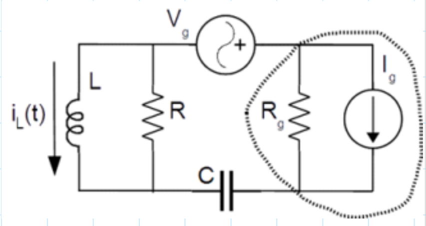
ESERCIZIO 1



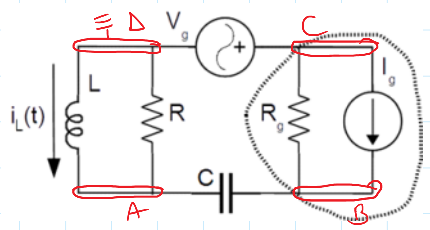
Il circuito in figura si trova a regime permanente sinusoidale, determinare (i) la potenza complessa generata ed erogata dal generatore reale di corrente racchiuso nella linea tratteggiata e formato dal generatore ideale di corrente Ig e dalla resistenza Rg; (ii) la corrente $i_L(t)$ che scorre nell'induttore.

DATI: $V_g = k_N cos(100t) + 2sen(100t)$ [V], $I_g = -3cos(100t+\pi)$ [A], R=2 [Ω], $R_g = \boldsymbol{k_c}$ [Ω], L = 20 [mH], C = 2 [mF].

SVOLGIMENTO

1) FASORI E IMPEDENZE $\bar V_g = K_N - 2J\,[V]$; $\bar I_g = 3\,[A]$; $Z_R \triangleq R = 2\,[\Omega]$

$Z_{R_g} \triangleq R_g = K_C\,[\Omega]$; $Z_L = J\omega L = 2J\,[\Omega]$; $Z_C = \frac{-J}{\omega C} = -5J\,[\Omega]$



$\bar e_D = \bar 0$; $\bar e_C = \bar V_g$; $\bar e_A, \bar e_B$ incogniti

A: $\frac{\bar e_A}{Z_L} + \frac{\bar e_A}{R} + \frac{\bar e_A - \bar e_B}{Z_C} = 0$

B: $\frac{\bar e_B - \bar V_g}{R_g} + \frac{\bar e_B - \bar e_A}{Z_C} = \bar I_g$

$$\begin{bmatrix} Y_L + Y_R + Y_C & -Y_C \\ -Y_C & Y_{R_g} + Y_C \end{bmatrix} \begin{bmatrix} \bar e_A \\ \bar e_B \end{bmatrix} = \begin{bmatrix} 0 \\ \bar I_g + \bar V_g Y_{R_g} \end{bmatrix} \Rightarrow \begin{bmatrix} -\frac{J}{2} + \frac{1}{2} + \frac{J}{5} & -\frac{J}{5} \\ -\frac{J}{5} & \frac{1}{K_C} + \frac{J}{5} \end{bmatrix} \begin{bmatrix} e_A \\ e_B \end{bmatrix} = \begin{bmatrix} 0 \\ 3 + \frac{(K_N - 2J)}{K_C} \end{bmatrix}$$

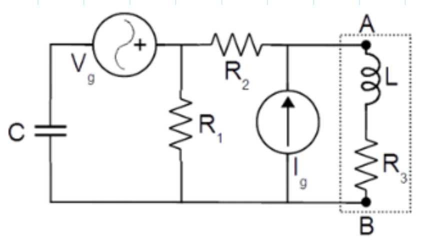
$$\bar S^{GEN}_{I_g} = \frac{1}{2} \bar V_{I_g} \cdot \bar I_g^* = \frac{1}{2}(e_B - V_g) I_g^*$$

$$\bar S^{ERO}_{I_g} = \bar S^{GEN}_{I_g} - \bar S_{R_g} = \frac{1}{2}(e_B - V_g) I_g^* - \frac{1}{2}(e_B - V_g)\frac{(e_B - V_g)^*}{R_g} = \frac{1}{2}(e_B - V_g)\left[I_g^* - \frac{(e_B - V_g)^*}{R_g}\right]$$

$$= \underset{[W]}{P} + J \underset{[VAR]}{Q}$$

$$\bar i_L = \frac{e_D - e_A}{Z_L} = -e_A Y_L \Rightarrow i_L(t) = |i_L| \cos(\omega t + Arg(I_L))$$

ESERCIZIO 1



Il circuito in figura si trova a regime permanente sinusoidale, determinare (i) il circuito equivalente di Thevenin visto dal bipolo L-R3; (ii) a partire dal risultato del punto precedente, calcolare la potenza istantanea del bipolo e rappresentarne graficamente l'andamento temporale.

