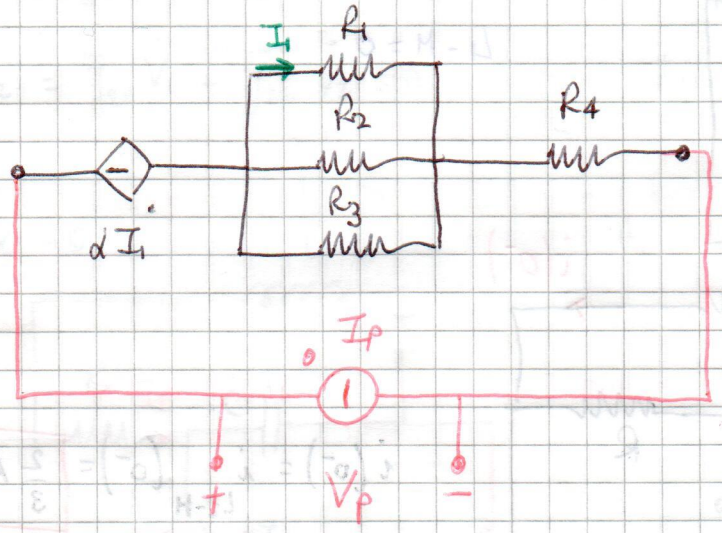
# Compito 1 Luglio 2020

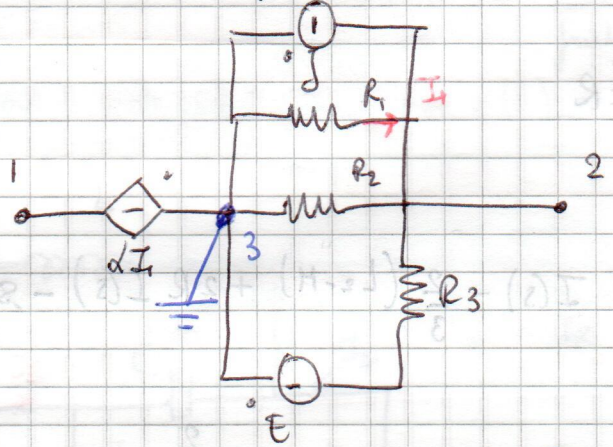
## ① $R_{TH}$




$$\begin{cases} V_p = -\alpha I_1 + R_1 I_1 + R_4 I_p \\ I_1 = I_p \cdot \dfrac{\frac{1}{R_1}}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}} = I_p \cdot \dfrac{\frac{1}{10}}{\frac{1}{10}+\frac{1}{20}+\frac{1}{30}} = I_p \cdot \dfrac{6}{6+3+2} = \dfrac{6}{11} I_p \end{cases}$$

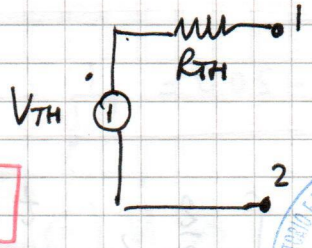
$$V_p = -\frac{6}{11}\alpha I_p + 10 \cdot \frac{6}{11} I_p + 40 I_p \Rightarrow R_{TH} = -\frac{6 \cdot 15}{11} + \frac{60}{11} + 40 = \boxed{37.273\ \Omega}$$

## ② $V_{TH}$



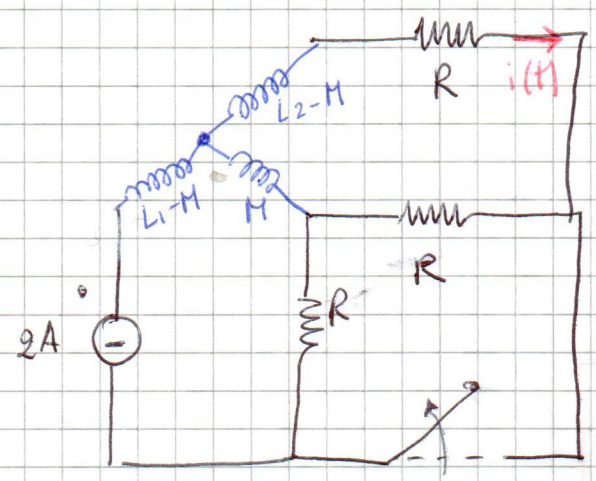

$V_3 = 0$; $\quad V_1 = -\alpha I_1$; $\quad -\frac{E}{R_3} - J = V_2\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right) \Rightarrow V_2 = \dfrac{-\frac{50}{3}-2}{\frac{1}{10}+\frac{1}{20}+\frac{1}{30}} = -20\,V$

