COMPITO ELETTROTECNICA 29-09-2016

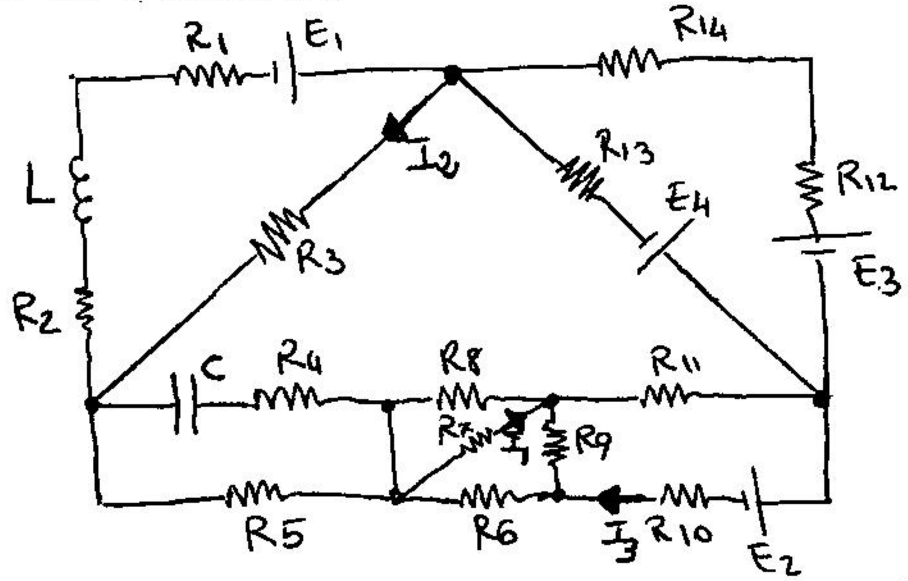
Allievo____ Matricola:_______________

Corso di Laurea: ______________________________________

Esercizio 1:

Il circuito in figura è a regime. Determinare il valore delle correnti $\mathbf{I_1}$, $\mathbf{I_2}$ e $\mathbf{I_3}$

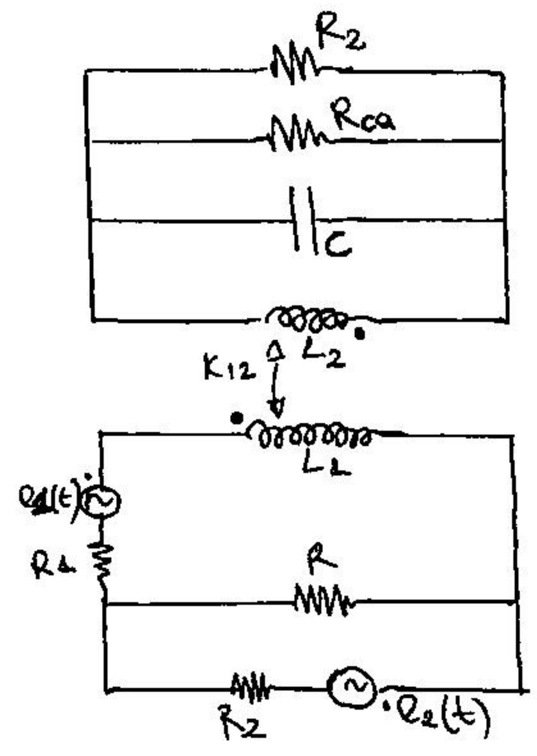
$E_1 = 2V$; $E_2= 3V$; $E_3= 4V$; $E_4= 1V$; $R_1=R_2= R_4=R_{11}= 3\Omega$; $R_3= R_5= R_7= R_9 =4\Omega$; $R_6= R_8= R_{10}= R_{12} = R_{13} = R_{14} =5\Omega$; $L=5mH$; $C=1mF$



