COMPITO ELETTROTECNICA 24-06-2015

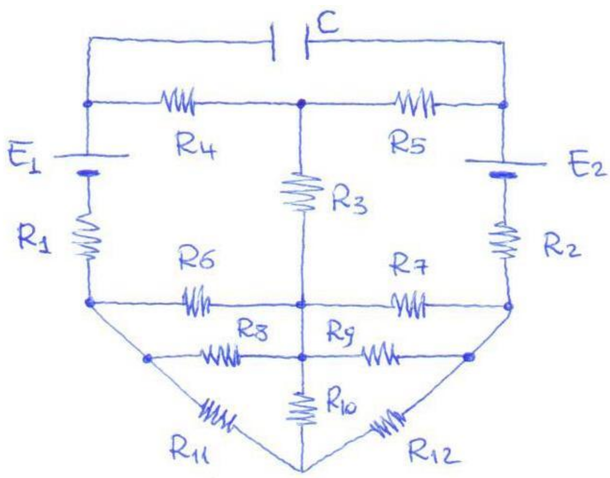
Allievo____ Matricola:_______________

Corso di Laurea: ____

Esercizio 1:

Dato il sistema di figura, determinare il valore dell' energia immagazzinata nel condensatore, la potenza generata ed erogata da E_1 e E_2.

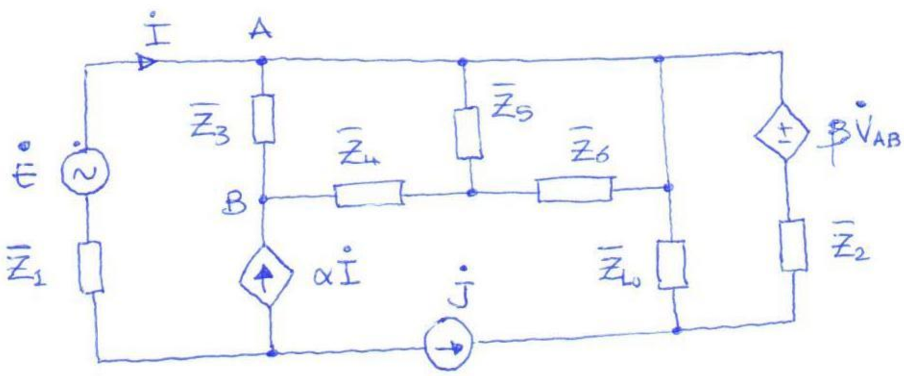
E_1=2 V, E_2=1V, R_1=R_9=R_{12}=3 Ω, R_2=R_4=R_6=R_8=R_{11}=4Ω, R_3=R_5=R_7=R_{10}=5 Ω, C=20 μF.



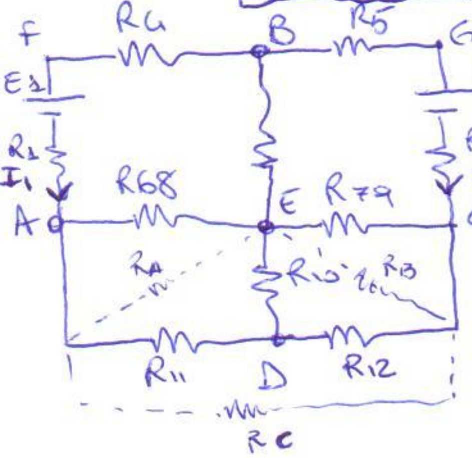
Esercizio 2:

Il sistema di figura si trova a regime. Determinare la potenza complessa che interessa il carico $\bar{Z}_{LO}$.

$\dot{E} = 5 + j2$ V, $\dot{J} = j2$ A, α=2, β=3, $\bar{Z}_1 = 1\,\Omega$, $\bar{Z}_2 = 2 + j\,\Omega$, $\bar{Z}_3 = 2 + j3\,\Omega$, $\bar{Z}_4 = 1 - j\,\Omega$, $\bar{Z}_5 = 2 + j4\,\Omega$, $\bar{Z}_6 = 2 + j4\,\Omega$, $\bar{Z}_{LO} = 2 - j3\,\Omega$



ES. N° 1



Il condensatore in continua si comporta da c.a.

$V_{FG} = ?$ $I_1 = ?$ $I_2 = ?$

$R_{68} = R_6 // R_8$

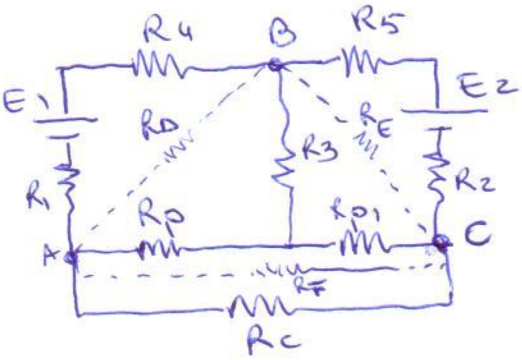
$R_{79} = R_7 // R_9$

Trasformo la stella R_{10}-R_{11}-R_{12} in triangolo

$$R_A = \frac{R_{10} \cdot R_{11} + R_{11} \cdot R_{12} + R_{10} \cdot R_{12}}{R_{12}}$$

$$R_B = \frac{R_{10} \cdot R_{11} + R_{11} \cdot R_{12} + R_{10} \cdot R_{12}}{R_{11}}$$