$$I_1 = \frac{V_3 - V_2}{R_1} = \frac{20}{R_1} = 2A$$

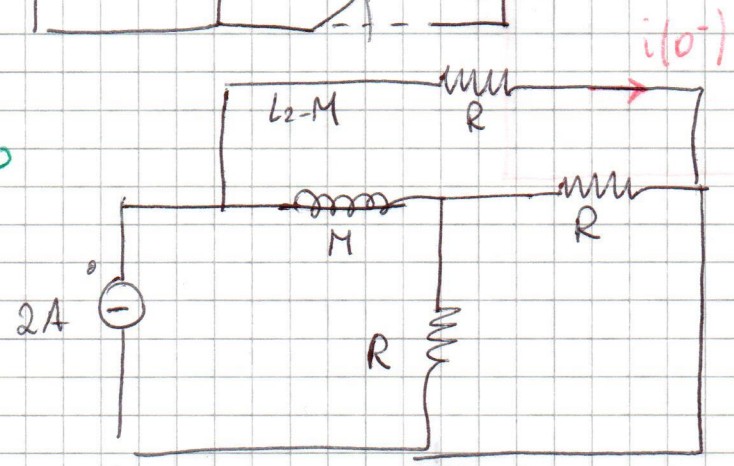



$$V_{TH} = V_1 - V_2 = (-\alpha I_1) - (-20) = -30 + 20 = \boxed{-10\,V}$$

②




$L_1 - M = 0$

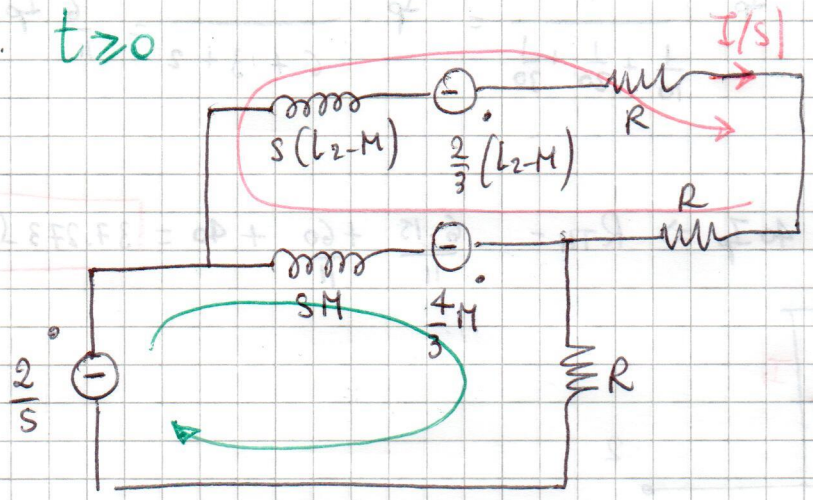



$t < 0$

$$i(0^-) = i_{L_2-M}(0^-) = \boxed{\frac{2}{3}\,A}$$

$$i_M(0^-) = \frac{2}{3} + \frac{2}{3} = \frac{4}{3}\,A$$

$t \geq 0$




$$\frac{4}{3}M + sM\,\cancel{I(s)} + s(L_2-M)\,I(s) - \frac{2}{3}(L_2-M) + 2R\,I(s) - sM\cdot\frac{2}{s} = 0$$

$$\frac{\cancel{\frac{2}{3}M} + \frac{2}{3}(L_2-\cancel{M})}{sL_2 + 2R} = I(s) \Rightarrow I(s) = \frac{\frac{2}{3}}{s + \frac{2R}{L_2}}$$

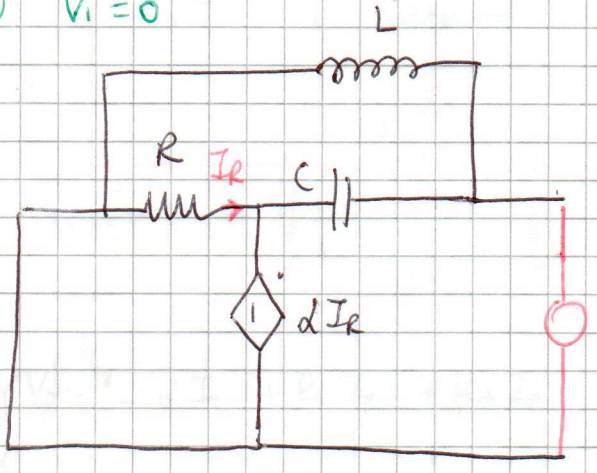
$$i(t) = \frac{2}{3}e^{-1333.3t}$$

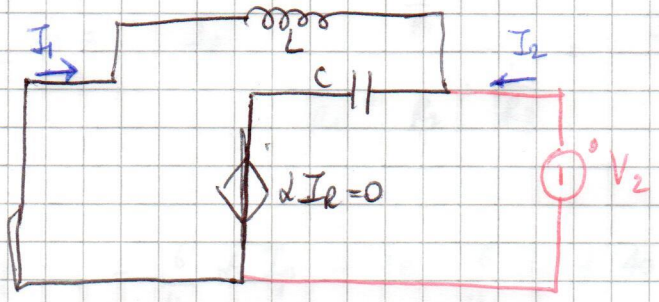
$$i(t) = \begin{cases} \frac{2}{3}, & t < 0 \\ \frac{2}{3}e^{-1333.3t}, & t \geq 0 \end{cases}$$

