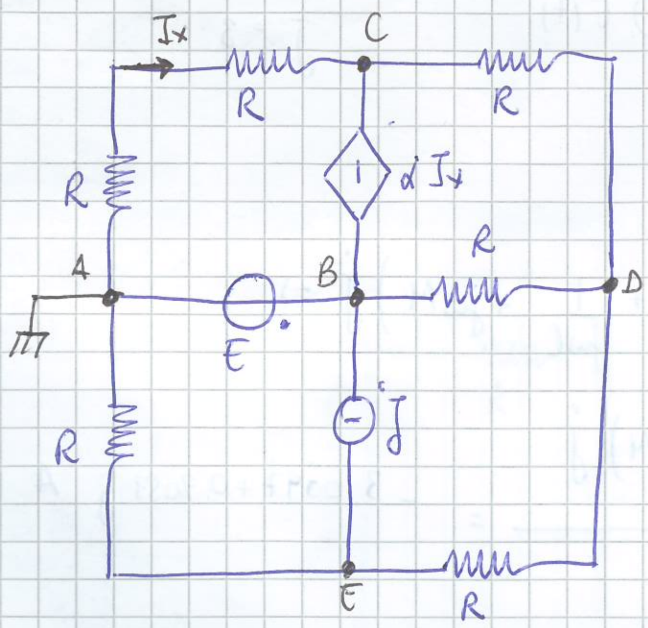
Risoluzione compito Ingegneria Informatica - I APPELLO

1



$V_A = \phi$

$V_B = E = 50V$

$V_C = 50 + \alpha I_x$

$V_J = V_B - V_E$

$$I_x = \frac{V_A - V_C}{2R} = -\frac{V_C}{2R} = -\frac{50 + \alpha I_x}{2R} \Rightarrow 2R I_x = -50 - \alpha I_x \Rightarrow$$

$$\Rightarrow I_x = \frac{-50}{2R + \alpha} = \frac{-50}{30} = -\frac{5}{3} = \boxed{-1,67\ A = I_x}$$

$$\begin{cases} \text{NODO D:} \quad \phi = V_D\left(\frac{1}{R} + \frac{1}{R} + \frac{1}{R}\right) - \frac{V_C}{R} - \frac{V_B}{R} - \frac{V_E}{R} \Rightarrow \\ \text{NODO E:} \quad -J = V_E\left(\frac{1}{R} + \frac{1}{R}\right) - \frac{V_D}{R} \end{cases}$$

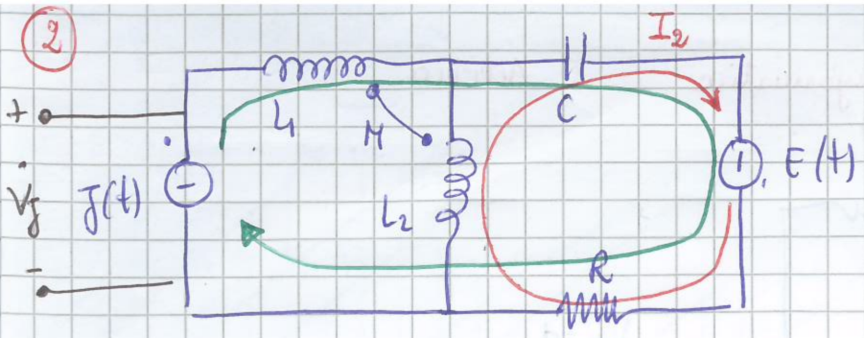
$$\Rightarrow \begin{cases} 3V_D = V_C + V_B + V_E = 50 - \frac{5\alpha}{3} + 50 + V_E \\ -20 = 2V_E - V_D \Rightarrow V_D = 2V_E + 20 \end{cases}$$

$$6V_E + 60 = 100 - \frac{50}{3} + V_E \Rightarrow 5V_E = 40 - \frac{50}{3} = \frac{70}{3} \Rightarrow \boxed{V_E = \frac{14}{3}}\ V$$

$$V_J = V_B - V_E = 50 - \frac{14}{3} = \frac{136}{3}\ V$$

$$P_J = \frac{2 \cdot 136}{3} = \frac{272}{3} = \boxed{90.67\ W}$$

(2)



