EXERCÍCIO DA AULA DE 15/09 - MODELAGEM

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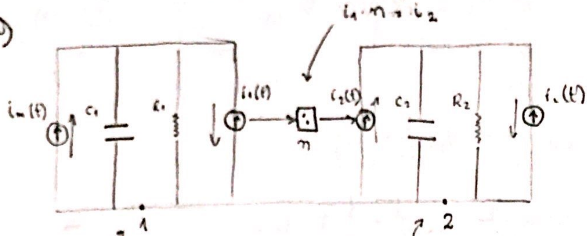
① a)

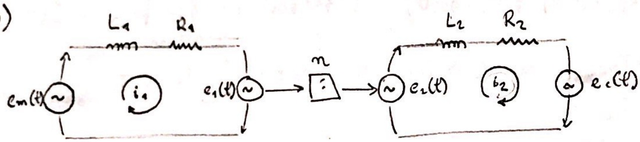


$$V_1\left(C_1 D + \frac{1}{R_1}\right) = i_m - i_1 \qquad V_2\left(C_2 D + \frac{1}{R_2}\right) = i_2 - i_c$$

ADEQUANDO A UM SISTEMA MECÂNICO

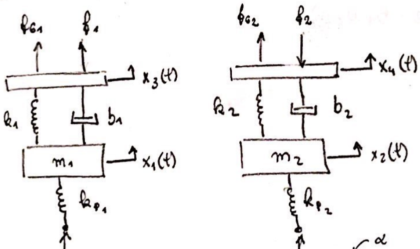
$$\begin{cases} \omega_1 (J_1 D + B_1) = T_m - T_1 \\ \omega_2 (J_2 D + B_2) = T_2 - T_c \\ T_2 = n T_1 \end{cases} \Rightarrow \begin{cases} J_1 \ddot{\theta}_1 + B_1 \dot{\theta}_1 = T_m - T_1 \\ J_2 \ddot{\theta}_2 + B_2 \dot{\theta}_2 = T_2 - T_c \\ \dot{\theta}_2 = \dfrac{\dot{\theta}_1}{n} \end{cases}$$

b)



$$\begin{cases} e_m(t) = (L_1 D + R_1)\, i_1 + e_1(t) \\ e_2(t) = (L_2 D + R_2)\, i_2 + e_c(t) \\ e_2(t) = n\, e_1(t) \end{cases} \Rightarrow \begin{cases} (J_1 D + B_1)\,\omega_1 = T_m - T_1 \\ (J_2 D + B_2)\,\omega_2 = T_2 - T_c \\ T_2 = n T_1 \end{cases} \Rightarrow \begin{cases} J_1 \ddot{\theta}_1 + B_1 \dot{\theta}_1 = T_m - T_1 \\ J_2 \ddot{\theta}_2 + B_2 \dot{\theta}_2 = T_2 - T_c \\ \dot{\theta}_2 = \dfrac{\dot{\theta}_1}{n} \end{cases}$$

②



$$\begin{cases} f_1(t) = l_1 (k_1 \theta + b_1 \dot{\theta}) \\ f_2(t) = l_2 (k_2 \theta + b_2 \dot{\theta}) \\ f_{G1}(t) = k_1 (x_G - x_1) + b_1 (\dot{x}_G - \dot{x}_1) \\ f_{G2}(t) = k_2 (x_G - x_2) + b_2 (\dot{x}_G - \dot{x}_2) \end{cases}$$

ARFAGEM

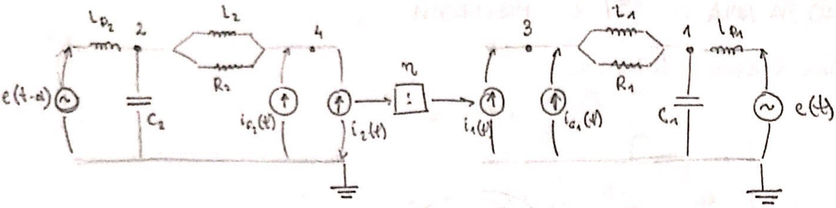
"BOUNCE"