## ③ PARAMETRI Y

$$\begin{cases} \dot{I}_1 = \bar{y}_{11}\dot{V}_1 + \bar{y}_{12}\dot{V}_2 \\ \dot{I}_2 = \bar{y}_{21}\dot{V}_1 + \bar{y}_{22}\dot{V}_2 \end{cases}$$

### ① $V_1 = 0$



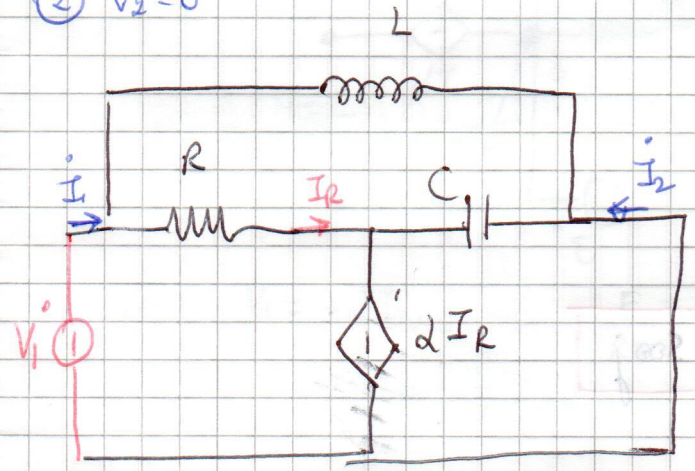

$$\alpha I_R = -R I_R \Rightarrow I_R = 0$$

$$\dot{I}_1 = -\frac{\dot{V}_2}{j\omega L} \Rightarrow \boxed{\bar{y}_{12} = -\frac{1}{j\omega L} = 0.1j}$$

$$\dot{I}_2 = \frac{\dot{V}_2}{j\omega L} + \dot{V}_2 \cdot j\omega C \Rightarrow \bar{y}_{22} = \frac{1}{j\omega L} + j\omega C \Rightarrow$$

$$\Rightarrow \boxed{\bar{y}_{22} = 0}$$

### ② $V_2 = 0$




$$\dot{I}_R = \frac{\dot{V}_1 - \alpha \dot{I}_R}{R} \Rightarrow$$

$$\Rightarrow R\dot{I}_R + \alpha \dot{I}_R = \dot{V}_1 \Rightarrow$$

$$\Rightarrow \dot{I}_R = \frac{\dot{V}_1}{2R}$$

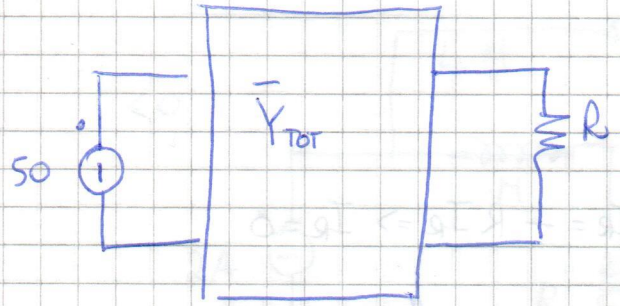
$$\dot{I}_1 = \dot{I}_R + \frac{\dot{V}_1}{j\omega L} = \frac{\dot{V}_1}{2R} + \frac{\dot{V}_1}{j\omega L} \Rightarrow \boxed{\bar{y}_{11} = \frac{1}{2R} + \frac{1}{j\omega L} = 0.05 - 0.1j}$$

$$\dot{I}_2 = -\frac{\dot{V}_1}{j\omega L} - \alpha \dot{I}_R \cdot j\omega C = \left(-\frac{1}{j\omega L} - \frac{\alpha}{2R} j\omega C\right)\dot{V}_1 \Rightarrow$$

$$\Rightarrow \boxed{\bar{y}_{21} = 0.05j}$$

$$\bar{Y} = \begin{bmatrix} 0.05 - 0.1j & 0.1j \\ 0.05j & 0 \end{bmatrix}$$

$$\bar{Y}_{TOT} = \bar{Y} + \bar{Y} = 2\bar{Y} = \begin{bmatrix} 0.1 - 0.2j & 0.2j \\ 0.1j & 0 \end{bmatrix}$$




$$\begin{cases} \dot{I}_1 = (0.1 - 0.2j)\,\dot{V}_1 + 0.2j\,\dot{V}_2 \\ \dot{I}_2 = 0.1j \cdot \dot{V}_1 \\ \dot{V}_1 = 50 \\ \dot{V}_2 = -10\,\dot{I}_2 \end{cases}$$

$$\dot{I}_2 = 0.1j \cdot \dot{V}_1 = 5j \Rightarrow i(t) = i_2(t) = \boxed{5\sqrt{2}\cos\left(1000t + \frac{\pi}{2}\right)}$$

$$\dot{V}_2 = -10\,\dot{I}_2 = -50j$$

$$\dot{I}_1 = 15 - 10j$$

$$\bar{S} = \dot{V}_1\,\dot{I}_1^* = 50\,(15 + 10j) = \boxed{750 + 500j}$$