$\dot{E} = 20$

$\dot{J} = 3$

$$\dot{E} = \left(R + j\omega L_2 + \frac{1}{j\omega C}\right)\dot{I}_2 + \left(R + \frac{1}{j\omega C} + j\omega M\right)\dot{J} \Rightarrow$$

$$\Rightarrow \dot{I}_2 = \frac{\dot{E} - \left(R + \frac{1}{j\omega C} + j\omega M\right)\dot{J}}{R + j\omega L_2 + \frac{1}{j\omega C}} = -3.0097 + 0.2051\,j \text{ A}$$

$$\dot{V}_J = \left(j\omega L_1 \dot{J} + j\omega M \dot{I}_2\right) + \left(-j\omega L_2 \dot{I}_2 - j\omega M \dot{J}\right) =$$

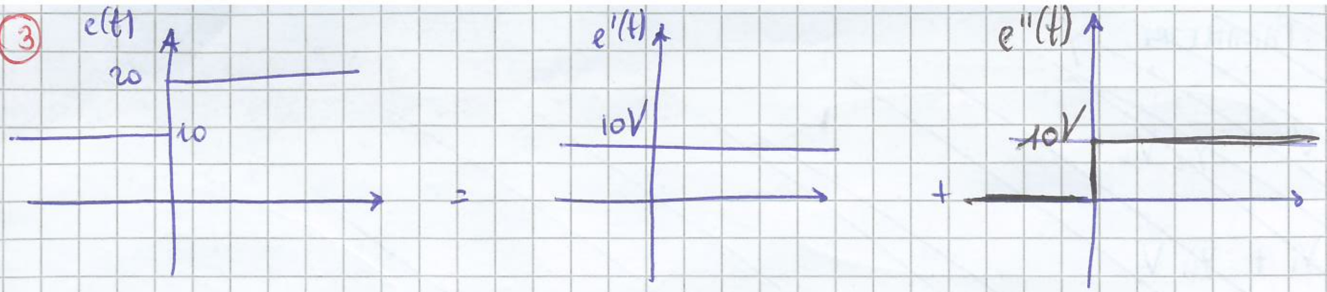
$$= 0.2051 + 3.0097\,j$$

$$\overline{S}_J = \dot{V}_J \cdot \dot{J}^* = 0.6152 + 9.0291\,j$$

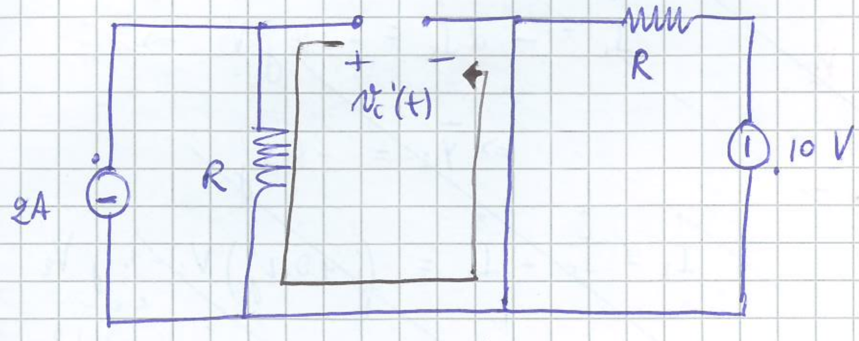
$$P = \mathrm{Re}\{\overline{S}_J\} = 0.6152 \text{ W} \simeq 615 \text{ mW}$$

