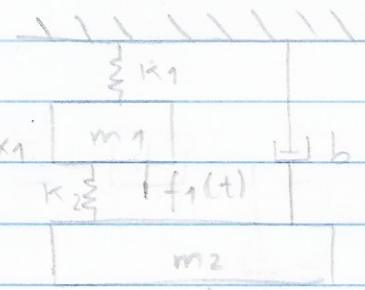
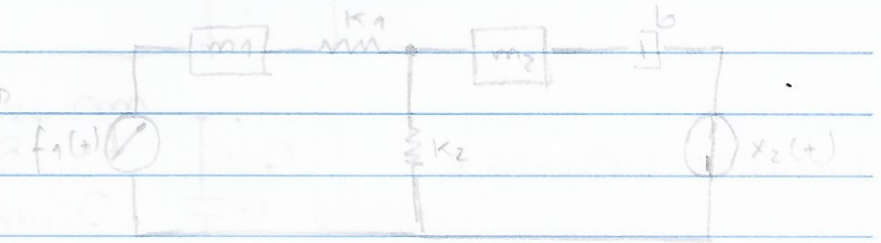
Victor Manoel Ferreira Rosa da Costa 107727 13

Analogia tipo 1

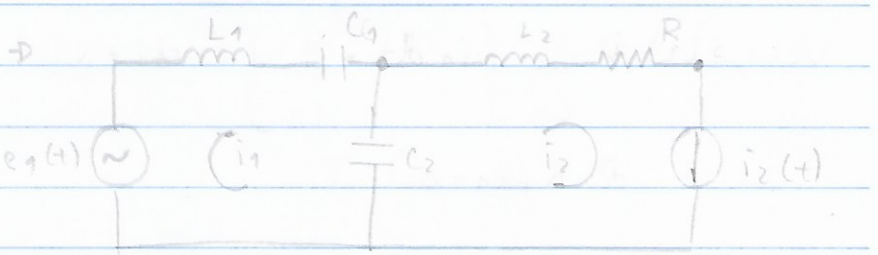
2-




circuito mecânico →




circuito elétrico →




$V_{L1} + V_{C1} + V_{L2} = e_1(t) \Rightarrow$

$\Rightarrow L_1 \frac{di_1}{dt} + \frac{1}{C_1}\int i_1\,dt + \frac{1}{C_2}\int i_1\,dt - \frac{1}{C_2}\int i_2\,dt = e_1(t) \Rightarrow$

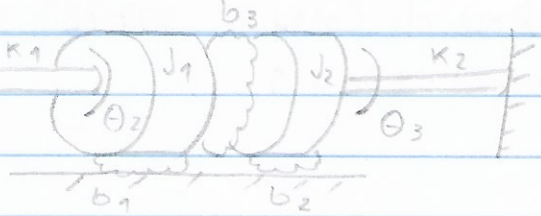
$\Rightarrow L_1 \ddot{q}_1 + \frac{q_1}{C_1} + \frac{q_1}{C_2} - \frac{q_2}{C_2} = e_1(t) \Rightarrow \boxed{m_1\ddot{x}_1 + K_1 x_1 + K_2(x_1 - x_2) = f_1(t)}$

$V_{L2} + V_R + V_{C2} = 0 \Rightarrow$

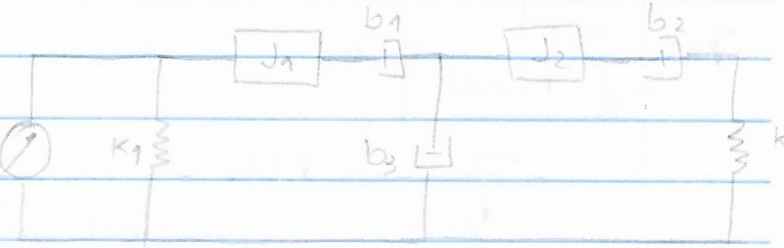
$\Rightarrow L_2 \frac{di_2}{dt} + Ri_2 + \frac{1}{C_2}\int i_2\,dt - \frac{1}{C_1}\int i_1\,dt = 0 \Rightarrow$

