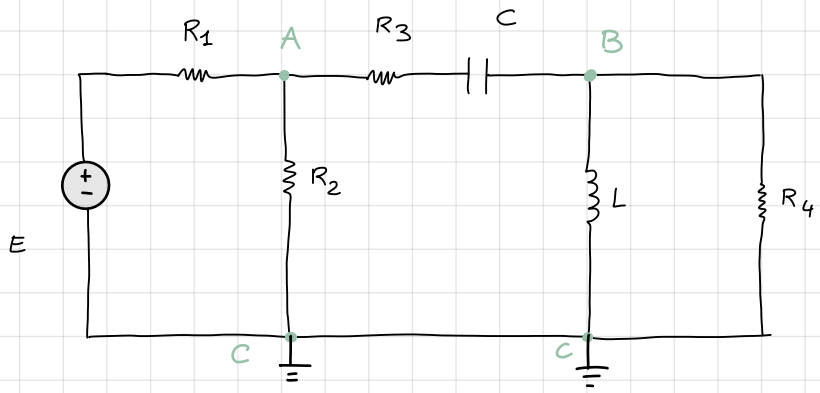
POTENZIALI DI NODO



DATI

$E(t) = 214\cos(314\,t)$ $\Rightarrow \omega = 314$

$R_1 = R_4 = 10\,\Omega$ (A, D) $\qquad R_2 = R_3 = 5\,\Omega$ (B, C)

$L = 40\,mH \qquad C = 470\,\mu F$

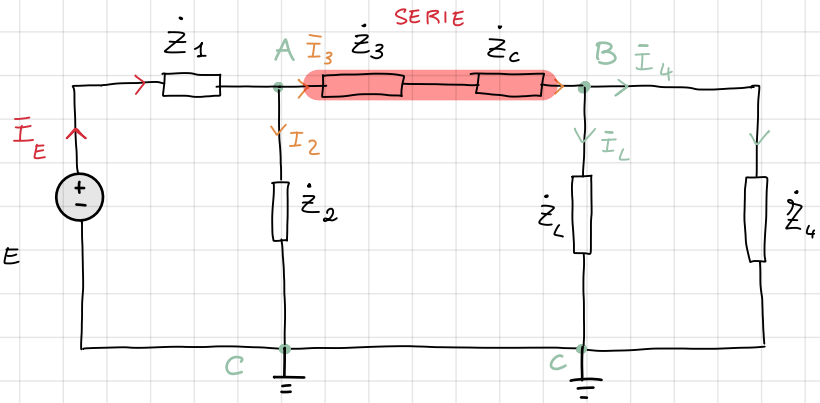
Q_1: Potenza erogata (cmplx) dal generatore

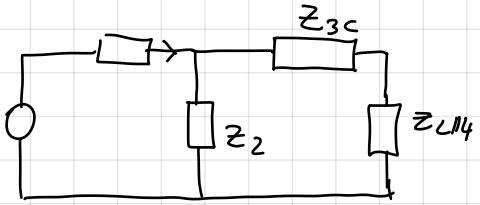
Q_2: Potenza Totale media assorbita da R_1, R_2, R_3, R_4

(1) Impedenze e circuito relativo

- $R_1 = R_4 = \dot{Z}_1 = \dot{Z}_4 = 10\,\Omega$ (A, D) $\qquad R_2 = R_3 = \dot{Z}_2 = \dot{Z}_3 = \boxed{5\,\Omega}$ (B, C)
- $L = \dot{Z}_L = j\omega L = j \cdot 314 \cdot 40 \times 10^{-3}\,H = \boxed{12.56j\,\Omega}$ (E)
- $C = \dot{Z}_C = -\frac{j}{\omega C} = -\frac{j}{314 \cdot 470 \times 10^{-6}} = \boxed{-6.78j\,\Omega}$ (F)

$A\cos(\omega t + \alpha) \rightleftharpoons A e^{j\alpha} \Rightarrow E(t) = 214\cos(314t) \rightleftharpoons \bar{E} = 214\, e^{j\cdot 0} = \boxed{214\,V}$ (X)





INIZIO COL METODO

(a) Assegno potenziale nullo $U_C = 0$

(b) LKC AI NODI $(n-1)$

$$A:\begin{cases} -\bar{I}_E + \bar{I}_3 + \bar{I}_2 = 0 \\ B: \; -\bar{I}_3 + \bar{I}_4 + \bar{I}_L = 0 \end{cases}$$