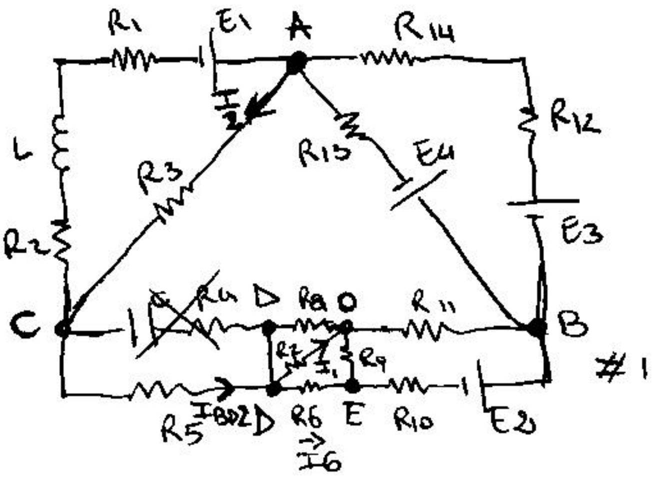
Esercizio 2:

Dato il seguente circuito, determinare l' andamento temporale di $v_{Rca}(t)$

$e_1(t) = 2\sqrt{2}\sin(wt + \frac{\pi}{3})$ V ; $e_2(t) = \sqrt{2}\cos(wt - \frac{\pi}{2})$ V; **$R_1=R_2=10\Omega$; $R=R_{ca}=3\ \Omega$; $L_1=2mH$; $L_2=5mH$; $\omega=314rad/sec$; $K_{12}=0.6$; $C=1mF$**



ES. N° 1



L si comporta da c.c.
C " " da c.a

Applico Millmann tra i nodi A e C, e A-B.

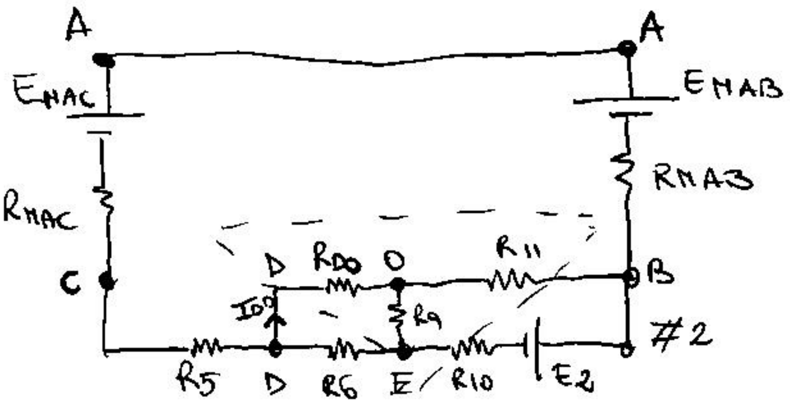
R_{DO} => resist. par. tra R8 e R7

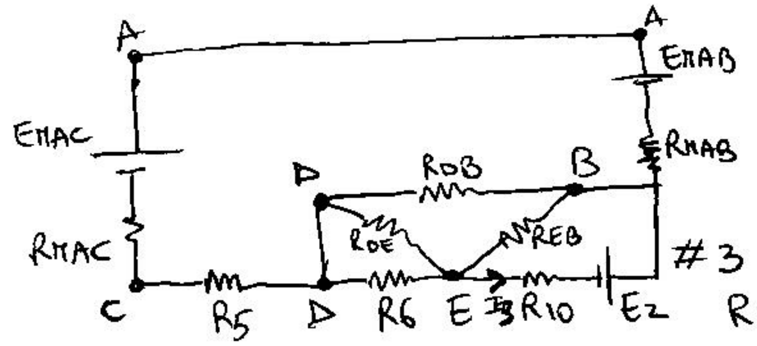
$$E_{MAC} = \frac{\frac{E_1}{(R_1+R_2)}}{\frac{1}{(R_1+R_2)} + \frac{1}{R_3}}$$

