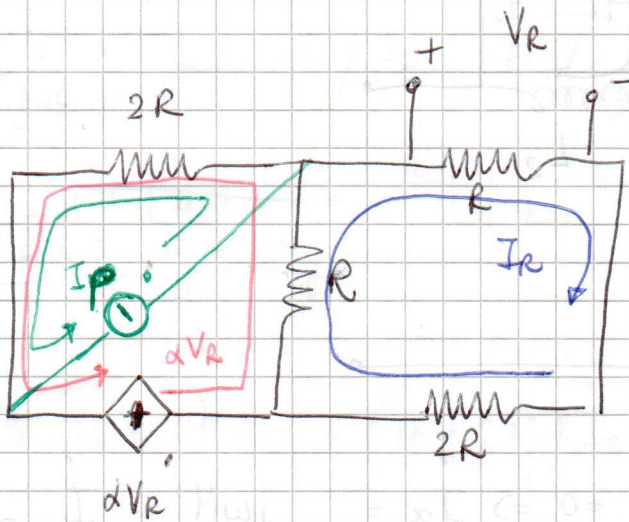


Compito 10 Giugno 2020

ESERCIZIO 1

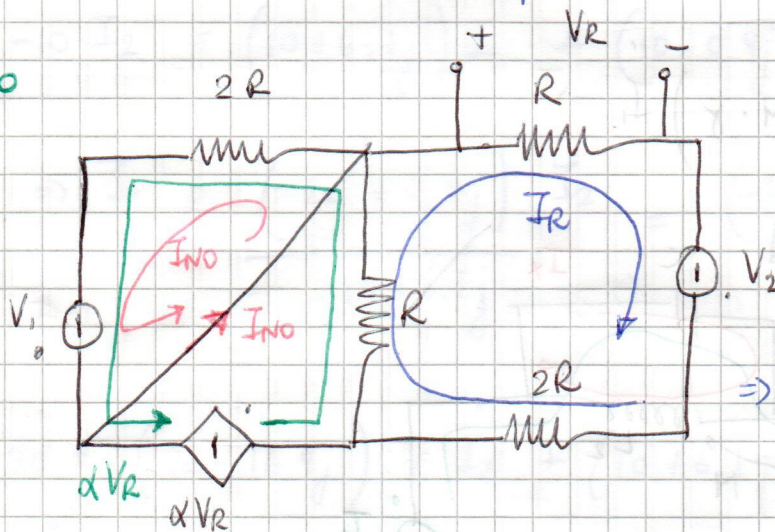
R_{NO}



$$\begin{cases} 4RI_R + \alpha V_R \cdot R = 0 \\ V_R = RI_R \end{cases} \Rightarrow 4RI_R + \alpha R^2 I_R = 0 \Rightarrow I_R = 0 \Rightarrow V_R = 0$$

$$V_p = 2RI_p \Rightarrow R_{NO} = \frac{V_p}{I_p} = 2R = 20 \Omega$$

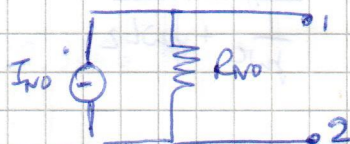
I_{NO}



$$\begin{cases} -V_2 + 4RI_R + \alpha V_R R = 0 \\ 2RI_{NO} - V_1 + \alpha V_R \cdot 2R = 0 \end{cases} \Rightarrow \begin{cases} V_2 = 4RI_R + RI_R = 5RI_R \\ 2RI_{NO} + 2RI_R = V_1 \end{cases}$$

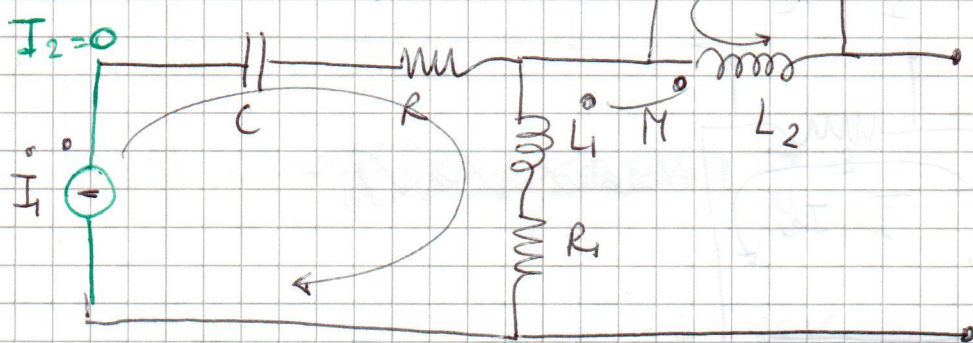
$$I_R = \frac{V_2}{5R} = \frac{20}{50} = \frac{2}{5} = 0.4 A$$