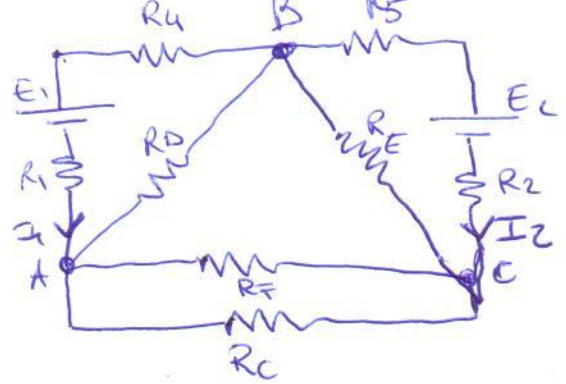
$$R_C = \frac{R_{10} \cdot R_{11} + R_{11} \cdot R_{12} + R_{10} \cdot R_{12}}{R_{10}}$$



$R_p = R_A // R_{68}$

$R_{p1} = R_B // R_{79}$

Trasformo la stella R_p-R_{p1}-R_3 in triangolo.



$$R_D = \frac{R_3 \cdot R_p + R_3 R_{p1} + R_p \cdot R_{p1}}{R_{p1}}$$

$$R_E = \frac{R_3 R_p + R_3 R_{p1} + R_p \cdot R_{p1}}{R_p}$$

$$R_F = \frac{R_3 R_p + R_3 R_{p1} + R_p \cdot R_{p1}}{R_3}$$

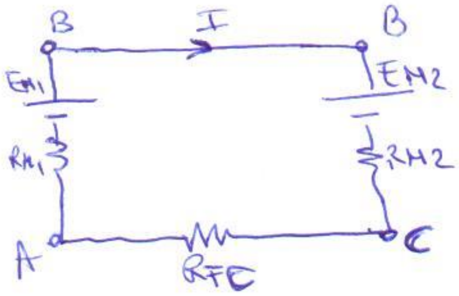
Applico Millman tra A-B e B-C:

