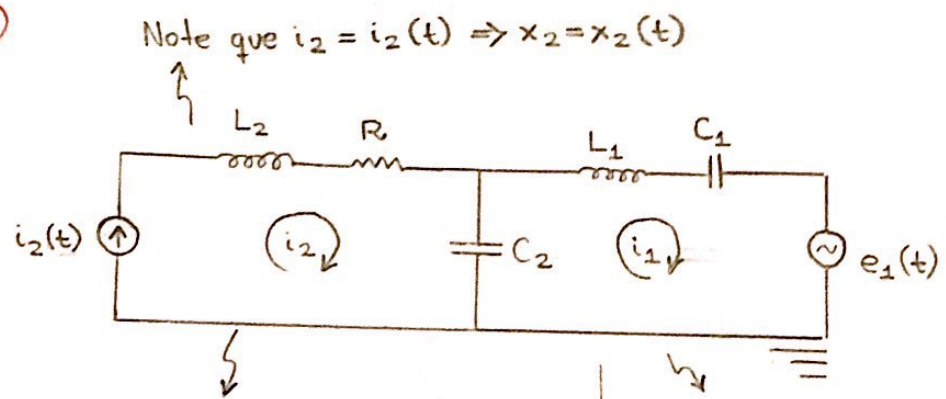


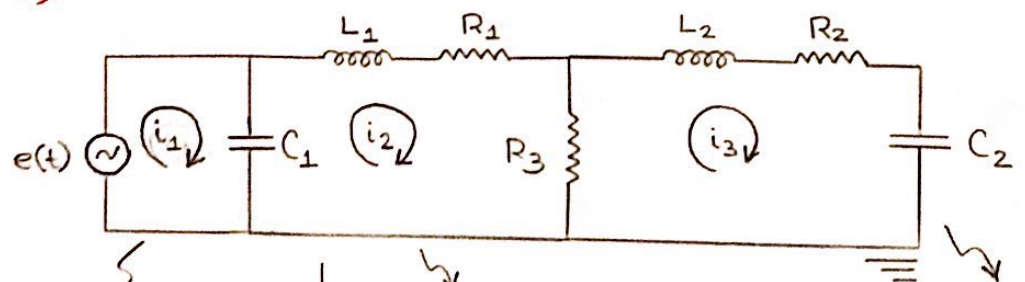
\*PME3380 - Lista de exercícios do dia 08/09

01) (PPT)



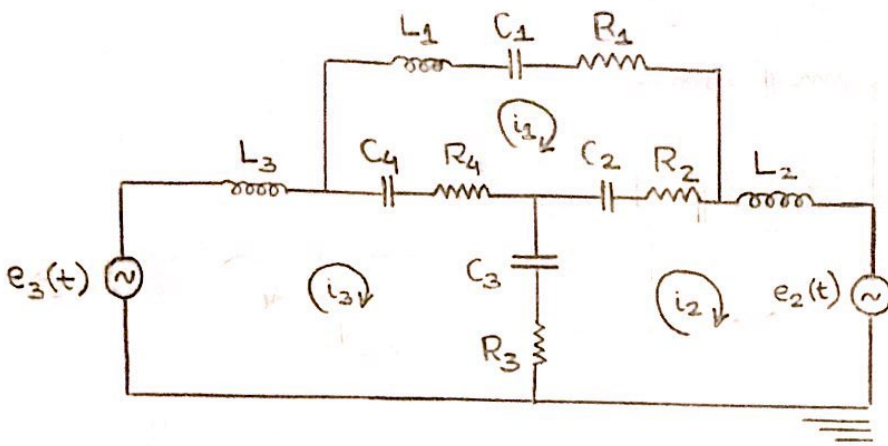
$$\begin{aligned} \rightarrow L_2 i_2 D + R i_2 + \frac{1}{C_2(i_2 - i_1)D} &= 0 & \rightarrow e_1(t) &= \frac{1}{C_2(i_1 - i_2)D} + L_1 i_1 D + \frac{1}{C_1 i_1 D} \\ \Rightarrow m_2 \ddot{x}_2 + b \dot{x}_2 + k_2(x_2 - x_1) &= 0 & \Rightarrow m_1 \ddot{x}_1 + k_1 x_1 + k_2(x_1 - x_2) &= e_1(t) \\ \Rightarrow m_2 \ddot{x}_2(t) + b \dot{x}_2(t) + k_2(x_2(t) - x_1) &= 0 & m_1 \ddot{x}_1 + x_1(k_1 + k_2) - k_2 x_2 &= e_1(t) \\ &= 0 & & \end{aligned}$$

