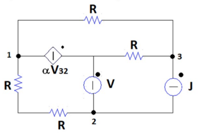
30/01/2019

lunedì 14 dicembre 2020 15:22

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

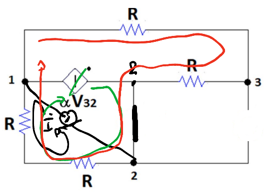


V = 25 V;
J = 1 A;
R = 10 Ω;
α = 0.5;

Risultati:

J_{NO} = -7 A;

R_{NO} = 2.857 Ω;



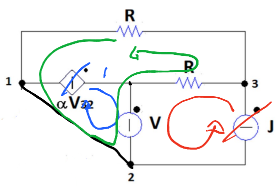
$$\begin{cases} V_{32} = R I_x \\ 4R I_x + 2R\alpha V_{32} - 2R I_p = 0 \\ 4R I_x + 2R^2 \alpha I_x - 2R I_p = 0 \end{cases}$$

$$I_x = \frac{2R I_p}{4R + 2R^2\alpha} = \frac{2 I_p}{4 + 2R\alpha}$$

$$V_p = 2R I_p - 2R I_x - 2R^2 \alpha I_x = 2R I_p - \frac{4R I_p}{4+2R\alpha} - \frac{4R^2\alpha I_p}{4+2R\alpha}$$

$$R_{No} = \frac{V_p}{I_p} = 2R - \frac{4R}{4+2R\alpha} - \frac{4R^2\alpha}{4+2R\alpha} = 2{,}857\ \Omega$$

I_{NO}



$$\begin{cases} 2R I_x - R J = V \\ V_{32} = RJ + V - R I_x \end{cases} \qquad I_x = \frac{V + RJ}{2R}$$

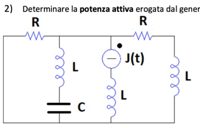
$$\searrow \quad V_{32} = RJ + V - \frac{V}{2} - \frac{RJ}{2}$$

$$V_{32} = \frac{RJ}{2} + \frac{V}{2} = 17{,}5\ V$$

$$I_{NO} = -\alpha V_{32} + I_x = -8{,}75 + 1{,}75 = -7\ A$$

ES 2

2) Determinare la **potenza attiva** erogata dal generatore di **corrente** nel circuito in figura.



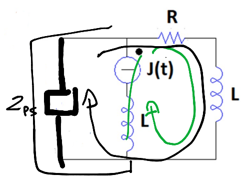
$J(t) = 3\sqrt{2}\sin(1000t)$ A;
R = 20 Ω;
L = 20 mH;
C = 10 μF.

Risultato esercizio 2:

P = 116.76 W;

Risultato esercizio 3:

$i(t) = -0.33e^{-1666.67t}u(t)A$



$$\frac{j\omega L + \frac{1}{j\omega C}}{}$$

$$\frac{-\omega^2 LC + 1}{j\omega C}$$

$$\frac{\frac{-\omega^2 LCR + R}{j\omega C}}{\frac{-\omega^2 LC + 1 + j\omega CR}{j\omega C}}$$

$$Z_{ps} = \frac{-\omega^2 LCR + R}{-\omega^2 LC + 1 + j\omega CR} = 18{,}82 - 4{,}7 j$$

$$Z_{ps} = \frac{-\omega^2 LCR + R}{-\omega^2 LC + 1 + j\omega CR} = 181{,}82 - 4{,}7j$$

$$(R + Z_{ps} + j\omega L)\, I_x + J(R + j\omega L) = 0$$

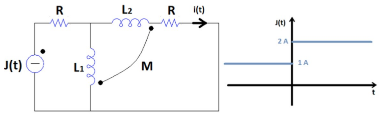
$$I_x = -\frac{J(R + j\omega L)}{R + Z_{ps} + j\omega L} = -1{,}8650 - 0{,}8105j$$

$$V_J = -I_x Z_{ps} + 3 j\omega L = 38{,}3096 + 66{,}4885j$$

$$P_J = V_J \cdot J^* \cong 116{,}76 \text{ W}$$

ES 3

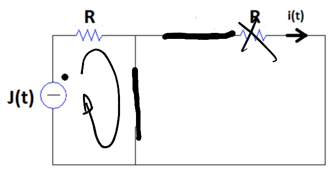
3) Determinare l'andamento temporale della corrente **i(t)** per $-\infty < t < +\infty$, dato l'andamento di corrente erogato dal generatore come da figura a destra. Il circuito è ipotizzato a regime per tempi negativi.