$$R_{MAC} = \frac{1}{\frac{1}{(R_1+R_2)} + \frac{1}{R_3}}$$

$$E_{MAB} = \frac{\frac{E_3}{(R_{14}+R_{12})} - \frac{E_4}{R_{13}}}{\frac{1}{(R_{14}+R_{12})} + \frac{1}{R_{13}}}$$

$$R_{MAB} = \frac{1}{\frac{1}{(R_{14}+R_{12})} + \frac{1}{R_{13}}}$$



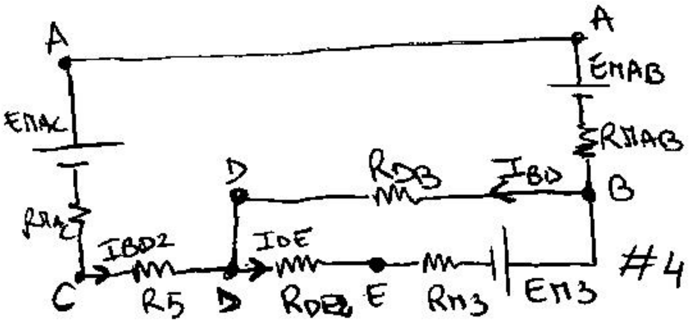


Trasformo la stella DOBE nel triangolo DBE

$$R_{DE} = \frac{R_{DO}\cdot R_9 + R_9\cdot R_{11} + R_{11}\cdot R_{DO}}{R_{11}}$$

$$R_{DB} = \frac{R_{DO}R_9 + R_9R_{11} + R_{11}R_{DO}}{R_9}$$

$$R_{EB} = \frac{R_{DO}R_9 + R_9R_{11} + R_{11}R_{DO}}{R_{DO}}$$

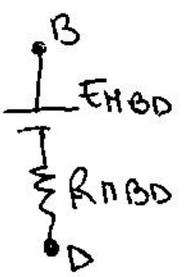


Applico Millmann tra B-E:

$$E_{M3} = \frac{(E_2/R_{10})}{\frac{1}{R_{10}} + \frac{1}{R_{EB}}}$$

$$R_{M3} = \frac{1}{\frac{1}{R_{10}} + \frac{1}{R_{EB}}}$$

$R_{DE2} = R_{DE} // R_6$



Applico Millmann tra B-D:

$$E_{MBD} = \frac{\frac{E_{M3}}{(R_{M3}+R_{DE2})} + \frac{(E_{MAC}-E_{MAB})}{(R_{MAB}+R_{MAC})}}{\frac{1}{(R_{M3}+R_{DE2})} + \frac{1}{R_{DB}} + \frac{1}{(R_{MAB}+R_{MAC})}}$$

$V_{BD} = E_{MBD}$

Dal circuito # 4:

$$I_{BD2} = \frac{E_{MAB} - E_{MAC} + V_{BD}}{R_{MAB} + R_{MAC} + R_5}$$

$$I_{BD} = \frac{V_{BD}}{R_{BD}}$$

$I_{DE} = I_{BD} + I_{BD2}$ $\qquad$ $V_{DE} = I_{DE} \cdot R_{DE2}$

$$V_{BE} = E_{M3} - I_{DE} \cdot R_{M3}$$

Dal circ. # 3:

$V_{BE} - E_2 = R_{10} \cdot I_3 \Rightarrow \boxed{I_3 = \frac{V_{BE} - E_2}{R_{10}}}$

Per calcolare la I_2:

$V_{AC} = I_2 \cdot R_3 \Rightarrow \boxed{I_2 = \frac{V_{AC}}{R_3}}$

Vediamo come calcolare la V_{AC}:

$$V_{AC} = E_{MAC} + R_{MAC} \cdot I_{BD2}$$

Infine per calcolare la I_1, consideriamo il circ. # 1 e

~~scriviamo la legge al nodo D:~~

$$V_{DO} = R_7 \cdot I_1$$

Mi serve calcolare la V_{DO}.

