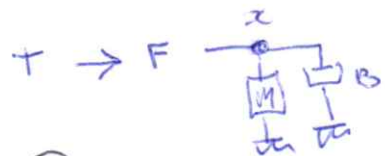


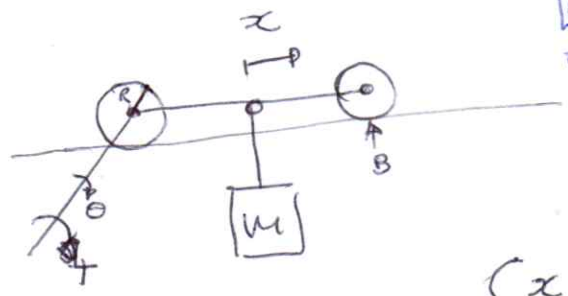
$$\Sigma T = J\alpha$$

$$\theta_1 \Rightarrow \quad J_1\ddot{\theta}_1 = T - K_1(\theta_1 - \theta_2) - B_1(\dot{\theta}_1 - \dot{\theta}_2)$$

$$\theta_2 \Rightarrow \quad J_2\ddot{\theta}_2 = K_1(\theta_1 - \theta_2) + B_1(\dot{\theta}_1\ \dot{\theta}_2) - K_2(\theta_2) - B_2(\dot{\theta}_2)$$

(3) Aula Pracdica.





$$\frac{X_{(s)}}{T_{(s)}} = ?$$

$$\begin{cases} x = \theta \cdot r \\ F_x = T \cdot \theta \\ F\cancel{\theta} r = T\cancel{\theta} \Leftrightarrow Fr = T \end{cases}$$

$$\Sigma F = M\ddot{x}$$

$$x \Rightarrow \quad M\ddot{x} = F - B\dot{x} \Leftrightarrow F = M\ddot{x} + B\dot{x}$$

$$\frac{T_t}{r} = M\ddot{x} + B\dot{x} \xrightarrow{\mathcal{L}} \frac{T_{(s)}}{r} = X_{(s)}(s^2M + sB)$$

$$\therefore \quad \frac{X_{(s)}}{T_{(s)}} = \frac{1}{s(sM+B).r}$$

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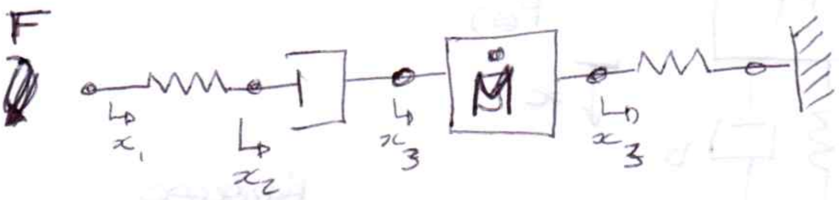
(13)

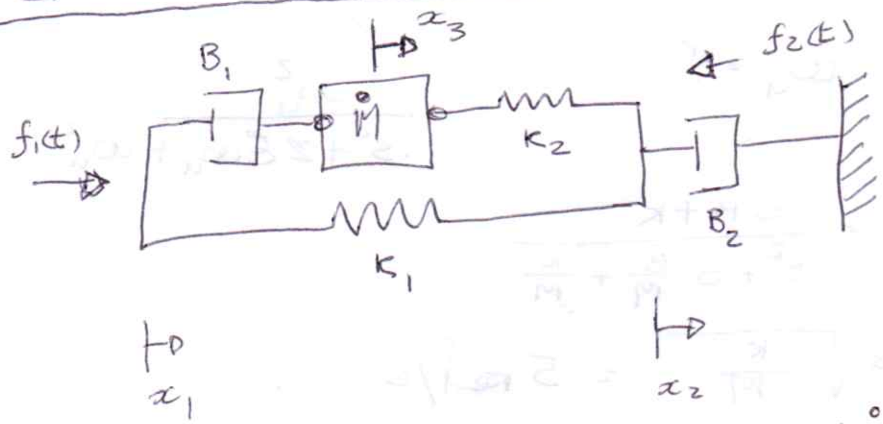


~~$Ma = F_{(t)} - (x_1(t) - x_2(t))K - B(\dot{x}_2(t) - \dot{x}_3(t))$~~

$\Sigma F = Ma$

$$\begin{cases} x_1 \Rightarrow 0 = f(t) - K_1(x_1(t) - x_2(t)) \\ x_2 \Rightarrow 0 = -B(\dot{x}_2(t) - \dot{x}_3(t)) + K(x_1(t) - x_2(t)) \\ x_3 \Rightarrow Ma_3 = -K_2\, x_3(t) + B(\dot{x}_2(t) - \dot{x}_3(t)) \end{cases}$$

$$\begin{cases} f(t) = K_1(x_1 - x_2) \\ f(t) = B(\dot{x}_2 - \dot{x}_3) \\ f(t) = M\ddot{x}_3 + K_2 x_3 \end{cases}$$



