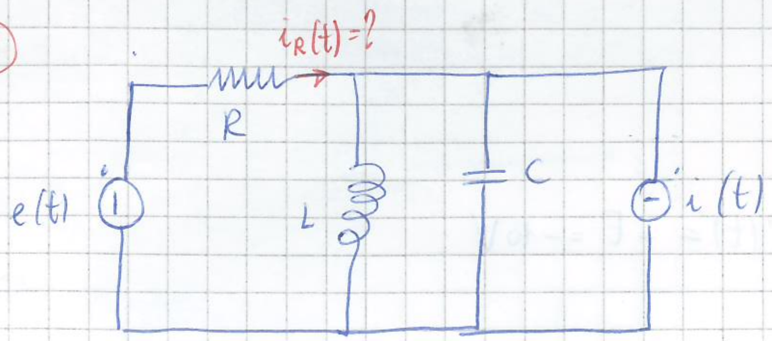
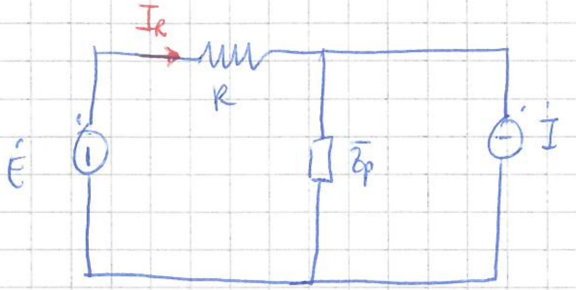
Soluzione II compitino Ingegneria Informatica 2·12·2017

(1)




$$\dot{E}=10 \qquad \dot{I}=1\cdot e^{j\pi/2}=j.$$

$$\bar{Z}_p=\frac{j\omega L\cdot\frac{1}{j\omega C}}{j\omega L+\frac{1}{j\omega C}}=\frac{j\omega L}{1-\omega^2 LC}=11{,}11j$$




$$\dot{I}_R=\frac{\dot{E}}{R+\bar{Z}_p}-\dot{I}\cdot\frac{\bar{Z}_p}{R+\bar{Z}_p}=$$

$$=0.9448-1.0497j=1.4123\cdot e^{-j0.838}$$

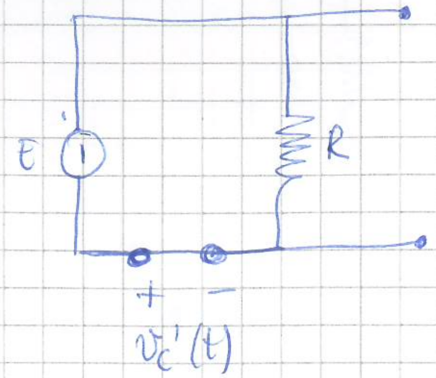
$$\boxed{i_R(t)=1.4123\sqrt{2}\cdot\operatorname{sen}(1000t-0.838)}$$

$$\dot{V}_I=\dot{E}-R\dot{I}_R=0.5525+10{,}4972j$$

$$P=\operatorname{Re}\{\dot{V}_I\cdot\dot{I}^*\}=\operatorname{Re}\{(0.5525+10.4972j)\cdot(-j)\}=\boxed{+10{,}4972\ W=P}$$

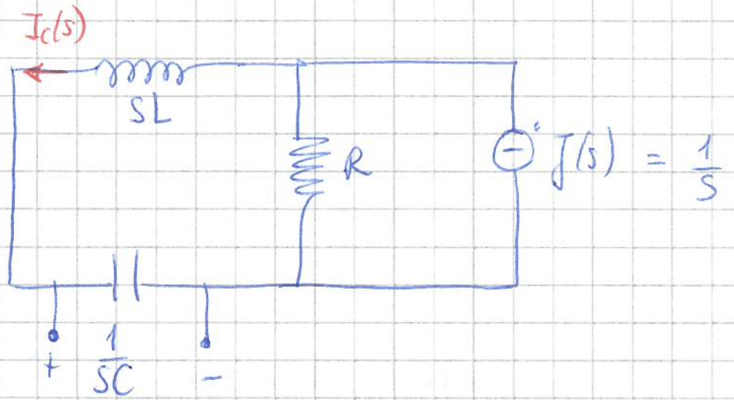
② Risolviamo con sovrapposizione degli effetti.

