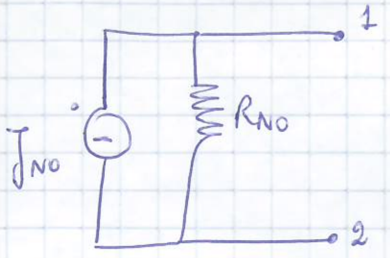
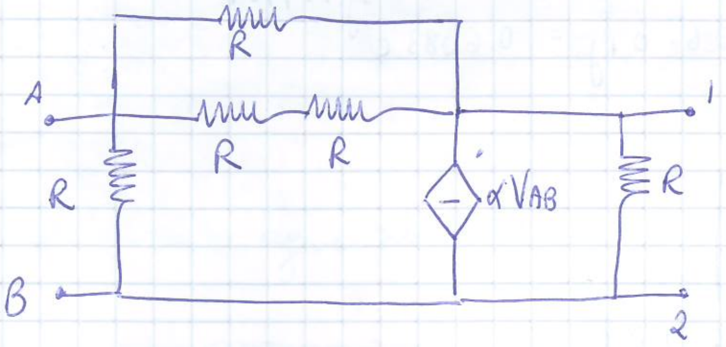
Risoluzione compito di Ingegneria Informatica del 16-2-2018



① Calcolo R_{NO}



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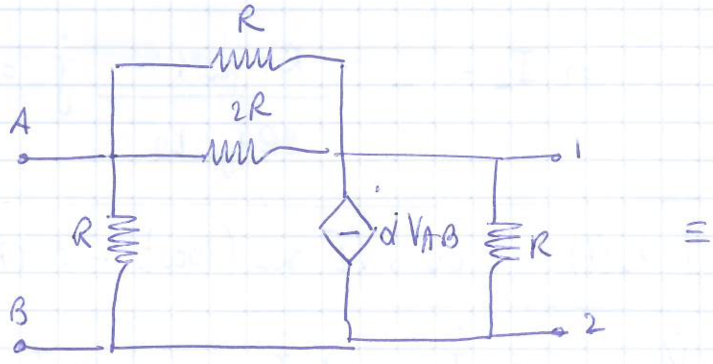

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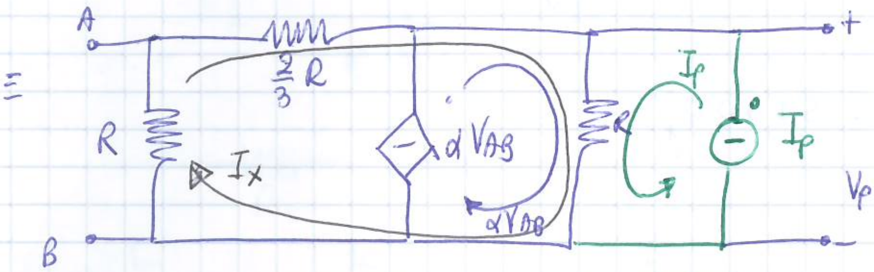
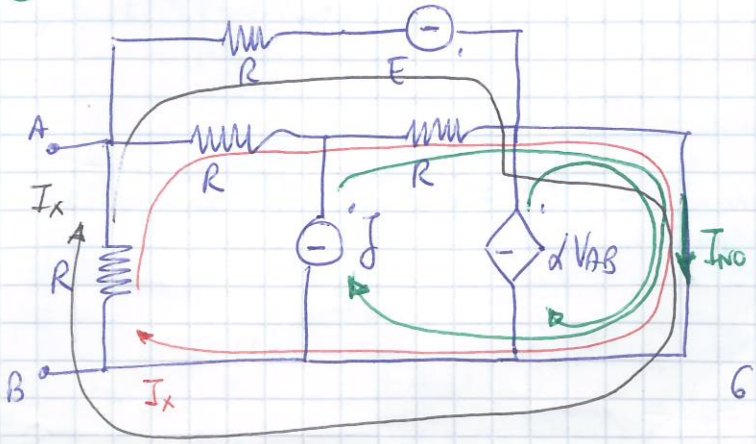