DATI: $V_g = 10cos(t + 53.13°)$ [V], $I_g = -sin(t)$ [A], R_1=5 [Ω], R_2=5[Ω], $R_3 = k_C$ [Ω], L = k_N [H], C = 1 [F].

FASORI E IMPEDENZE

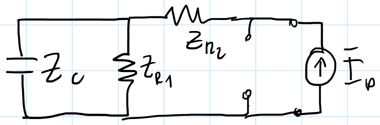
$\bar V_g = 6 + 4J$ [V]; $\bar I_g = J$ [A]; $Z_{R_1} \triangleq R_1 = 5\,[\Omega]$; $Z_{R_2} \triangleq R_2 = 5\,[\Omega]$; $Z_{R_3} \triangleq R_3 = K_C\,[\Omega]$

FASORI E IMPEDENZE

$\bar{V}_g = 6 + 4J \; [V] \; ; \; \bar{I}_g = J \; [A] \; ; \; Z_{R_1} \doteq R_1 = 5 [\Omega] ; \; Z_{R_2} \doteq R_2 = 5 [\Omega] ; \; Z_{R_3} \doteq R_3 = K_C [\Omega]$

$Z_L = J\omega L = K_N J \; [\Omega] \; ; \; Z_C = \frac{-J}{\omega C} = -J \; [\Omega] \; ; \; Z_{LR_3} = K_C + K_N J$

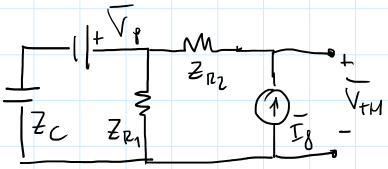
Z_{TH} => DISATTIVO I GENERATORI



$$Z_{TH} = (Z_C // Z_{R1}) + Z_{R2} = \frac{Z_C \, Z_{R1}}{Z_C + Z_{R1}} + Z_{R2}$$

$$Z_{TH} = \frac{-5J}{5-J} + 5 = \frac{-5J + 25 - 5J}{5-J} = \frac{25 - 10J}{5-J} = \frac{125 + 25J - 50J + 10}{26} = \frac{135 - 25J}{26} \; [\Omega]$$

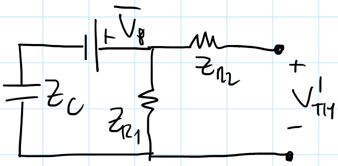
V_{TH}



PSE

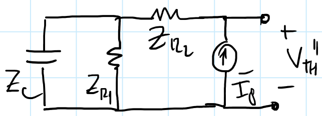
$$V_{TH} = V'_{TH}\Big|_{\bar{I}_g = 0} + V''_{TH}\Big|_{\bar{V}_g = 0}$$

V'_{TH}



$$V'_{TH} = \frac{\bar{V}_g \cdot Z_{R_1}}{Z_{R1} + Z_C} = \frac{\bar{V}_g \cdot 5}{5 - J} = \frac{\bar{V}_g \, (25 + 5J)}{26}$$

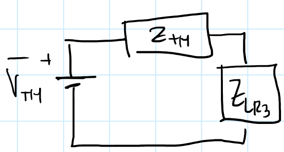
V''_{TH}



$$V''_{TH} = \bar{I}_g \cdot Z_{TH} = \bar{I}_g \cdot \frac{135 - 25J}{26}$$

$$V_{TH} = V'_{TH} + V''_{TH} = \frac{\bar{V}_g (25 + 5J) + \bar{I}_g (135 - 25J)}{26} = \frac{155 + 265J}{26}$$

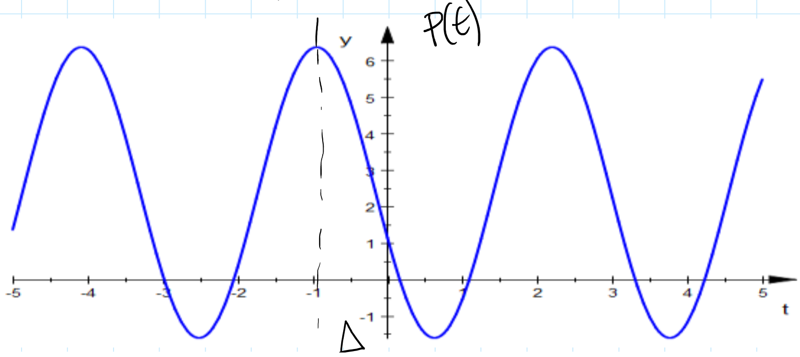
$S_{L-R_3} = ?$



$$S_{L-R_3} = \frac{1}{2} Z_{L-R_3} \cdot \frac{|V_{TH}|^2}{|Z_{TH} + Z_{LR_3}|^2}$$

$$\phi_{S_{L-R_3}} = \operatorname{arctg}\left(\frac{K_N}{K_C}\right)$$

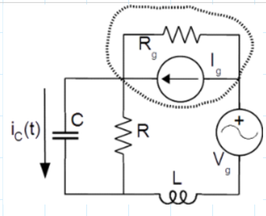
$$\theta_i = \operatorname{Arg}\left(\frac{V_{TH}}{Z_{TH} + Z_{LR_3}}\right) =$$



