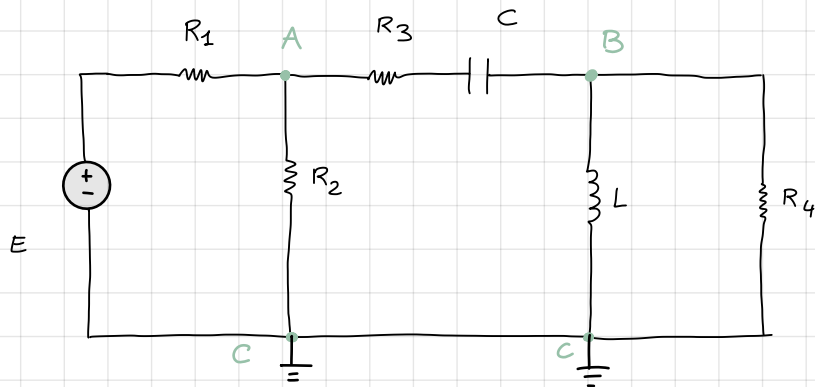


POTENZIALI DI NODO



DATI

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

$$R_1 = R_4 = 10 \Omega \quad R_2 = R_3 = 5 \Omega$$

A D B C

$$L = 40 \text{ mH} \quad C = 470 \mu\text{F}$$

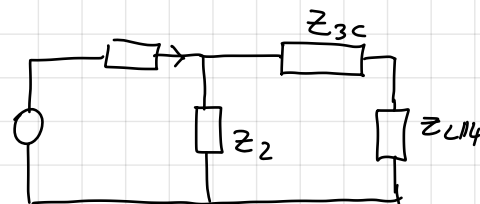
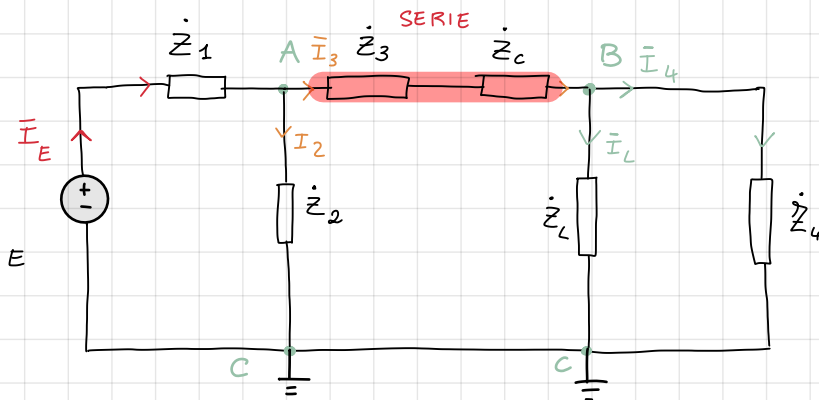
Q_1 : Potenza erogata (comp) dal generatore

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

$$A \cos(\omega t + \alpha) \Rightarrow A e^{j\omega t} \Rightarrow E(t) = 214 \cos(314 t) \Rightarrow \bar{E} = 214 e^{j0} = 214 \text{ V}$$



INIZIO COL METODO

(a) Assegno potenziale nullo $U_C = 0$

(b) LKC A, NODi (n-1)

$$\begin{aligned} A: & \begin{cases} -\bar{I}_E + \bar{I}_3 + \bar{I}_2 = 0 \\ -\bar{I}_3 + \bar{I}_4 + \bar{I}_L = 0 \end{cases} \\ B: & \end{aligned} \quad * \bar{I}_E = \bar{I}_1 = \bar{V}_{Z_1} \cdot \dot{Z}_1$$

(c) Tensioni di Lato in funzione dei potenziali

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

(d) Sostituisco i potenziali nelle LKC

$$\bar{V} = \dot{Z} \cdot \bar{I} = 0 \quad \bar{I} = \frac{\bar{V}}{\dot{Z}}$$

$$\begin{cases} -\frac{\bar{V}_E}{\dot{Z}_1} + \frac{\bar{V}_{z_3}}{\dot{Z}_3 + \dot{Z}_c} + \frac{\bar{V}_{z_2}}{\dot{Z}_2} = 0 \\ -\frac{\bar{V}_{z_3}}{\dot{Z}_3 + \dot{Z}_c} + \frac{\bar{V}_{z_4}}{\dot{Z}_4} + \frac{\bar{V}_{z_L}}{\dot{Z}_L} = 0 \end{cases} = 0 \quad \begin{cases} -\frac{\bar{U}_E - \bar{U}_A}{\dot{Z}_1} + \frac{\bar{U}_A - \bar{U}_B}{\dot{Z}_3 + \dot{Z}_c} + \frac{\bar{U}_A}{\dot{Z}_2} = 0 \\ -\frac{\bar{U}_A - \bar{U}_B}{\dot{Z}_3 + \dot{Z}_c} + \frac{\bar{U}_B}{\dot{Z}_4} + \frac{\bar{U}_B}{\dot{Z}_L} = 0 \end{cases}$$

