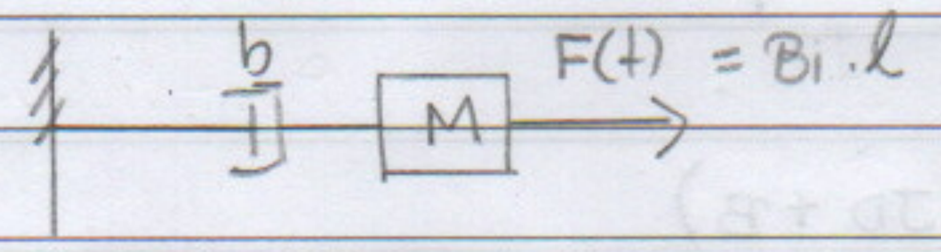
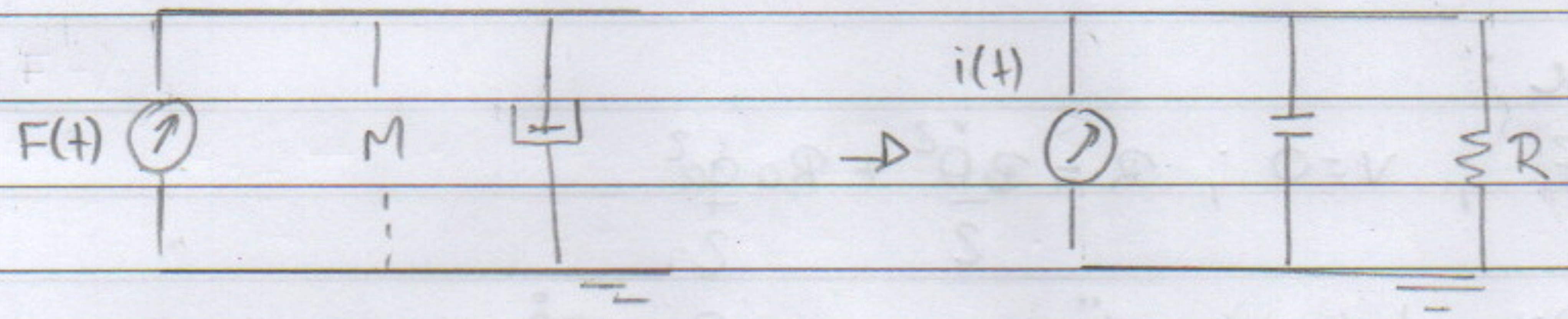
PME 3380 - EX AULA 10/09/2020

Gabriela Vasconcelos Araujo - 10771497

1 

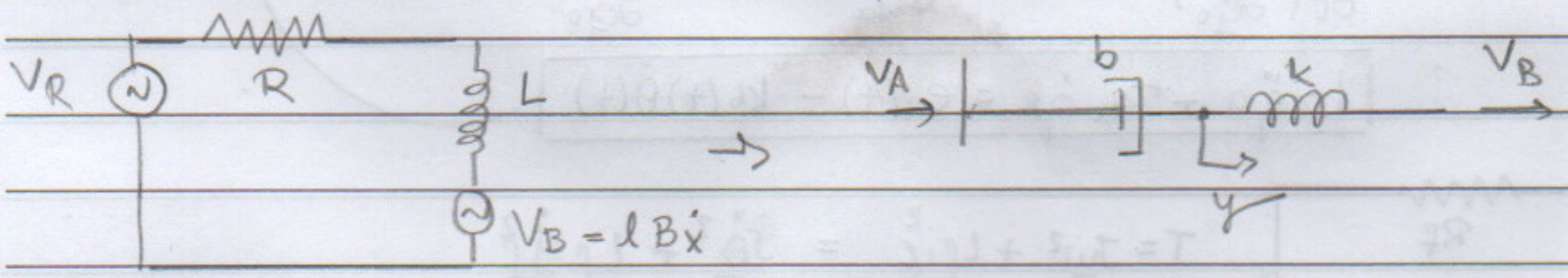
analogia do tipo 2



$$V\left(\frac{1}{R} + CD\right) = i(t) \Rightarrow M\ddot{x} + b\dot{x} = F(t)$$

$$\boxed{M\ddot{x} + b\dot{x} = Bil}$$

para o alto falante:



Lagrange $\begin{cases} L = T - V \\ \dfrac{d}{dt}\left(\dfrac{\partial L}{\partial \dot{q}_i}\right) - \dfrac{\partial L}{\partial q_i} + \dfrac{\partial R}{\partial \dot{x}} = Q_i \end{cases}$

$$T = \frac{M\dot{x}^2}{2} \; ; \; V = \frac{\lambda^2}{2L} \; ; \; R = \frac{b\dot{x}^2}{2} + \frac{\dot{\lambda}^2}{2R_1} \; ; \; F(t) = \frac{bV_a + KV_b}{D} = \frac{V_a}{R} + \frac{Bl\dot{x}}{LD}$$