SOLO E (continua)




$$v_c'(t) = -E = -10\,V$$

SOLO J (niente condizioni iniziali)




$$I_c(s) = J(s) \cdot \frac{R}{R + sL + \frac{1}{sC}}$$

$$V_c''(s) = \frac{1}{sC} \cdot I_c(s) = \frac{1}{sC} \cdot \frac{1}{s} \cdot \frac{R}{R + sL + \frac{1}{sC}} = \frac{R}{s\left(RCs + s^2LC + 1\right)} =$$

$$= \frac{50}{s\left(10^{-6}s^2 + 0.005s + 1\right)}$$

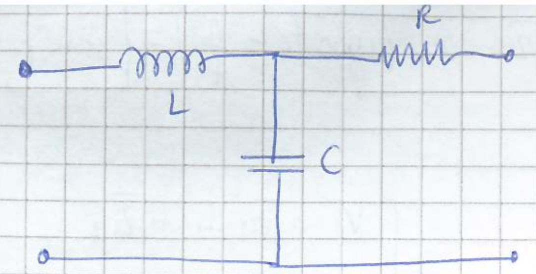
$$v_c''(t) = \left(2.2772 \cdot e^{-4791.3t} - 52.2772 \cdot e^{-208.7t} + 50\right)u(t)$$

$$v_c(t) = v_c'(t) + v_c''(t) = -10 + v_c''(t) = \boxed{-10 + \left(2.2772\,e^{-4791.3t} - 52.2772\,e^{-208.7t} + 50\right)u(t)}$$

$$\lim_{t \to 0^-} v_c(t) = -10 = \lim_{t \to 0^+} v_c(t)$$

$$\lim_{t \to +\infty} v_c(t) = 40\,V = -E + RJ = 40\,V \quad \text{ok!}$$

3




$$\dot V_1 = \bar z_{11}\dot I_1 + \bar z_{12}\dot I_2$$

$$\dot V_2 = \bar z_{21}\dot I_1 + \bar z_{22}\dot I_2$$

① $\dot I_1 = \phi$

$$\dot V_1 = \frac{1}{j\omega C}\dot I_2 \Rightarrow \bar z_{12} = \frac{1}{j\omega C} \qquad \dot V_2 = \left(R + \frac{1}{j\omega C}\right)\dot I_2 \Rightarrow \bar z_{22} = R + \frac{1}{j\omega C}$$

② $\dot I_2 = \phi$

$$\dot V_1 = \left(j\omega L + \frac{1}{j\omega C}\right)\dot I_1 \Rightarrow \bar z_{11} = j\omega L + \frac{1}{j\omega C}$$

$$\dot V_2 = \frac{1}{j\omega C}\cdot \dot I_1 \Rightarrow \bar z_{21} = \frac{1}{j\omega C} \qquad \left(\bar z_{12} = \bar z_{21}\ !\right)$$

$$\bar z = \begin{bmatrix} j\omega L + \frac{1}{j\omega C} & \frac{1}{j\omega C} \\ \frac{1}{j\omega C} & R + \frac{1}{j\omega C}\end{bmatrix} = \boxed{\begin{bmatrix} \phi & -10j \\ -10j & 10-10j \end{bmatrix}}$$

$$z_{TOT} = 2\bar z = \begin{bmatrix} \phi & -20j \\ -20j & 20-20j \end{bmatrix}$$

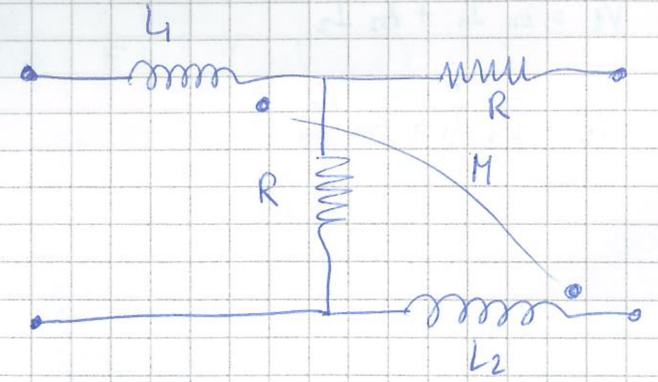
$$\begin{cases} \dot V_1 = \bar z_{11}\dot I_1 + \bar z_{12}\dot I_2 \\ \dot V_2 = \bar z_{21}\dot I_1 + \bar z_{22}\dot I_2 \end{cases} \Rightarrow \begin{cases} \dot V_1 = (-20j)\dot I_2 \\ \dot V_2 = (-20j)\dot I_1 + (20-20j)\dot I_2 \end{cases}$$