$$V_p \begin{cases} \left(2\cancel{R} + \frac{2}{3}\cancel{R}\right) I_x + \cancel{R} I_p + \alpha \cancel{R} V_{AB} = 0 \\ V_{AB} = -R I_x \end{cases} \Rightarrow$$

$$\Rightarrow \frac{8}{3} I_x + I_p - \alpha R I_x = 0 \Rightarrow I_x = -\frac{I_p}{\frac{8}{3} - \alpha R} = -\frac{I_p}{\frac{8}{3} - \frac{5}{2}} = -\frac{I_p}{\frac{16-15}{6}} = -6 I_p$$

$$V_p = -\left(\frac{2}{3}R + R\right) I_x = -\frac{5}{3} R I_x = +\frac{5}{3} \cdot 10 \cdot 6 I_p = +100 I_p \Rightarrow R_{NO} = \frac{V_p}{I_p} = \boxed{100\ \Omega}$$

② Calcolo I_{NO}



$$\begin{cases} I_x: & 3\cancel{R} I_x + \cancel{R} J + \cancel{R} I_y = 0 \\ I_y: & 2R I_y + R I_x = E \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} 3 I_x + I_y = -J \\ I_x + 2 I_y = \frac{E}{R} \Rightarrow I_x = \frac{E}{R} - 2 I_y = 2 - 2 I_y \end{cases}$$

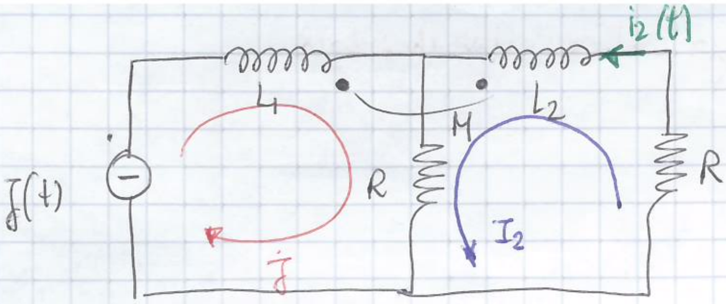
$$6 - 6 I_y + I_y = -1 \Rightarrow I_y = +\frac{7}{5}\ \text{A} = 1.4\ \text{A}$$

$$\Rightarrow I_x = -\frac{4}{5}\ \text{A} = -0.8\ \text{A}$$

$$I_{NO} = I_x + I_y + J + \alpha V_{AB}$$

$$V_{AB} = -R(I_x + I_y) = -6\ \text{V} \Rightarrow I_{NO} = 0.6 + 1 + \frac{1}{4} \cdot (-6) = \boxed{+0.1\ \text{A}}$$

2



$$(2R + j\omega L_2)\dot{I}_2 + j\omega M \dot{J} + R\dot{J} = \emptyset \Rightarrow$$

$$\Rightarrow \dot{I}_2 = -\frac{R + j\omega M}{2R + j\omega L_2}\dot{J} = -0.6 - 0.1j = 0.6083\, e^{-j\,2.9764}$$

