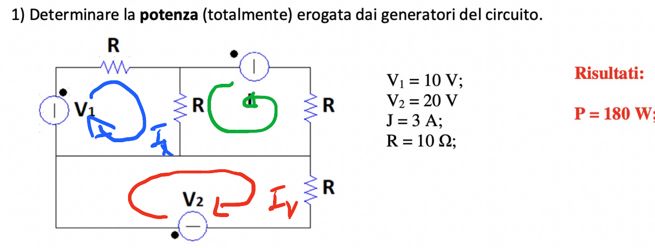
5/06/2019

sabato 19 dicembre 2020 10:26

1) Determinare la **potenza** (totalmente) erogata dai generatori del circuito.



$V_1 = 10$ V;
$V_2 = 20$ V
$J = 3$ A;
$R = 10\ \Omega$;

Risultati:

P = 180 W;

$$\begin{cases} I_y = \dfrac{V_2}{R} = 2\ A \\ 2R I_x + RJ = V_1 \end{cases} \qquad I_x = \frac{V_1 - RJ}{2R} = -1\ A$$

$$P_2 = 2 \cdot 20 = 40\ W$$

$$P_1 = 10 \cdot (-1) = -10\ W$$

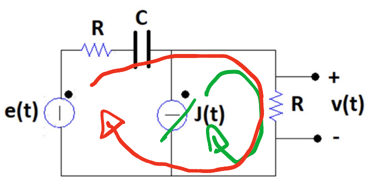
$$V_J = 2RJ + I_x \cdot R = 60 - 10 = 50$$

$$P_J = 50 \cdot 3 = 150\ W$$

$$P_{TOT} = P_1 + P_2 + P_J = 180\ W$$

ES 2

2) Determinare l'andamento temporale della tensione **v(t)** e la **potenza reattiva Q** impegnata nel condensatore del circuito in figura.



$e(t) = 50\sqrt{2}\sin(1000t)$ V;
$J(t) = 2\sqrt{2}\cos(1000t)$ A; $2\sqrt{2}\sin(1000t + \pi/2)$ A
$R = 10\ \Omega$;
$C = 100\ \mu$F;

Risultati:

$v(t) = 32.56\sqrt{2}\sin(1000t + 0.74)$ V;

Q = -58 VAR;

$$\dot{E} = 50$$

$$\dot{J} = +2j$$

$$2R\dot{I}_x + \frac{\dot{I}_x}{jwC} + R\dot{J} = \dot{e}$$

$$I_x = \frac{\dot{E} - R\dot{J}}{\ldots} = 2{,}4 + 0{,}2j$$

$$I_x = \frac{\dot{E} - R J}{2R + \frac{1}{J\omega C}} = 2{,}4 + 0{,}2J$$

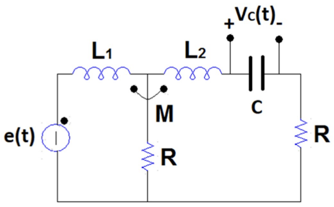
$$\dot{V}_R = R(I_x + \dot{J}) = 24 + 22J =$$

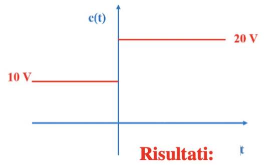
$$V(t) = 32{,}56\sqrt{2}\,\sin(1000t + 0{,}74)$$

$$P_c = \frac{I_x}{J\omega C} I_x^* = -58 \text{ VAR}$$

Es 3

3) Determinare l'andamento temporale della tensione **Vc(t)** ai capi del condensatore per $-\infty < t < +\infty$, considerando l'andamento della tensione e(t) come in figura.





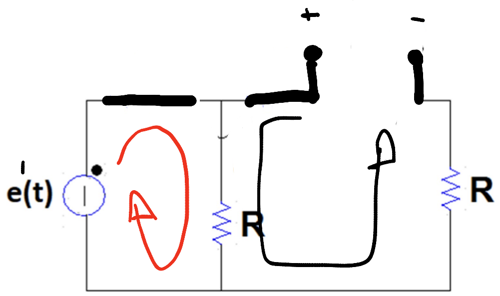
R = 100 Ω;
L_1 = 10 mH;
L_2 = 20 mH;
M = 10 mH;
C = 10 μF.

Risultati:

v(t) = [10 + (1.455 e^{-8873t}-11.455 e^{-1127t}+10)u(t)] V

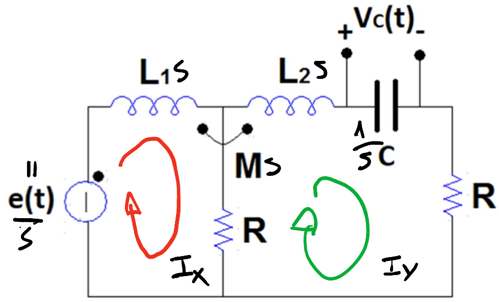
$$e(t) = e' + e'' = 10 + 10\,u(t)$$

ATTIVO e'



$$V_c'(t) = e' = 10 \text{ V}$$

ATTIVO e''