$$Q = \mathrm{Im}\{\overline{S}_J\} \simeq 9.03 \text{ VAR}$$

3

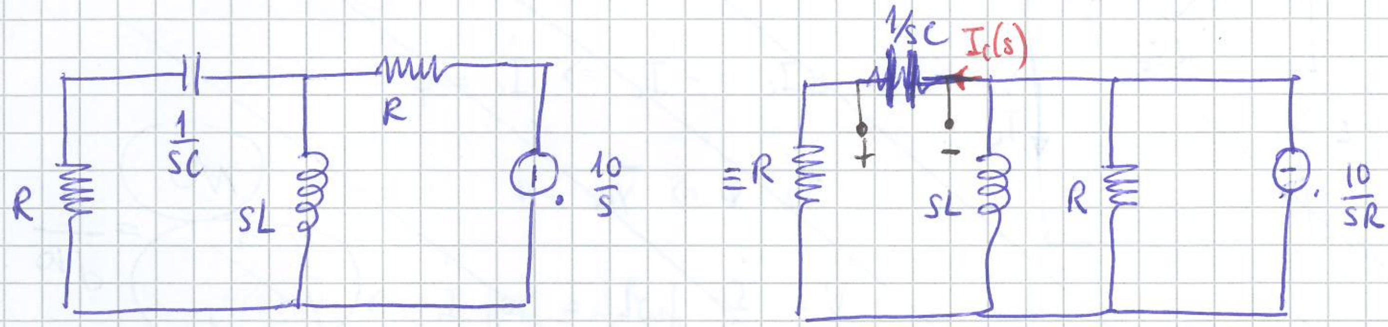


SOVRAPPOSIZIONE DEGLI EFFETTI: PRIMA $e'(t)$ e J $\Rightarrow v_c'(t)$



$$v_c'(t) = R \cdot 2A = 20V$$

ORA $e''(t) \Rightarrow v_c''(t)$



$$I_c(s) = -\frac{10}{sR} \cdot \frac{\frac{1}{R+\frac{1}{sC}}}{\frac{1}{R+\frac{1}{sC}} + \frac{1}{sL} + \frac{1}{R}} \Rightarrow V_c(s) = -\frac{1}{sC} \cdot I_c(s)$$

$$V_c(s) = \frac{10}{s^2RC} \cdot \frac{\frac{sC}{1+RCs}}{\frac{sC}{1+RCs} + \frac{1}{sL} + \frac{1}{R}} = \frac{\cancel{s}0}{\cancel{s^2RC}} \cdot \frac{RL\cancel{C}\cancel{s^2}}{s^2RLC + R + R^2Cs + sL + s^2RLC} =$$

$$= \frac{10\,L}{2s^2RLC + (R^2C+L)s + R} = \frac{0.1}{2\cdot 10^{-6}s^2 + 0.011s + 10} \Rightarrow v_c''(t) = \left(-15.6174\,e^{-4350.8t} + 15.6174\cdot e^{-1149.2t}\right)u(t)$$

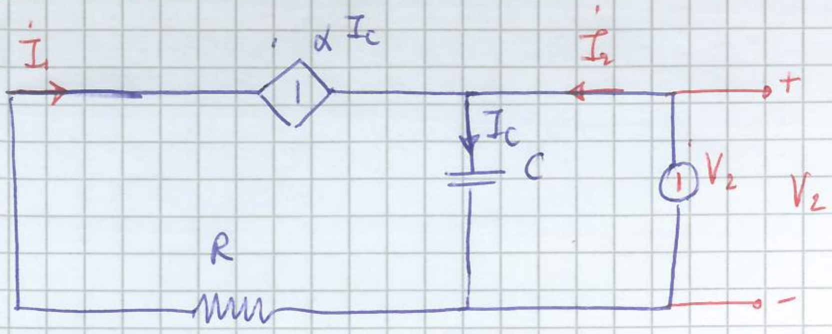
$$v_c(t) = v_c'(t) + v_c''(t) = \left[20 + \left(-15.6174\,e^{-4350.8t} + 15.6174\,e^{-1149.2t}\right)u(t)\right] V$$

$\lim_{t\to 0^+} v_c(t) = \lim_{t\to 0^-} v_c(t) \Rightarrow$ ok! $\lim_{t\to+\infty} v_c(t) = 20V$ ok!