$\ast\ \bar{I}_E = \bar{I}_1 = \bar{V}_{Z_1} \cdot \dot{Z}_1$

(c) Tensioni di Lato in funzione dei potenziali

- $\bar{V}_{Z_1} = \bar{U}_E - \bar{U}_A$
- $\bar{V}_{Z_2} = \bar{U}_A$
- $\bar{V}_{Z_3} = \bar{U}_A - \bar{U}_B$
- $\bar{V}_{Z_4} = \bar{U}_B$
- $\bar{V}_{Z_C} = \bar{U}_A - \bar{U}_B$
- $\bar{V}_{Z_L} = \bar{U}_B$

(d) Sostituisco i potenziali nelle 2 KC $\quad \bar{V} = \dot{Z}\cdot\bar{I} = 0 \;\; \bar{I} = \frac{\bar{V}}{\dot{Z}}$

$$\begin{cases} -\frac{\bar{V}_E}{\dot{Z}_1} + \frac{\bar{V}_{Z_3}}{\dot{Z}_3+\dot{Z}_C} + \frac{\bar{V}_{Z_2}}{\dot{Z}_2} = 0 \\ -\frac{\bar{V}_{Z_3}}{\dot{Z}_3+\dot{Z}_C} + \frac{\bar{V}_{Z_4}}{\dot{Z}_4} + \frac{\bar{V}_{Z_L}}{\dot{Z}_L} = 0 \end{cases} = 0 \quad \begin{cases} -\frac{\bar{U}_E-\bar{U}_A}{\dot{Z}_1} + \frac{\bar{U}_A-\bar{U}_B}{\dot{Z}_3+\dot{Z}_C} + \frac{\bar{U}_A}{\dot{Z}_2} = 0 \\ -\frac{\bar{U}_A-\bar{U}_B}{\dot{Z}_3+\dot{Z}_C} + \frac{\bar{U}_B}{\dot{Z}_4} + \frac{\bar{U}_B}{\dot{Z}_L} = 0 \end{cases}$$

$$\begin{cases} -\frac{U_E}{Z_1} + \frac{U_A}{Z_1} + \frac{U_A}{Z_3+Z_C} - \frac{U_B}{Z_3+Z_C} + \frac{U_A}{Z_2} = 0 \\ -\frac{U_A}{Z_3+Z_C} + \frac{U_B}{Z_3+Z_C} + \frac{U_B}{Z_4} + \frac{U_B}{Z_L} = 0 \end{cases}$$

$$\begin{cases} U_A\left(\frac{1}{Z_1} + \frac{1}{Z_3+Z_C} + \frac{1}{Z_2}\right) + U_B\left(-\frac{1}{Z_3+Z_C}\right) = \frac{U_E}{Z_1} \\ U_A\left(-\frac{1}{Z_3+Z_C}\right) + U_B\left(\frac{1}{Z_3+Z_C} + \frac{1}{Z_4} + \frac{1}{Z_L}\right) = 0 \end{cases}$$

a, b, c = F, d, e

Cramer

$$U_A = \frac{\begin{vmatrix} e & b \\ f & d \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}} = \frac{ed-bf}{ad-bc} = 44.96 - 19.21j \;\; U_A$$

$a = 0.37 + 0.096\,j$
$b = -0.07 + 0.096\,j = c$
$d = 0.17 + 0.016\,j$
$e = 21.4$
$f = 0$

$$U_B = \frac{\begin{vmatrix} a & e \\ c & f \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}} = \frac{af-ec}{ad-bc} = 4.49 - 33.72j \;\; U_B$$

$\bar{I}_1$ Y, X

$\Rightarrow \bar{I}_E = \frac{\bar{E}-\bar{U}_A}{\dot{Z}_1} = 16.9 + 1.92j$ A

$\Rightarrow P_E^e = \frac{1}{2}\bar{E}\cdot\bar{I}^* = 1809 - 205.5j$ W

NON MI TROVO CON I RISULTATI NUMERICI

$$\begin{cases} \bar{U}_A = 62.4 - 2,44\,j \text{ V} \\ \bar{U}_B = 28.68 - 30,13\,j \text{ V} \end{cases}$$

$\bar{I}_1 \equiv \bar{I}_E = \frac{214 - U_A}{10} = 16.9 + 1.92j$

$\Rightarrow \bar{I}_E = \frac{\bar{V}_1}{\dot{Z}_1} = \frac{(\bar{U}_E - \bar{U}_A)}{\dot{Z}_1} =$ ($V_1 = U_E - U_A$)

D

$\frac{\bar{E}-\bar{U}_A}{\dot{Z}_1} = 15.16 + 0.24j$??

esce $24 - 6j$ A ??