$$E_{M1} = \frac{\frac{E_1}{R_1 + R_4}}{\frac{1}{R_1 + R_4} + \frac{1}{R_D}}$$

$$R_{M1} = \frac{1}{\frac{1}{R_1 + R_4} + \frac{1}{R_D}}$$

$$E_{M2} = \frac{\frac{E_2}{R_2 + R_5}}{\frac{1}{R_2 + R_5} + \frac{1}{R_E}}$$

$$R_{M2} = \frac{1}{\frac{1}{R_2 + R_5} + \frac{1}{R_E}}$$



$R_{FC} = R_F // R_C$

$$I = \frac{E_{M1} - E_{M2}}{R_{M1} + R_{M2} + R_{FC}}$$

$$V_{BA} - E_{M1} = -I R_{M1} \Rightarrow V_{BA}$$

$$V_{BA} - E_1 = I_1 (R_1 + R_4) \Rightarrow I_1$$

$$V_{BC} - E_{M2} = I R_{M2} \Rightarrow V_{BC}$$

$$V_{BC} - E_2 = I_2 (R_2 + R_5) \Rightarrow I_2$$

$$P_{g1} = E_1 \cdot (-I_1)$$

$$P_{e1} = V_{FA} \cdot (-I_1) = (E_1 + R_1 I_1) \cdot (-I_1)$$

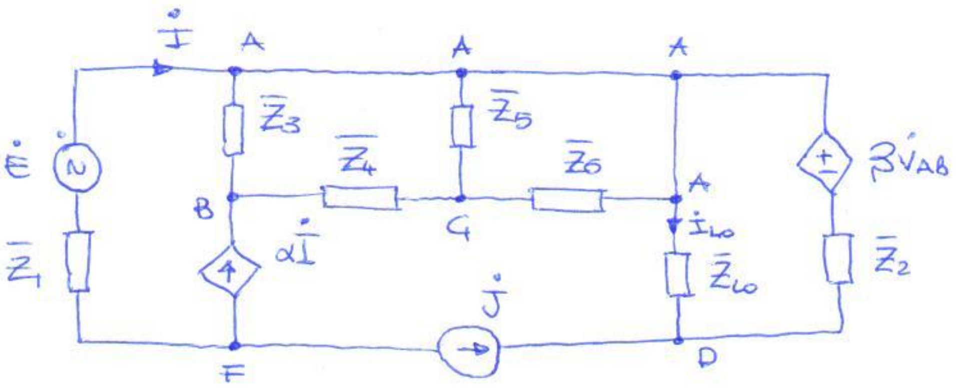
$$P_{g2} = E_2 (-I_2)$$

$$P_{e2} = V_{GC} (-I_2) = (E_2 + R_2 I_2) \cdot (-I_2)$$

$$V_{FG} = V_{FB} + V_{BG} = -I_1 R_4 + I_2 R_5$$

$$E_{WC} = \frac{1}{2} (V_{FG})^2 \cdot C$$

Es. 2

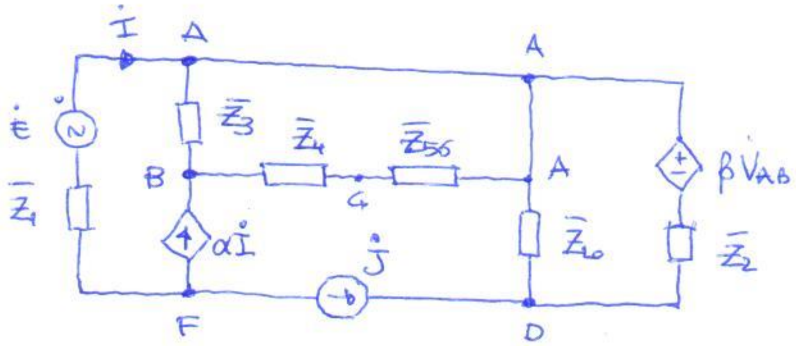


POTENZA COMPLESSA

$\bar{S} = \dot{V}_{AD} \cdot \breve{I}_{L0}$

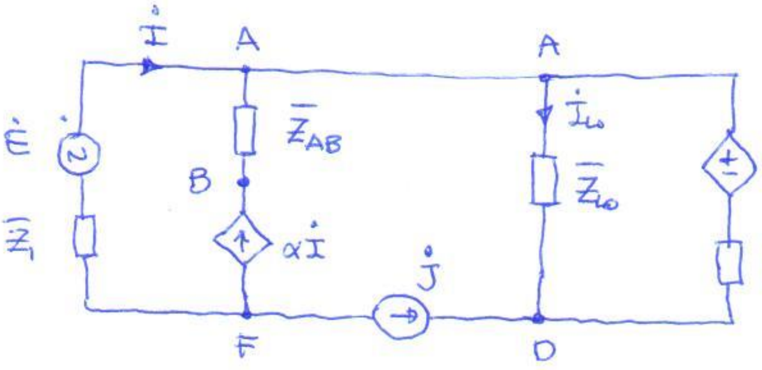
Dobbiamo trovare $\dot{I}_{L0}$.

$\bar{Z}_5$ e $\bar{Z}_6$ sono in parallelo (tra G e A) : $\bar{Z}_{56} = \dfrac{\bar{Z}_5 \cdot \bar{Z}_6}{\bar{Z}_5 + \bar{Z}_6} = \dfrac{\bar{Z}_5}{2}$



$\bar{Z}_4$ e $\bar{Z}_{56}$ sono in serie : $\bar{Z}_{456} = \bar{Z}_4 + \bar{Z}_{56}$

$\bar{Z}_3$ e $\bar{Z}_{456}$ sono in parallelo (tra A e B): $\bar{Z}_{AB} = \dfrac{\bar{Z}_3 \cdot \bar{Z}_{456}}{\bar{Z}_3 + \bar{Z}_{456}}$

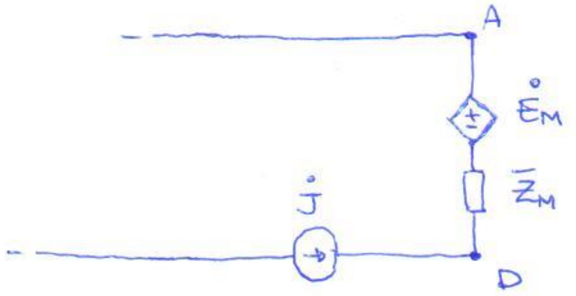


$\beta \dot{V}_{AB} = \beta \cdot \left(-\bar{Z}_{AB} \cdot \alpha \dot{I}\right) = \dot{E}_{DIP}$

Dalla legge al nodo F: $\dot{I} + \alpha \dot{I} + \dot{J} = 0$ ricavo subito $\dot{I} = -\dfrac{\dot{J}}{1+\alpha}$

Quindi il generatore dipendente di tensione è noto : $\dot{E}_{DIP} = \dfrac{\alpha\beta}{1+\alpha} \bar{Z}_{AB} \dot{J}$

Applico Millman tra A e D



con $\dot{E}_M = \dfrac{\dfrac{\dot{E}_{eq}}{\bar{Z}_2}}{\dfrac{1}{\bar{Z}_{L0}} + \dfrac{1}{\bar{Z}_2}}$

$$\bar{Z}_M = \frac{1}{\dfrac{1}{\bar{Z}_{L0}} + \dfrac{1}{\bar{Z}_2}}$$

Risulta $\dot{V}_{AD} = \dot{E}_M - \bar{Z}_M \cdot \dot{J}$

per cui posso calcolare $\dot{I}_{L0} = \dfrac{\dot{V}_{AD}}{\bar{Z}_{L0}}$

e quindi otteniamo la potenza complessa $\bar{S} = \dot{V}_{AD} \cdot \overset{\smile}{I}_{L0}$