R = 10 Ω;
L₁ = 10 mH;
L2 = 20 mH;
M = 12 mH

SOVRAPPOSIZIONE DEGLI EFFETTI

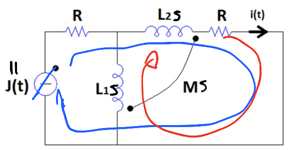
J'



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

$$i' = 0$$

J''



$$(J(s) + I_x) L_2 s - Ms I_x + R(J(s) + I_x) + I_x L_1 s - Ms(I_x + J(s)) = 0$$

$$I_x(s)\left(L_2 s + Ms + R + L_1 s - Ms\right) + J(s) L_2 s + R J(s) - Ms J(s) = 0$$

$$I_x = \frac{L_2 + \frac{R}{s} - M}{R + s(L_2 - 2M + L_1)}$$

$$i''(s) = \frac{L_2 + \frac{R}{s} - M}{R + s(L_2 - 2M + L_1)} + \frac{1}{s} = \frac{L_2 s + R - Ms + R + s L_2 - 2Ms + sL_1}{s(R + s(-2M + L_1 + L_2))} = \frac{2R + s(2L_2 + L_1 - 3M)}{s(R + s(-2M + L_1 + L_2))}$$

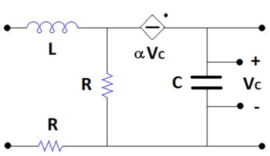
$$s_1 = 0 \qquad s_2 = -1666{,}67$$

$$A_1 = \lim_{s \to 0}$$

$$A_2 = \lim_{s \to s_2} \frac{3333{,}33 + s(2{,}33)}{-1666{,}67} = 0{,}33$$

ES 4

4) Determinare la rappresentazione a parametri **T** della rete a due porte indicata in figura. Si ipotizzi che il circuito si trovi a regime periodico sinusoidale con pulsazione ω.

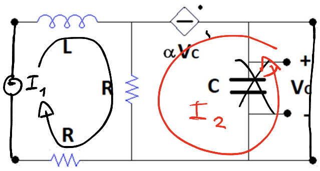


R = 10 Ω;
L = 10 mH;
C = 50 μF;
α = 0.8;
ω = 1000 rad/sec.

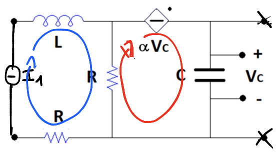
Risultati:

$$T = \begin{bmatrix} -0.1 + 0.7j & 10 + 10j \\ 0.02 + 0.05j & 1 \end{bmatrix}$$

$$\begin{cases} V_1 = A V_2 + B(-I_2) \\ I_1 = C V_2 + D(-I_2) \end{cases} \qquad -I_2 = \frac{I_1}{D} - \cancel{\frac{C}{D} V_2} \qquad -D I_2 = I_1$$



$$\begin{cases} V_c = 0 \\ I_1 = -I_2 \quad \Rightarrow \quad D = 1 \\ V_1 = (2R + j\omega L) - I_2 + R I_2 = (R + j\omega L) - I_2 \quad \Rightarrow \quad B = 10 + 10j \end{cases}$$



$$\begin{cases} V_c = \frac{1}{j\omega C} I_x \\ \alpha V_c = -R I_1 + \frac{I_x}{j\omega C} + R I_x \end{cases}$$

$$I_x \left(\frac{\alpha - 1}{j\omega C} - R \right) = -R I_1 \qquad I_x = \frac{-R}{\frac{\alpha-1}{j\omega C} - R} I_1 = \gamma I_1 = (0{,}862 + 0{,}3448 j) I_1$$

$$V_2 = \frac{\gamma I_1}{j\omega C} \qquad I_1 = \frac{j\omega C}{\gamma} V_2$$

$$C = 0{,}02 + 0{,}05 j$$

$$V_1 = (2R + j\omega L) I_1 - R \gamma I_1 = (2R + j\omega L) \frac{j\omega C}{\gamma} V_2 - R j\omega C V_2$$

$$V_1 = V_2 \left(\frac{2R j\omega C}{\gamma} + - \frac{\omega^2 LC}{\gamma} - R j\omega C \right)$$