$\Rightarrow \hat{P}^{e}_{\bar{E}} = \frac{1}{2}\,\bar{E}\cdot\bar{I}_{E}^{*} = 2568 + 642j$?? 2880 W + 720 j

Potenza media = potenza erogata

$P_{TOT} = \bar{P}_1 + \bar{P}_2 + \bar{P}_3 + \bar{P}_4$ Potenza attiva $\Rightarrow P_{TOT} = 2880\,W$

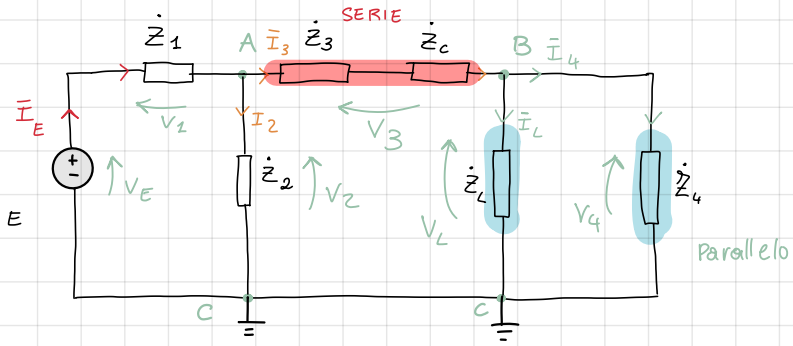
P_{TOT} ↑ ATTIVA

(1) Impedenze e circuito relativo

$\dot{Z}_1 = \dot{Z}_4 = 10\ \Omega$ (A, D) $\quad \dot{Z}_2 = \dot{Z}_3 = 5\ \Omega$ (B, C)

$\dot{Z}_L = 12.56j\ \Omega$ (E) $\quad \dot{Z}_C = -6.78j\ \Omega$ (F)

$\bar{E} = 214\ V$ (X)



(1) LKC

$$\begin{cases} -\bar{I}_E + \bar{I}_2 + \bar{I}_3 = 0 \\ -\bar{I}_3 + \bar{I}_L + \bar{I}_4 = 0 \end{cases}$$

(2) Potenziali $(U_C = 0)$

$\bar{V}_{Z_1} = \bar{U}_E - \bar{U}_A$
$\bar{V}_{Z_2} = \bar{U}_A$
$\bar{V}_{Z_{3C}} = \bar{U}_A - \bar{U}_B$
$\bar{V}_{Z_L} = \bar{U}_B$
$\bar{V}_{Z_4} = \bar{U}_B$

(3) Sostituisco $\quad V = ZI \rightarrow I = \frac{V}{Z}$

$$\Rightarrow \begin{cases} -\dfrac{\bar{U}_E - \bar{U}_A}{\dot{Z}_1} + \dfrac{\bar{U}_A}{\dot{Z}_2} + \dfrac{\bar{U}_A - \bar{U}_B}{\dot{Z}_{3C}} = 0 \\ -\dfrac{\bar{U}_A - \bar{U}_B}{\dot{Z}_{3C}} + \dfrac{\bar{U}_B}{\dot{Z}_L} + \dfrac{\bar{U}_B}{\dot{Z}_4} = 0 \end{cases}$$

$$\Rightarrow \begin{cases} U_A \left(\dfrac{1}{Z_1} + \dfrac{1}{Z_2} + \dfrac{1}{Z_{3C}} \right) + U_B \left(-\dfrac{1}{\dot{Z}_{3C}} \right) = \dfrac{U_E}{Z_1} \quad e \\ \bar{U}_A \left(-\dfrac{1}{Z_{3C}} \right) + \bar{U}_B \left(\dfrac{1}{Z_{3C}} + \dfrac{1}{Z_L} + \dfrac{1}{\dot{Z}_4} \right) = 0 \end{cases}$$

(a) (b) (c) (d)

$a = 0.37 + 0.96j$
$b = -0.7 - 0.096j$
$c = -0.7 - 0.096j$
$d = 0.17 + 0.016j$
$e = 21.4\ V$

$$\Rightarrow \bar{U}_A = \frac{\begin{vmatrix} e & b \\ 0 & d \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}} = \frac{ed}{ad - bc} = 2.7 - 2.42j\ V \quad (\bar{U}_A)$$

$$\bar{U}_B = \frac{\begin{vmatrix} a & e \\ c & 0 \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}} = \frac{ec}{ad - bc} = 8.69 + 17.6j\ V \quad (\bar{U}_B)$$

→ Posso calcolare $\bar{I}_E$ $\quad \bar{V} = \dot{z}\,\bar{I} \rightarrow I = \frac{V}{z}$

→ $\bar{I}_E = \frac{\bar{V}_1}{\dot{z}_1} = \frac{\bar{U}_E - \bar{U}_A}{\dot{z}_1} = \frac{\bar{E} - \bar{U}_A}{\dot{z}_1} = 21.13 + 0.242j \text{ A}$

⇒ $\hat{P}_E = \frac{1}{2}\,\bar{E} \cdot \bar{I}_E^* = 2261 - 25.89j$