(4)

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) $\dot V_1 = \phi$



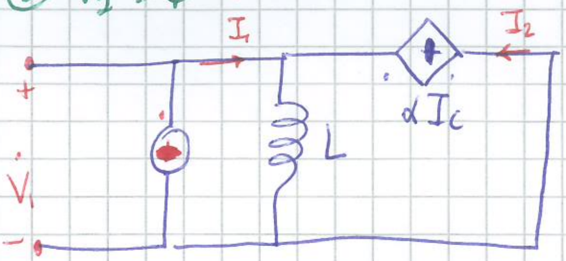
$\dot I_c = \dot V_2 \cdot j\omega C = j\dot V_2$

$\dot I_1 = -\alpha \dot I_c = -0.2j\,\dot V_2 \Rightarrow$

$\Rightarrow \bar Y_{12} = -0.2j$

$\dot I_2 = \dot I_c - \dot I_1 = (j + 0.2j)\dot V_2 = \underbrace{1.2j}_{\bar Y_{22} = 1.2j}\dot V_2$

(2) $\dot V_2 = \phi$



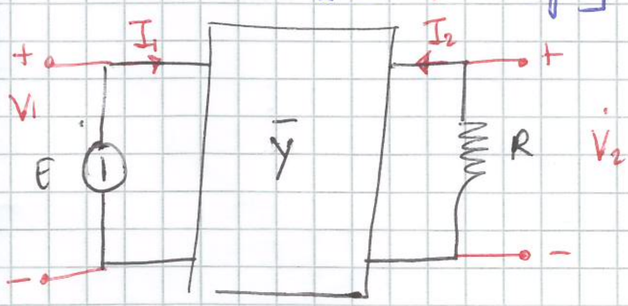
$\dot I_c = \phi \Rightarrow \alpha \dot I_c = \phi$

$\dot I_2 = \phi \Rightarrow \bar Y_{21} = \phi$

$\dot V_1 = j\omega L \dot I_1 \Rightarrow \bar Y_{11} = \dfrac{1}{j\omega L} = \dfrac{1}{10j} = -0.1j$

$\bar Y_1 = \begin{bmatrix} -0.1j & -0.2j \\ \phi & 1.2j \end{bmatrix}$ $\qquad \bar Z_2 = \begin{bmatrix} 10 & 0 \\ 1 & 2 \end{bmatrix} \Rightarrow \bar Y_2 = \dfrac{1}{20}\begin{bmatrix} 2 & 0 \\ -1 & 10 \end{bmatrix} = \begin{bmatrix} 0.1 & 0 \\ -0.05 & 0.5 \end{bmatrix}$

$\bar Y = \bar Y_1 + \bar Y_2 = \begin{bmatrix} -0.1j & -0.2j \\ 0 & 1.2j \end{bmatrix} + \begin{bmatrix} 0.1 & 0 \\ -0.05 & 0.5 \end{bmatrix} = \begin{bmatrix} 0.1-0.1j & -0.2j \\ -0.05 & 0.5+1.2j \end{bmatrix}$



$\begin{cases} \dot I_1 = \bar Y_{11}\dot V_1 + \bar Y_{12}\dot V_2 & (**) \\ \dot I_2 = \bar Y_{21}\dot V_1 + \bar Y_{22}\dot V_2 & (*) \\ \dot V_1 = 10 \\ \dot I_2 = -\dfrac{\dot V_2}{R} = -0.1\dot V_2 \end{cases}$

$(*)\ -0.1\dot V_2 = -0.05\dot V_1 + (0.5 + 1.2j)\dot V_2 \Rightarrow \dot V_1 = \dfrac{0.6 + 1.2j}{0.05}\dot V_2 = (12 + 24j)\dot V_2 \Rightarrow$

$\Rightarrow \dot V_2 = (0.0167 - 0.033j)\dot V_1$

$(**)\ \dot I_1 = (0.1 - 0.1j)\dot V_1 + (-0.2j)\cdot \dot V_2 = (0.1 - 0.1j)\cdot 10 - 0.2j(0.0167 - 0.033j)\cdot 10 = 0.933 - 1.03$

$P = \mathrm{Re}\{\dot E \cdot \dot I_1^*\} = \mathrm{Re}\{10\cdot(0.933 + 1.033j)\} = 9.33\,W$