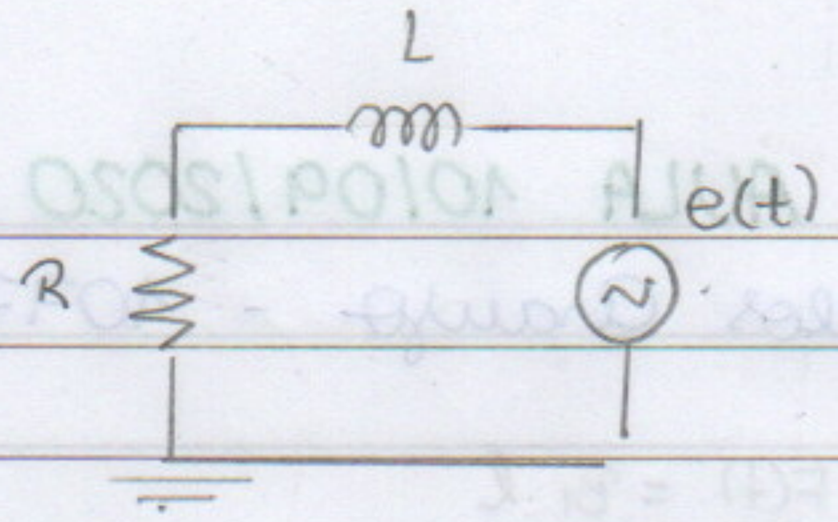
para $q_i = x$:

$$\boxed{M\ddot{x} + b\dot{x} = Bil}$$

para $q_i = \lambda$:

$$\boxed{\frac{\lambda}{L} + \frac{\dot{\lambda}}{R} = \frac{V_a}{R} + \frac{lB\dot{x}}{L}} \; ; \quad \lambda = \int V \, dT$$

(2) a.



$e(t) = (LD + R)i \rightarrow K i_a(t) = \omega(JD + B)$

$$\boxed{J\ddot{\theta} + B\dot{\theta} = K i_a(t)}$$

por Lagrange:

$T = \frac{J\dot{\theta}^2}{2} + \frac{L_a\dot{q}_a^2}{2}$; $V = 0$; $R = \frac{B\dot{\theta}^2}{2} + \frac{R_a\dot{q}_a^2}{2}$

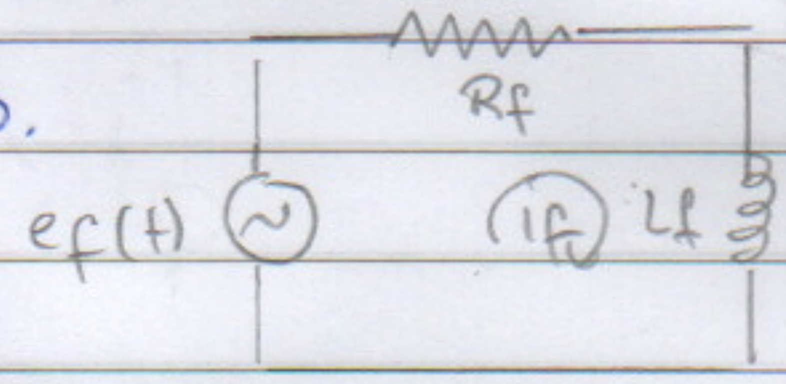
para $q_i = \theta$: $\frac{d}{dt}\left(\frac{\partial L}{\partial\dot{\theta}}\right) = J\ddot{\theta}$; $\frac{\partial L}{\partial\theta} = 0$; $\frac{\partial R}{\partial\dot{\theta}} = B\dot{\theta}$

$\boxed{J\ddot{\theta} + B\dot{\theta} = K\dot{q}_a}$ para $L_a \approx 0$: $\dot{q}_a = \frac{e_a - K_b\dot{\theta}}{R_a}$

para $q_i = q_a$: $\frac{d}{dt}\left(\frac{\partial L}{\partial\dot{q}_a}\right) = L_a\ddot{q}_a$, $\frac{\partial L}{\partial q_a} = 0$; $\frac{\partial R}{\partial\dot{q}_a} = R_a\dot{q}_a$

$$\boxed{L_a\ddot{q}_a + R_a\dot{q}_a = e_a(t) - k_b(t)\dot{\theta}(t)}$$

b.



$T = \frac{J\omega^2}{2} + \frac{L_f i_f^2}{2} = \frac{J\dot{\theta}^2}{2} + \frac{L_f\dot{q}_f^2}{2}$

$V = 0$; $R = \frac{B\omega^2}{2} + \frac{R_f i_f^2}{2} = \frac{R\dot{\theta}^2}{2} + \frac{R_f\dot{q}_f^2}{2}$

para $q_i = \theta$: $\boxed{J\ddot{\theta} + B\dot{\theta} = K\dot{q}_f(t)}$

para $q_i = q_f$: $\boxed{L_f\ddot{q}_f + R_f\dot{q}_f = e_f(t)} \Rightarrow \dot{q}_f = \frac{e_f(t)}{R_f + L_f D}$

∴ se $L_f \approx 0$: $\ddot{\theta} + \frac{B}{J}\dot{\theta} = \frac{K}{JR_f}e_f(t) \rightarrow \boxed{\ddot{\theta} + \frac{1}{\tau_J}\dot{\theta} = K_m e_f(t)}$

caso geral: $\ddot{\theta} + \frac{B\dot{\theta}}{J} = \frac{K}{JR_f} \cdot \frac{1}{\left(1 + \frac{L_f}{R_f}D\right)} e_f(t) \rightarrow \boxed{\ddot{\theta} + \frac{1}{\tau_J}\dot{\theta} = \frac{K_m}{1 + \tau_f D} e_f(t)}$