ESONERO 31 MAGGIO COMPITOB

06 June 2017 00:30

ESERCIZIO 1



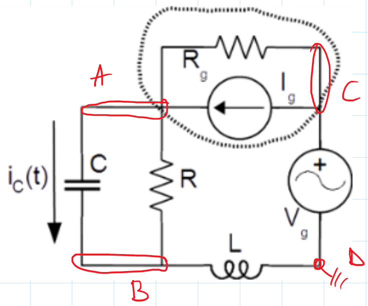
Il circuito in figura si trova a regime permanente sinusoidale, determinare (i) la potenza complessa generata ed erogata dal generatore reale di corrente racchiuso nella linea tratteggiata e formato dal generatore ideale di corrente Ig e dalla resistenza Rg; (ii) la corrente $i_C(t)$ che scorre nel condensatore.

DATI: $V_g = 3cos(50t) - \boldsymbol{k_n}sen(50t)$ [V], $I_g = 3cos(50t-\pi)$ [A], R=4 [Ω], $R_g = \boldsymbol{k_c}$ [Ω], L = 80 [mH], C = 2 [mF].

SVOLGIMENTO

1) FASORI E IMPEDENZE $\bar{V}_g = 3 + K_N J\,[V]$; $\bar{I}_g = -3\,[A]$; $Z_R \doteq R = 4\,\Omega$

$Z_{R_g} \doteq R_g = K_C[\Omega]$; $Z_L = J\omega L = 4J\,[\Omega]$; $Z_C = \frac{-J}{\omega C} = -10J\,[\Omega]$



$\bar{e}_C = \bar{V}_g$; $\bar{e}_D = \bar{0}$; $\bar{e}_A, \bar{e}_B$ incognite

(A) $(\bar{e}_A - \bar{e}_B)(Y_C + Y_R) + (\bar{e}_A - \bar{V}_g)Y_{R_g} = \bar{I}_g$

(B) $(\bar{e}_B - \bar{e}_A)(Y_C + Y_R) + \bar{e}_B Y_L = \bar{0}$

$$\begin{bmatrix} Y_C + Y_R + Y_{R_g} & -(Y_C + Y_R) \\ -(Y_C + Y_R) & Y_C + Y_R + Y_L \end{bmatrix} \begin{bmatrix} \bar{e}_A \\ \bar{e}_B \end{bmatrix} = \begin{bmatrix} \bar{I}_g + \bar{V}_g Y_{R_g} \\ 0 \end{bmatrix} \Rightarrow \begin{bmatrix} \frac{J}{10} + \frac{1}{4} + \frac{1}{K_C} & -\left(\frac{J}{10} + \frac{1}{4}\right) \\ -\left(\frac{J}{10} + \frac{1}{4}\right) & \frac{J}{10} + \frac{1}{4} - \frac{J}{4} \end{bmatrix} \begin{bmatrix} \bar{e}_A \\ \bar{e}_B \end{bmatrix} = \begin{bmatrix} -3 + \frac{(3 + K_N J)}{K_C} \\ 0 \end{bmatrix}$$

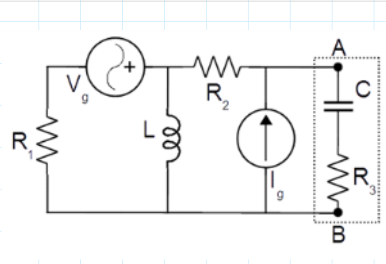
$S_{I_g}^{GEN} = \frac{1}{2} V_{I_g} \cdot I_g^* = \frac{1}{2}(\bar{e}_A - \bar{V}_g) I_g^*$

$S_{I_g}^{ERO} = S_{I_g}^{GEN} - S_{R_g} = \frac{1}{2}(\bar{e}_A - V_g)\left[I_g^* - \frac{(e_A - V_g)^*}{R_g^*}\right] = \frac{1}{2}(\bar{e}_A - \bar{V}_g) I_g^* - \frac{1}{2R_g}\left|\bar{e}_A - \bar{V}_g\right|^2$

