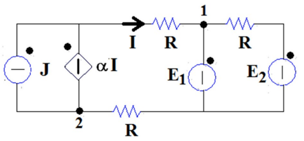
12/09/2018

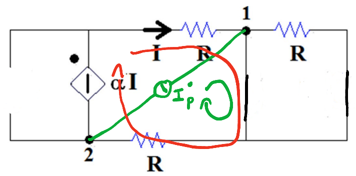
domenica 13 dicembre 2020 10:24

1) Determinare il **circuito equivalente di Norton** fra i punti **1** e **2** del circuito in figura.



$E_1 = 10$ V;
$E_2 = 20$ V;
$J = 2$ A;
$R = 10\ \Omega$;
$\alpha = 5$ V/A;

R_{No}



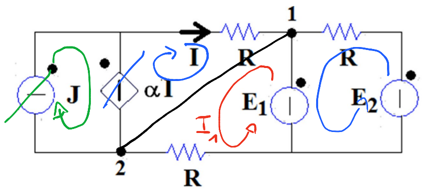
$$-\alpha I + 2RI + RI_p = 0$$

$$I(-\alpha + 2R) + RI_p = 0$$

$$I = \frac{-RI_p}{-\alpha + 2R}$$

$$V_p = R(I + I_p) = R\left(\frac{-RI_p}{-\alpha + 2R} + I_p\right) = I_p\left(\frac{-R^2}{-\alpha + 2R} + R\right) = 3{,}3\bar{3}$$

I_{NO}



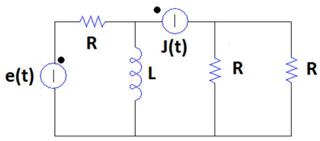
$$I_1 = \frac{E_1}{R}$$

$$-\alpha I + RI = 0 \qquad I = 0$$

$$I_{No} = I_1 = \frac{E_1}{R} = 1\ \text{A}$$

Es 2

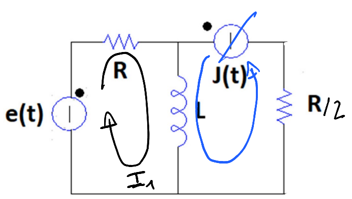
2) Determinare **la potenza reattiva** erogata dal generatore di tensione **e(t)**.



$e(t) = 10\sqrt{2}\cos(1000t)\ V$;
$J(t) = \sqrt{2}\sin(1000t)\ A$;
$R = 10\ \Omega$;
$L = 10$ mH;

$$J(t) = \sqrt{2}\cos(1000t - \pi/2) = 1\, e^{-\pi/2\, J}$$

$$\dot{J} = -J$$



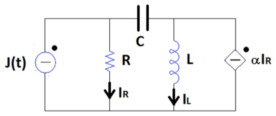
$$\dot{E} = R\dot{I}_1 + j\omega L\dot{I}_1 + j\omega L\dot{J}$$

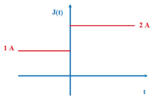
$$I_1 = \frac{E - j\omega L\dot{J}}{R + j\omega L} = \frac{E - \omega L}{R + j\omega L} = 0$$

$$I_1 = 0 \qquad P = 0$$

Es 3

3) Determinare l'andamento temporale della corrente $\mathbf{i_L(t)}$ che scorre sull'induttore **L** per **-∞ < t < +∞**, considerando l'**andamento a gradino della corrente erogata del generatore di corrente J(t)**, come in figura. Il circuito è ipotizzato a regime per tempi negativi.