$$\begin{matrix}\dot V_1 = 10 \\ \dot V_2 = \phi\end{matrix} \Rightarrow \begin{cases} \dot V_1 = (-20j)\dot I_2 \Rightarrow 10 = -20j\,\dot I_2 \\ \phi = (-20j)\dot I_1 + (20-20j)\dot I_2 \end{cases}$$

$$\dot I_2 = \frac{10}{-20j}\ \text{(dalla prima)} = 0.5j \qquad \dot I_1 = 0.5 - 0.5j\ \text{(dalla seconda)}$$

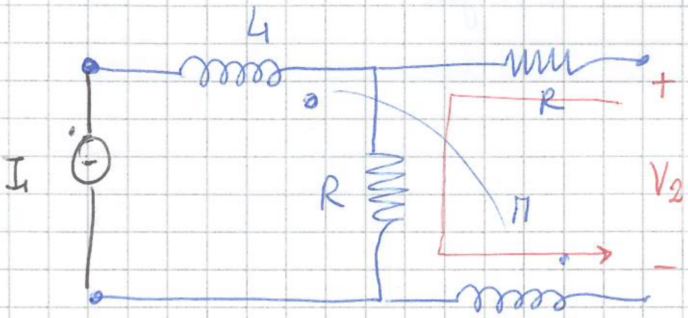
quindi $\dot{I}_1 = 0.5 - 0.5j$ e $i_1(t) = 0.5 \cdot \sqrt{2}\,\sqrt{2} \cdot \text{sen}\left(1000t - \frac{\pi}{4}\right) = \boxed{\text{sen}\left(1000t - \frac{\pi}{4}\right)}$

(4)




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

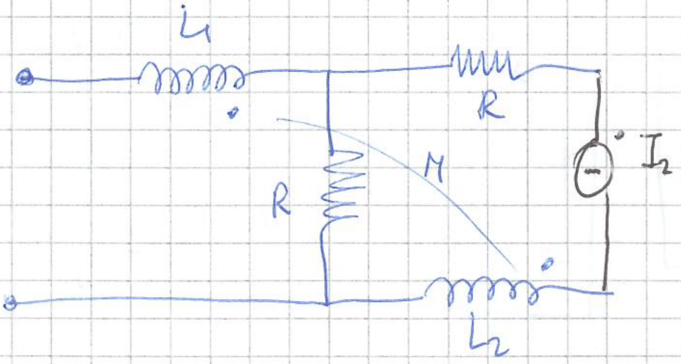
(1) $\dot{I}_2 = \emptyset$




$$\dot{V}_1 = (R + j\omega L_1)\dot{I}_1 \Rightarrow \bar{Z}_{11} = R + j\omega L_1$$

$$\dot{V}_2 = R\dot{I}_1 + j\omega M\dot{I}_1 \Rightarrow \bar{Z}_{21} = R + j\omega M$$

(2) $\dot{I}_1 = \emptyset$

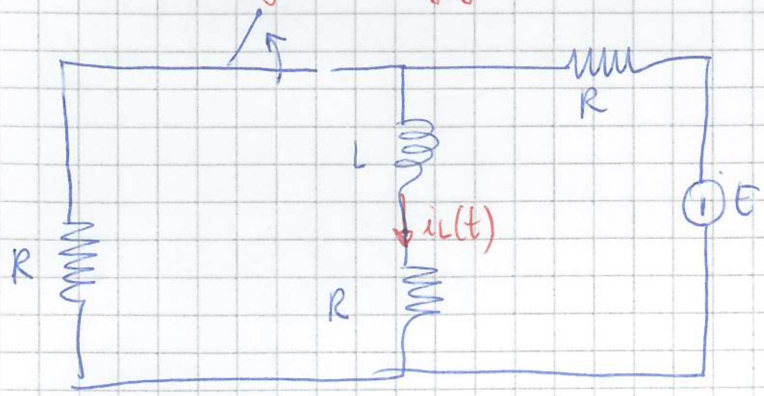



$$\dot{V}_2 = (2R + j\omega L_2)\dot{I}_2 \Rightarrow \bar{Z}_{22} = 2R + j\omega L_2$$

$$\dot{V}_1 = R\dot{I}_2 + j\omega M\dot{I}_2 \Rightarrow \bar{Z}_{12} = \bar{Z}_{21} = R + j\omega M$$

$$Z = \begin{bmatrix} R + j\omega L_1 & R + j\omega M \\ R + j\omega M & 2R + j\omega L_2 \end{bmatrix} = \boxed{\begin{bmatrix} 10 + 10j & 10 + 10j \\ 10 + 10j & 20 + 20j \end{bmatrix}}$$