$\Rightarrow L_2 \ddot{q}_2 + R\dot{q}_2 + \frac{q_2}{C_2} - \frac{q_1}{C_2} = 0 \Rightarrow \boxed{m_2\ddot{x}_2 + b\dot{x}_2 + K_2(x_2 - x_1) = 0}$

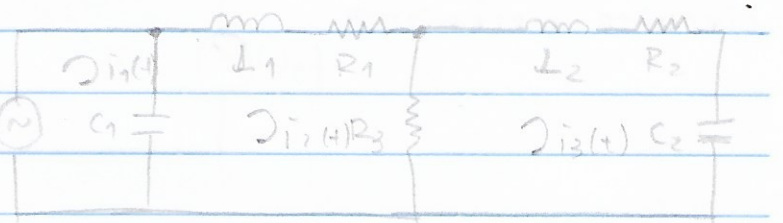
3-




circuito mecânico ⇒




circuito elétrico ⇒




$V_{C_1} = e(t) \Rightarrow \frac{1}{C_1}\int i_1\,dt - \frac{1}{C_1}\int i_2\,dt = e(t) \Rightarrow \frac{q_1}{C_1} - \frac{q_2}{C_1} = e(t) \Rightarrow$

$\Rightarrow K_1(\theta_1 - \theta_2) = T$

$V_{L_1} + V_{R_1} + V_{C_1} + V_{R_3} = 0 \Rightarrow$

$\Rightarrow L_1\frac{di_2}{dt} + R_1 i_2 + \frac{1}{C_1}\int i_2\,dt - \frac{1}{C_1}\int i_1\,dt + R_3 i_2 - R_3 i_3 = 0 \Rightarrow$

$\Rightarrow L_1\ddot{q}_2 + R_1\dot{q}_2 + \frac{q_2}{C_1} - \frac{q_1}{C_1} + R_3\dot{q}_2 - R_3\dot{q}_3 = 0 \Rightarrow$

$\Rightarrow J_1\ddot{\theta}_2 + b_1\dot{\theta}_2 + b_3(\dot{\theta}_2 - \dot{\theta}_3) = -K_1(\theta_2 - \theta_1) \Rightarrow$

$\Rightarrow \boxed{J_1\ddot{\theta}_2 + b_1\dot{\theta}_2 + b_3(\dot{\theta}_2 - \dot{\theta}_3) = T}$

$V_{L_2} + V_{R_2} + V_{C_2} + V_{R_3} = 0 \Rightarrow$

$\Rightarrow L_2\frac{di_3}{dt} + R_2 i_3 + \frac{1}{C_2}\int i_3\,dt + R_3 i_3 - R_3 i_2 = 0 \Rightarrow$

$\Rightarrow L_2\ddot{q}_3 + R_2\dot{q}_3 + \frac{q_3}{C_2} + R_3\dot{q}_3 - R_3\dot{q}_2 = 0 \Rightarrow$

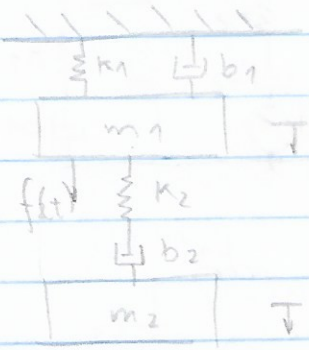
$\Rightarrow \boxed{J_2\ddot{\theta}_3 + b_2\dot{\theta}_3 + b_3(\dot{\theta}_3 - \dot{\theta}_2) + K_2\theta_3 = 0}$

