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Disciplina: Sistema de Controle

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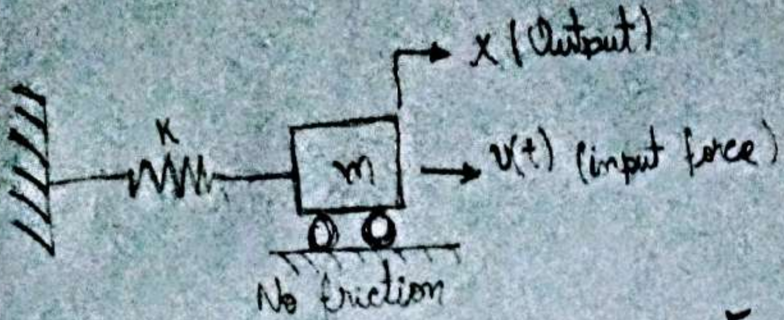
# Tarefa 14/10/21

1)




Encontrando função transferência

$$m\frac{d^2y}{dt^2} = -K(y-u)$$

modelo

$$m\ddot{y} + Ky = Ku \quad \div m$$

$$\ddot{y} + \frac{K}{m}y = \frac{K}{m}u$$

$$\boxed{\ddot{y} + a_1\dot{y} + a_2 y = b_0\ddot{u} + b_1\dot{u} + b_2 u}$$

1- Aplicando a transformada de laplace

$$(ms^2 + K)Y(s) = KU(s)$$

$$\boxed{G(s) = \frac{Y(s)}{U(s)} = \frac{K}{ms^2 + K}}$$

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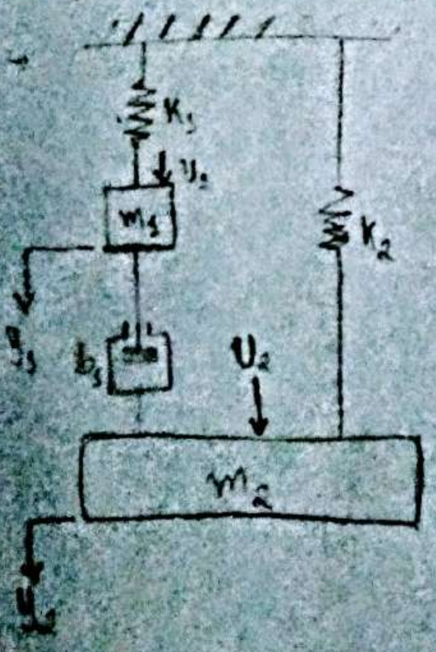
2)




$$m_1\ddot{y}_1 + b_1(\dot{y}_1 - \dot{y}_2) + K_1 y_1 = U_1 \quad \div m_1$$

$$m_2\ddot{y}_2 + b_1(\dot{y}_2 - \dot{y}_1) + K_2 y_2 = U_2 \quad \div m_2$$

$$\begin{cases} X_1 = y_1 \\ X_2 = \dot{y}_1 \\ X_3 = y_2 \\ X_4 = \dot{y}_2 \end{cases}$$

$$\dot{X}_2 + \frac{b_1}{m_1}(X_2 - X_4) + \frac{K_1}{m_1}X_1 = \frac{U_1}{m_1}$$

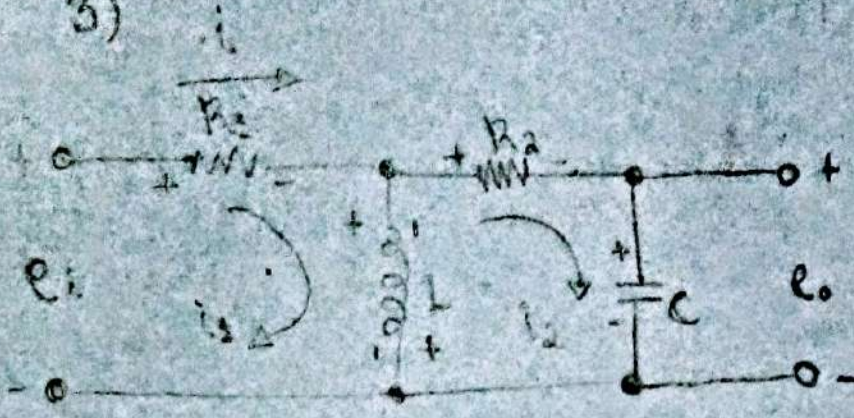
$$\dot{X}_4 + \frac{b_1}{m_2}(X_4 - X_2) + \frac{K_2}{m_2}X_3 = \frac{U_2}{m_2}$$