$i_C(t)? \Rightarrow \bar{I}_C = \frac{\bar{e}_A - \bar{e}_B}{Z_C} \Rightarrow i_C(t) = \left|\frac{e_A - e_B}{Z_C}\right| \cos\left(\omega t + Arg\left(\frac{e_A - e_B}{Z_C}\right)\right)$

$Arg\left(\frac{e_A - e_B}{Z_C}\right) = Arg(e_A - e_B) - Arg(Z_C) = Arg(e_A - e_B) + \frac{\pi}{2}$; $\left|\frac{e_A - e_B}{Z_C}\right| = \frac{|e_A - e_B|}{10}$

ESERCIZIO 2



Il circuito in figura si trova a regime permanente sinusoidale, determinare (i) il circuito equivalente di Thevenin visto dal bipolo C-R3; (ii) a partire dal risultato del punto precedente, calcolare la potenza istantanea del bipolo e rappresentarne graficamente l'andamento temporale.

DATI: $V_g = 5cos(t + 36.87°)$ [V], $I_g = \mathbf{2}sin(t)$ [A], R_1=10 [Ω], R_2=10 [Ω], $R_3 = k_C$ [Ω], L = 5 [H], $C = \frac{1}{kN}$ [F].

FASORI E IMPEDENZE $\bar{V}_g = 4 + 3J\,[V]$; $\bar{I}_g = -2J\,[A]$

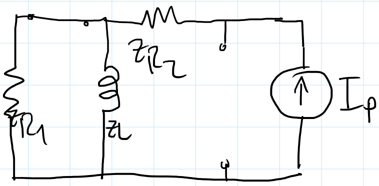
$Z_{R_1} = R_1 = 10[\Omega]$; $Z_{R_2} \doteq R_2 = 10[\Omega]$; $Z_{R_3} \doteq R_3 = K_C[\Omega]$; $\omega = 1$

$Z_L = J\omega L = 5J\,[\Omega]$; $Z_C = \frac{-J}{\omega C} = -K_N J\,[\Omega]$ $Z_{CR_3} = K_C - K_N J$

$Z_{TH} \Rightarrow$ DISATTIVO I GENERATORI

$R_1 J\omega L$ ... R_2

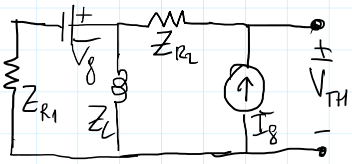
Z_{TH} => DISATTIVO I GENERATORI



$$Z_{TH} = (Z_{R_1} // Z_L) + Z_{R_2} = \frac{R_1 J\omega L}{R_1 + J\omega L} + R_2$$

$$= \frac{(R_1+R_2)J\omega L + R_1R_2}{R_1 + J\omega L} = \frac{100J + 100}{10+5J} = \frac{\cancel{1500} - \cancel{600}J}{\cancel{125}} \; 12-4J \; [\Omega]$$

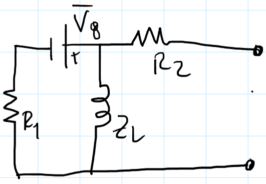
V_{TH}



PSE

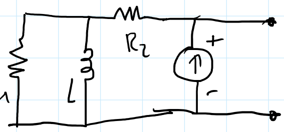
$$V_{TH} = V'_{TH}\Big|_{\bar{I}_g=0} + V''_{TH}\Big|_{\bar{V}_g=0}$$

V'_{TH}



$$V'_{TH} = \frac{\bar{V}_g}{Z_L + R_1} \cdot Z_L = \frac{4+3J}{10+5J} \cdot 5J = \frac{-15+20J}{10+5J}$$

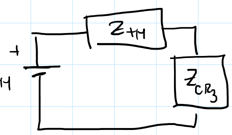
V''_{TH}



$$V''_{TH} = \bar{I}_g \cdot Z_{TH} = -2J \cdot \frac{100J+100}{10+5J} = \frac{200-200J}{10+5J}$$

$$V_{TH} = V'_{TH} + V''_{TH} = \frac{185-180J}{10+5J} = \frac{37-36J}{2+J} = \frac{38-109J}{5}$$

$S_{L-R_3} = ?$



$$S_{C-R_3} = \frac{1}{2} Z_{C-R_3} \cdot \frac{|V_{TH}|^2}{|Z_{TH} + Z_{CR_3}|^2}$$

$$\phi_{Z_{C-R_3}} = \operatorname{arctg}\left(\frac{-K_W}{K_C}\right)$$

$$\theta_i = Arg\left(\frac{V_{TH}}{Z_{TH} + Z_{LR_3}}\right) =$$