$V_{L3} + V_{C3} + V_{R3} + V_{C4} + V_{R4} = e_3(t) \Rightarrow$

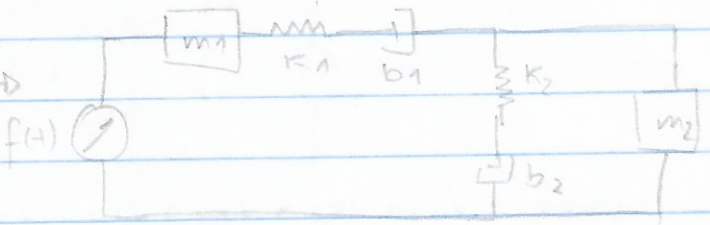
$\Rightarrow L_3 \frac{di_3}{dt} + R_3 i_3 - R_3 i_2 + R_4 i_3 - R_4 i_4 + \frac{1}{C_3}\int i_3\,dt - \frac{1}{C_3}\int i_2\,dt + \frac{1}{C_4}\int i_3\,dt - \frac{1}{C_4}\int i_4\,dt = e_3(t) \Rightarrow$

$\Rightarrow \boxed{m_3 \ddot{x}_3 + b_3(\dot{x}_3 - \dot{x}_2) + b_4(\dot{x}_3 - \dot{x}_4) + K_3(x_3 - x_2) + K_4(x_3 - x_2) = f_3(t)}$

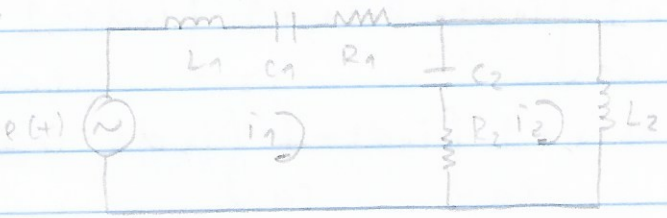
6-




circuito mecânico $\Rightarrow$




circuito elétrico $\Rightarrow$




$V_{L1} + V_{C1} + V_{R1} + V_{C2} + V_{R2} = e(t) \Rightarrow$

$\Rightarrow L_1 \frac{di_1}{dt} + R_1 i_1 + R_2 i_1 - R_2 i_2 + \frac{1}{C_1}\int i_1\,dt + \frac{1}{C_2}\int i_1\,dt - \frac{1}{C_2}\int i_2\,dt = e(t) \Rightarrow$

$\Rightarrow \boxed{m_1 \ddot{x}_1 + b_1 \dot{x}_1 + b_2(\dot{x}_1 - \dot{x}_2) + K_1 x_1 + K_2(x_1 - x_2) = f(t)}$

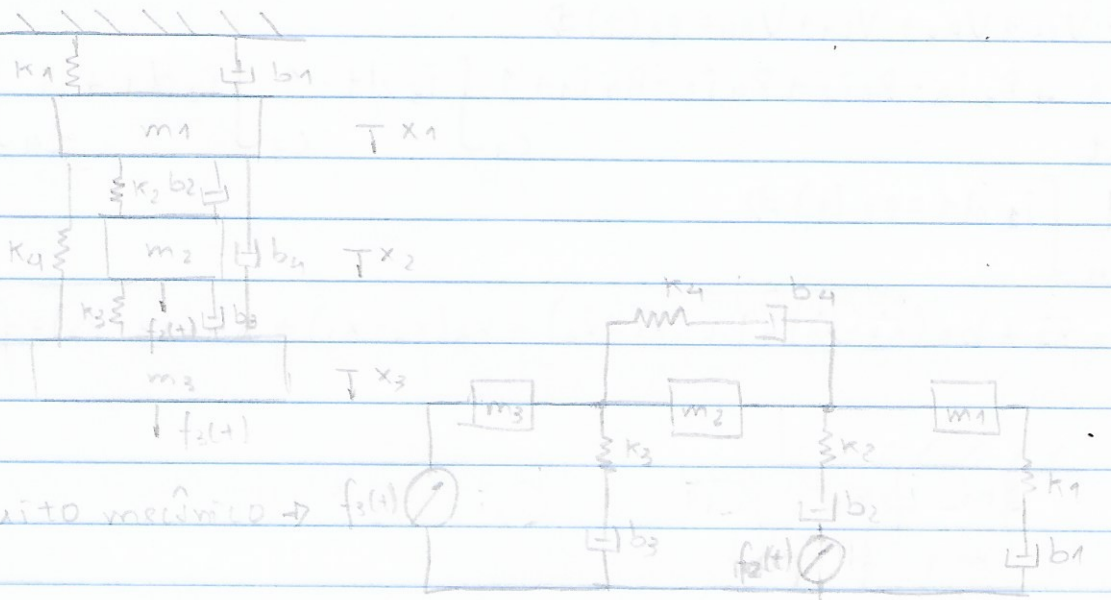
$V_{L2} + V_{C2} + V_{R2} = 0 \Rightarrow$