$$I_{NO} = \frac{V_1 - 2RI_R}{2R} = \frac{10 - 20 \cdot \frac{2}{5}}{20} = \frac{10 - 8}{20} = \frac{2}{20} = 0.1 A$$



ESERCIZIO 2

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



$$\left(\frac{1}{j\omega C} + j\omega L_2 \right) \dot{I}_x + j\omega M \dot{I}_1 = 0 \Rightarrow \dot{I}_x = - \frac{j\omega M}{\frac{1}{j\omega C} + j\omega L_2} \dot{I}_1 = \gamma \dot{I}_1$$

$$\gamma = -1.3$$

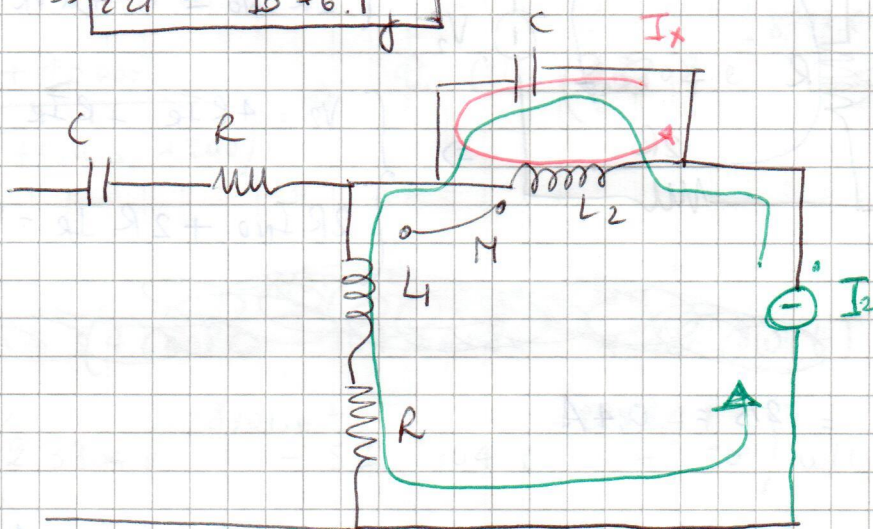
$$\dot{V}_1 = \left(\frac{1}{j\omega C} + 2R + j\omega L_1 \right) \dot{I}_1 + j\omega M \gamma \dot{I}_1 \Rightarrow$$

$$\Rightarrow \boxed{\bar{z}_{11} = 20 - 16.9j}$$

$$\dot{V}_2 = \left(\frac{1}{j\omega C} \gamma + j\omega L_1 + R + j\omega M \cdot \gamma \right) \dot{I}_1 \Rightarrow$$

$$\Rightarrow \boxed{\bar{z}_{21} = 10 + 6.1j}$$

$$\dot{I}_1 = 0$$



$$\dot{I}_x \left(\frac{1}{j\omega C} + j\omega L_2 \right) + j\omega M \dot{I}_2 = 0 \Rightarrow \dot{I}_x = - \frac{j\omega M + \frac{1}{j\omega C}}{\frac{1}{j\omega C} + j\omega L_2} \dot{I}_2 = \gamma \dot{I}_2$$

$$\gamma = -0.3$$

$$\dot{V}_1 = (j\omega L_1 + R) \dot{I}_2 + j\omega M \cdot \gamma \cdot \dot{I}_2 \Rightarrow$$

$$\Rightarrow \boxed{\bar{Z}_{12} = 10 + 6.1j} = \bar{Z}_{21}!$$

$$\dot{V}_2 = \left(\frac{1}{j\omega C} + j\omega L_1 + R \right) \dot{I}_2 + \left(\frac{1}{j\omega C} + j\omega M \right) \gamma \dot{I}_2 \Rightarrow$$