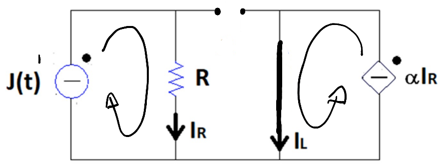




R = 100 Ω;
L = 10 mH;
C = 20 μF;
α = 0.5;

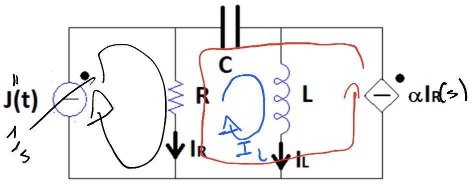
$$J(t) = 1 + 1\, u(t)$$

ATTIVO $J'(t)$



$$I_R' = J'$$

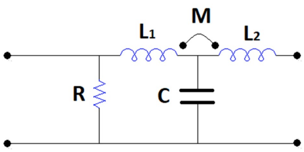
$$I_L' = \alpha I_R' = 0{,}5 \text{ A}$$



$$\begin{cases} \alpha I_R(s)\left(\frac{1}{sC} + R\right) + \frac{R}{s} - I_L(s)\left(R + \frac{1}{sC}\right) \\ I_R(s) = \frac{1}{s} + \alpha I_R(s) - I_L(s) \end{cases} \Rightarrow \quad I_R(s) = \frac{\frac{1}{s} - I_L(s)}{1-\alpha} =$$

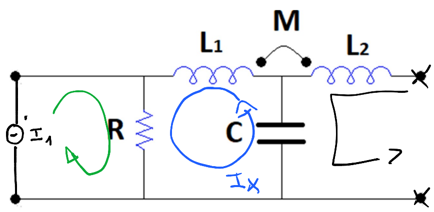
ES 4

4) Determinare la rappresentazione a parametri **Z** della rete a due porte indicata in figura, ipotizzata a regime periodico sinusoidale a pulsazione **ω**.



R = 10 Ω;
L₁ = 10 mH;
L₂ = 20 mH;
M = 13 mH;
C = 200 μF;
ω = 100 rad/s;

$$\begin{cases} V_1 = Z_{11} I_1 + Z_{12} I_2 \\ V_2 = Z_{21} I_1 + Z_{22} I_2 \end{cases}$$

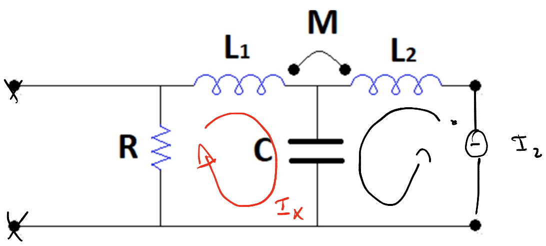


$$\left(j\omega L_1 + \frac{1}{j\omega C} + R\right) I_x + R\, I_1 = 0$$

$$I_x = \frac{-R\, I_1}{j\omega L_1 + \frac{1}{j\omega C} + R} = \gamma\, I_1 = (-0{,}04 + 0{,}1959 j)\, I_1$$

$$V_1 = R I_1 + \gamma R I_1 = I_1 (R + R\gamma) = I_1(9{,}6 + 1{,}959\, j) \searrow z_{11}$$

$$V_2 = j\omega M \gamma I_1 - \frac{1}{j\omega C} \gamma I_1 = I_1 \left(-\gamma j\omega M - \frac{\gamma}{j\omega C} \right) = (+9{,}541 - 1{,}947\, j)\, I_1 \searrow z_{21}$$



$$\left(R + \frac{1}{j\omega C} + j\omega L_1 \right) I_x + j\omega M I_2 + \frac{1}{j\omega C} I_2 = 0$$

$$I_x = \frac{-j\omega M I_2 - \frac{1}{j\omega C} I_2}{R + \frac{1}{j\omega C} + j\omega L_1} = \gamma I_2 = (-0{,}9541 + 0{,}1947\, j)\, I_2$$

$$V_1 = R I_x = R \gamma I_2 \Rightarrow -R\gamma = z_{12} = +9{,}5441 + 1{,}947 \leftrightarrows z_{21}$$

$$V_2 = j\omega L_2 I_2 + j\omega M \gamma I_2 + (I_2 + \gamma I_2) \frac{1}{j\omega C} = I_2 \left(j\omega L_2 + j\omega M \gamma + \frac{1}{j\omega C} + \frac{\gamma}{j\omega C} \right)$$

$$z_{22} = 9{,}4830 - 1{,}5335\, j$$