02) (PPT)



$$\begin{aligned} \rightarrow \frac{1}{C_1(i_1 - i_2)D} &= e(t) & \rightarrow \frac{1}{C_1(i_2 - i_1)D} + L_1 i_2 D + R_1 i_2 + & \\ & & + R_3(i_2 - i_3) &= 0 \\ \Rightarrow \boxed{k_1(\theta_1 - \theta_2) = \tau(t)} & & \Rightarrow \boxed{k_1(\theta_2 - \theta_1) + J_1 \ddot{\theta}_2 + b_1 \dot{\theta}_2} & \\ & & + \boxed{b_3(\dot{\theta}_2 - \dot{\theta}_3) = 0} & \\ \rightarrow R_3(i_3 - i_2) + L_2 i_3 D + & & \Rightarrow \boxed{b_3(\dot{\theta}_3 - \dot{\theta}_2) + J_2 \ddot{\theta}_3 +} & \\ + R_2 i_3 + \frac{1}{C_2 i_3 D} &= 0 & \boxed{b_2 \dot{\theta}_3 + k_2 \theta_3 = 0} & \end{aligned}$$

03)



$$\rightarrow e_3(t) = L_3 i_3 D + \frac{1}{C_4(i_3 - i_1)D} + R_4(i_3 - i_1) + \frac{1}{C_2(i_3 - i_2)D} + R_3(i_3 - i_2)$$

$$m_3 \ddot{x}_3 + k_4(x_3 - x_1) + b_4(\dot{x}_3 - \dot{x}_1) + k_3(x_3 - x_2) + b_3(\dot{x}_3 - \dot{x}_2) = f_3(t)$$

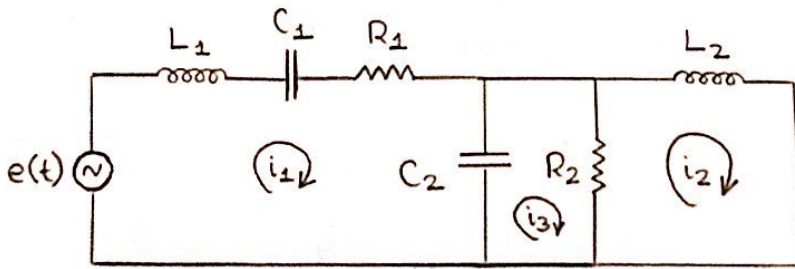
$$\rightarrow e_2(t) = L_2 i_2 D + R_3(i_2 - i_3) + \frac{1}{C_3(i_2 - i_3)D} + \frac{1}{C_2(i_2 - i_1)D} + R_2(i_2 - i_1)$$

$$m_2 \ddot{x}_2 + b_3(\dot{x}_2 - \dot{x}_3) + k_3(x_2 - x_3) + k_2(x_2 - x_1) + b_2(\dot{x}_2 - \dot{x}_1) = f_2(t)$$

$$\rightarrow L_1 i_1 D + \frac{1}{C_1 i_1 D} + R_1 i_1 + R_2(i_1 - i_2) + \frac{1}{C_2(i_1 - i_2)D} + R_4(i_1 - i_3) + \frac{1}{C_4(i_1 - i_3)D} = 0$$

$$m_1 \ddot{x}_1 + k_1 x_1 + b_1 \dot{x}_1 + b_2(\dot{x}_1 - \dot{x}_2) + k_2(x_1 - x_2) + b_4(\dot{x}_1 - \dot{x}_3) + k_4(x_1 - x_3) = 0$$

04)

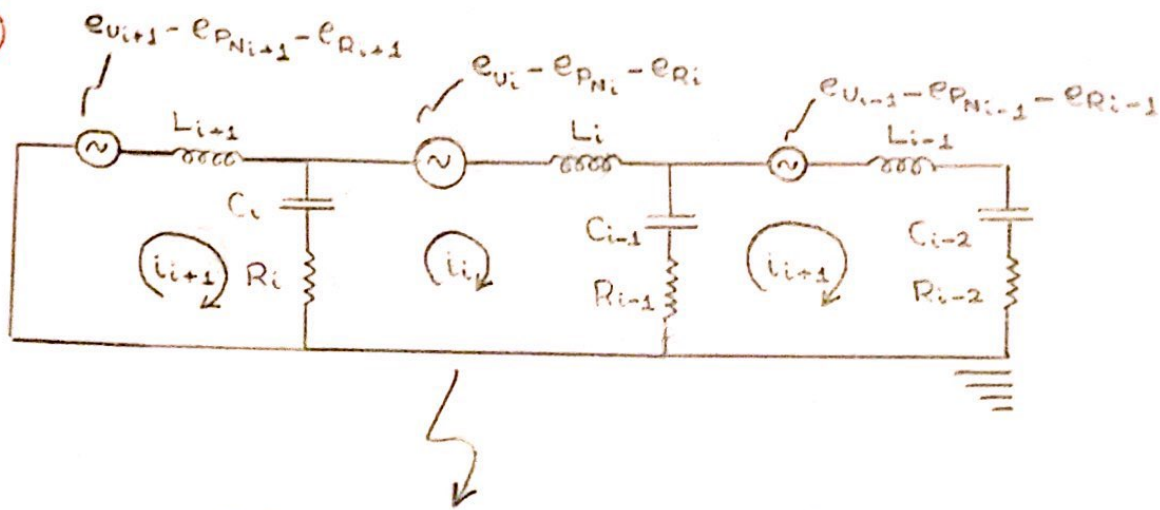


$$\rightarrow e(t) = L_1 i_1 D + \frac{1}{C_1 i_1 D} + R_1 i_1 + \frac{1}{C_2(i_1 - i_3)D} \Rightarrow m_1 \ddot{x}_1 + k_1 x_1 + b_1 \dot{x}_1 + k_2(x_1 - x_3) = f(t)$$

