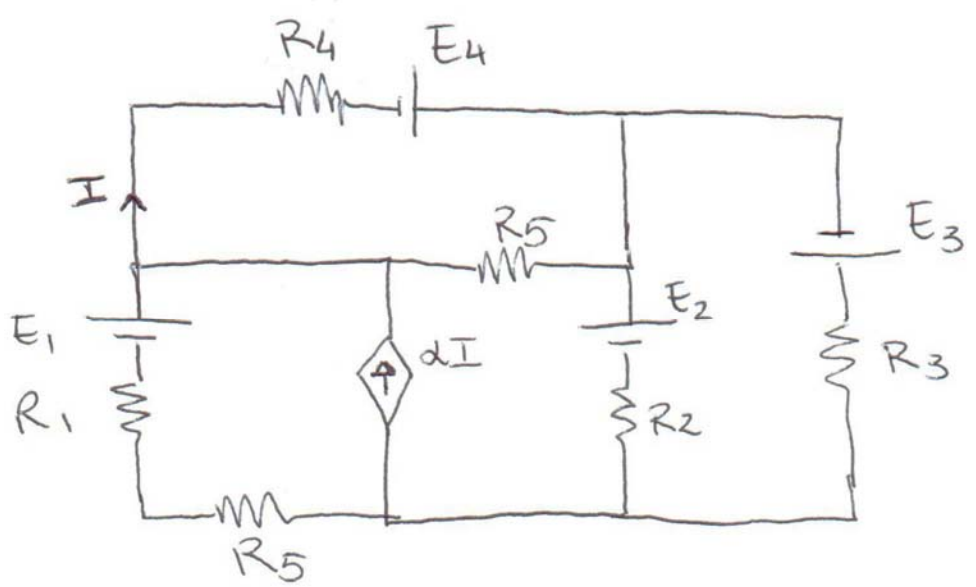
COMPITO ELETTROTECNICA 10-12-2015

Allievo____ Matricola:_______________

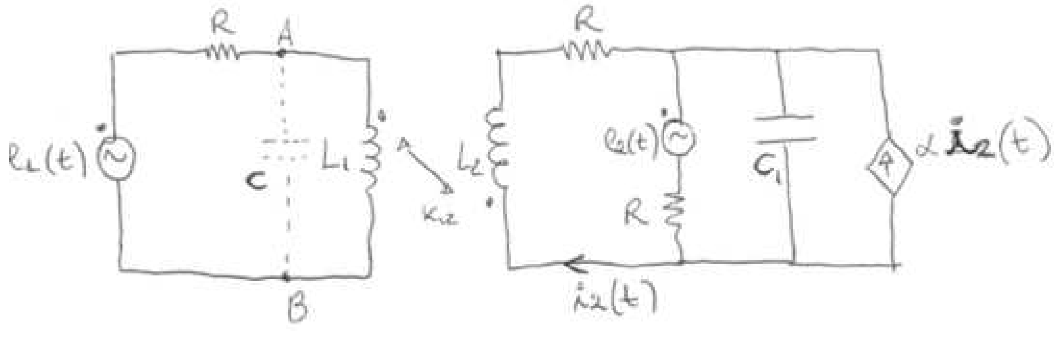
Corso di Laurea: ______________________________________

Esercizio 1:
Dato il sistema di figura, determinare il valore della corrente I, la potenza generata ed erogata da E_3-R_3
$E_1=E_2=2$ V, $E_3=E_4=1$V, $R_1=R_4= 3\ \Omega$, $R_2=R_3=R_5=4\Omega$, $\alpha=3$

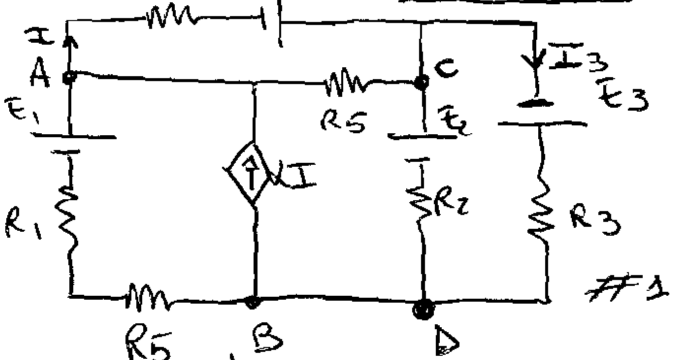


Esercizio 2:
Il sistema di figura si trova a regime. Determinare la capacità C da inserire come in figura per rifasare il carico a cosΦ=0.85.