$$\Rightarrow \boxed{\bar{Z}_{22} = 10 - 0.9j}$$

$$\dot{V}_1 = (20 - 16.9j) \dot{I}_1 + (10 + 6.1j) \dot{I}_2$$

$$\dot{V}_2 = (10 + 6.1j) \dot{I}_1 + (10 - 0.9j) \dot{I}_2$$

$$\dot{V}_1 = 50$$

$$\dot{V}_2 = -10 \dot{I}_2$$

$$-10 \dot{I}_2 = (10 + 6.1j) \dot{I}_1 + (10 - 0.9j) \dot{I}_2 \Rightarrow$$

$$\Rightarrow \dot{I}_1 = \frac{(-20 + 0.9j)}{10 + 6.1j} \dot{I}_2 = (-1.4176 + 0.9547j) \dot{I}_2 = \gamma \dot{I}_2$$

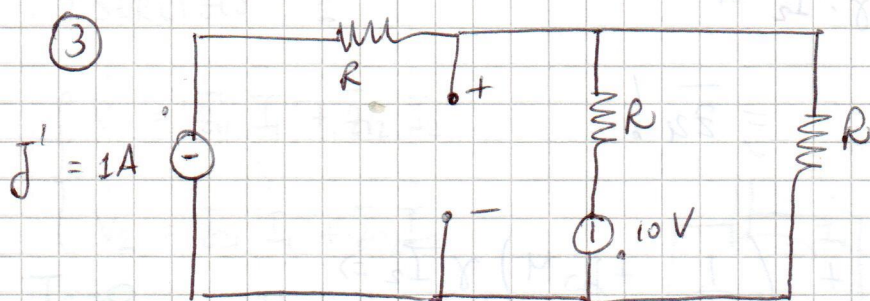
$$50 = (20 - 16.9j) \gamma \dot{I}_2 + (10 + 6.1j) \dot{I}_2 \Rightarrow$$

$$\Rightarrow \dot{I}_2 = -0.0458 - 1.0152j = 1.0162 e^{-j1.6159}$$

$$i_2(t) = 1.0162 \sqrt{2} \sin(1000t - 1.6159)$$

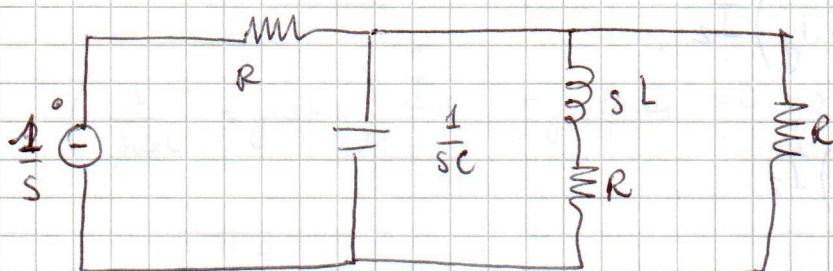
$$i_R(t) = -i_2(t) = 1.0162 \sqrt{2} \sin(1000t + 1.5257) \text{ A}$$

$$P = R |i_R|^2 = 10.3266 \text{ W}$$



$$V_c'(t) = \cancel{50 - 5} J' \cdot \frac{R}{2} - R \cdot \frac{10}{2R} =$$

$$= 50 - 5 = 45V$$



$$\frac{1}{s} = V_c''(s) \cdot \left[sC + \frac{1}{R+sL} + \frac{1}{R} \right] \Rightarrow$$

$$V_c''(s) = \frac{1}{s} \cdot \frac{R(R+sL)}{RCs(R+sL) + R + R+sL} = \frac{1}{s} \cdot \frac{R(R+sL)}{RCLs^2 + (R^2C+L)s + 2R} =$$

$$= \frac{2s + 10000}{s(10^{-5}s^2 + 0.1s + 200)} \Rightarrow V_c''(t) = \left(2.3304 e^{-8701.6t} - 52.3304 e^{-2298.4t} + 50 \right) u(t)$$

~~$$V_c(t) = 45 + (4.6608 e^{-8701.6t} - 104.6608 e^{-2298.4t} + 100) u(t)$$~~

$$V_c''(t) = \left(2.3304 e^{-8701.6t} - 52.3304 e^{-2298.4t} + 50 \right) u(t)$$

$$\lim_{t \rightarrow 0^-} V_c(t) = \lim_{t \rightarrow 0^+} V_c(t) = 45V$$

$$\lim_{t \rightarrow +\infty} V_c(t) = 95V \quad \text{OK!}$$