$$\boxed{i_2(t) = 0.6083\sqrt{2}\,\text{sen}(1000t - 2.9764)}$$

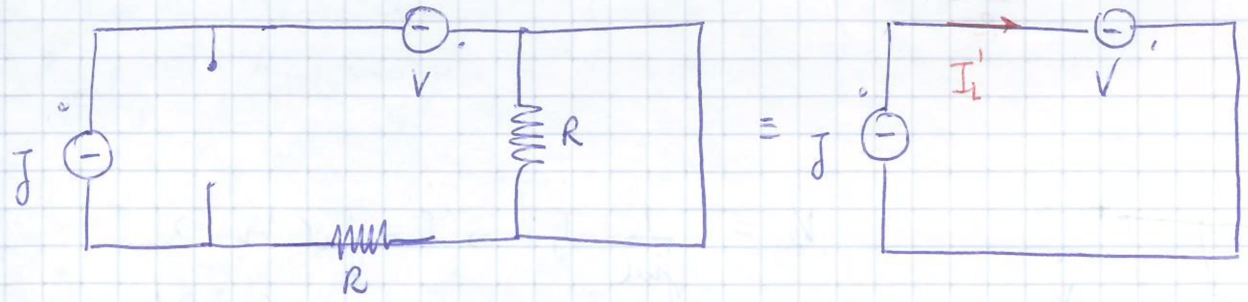
$$\dot{V}_J = j\omega L_1 \dot{J} + j\omega M \dot{I}_2 + R\dot{J} + R\dot{I}_2 = 5.4 + 0.6j$$

$$\bar{S}_J = \dot{V}_J \cdot \dot{J}^* = \dot{V}_J \cdot \dot{J} = \dot{V}_J = 5.4 + 0.6j$$

$$\boxed{Q = 0.6 \text{ VAR}}$$

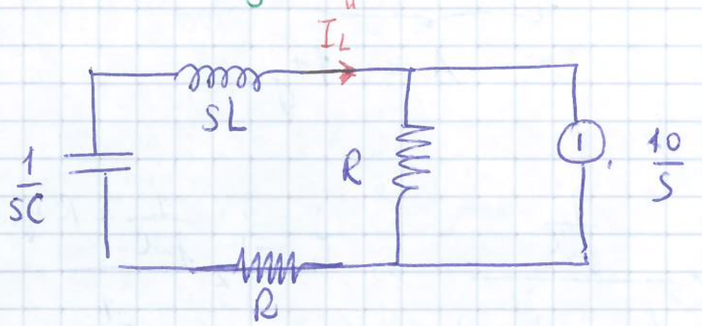
③ Risolviamo con sovrapposizione degli effetti

① Facciamo agire i generatori costanti → siamo in continua



$i_L'(t) = J = 1A$

② Facciamo agire solo $e(t)$



$$I_L''(s) = \frac{10}{s} \cdot \frac{1}{sL + \frac{1}{sC} + R} = \frac{10\cancel{s}C}{\cancel{s}(1 + s^2LC + RCs)} =$$

$$= \frac{10\ C}{s^2LC + RCs + 1} = \frac{10^{-4}}{10^{-7}s^2 + 0.001s + 1}$$

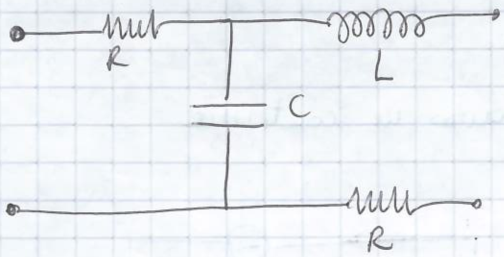
$$i_L''(t) = \left(-0.1291 \cdot e^{-8873t} + 0.1291\, e^{-1127t}\right) u(t)$$

$$i_L(t) = i_L'(t) + i_L''(t) = \boxed{1 + \left(-0.1291\, e^{-8873t} + 0.1291\, e^{-1127t}\right) u(t)}$$

$$\lim_{t\to 0^-} i_L(t) = \lim_{t \to 0^+} i_L(t) = 1A$$

$$\lim_{t\to +\infty} i_L(t) = 1A$$ (ok, perché sempre in serie al generatore di corrente)