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

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

Cramer

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

$$U_B = \frac{\begin{vmatrix} a & e \\ c & f \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}} = \frac{af - ec}{ad - bc} = \frac{4.49 - 33.72j}{44.96 - 19.21j} U_B$$

$$\begin{aligned} a &= 0.37 + 0.096j \\ b &= -0.07 + 0.096j = c \\ d &= 0.17 + 0.016j \\ e &= 21.4 \\ f &= 0 \end{aligned}$$

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

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

NON MI TROVO CON I RISULTATI NUMERICI

$$\begin{cases} \bar{U}_A = 62.4 - 2.44j \text{ V} \\ \bar{U}_B = 28.68 - 30.13j \text{ V} \end{cases}$$

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

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

$$\frac{\bar{E} - \bar{U}_A}{\dot{Z}_1} = 15.16 + 0.24j \quad \text{esce } 24 - 6j \text{ A} \quad ??$$

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

Potenza media = Potenza erogata

$$P_{TOT} = \bar{P}_1 + \bar{P}_2 + \bar{P}_3 + \bar{P}_4$$

Potenza attiva

$$\Rightarrow P_{TOT} = 2880W$$

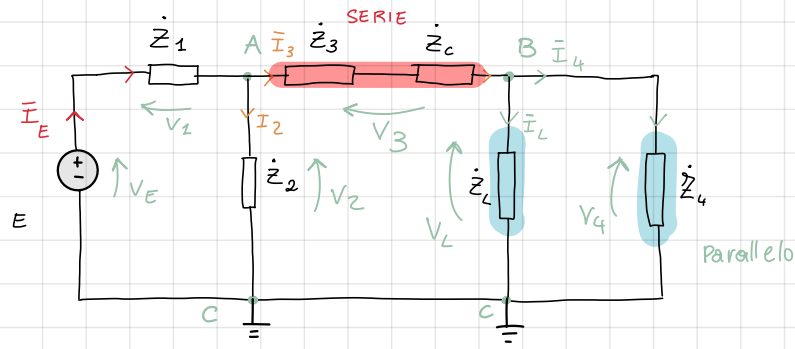
↑
ATTIVA

(1) Impedenze e circuito relativo

$$\dot{Z}_1 = \dot{Z}_4 = 10 \Omega \quad \dot{Z}_2 = \dot{Z}_3 = 5 \Omega$$

$$\dot{Z}_L = 12.56j \Omega \quad \dot{Z}_C = -6.78j \Omega$$

$$\bar{E} = 214 V$$



(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 ($V_c = 0$)

$$\begin{aligned} \bar{V}_{Z_1} &= \bar{U}_E - \bar{U}_A \\ \bar{V}_{Z_2} &= \bar{U}_A \\ \bar{V}_{Z_{3c}} &= \bar{U}_A - \bar{U}_B \\ \bar{V}_{Z_L} &= \bar{U}_B \\ \bar{V}_{Z_4} &= \bar{U}_B \end{aligned}$$

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

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

$$\Rightarrow \begin{cases} \bar{U}_A \left(\frac{1}{\dot{Z}_1} + \frac{1}{\dot{Z}_2} + \frac{1}{\dot{Z}_{3c}} \right) + \bar{U}_B \left(-\frac{1}{\dot{Z}_{3c}} \right) = \frac{\bar{U}_E}{\dot{Z}_1} \quad (a) \\ \bar{U}_A \left(-\frac{1}{\dot{Z}_{3c}} \right) + \bar{U}_B \left(\frac{1}{\dot{Z}_{3c}} + \frac{1}{\dot{Z}_L} + \frac{1}{\dot{Z}_4} \right) = 0 \quad (b) \end{cases}$$

$$\begin{aligned} a &= 0.37 + 0.96j \\ b &= -0.7 - 0.096j \\ c &= -0.7 - 0.096j \\ d &= 0.17 + 0.016j \\ e &= 21.4 V \end{aligned}$$

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

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

-> Posso Calcolare \bar{I}_E $\bar{V} = \bar{Z} \bar{I} \rightarrow I = \frac{V}{Z}$

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

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