$$\begin{cases} (R + L_1 s)\, I_x(s) - R\, I_y - M s\, I_y(s) = e''(s) \\ \left(L_2 s + 2R + \dfrac{1}{sC}\right) I_y - (R + Ms)\, I_x = 0 \end{cases}$$

$$I_x(s) = \frac{e''/s + (R + Ms)\, I_y}{R + L_1 s}$$

$$\left(L_2 s + 2R + \frac{1}{sC}\right) I_y - \frac{e''}{s} - (R + Ms)\, I_y = 0$$

$$I_y \left(L_2 s + 2R + \frac{1}{sC} - R - Ms \right) = \frac{e''}{s}$$

$$I_y = \frac{e''/s}{(L_2 - M)s + \frac{1}{sC} + R} = \frac{e''}{(L_2 - M)s^2 + 1/C + Rs}$$

$$V_c(s) = \frac{e''}{\left[(L_2 - M)s^2 + \frac{1}{C} + Rs\right] sC} = \frac{e''}{\left[(L_2C - MC)s^2 + 1 + RCs\right] s}$$

$$V_c(s) = \frac{10^8}{s\left(s^2 + 10^7 + 10^4 s\right)}$$

$$s_1 = 0$$

$$s_{2,3} = \underline{-10^4 \pm \sqrt{10^8 - 4\,10^7}} = \begin{cases} -1127{,}01 \simeq -1127 \\ -8872{,}98 = -8873 \end{cases}$$

$$s_{2,3} = \frac{-10^4 \pm \sqrt{10^8 - 4\,10^7}}{2} = \begin{cases} -1127,04 \approx -1127 \\ -8872,98 = -8873 \end{cases}$$

$$A_1 = \lim_{s \to 0} \frac{10}{1} = 10$$

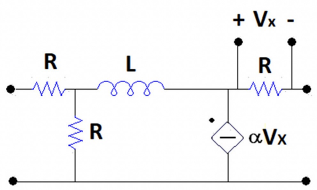
$$A_2 = \lim_{s \to -1127} \frac{10^8}{s(s+8873)} = -11,455$$

$$A_3 = \lim_{s \to -8873} \frac{10^8}{s(s+1127)} = 1,455$$

$$V_c(t) = 10 + \left(10 + 1,455\, e^{-8873t} - 11,455\, e^{-1127t}\right) u(t)$$

ES 4

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

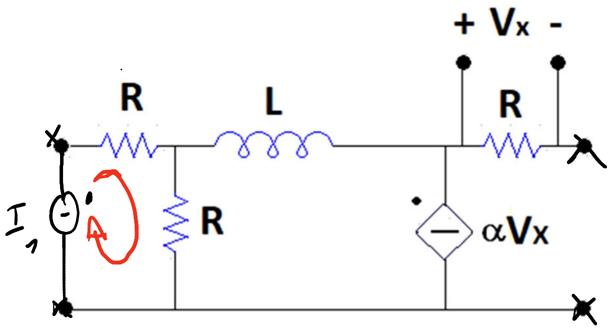


R = 10 Ω;
L = 10 mH;
α = 0.1 A/V;
ω = 1000 rad/sec.

Risultati:

$$T = \begin{bmatrix} 2 & 20 \\ 0.1 & 1 \end{bmatrix}$$

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



$V_x = 0 \Rightarrow \alpha V_x = 0$

$V_1 = 2R\,I_1$

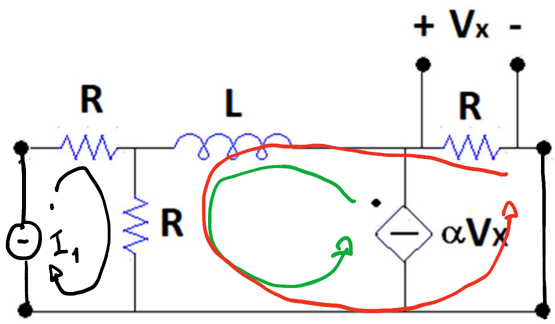
$V_2 = R\,I_1$

$I_1 = \frac{V_2}{R} \Rightarrow C = \frac{1}{R} = 0,1$

R R

$V_2 = R I_1$

$V_1 = 2 V_2 \Rightarrow A = 2$



$$\begin{cases} V_x = -R I_2 \\ (2R + j\omega L) I_2 + (R + j\omega L)\, \alpha V_x + R I_1 = 0 \end{cases}$$

$$(2R + j\omega L) I_2 - R^2 \alpha I_2 - R\alpha j\omega L I_2 = -R I_1$$

$$I_1 = \frac{I_2 (2R + \cancel{j\omega L} - R^2\alpha - \cancel{j\omega L})}{-R}$$

$$I_1 = -I_2 \left(\frac{2\cancel{R} - R^{\cancel{2}}\alpha}{\cancel{R}} \right) = -I_2 (1)$$

$D = 1$

$$V_1 = 2R I_1 + \alpha V_x R + R I_2$$

$$V_1 = -2R I_2 - \alpha R^2 I_2 + R I_2$$

$$V_1 = (-2R - \alpha R^2 + R) I_2 = (2R + \alpha R^2 - R)(-I_2)$$

$B = 20$