$\Sigma F = Ma$

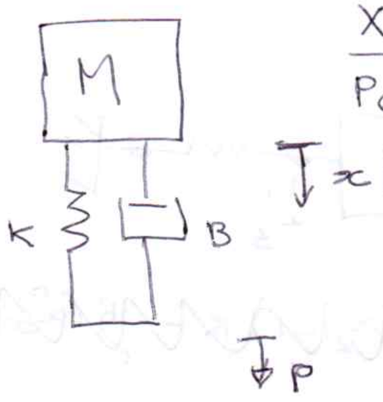
$x_1 \Rightarrow 0 = f_1(t) - K_1(x_1 - x_2) - B_1(\dot{x}_1 - \dot{x}_3)$

$x_2 \Rightarrow 0 = -B_2\dot{x}_2 + K_1(x_1 - x_2) + K_2(x_3 - x_2) - f_2(t)$

$x_3 \Rightarrow M\ddot{x}_3 = B_1(\dot{x}_1 - \dot{x}_3) - K_2(x_3 - x_2)$

LMTIK

EX 1.



$$\frac{X_{(s)}}{P_{(s)}}$$

Repouso

$X_{(s)} = P_{(s)}$

$$Ma = \Sigma F$$

$$M\ddot{x} = -K(x-p) - B(\dot{x}-\dot{p})$$

$$\mathcal{L}\Rightarrow \quad M X_{(s)} s^2 = -K(X_{(s)} - P_{(s)}) - B(X_{(s)} s - P_{(s)} s)$$

$$X_{(s)}(s^2 M + sB + K) - P_{(s)}(sB + K) = 0$$

$$\frac{X_{(s)}}{P_{(s)}} = \frac{sB+K}{s^2 M + sB + K}$$

b)

$\xi = ?$ $\quad \omega_n = ?$

$$\frac{\omega_n^2}{s^2 + 2\xi\omega_n + \omega_n^2}$$

$$\frac{X_{(s)}}{P_{(s)}} = \frac{1}{M} \cdot \frac{sB+K}{s^2 + s\frac{B}{M} + \frac{K}{M}}$$

$$\omega_n = \sqrt{\frac{K}{M}} = 5 \text{ rad/s}$$

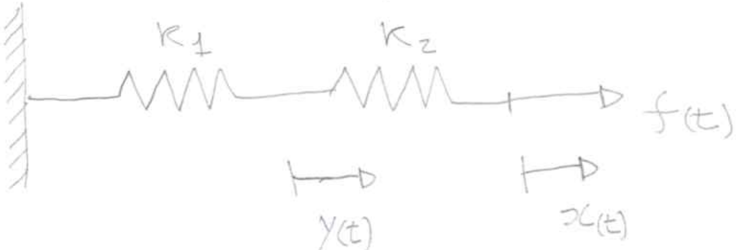
$$2\xi\omega_n = \frac{B}{M} \Leftrightarrow \frac{B}{M} \cdot \frac{1}{2\omega_n} = 0{,}01$$

$$G_{(s)} = \frac{sB+K}{s^2 M + sB + K}$$

$|G(j\omega)| \rightarrow 20\log|G(j\omega)|$

$\angle G(j\omega)$

Análise



$$\begin{cases} f(t) = k_1\, y(t) \\ f(t) = k_2\,(x(t) - y(t)) \end{cases}$$

$$f(t) = k_2\left(x(t) - \frac{f(t)}{k_1}\right)$$
$$= k_2\, x(t) - \frac{k_2}{k_1} f(t) \qquad (f(t) \text{ em evidencia})$$

$$k_2\, x(t) = f(t) + \frac{k_2}{k_1} f(t)$$
$$= \left(\frac{k_2}{k_1} + 1\right) f(t)$$