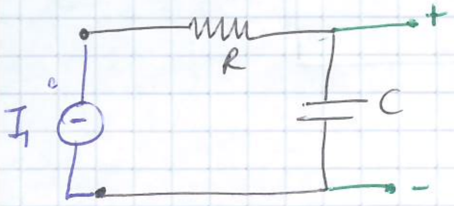
4



$$\dot{V}_1 = A\dot{V}_2 + B(-\dot{I}_2)$$

$$\dot{I}_1 = C\dot{V}_2 + D(-\dot{I}_2)$$

1 $\dot{I}_2 = \phi$

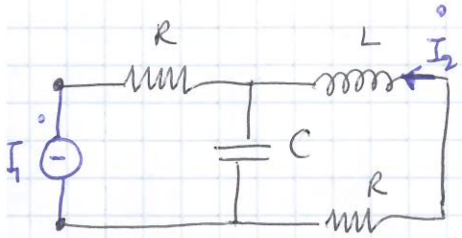


$$\dot{V}_2 = \frac{1}{j\omega C}\dot{I}_1 \Rightarrow \dot{I}_1 = j\omega C\dot{V}_2 \Rightarrow$$

$$\Rightarrow C = 0.1j$$

$$\dot{V}_1 = \left(R + \frac{1}{j\omega C}\right)\dot{I}_1 = \underbrace{\left(R + \frac{1}{j\omega C}\right)\cdot C}_{A\,=\,1+j}\cdot\dot{V}_2$$

2 $\dot{V}_2 = \phi$



$$\dot{I}_2 = -\dot{I}_1\cdot\frac{\frac{1}{j\omega C}}{\frac{1}{j\omega C} + R + j\omega L} \Rightarrow \dot{I}_1 = -\dot{I}_2\,\frac{\frac{1}{j\omega C} + R + j\omega L}{\frac{1}{j\omega C}}$$

$$\Rightarrow D = \frac{\frac{1}{j\omega C} + R + j\omega L}{\frac{1}{j\omega C}} = j$$

$$\dot{V}_1 = R\dot{I}_1 - j\omega L\dot{I}_2 - R\dot{I}_2 =$$

$$= R\cdot D(-\dot{I}_2) - j\omega L\dot{I}_2 - R\dot{I}_2 = (RD + j\omega L + R)(-\dot{I}_2) \Rightarrow B = 10 + 20j$$

$$T = \begin{bmatrix} 1+j & 10+20j \\ 0.1j & j \end{bmatrix} \Rightarrow T^2 = \begin{bmatrix} 1+j & 10+20j \\ 0.1j & j \end{bmatrix}\begin{bmatrix} 1+j & 10+20j \\ 0.1j & j \end{bmatrix} =$$

$$= \begin{bmatrix} \cancel{1} + 2j \cancel{-1} + j - 2 & 10 + 20j + 20j - 20 + 10j - 20 \\ 0.1j - 0.1 - 0.1 & j - 2 - 1 \end{bmatrix} = \begin{bmatrix} -2+3j & -30+40j \\ -0.2+0.1j & -3+j \end{bmatrix}$$

$$\begin{cases} \dot{V}_1 = (-2+3j)\,\dot{V}_2 + (-30+40j)(-\dot{I}_2) & (i) \\ \dot{I}_1 = (-0.2+0.1j)\,\dot{V}_2 + (-3+j)(-\dot{I}_2) & (ii) \\ \dot{V}_1 = 10 \\ \dot{V}_2 = 10 \cdot (-\dot{I}_2) \end{cases}$$

$\dot{I}_1 = ?$

Dalla (i)

$$10 = (-2+3j) \cdot 10(-\dot{I}_2) + (-30+40j)(-\dot{I}_2) \Rightarrow$$

$$\Rightarrow -\dot{I}_2 = \frac{10}{(-2+3j)(10)+(-30+40j)} = -0.0676 - 0.0946j \Rightarrow$$

$$\Rightarrow \dot{I}_1 = (-0.2+0.1j) \cdot 10(-0.0676-0.0946j) + (-3+j)(-0.0676-0.0946j) =$$

$$= 0.5270 + 0.3378j$$

$$P = Re\{\dot{V}_1 \cdot \dot{I}_1^*\} = Re\{5.2703 - 3.3784j\} = \boxed{5.2703\ W}$$