$$\rightarrow R_2(i_2 - i_3) + L_2 i_2 D = 0 \Rightarrow m_2 \ddot{x}_2 + b_2(\dot{x}_2 - \dot{x}_3) = 0$$

$$\rightarrow \frac{1}{C_2(i_3 - i_2)D} + R_2(i_3 - i_2) = 0 \Rightarrow k_2(x_3 - x_1) + b_2(\dot{x}_3 - \dot{x}_2) = 0$$

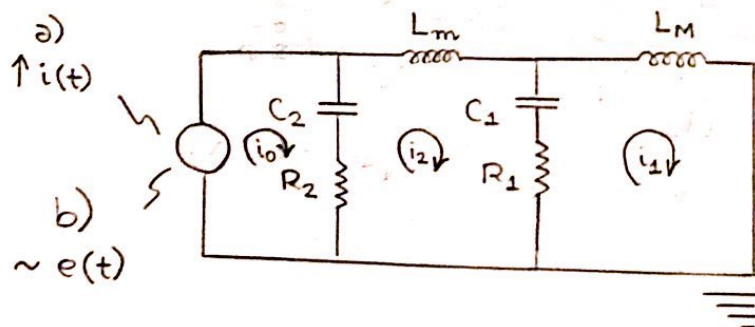
05)



$$\rightarrow e_{u_i} - e_{p_{N_i}} - e_{R_i} = L_i i_i D + \frac{1}{C_{i-1}(i_i - i_{i-1})D} + R_{i-1}(i_i - i_{i-1}) + R_i(i_i - i_{i+1}) + \frac{1}{C_i(i_i - i_{i+1})D}$$

$$\Rightarrow m_i \ddot{x}_i + k_{i-1}(x_i - x_{i-1}) + b_{i-1}(\dot{x}_i - \dot{x}_{i-1}) + b_i(\dot{x}_i - \dot{x}_{i+1}) + k_i(x_i - x_{i+1}) = u_i - m_i g \sin \theta_i - R_i$$

06) a) e b)



a)  $\rightarrow \frac{1}{C_2(i_0 - i_2)D} + R_2(i_0 - i_2) = 0$

Note que  $i(t) = i_0 \Rightarrow w(t) = x_0$

$$\Rightarrow k_2(x_0 - x_2) + b_2(\dot{x}_0 - \dot{x}_2) = 0$$

$$\Rightarrow k_2(w(t) - x_2) + b_2(\dot{w}(t) - \dot{x}_2) = 0$$

$$\rightarrow L_m i_2 D + \frac{1}{C_1(i_2 - i_1)D} + R_1(i_2 - i_1) + R_2(i_2 - i_0) + \frac{1}{C_2(i_2 - i_0)D} = 0$$

$$\Rightarrow m \ddot{x}_2 + k_1(x_2 - x_1) + b_1(\dot{x}_2 - \dot{x}_1) + b_2(\dot{x}_2 - \dot{w}(t)) + k_2(x_2 - w(t)) = 0$$

$$\rightarrow L_m i_1 D + R_1(i_1 - i_2) + \frac{1}{C_1(i_1 - i_2)D} = 0 \Rightarrow M \ddot{x}_1 + b_1(\dot{x}_1 - \dot{x}_2) + k_1(x_1 - x_2) = 0$$

b)  $\frac{1}{C_2(i_0 - i_2)D} + R_2(i_0 - i_2) = e(t) \Rightarrow k_2(x_0 - x_2) + b_2(\dot{x}_0 - \dot{x}_2) = e(t)$

$$L_m i_2 D + \frac{1}{C_1(i_2 - i_1)D} + R_1(i_2 - i_1) + R_2(i_2 - i_0) + \frac{1}{C_2(i_2 - i_0)D} = 0$$

$$\Rightarrow m \ddot{x}_2 + k_1(x_2 - x_1) + b_1(\dot{x}_2 - \dot{x}_1) + b_2(\dot{x}_2 - \dot{x}_0) + k_2(x_2 - x_0) = 0$$

$$m \ddot{x}_2 + k_1(x_2 - x_1) + b_1(\dot{x}_2 - \dot{x}_1) = e(t)$$

$$\rightarrow L_m i_1 + R_1(i_1 - i_2) + \frac{1}{C_1(i_1 - i_2)D} = 0 \Rightarrow M \ddot{x}_1 + b_1(\dot{x}_1 - \dot{x}_2) + k_1(x_1 - x_2) = 0$$