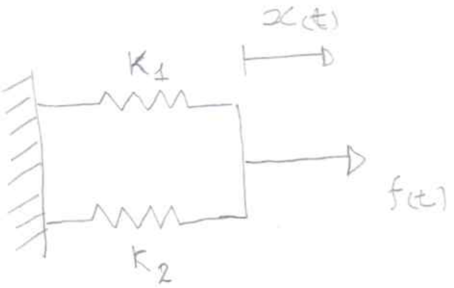
$$f(t) = \frac{k_2}{\frac{k_2}{k_1} + 1}\, x(t) \qquad \left(\frac{1}{k_2}\right)$$

$$= \frac{1}{\frac{k_2}{k_1} \cdot \frac{1}{k_2} + \frac{1}{k_2}} \ldots = \frac{1}{\frac{k_2}{k_1 k_2} + \frac{1}{k_2}\left(\frac{k_1}{k_1}\right)} \ldots$$

$$= \frac{1}{\frac{k_2}{k_1 k_2} + \frac{k_1}{k_2 k_1}} \ldots = \frac{1}{\frac{k_2 + k_1}{k_1 k_2}} \ldots$$

$$= \frac{k_1 k_2}{k_1 + k_2} \times x(t) \qquad (\text{inverso})$$

Analise

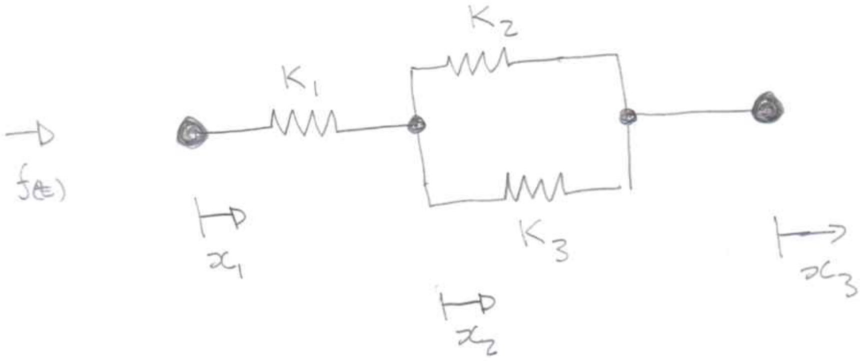


Determine K_{eq}, tal que $f(t) = K_{eq}\, x(t)$

$$f(t) = K_1\, x(t) + K_2\, x(t)$$

$$= (K_1 + K_2)\, x(t)$$

$$\therefore K_{eq} = K_1 + K_2$$



$$\boxed{\sum F_R = m\,\ddot{x}_{(t)}}$$

$$\begin{cases} f_{(t)} - K_1(x_1 - x_2) = \emptyset \iff f(t) - K_1x_1 + K_1x_2 = 0 \\ K_1(x_1 - x_2) - K_2(x_2 - x_3) - K_3(x_2 - x_3) = \emptyset \end{cases}$$

$$\begin{cases} K_1x_2 = K_1x_1 - f(t) \iff x_2 = \dfrac{K_1x_1 - f(t)}{K_1} \\ f(t) - K_2(x_2 - x_3) - K_3(x_2 - x_3) = \emptyset \end{cases}$$

$$\begin{cases} x_2 = x_1 - \dfrac{1}{K_1} \cdot f(t) \\ f(t) - K_2x_2 + K_2x_3 - K_3x_2 + K_3x_3 = \emptyset \end{cases}$$

$$f_{(t)} - K_2\left[x_1 - \frac{1}{K_1} \cdot f(t)\right] + K_2x_3 - K_3\left[x_1 - \frac{1}{K_1} f(t)\right]$$

$$+ K_3x_3 = 0$$

$$\frac{K_1}{K_1} \cdot f(t) - K_2x_1 + \frac{K_2}{K_1} \cdot f(t) + K_2x_3 - K_3x_1 + \frac{K_3}{K_1} f(t) + K_3x_3 = 0$$

$$\frac{K_1 + K_2 + K_3}{K_1} f(t) - K_2x_1 + K_2x_3 - K_3x_1 + K_3x_3 = 0$$

$$\frac{K_1 + K_2 + K_3}{K_1} f(t) + K_2(x_3 - x_1) + K_3(x_3 - x_1) = 0$$

$$\frac{K_1 + K_2 + K_3}{K_1} f(t) + (K_2 + K_3)(x_3 - x_1) = 0$$

$$\frac{K_1+K_2+K_3}{K_1} f(t) = -(K_2+K_3)(x_3-x_1)$$

$$f(t) = -\frac{K_1(K_2+K_3)}{K_1+K_2+K_3}(x_3-x_1)$$