$P_1 = P_2$ ← POTÊNCIAS DEVIDO A ARFAGEM

$f_1 v_{1\,arf} = f_2 v_{2\,arf}$

$$f_1 l_1 \cancel{\dot{\theta}} = f_2 l_2 \cancel{\dot{\theta}} \Rightarrow \frac{f_2}{f_1} = \frac{l_1}{l_2} = n$$

Digitalizada com CamScanner



$$V_1\left(C_1D+\frac{1}{R_1}+\frac{1}{L_1D}+\frac{1}{L_{P_1}D}\right)-e(t)\frac{1}{L_{P_1}D}-V_3\left(\frac{1}{R_1}+\frac{1}{L_1D}\right)=0$$

$$V_2\left(C_2D+\frac{1}{R_2}+\frac{1}{L_2D}+\frac{1}{L_{P_2}D}\right)-e(t-\alpha)\frac{1}{L_{P_2}D}-V_4\left(\frac{1}{R_2}+\frac{1}{L_2D}\right)=0$$

$$V_3\left(\frac{1}{R_1}+\frac{1}{L_1D}\right)=i_1(t)+i_{G_1}(t)$$

$$V_4\left(\frac{1}{R_2}+\frac{1}{L_2D}\right)=-i_2(t)+i_{G_2}(t)$$

$$\Rightarrow\begin{cases}V_1\left(C_1D+\frac{1}{R_1}+\frac{1}{L_1D}+\frac{1}{L_{P_1}D}\right)=e(t)\frac{1}{L_{P_1}D}+i_1(t)+i_{G_1}(t)\\ V_2\left(C_2D+\frac{1}{R_2}+\frac{1}{L_2D}+\frac{1}{L_{P_2}D}\right)=e(t-\alpha)\frac{1}{L_{P_2}D}-i_2(t)+i_{G_2}(t)\end{cases}$$

P/ SISTEMA MECÂNICO:

$$\begin{cases}m_1\ddot{x}_1+b_1\dot{x}_1+(k_1+k_{P_1})x_1=k_{P_1}z(t)+f_1(t)+f_{G_1}(t)\\ m_2\ddot{x}_2+b_2\dot{x}_2+(k_2+k_{P_2})x_2=k_{P_2}z(t-\alpha)-f_2(t)+f_{G_2}(t)\end{cases}\Rightarrow\begin{cases}f_1+f_{G_1}-f_2+f_{G_2}=M\ddot{x}_G\\ (f_1+f_{G_1})l_1+(f_{G_2}-f_2)l_2=J_G\ddot{\theta}\end{cases}$$

3. $$\begin{cases}J_1\dot{\omega}_1+B_1\omega_1+T_1=T_m\\ J_2\dot{\omega}_2+B_2\omega_2+T_C=T_2\end{cases}\qquad P_1=P_2\Rightarrow T_1\omega_1=T_2\omega_2\Rightarrow T_2=\frac{T_1\omega_1}{\omega_2}=\eta T_1$$

$$\begin{cases}J_2\dot{\omega}_2+B_2\omega_2+T_C=\eta T_1\\ T_1=T_m-J_1\dot{\omega}_1-B_1\omega_1\end{cases}\Rightarrow J_2\dot{\omega}_2+B_2\omega_2+T_C=\eta(T_m-J_1\dot{\omega}_1-B_1\omega_1)$$

SENDO $\omega_1=\eta\omega_2$, $\dot{\omega}_1=\eta\dot{\omega}_2$

$$J_2\dot{\omega}_2+B_2\omega_2+T_C=\eta(T_m-J_1\eta\dot{\omega}_2-B_1\omega_2\eta)$$

$$\dot{\omega}_2\underbrace{(J_1\eta^2+J_2)}_{J_{EQ}}+\omega_2\underbrace{(B_1\eta^2+B_2)}_{B_{EQ}}+T_C=T_m\cdot\eta$$