$\Rightarrow L_2 \frac{di_2}{dt} + R_2 i_2 - R_2 i_1 + \frac{1}{C_2}\int i_2\,dt - \frac{1}{C_2}\int i_1\,dt = 0 \Rightarrow$

$\Rightarrow \boxed{m_2 \ddot{x}_2 + b_2(\dot{x}_2 - \dot{x}_1) + K_2(x_2 - x_1) = 0}$

Lista 2 ⇒

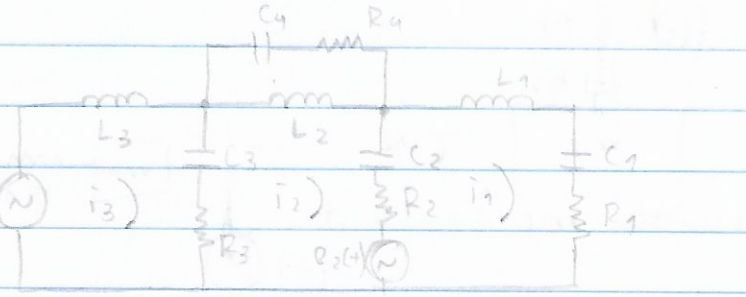
3-




circuito mecânico ⇒




circuito elétrico ⇒




$V_{L1} + V_{C1} + V_{R1} + V_{C2} + V_{R2} + V_{R4} + V_{C4} = 0$ ⇒

⇒ $L_1 \frac{di_1}{dt} + \frac{1}{C_1}\int i_1 dt + R_1 i_1 + \frac{1}{C_2}\int i_1 dt - \frac{1}{C_2}\int i_2 dt + R_2 i_1 - R_2 i_2 +$

$+ R_4 i_1 - R_4 i_2 + \frac{1}{C_4}\int i_1 dt - \frac{1}{C_4}\int i_3 dt = 0$ ⇒

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

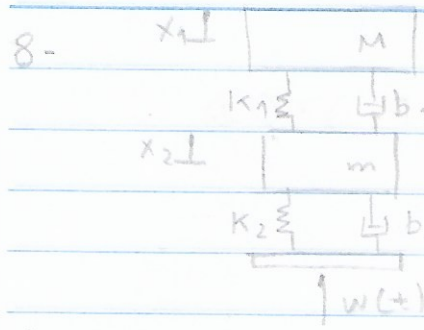
$V_{L2} + V_{C2} + V_{R2} + V_{C3} + V_{R3} = e_2(t)$ ⇒

⇒ $L_2 \frac{di_2}{dt} + R_2 i_2 - R_2 i_1 + R_3 i_2 - R_3 i_3 + \frac{1}{C_2}\int i_2 dt - \frac{1}{C_2}\int i_1 dt +$

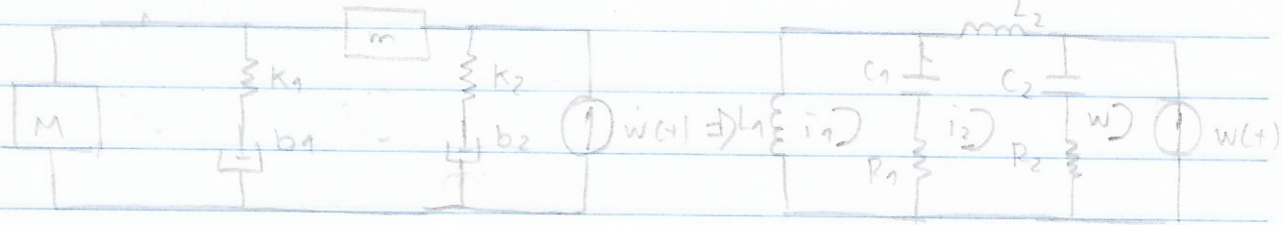
$+ \frac{1}{C_2}\int i_2 dt - \frac{1}{C_3}\int i_2 dt = e_2(t)$ ⇒