Soluzione compitino Ingegneria Informatica – parte III 2.12.2017

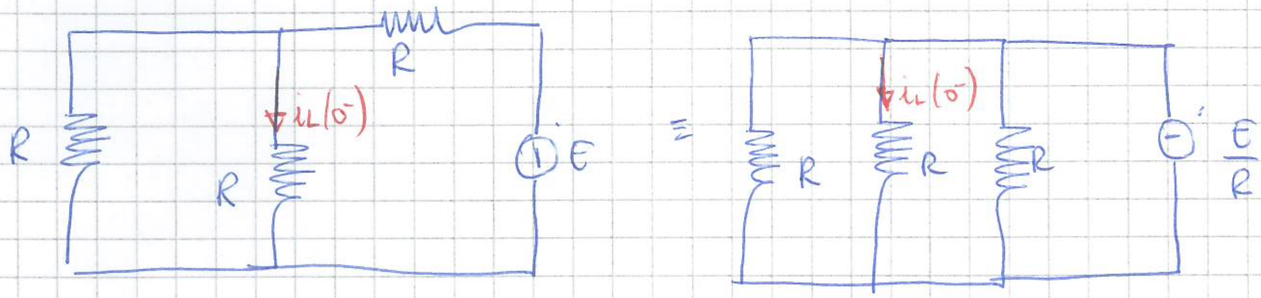



$E = 10\,V$

$R = 10\,\Omega$

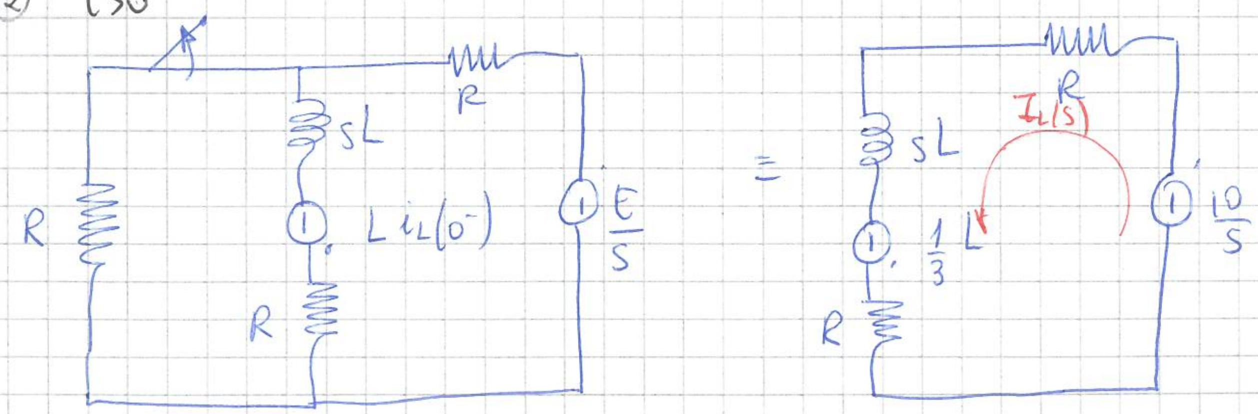
$L = 10\,mH$

① $t < 0$




$$i_L(t) = \frac{E}{R} \cdot \frac{1}{3} = 0.33\,A = i_L(0^-)$$

② $t > 0$




$$I_L(s) = \frac{\frac{10}{s} + \frac{1}{3}L}{2R + sL} = \frac{\frac{1}{3}sL + 10}{s(sL + 2R)} = \boxed{\frac{0{,}00333\,s + 10}{0.01\,s^2 + 20\,s} = I_L(s)}$$

$$i_L(t) = \left(-\frac{1}{6}e^{-2000t} + 0.5\right)u(t)$$

$$\boxed{i_L(t) = \begin{cases} 0.33 & t < 0 \\ -\frac{1}{6}e^{-2000t} + 0.5 & t > 0 \end{cases}}$$

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

$\lim_{t \to +\infty} i_L(t) = 0.5 = \frac{E}{2R}$ ok!