Dal circ. # 1 mi calcolo la I_6:

$$I_6 = \frac{V_{DE}}{R_6}$$

Dal circ. # 2 scrivo la legge al nodo D:

$$I_{DO} = I_{BD2} - I_6$$

$$V_{DO} = R_{DO} \cdot I_{DO}$$

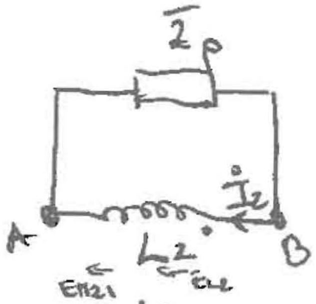
Noto la $V_{DO} \Rightarrow I_1 = \frac{V_{DO}}{R_7}$

ES. N° 2

Trasformo subito le grandezze nel dom. del tempo in fasori.
E' necessario però che e_1 e e_2 siano entrambi o seni o coseni.
Poiché $\cos\alpha = \operatorname{sen}\left(\alpha + \frac{\pi}{2}\right)$ possiamo scrivere:

$$e_1(t) = 2\sqrt{2}\,\operatorname{sen}\left(\omega t + \frac{\pi}{3}\right) \Rightarrow \dot{E}_1 = 2\left(\frac{1}{2} + j\frac{\sqrt{3}}{2}\right) = 1 + j\,1{,}74\ V$$

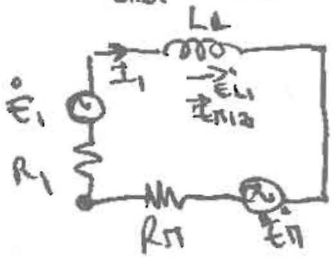
$$e_2(t) = \sqrt{2}\cos\left(\omega t - \frac{\pi}{2}\right) = \sqrt{2}\,\operatorname{sen}(\omega t) \Rightarrow \dot{E}_2 = 1\,V$$



Applico Millman tra $\dot{E}_2$-R_2 e il ramo con R:

$$\dot{E}_M = \frac{\frac{\dot{E}_2}{R_2}}{\frac{1}{R_2} + \frac{1}{R}}$$

$$R_M = (R_2 \,//\, R)$$



Per calcolare la tens. ai capi del carico R_{ca} devo calcolarmi la $\dot{V}_{AB}$, quindi mi serve conoscere la $\dot{I}_2$.

$$\bar{Z}_c = -\frac{j}{\omega C} \qquad \bar{Z}_p = \bar{Z}_c \,//\, \left(\frac{R_2 \cdot R_{ca}}{R_2 + R_{ca}}\right)$$

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

$$\begin{cases} -\dot{E}_M + \dot{E}_1 + \dot{E}_{L1} + \dot{E}_{M12} = \dot{I}_1 (R_1 + R_M) \\ +\dot{E}_{L2} + \dot{E}_{M21} = \dot{I}_2 \bar{Z}_p \end{cases}$$

$$\begin{cases} -\dot{E}_M + \dot{E}_1 - j\omega L_1 \dot{I}_1 - j\omega M_{12} \cdot \dot{I}_2 = \dot{I}_1 (R_1 + R_M) \\ -j\omega L_2 \dot{I}_2 - j\omega M_{21} \cdot \dot{I}_1 = \dot{I}_2 \cdot \bar{Z}_p \end{cases} \Rightarrow \dot{I}_1 \text{ e } \dot{I}_2$$

$$\dot{V}_{AB} = \dot{I}_2 \bar{Z}_p \qquad \Rightarrow v_{Rca}(t) = v_{AB}(t)$$

$$\Rightarrow v_{Rca}(t) = \sqrt{2}\,|V_{AB}| \cdot \operatorname{sen}\left(\omega t + \operatorname{arctg}(\dot{V}_{AB})\right)$$