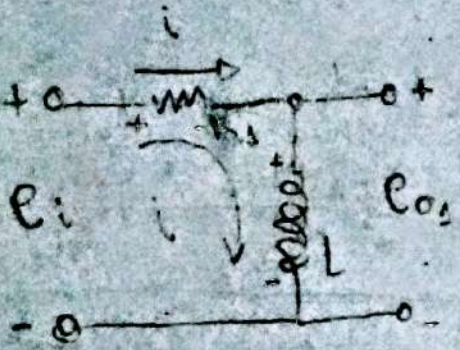
$$\begin{cases} \beta_0 = b_0 = 0 \\ \beta_1 = 0 \\ \beta_2 = b_2 = \frac{1}{m} \\ \beta_3 = -a_1\beta_2 = \frac{b}{m} \\ \beta_4 = \cancel{b_4} - a_1\cancel{\beta_3} - \\ \quad -a_2\cancel{\beta_1} \end{cases}$$

$$\begin{cases} \dot{X}_1 = X_2 \\ \dot{X}_2 = -\frac{1}{m_1}[(X_2 - X_4)b_1 + K_1 X_1] + \frac{U_1}{m_1} \\ \dot{X}_3 = X_4 \\ \dot{X}_4 = -\frac{1}{m_2}[(X_4 - X_2)b_1 + K_2 X_3] + \frac{U_2}{m_2} \end{cases}$$

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \\ \dot{X}_3 \\ \dot{X}_4 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -\frac{K_1}{m_1} & -\frac{b_1}{m_1} & 0 & +\frac{b_1}{m_1} \\ 0 & 0 & 0 & 1 \\ 0 & +\frac{b_1}{m_2} & -\frac{K_2}{m_2} & -\frac{b_1}{m_2} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ \frac{1}{m_1} & 0 \\ 0 & 0 \\ 0 & \frac{1}{m_2} \end{bmatrix} \begin{bmatrix} U_1 \\ U_2 \end{bmatrix}$$

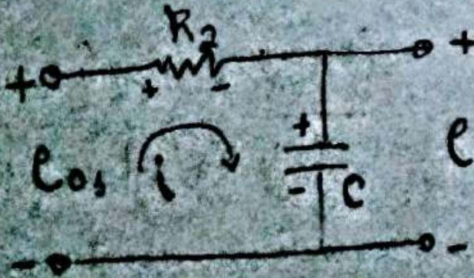
3)




$$-e_i + iR_1 + L\frac{di}{dt} = 0$$
$$e_{o1} - L\frac{di}{dt} = 0$$
$$\xrightarrow{\mathcal{L}}$$
$$I(s)R_1 + LsI(s) = e_i$$
$$LsI(s) = e_o$$

$$\boxed{F.T._1 = \frac{e_o}{e_i} = \frac{Ls\cancel{I(s)}}{(R_1 + Ls)\cancel{I(s)}} = \frac{Ls}{R_1 + Ls}}$$




$$I(s)R_2 + \frac{1}{Cs}I(s) = e_{o1}$$
$$\frac{1}{Cs}I(s) = e_o$$

$$-e_{o1} + iR_2 + \frac{1}{C}\int i\,dt = 0$$
$$e_o - \frac{1}{C}\int i\,dt = 0$$
$$\mathcal{L}$$


$$F.T._2 = \frac{e_{o1}}{e_o} = \frac{\frac{1}{Cs}\cancel{I(s)}}{\left(R_2 + \frac{1}{Cs}\right)\cancel{I(s)}} = \frac{1}{R_2Cs+1}$$

$$\boxed{= \frac{Ls}{R_1R_2Cs + R_1 + LR_1Cs^2 + Ls}}$$