e_1 (t) $=2\sqrt{2}\sin(wt)$V; e_2 (t) $=5\sqrt{2}\cos(wt)$V; R=3Ω, ω=314rad/s, L_1=50mH, L_2=100mH, C_1=10mF; k_{12}=0.6; α=2

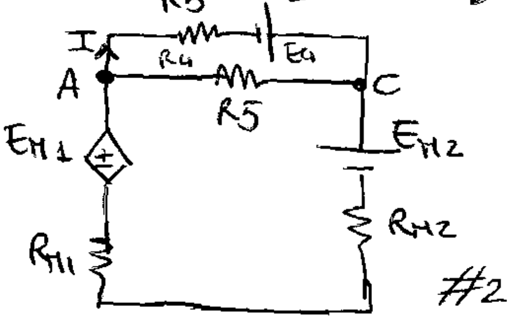


ES. N° 1



Applico Millmann tra A-B e C-D

$$E_{M1} = \frac{\frac{E_1}{(R_1+R_5)} + \alpha I}{\frac{1}{R_1+R_5}}$$



$$R_{M1} = \frac{1}{\frac{1}{R_1+R_5}}$$

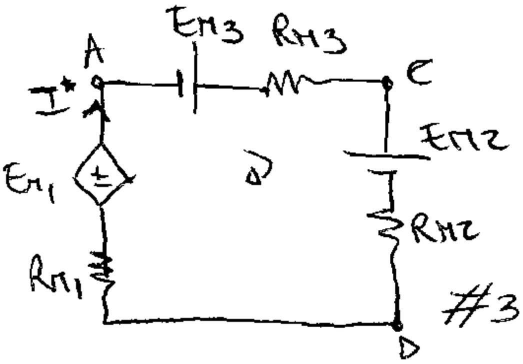
$$E_{M2} = \frac{\frac{E_2}{R_2} - \frac{E_3}{R_3}}{\frac{1}{R_2} + \frac{1}{R_3}}$$

$$R_{M2} = \frac{1}{\frac{1}{R_2} + \frac{1}{R_3}}$$

$$E_{M3} = \frac{\frac{E_4}{R_4}}{\frac{1}{R_4} + \frac{1}{R_5}}$$

Applico Millmann tra A - C:

$$R_{M3} = \frac{1}{\frac{1}{R_4} + \frac{1}{R_5}}$$



$$E_{M1} + E_{M3} - E_{M2} = I^*(R_{M1} + R_{M3} + R_{M2})$$

$$I^* = \frac{E_{M1} + E_{M3} - E_{M2}}{R_{M1} + R_{M3} + R_{M2}}$$

Ricordiamoci che E_{M1} é f.ne di I.

$V_{AC} = -E_{M3} + I^* R_{M3}$

Dal #2 ⇒ $V_{AC} = -E_4 + I R_4$

quindi uguagliando le due equazioni:

$$\begin{cases} -E_{M3} + I^* R_{M3} = -E_4 + I R_4 \\ I^* = \dfrac{E_{M1} + E_{M3} - E_{M2}}{R_{M1} + R_{M3} + R_{M2}} \end{cases}$$

⇒ Due equaz. in due incognite I e I^*.

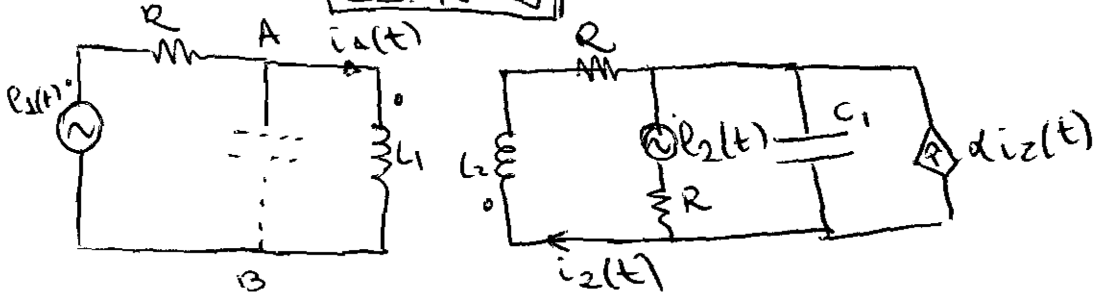
$P_g = E_3 \cdot I_3$
$P_e = V_{DC} \cdot I_3$

Per calcolare I_3 dal #3 mi calcolo la V_{CD}:

$V_{CD} - E_{M2} = I^* R_{M2}$ ⇒ $V_{CD} = E_{M2} + I^* R_{M2}$

$$I_3 = \frac{V_{CD} + E_3}{R_3}$$

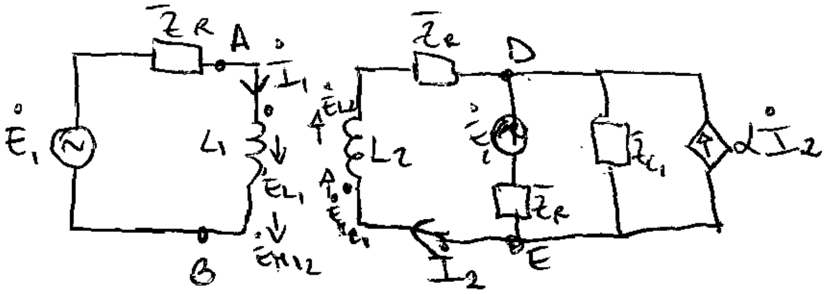
ES. N° 2



Poiché $\cos(x) = \operatorname{sen}\left(x + \frac{\pi}{2}\right)$:

$$e_1(t) = 2\sqrt{2}\,\operatorname{sen}\omega t \Rightarrow \dot{E}_1 = 2\left(\cos 0^\circ + j\operatorname{sen} 0^\circ\right) = 2\ \text{V}$$

$$e_2(t) = 5\sqrt{2}\,\operatorname{sen}\left(\omega t + \frac{\pi}{2}\right) \Rightarrow \dot{E}_2 = 5\left(\cos\frac{\pi}{2} + j\operatorname{sen}\frac{\pi}{2}\right) = j5\ \text{V}$$



$$\bar{Z}_R = R$$

$$\bar{Z}_{C_1} = -\frac{j}{\omega C_1}$$

$$\dot{E}_{L2} = -j\omega L_2 \dot{I}_2$$

$$\dot{E}_{L1} = -j\omega L_1 \dot{I}_1$$

$$\dot{E}_{M12} = -j\omega M_{12} \dot{I}_2$$

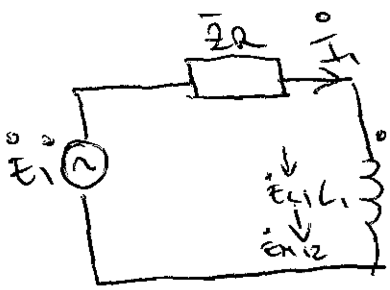
$$\dot{E}_{M21} = -j\omega M_{21} \dot{I}_1$$

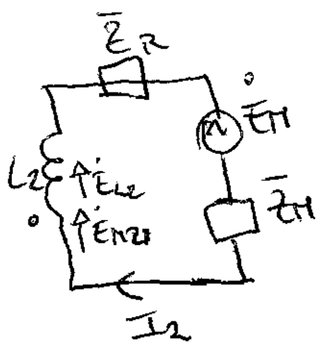
dove: $M_{12} = M_{21} = K_{12}\sqrt{L_1 L_2}$

Applico Millman tra D-E:

$$\dot{E}_M = \frac{\frac{\dot{E}_2}{\bar{Z}_R} + \alpha\dot{I}_2}{\frac{1}{\bar{Z}_R} + \frac{1}{\bar{Z}_{C_1}}}$$

$$\bar{Z}_M = \frac{1}{\frac{1}{\bar{Z}_R} + \frac{1}{\bar{Z}_{C_1}}}$$





$$\begin{cases} \dot{E}_1 + \dot{E}_{L1} + \dot{E}_{M12} = \dot{I}_1 \bar{Z}_R \\ -\dot{E}_M + \dot{E}_{L2} + \dot{E}_{M21} = \dot{I}_2\left(\bar{Z}_R + \bar{Z}_M\right) \end{cases} \Rightarrow \text{Mi ricavo } \dot{I}_2 \text{ e } \dot{I}_1$$

Procedo con il calcolo di $\dot{V}_{AB}$

$$\dot{V}_{AB} - \dot{E}_1 = -\dot{I}_1\bar{Z}_R \Rightarrow \dot{V}_{AB} = \dot{E}_1 - \dot{I}_1\bar{Z}_R$$

$$\bar{S} = \dot{V}_{AB} \cdot \breve{I}_1 = P_{AB} + jQ_{AB}$$

Se: $Q_{AB} < 0$ $\Rightarrow$ non è necessario rifasare

Se: $Q_{AB} > 0$ $\Rightarrow$ $\varphi_{AB} = \arctg \frac{Q_{AB}}{P_{AB}}$

se: $\varphi_{AB} \leq \varphi_R$ (sfasamento richiesto) $\Rightarrow$ non rifasare

se: $\varphi_{AB} > \varphi_R$ $\Rightarrow$ rifasare

$$C = \frac{Q_{AB} - P_{AB} \, tg \, \varphi_R}{\omega |V_{AB}|^2}$$