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

8-




a) w(t) - deslocamento




$V_{L_1} + V_{C_1} + V_{R_1} = 0 \Rightarrow$

$\Rightarrow L_1 \frac{di_1}{dt} + R_1 i_1 - R_1 i_2 + \frac{1}{C_1}\int i_1 dt - \frac{1}{C_1}\int i_2 dt = 0 \Rightarrow$

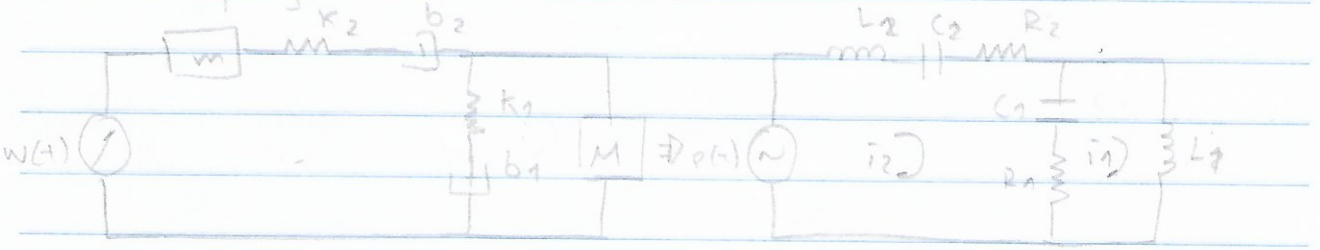
$\Rightarrow \boxed{M\ddot{x}_1 + b_1(\dot{x}_1 - \dot{x}_2) + K_1(x_1 - x_2) = 0}$

$V_{L_2} + V_{C_1} + V_{R_1} + V_{C_2} + V_{R_2} = 0 \Rightarrow$

$\Rightarrow L_2 \frac{di_2}{dt} + R_1 i_2 - R_1 i_1 + R_2 i_2 - R_2 w + \frac{1}{C_1}\int i_2 dt - \frac{1}{C_1}\int i_1 dt +$

$+ \frac{1}{C_2}\int i_2 dt - \frac{1}{C_2}\int w\, dt = 0 \Rightarrow \boxed{m\ddot{x}_2 + b_1(\dot{x}_2 - \dot{x}_1) + b_2(\dot{x}_2 - \dot{w}(t)) + K_1(x_2 - x_1) + K_2(x_2 - w(t)) = 0}$

b) w(t) - forçado




$V_{L_2} + V_{L_1} + V_{R_2} + V_{C_1} + V_{R_1} = e(t) \Rightarrow$

$\Rightarrow L_2 \frac{di_2}{dt} + R_2 i_2 + R_1 i_2 - R_1 i_1 + \frac{1}{C_2}\int i_2 dt + \frac{1}{C_1}\int i_2 dt - \frac{1}{C_1}\int i_1 dt = e(t) \Rightarrow$

$\Rightarrow \boxed{m\ddot{x}_2 + b_2\dot{x}_2 + b_1(\dot{x}_2 - \dot{x}_1) + K_2 x_2 + K_1(x_2 - x_1) = w(t)}$

$V_{L_1} + V_{C_1} + V_{R_1} = 0 \Rightarrow$

$\Rightarrow L_1 \frac{di_1}{dt} + \frac{1}{C_1}\int i_1\,dt - \frac{1}{C_1}\int i_2\,dt + R_1 i_1 - R_1 i_2 = 0 \Rightarrow$

$\Rightarrow \boxed{M\ddot{x}_1 + b_1(\dot{x}_1 - \dot{x}_2) + k_1(x_1 - x_2) = 0}$