Compito di Elettrotecnica

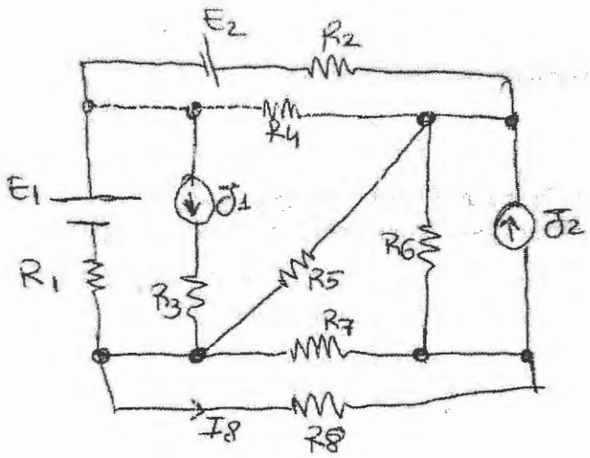
10 Maggio 2022

Nome e Cognome .....Matricola.....

Corso di Laurea.....

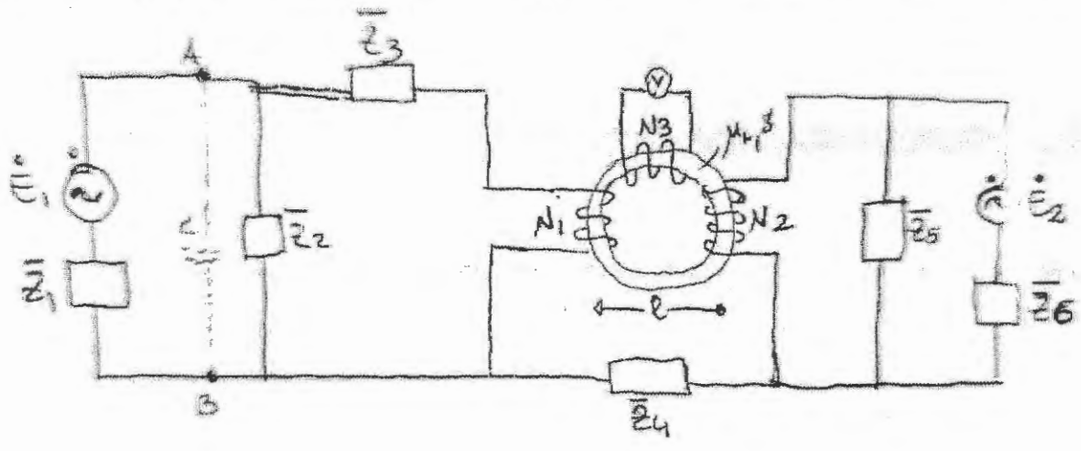
ES.1–Il sistema si trova a regime. Determinare la corrente che scorre sulla resistenza R_8 applicando il teorema di Thevenin.

$E_1 = 3V$; $E_2=5V$; $J_1 = J_2 = 2A$; $R_1= 1\Omega$; $R_2=R_4=R_6=2\ \Omega$; $R_3= R_5 = R_7= 3\ \Omega$; $R_8= 4\ \Omega$



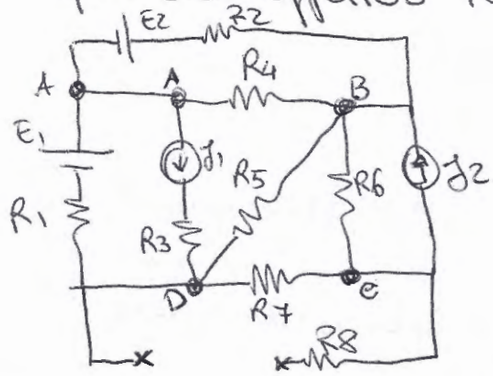
ES.2 – Dato il circuito in figura, determinare la capacità da inserire tra i punti A e B per rifasare totalmente il carico a valle. Determinare inoltre il valore della tensione misurata dal voltmetro ideale prima del rifasamento.

$\dot{E}_1 = 3 + j\ [V]$; $\dot{E}_2 = 4 + 2j\ [V]$; $\bar{Z}_1 = \bar{Z}_3 = \bar{Z}_5 = 1 - 2j\ [\Omega]$; f=50Hz; $\bar{Z}_2 = \bar{Z}_4 = \bar{Z}_6 = 1 + 5j\ [\Omega]$; S=4cm^2; l= 2cm; $\mu_r = 1000$; N_1=100; N_2=200; N_3=300

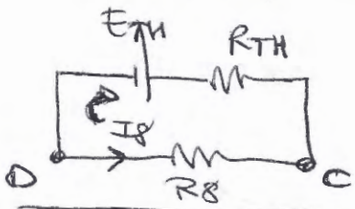


ES. N° 1

Determinare la corrente I_8 applicando il Teo. Thevenin, quindi effettuo il Taglio sul ramo in cui è posta R_8!



Circ. equiv. applicando Thevenin ⇒

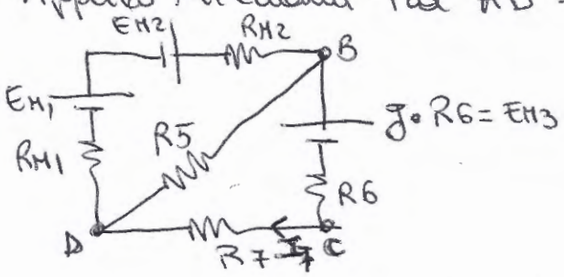


$$I_8 = -\frac{E_{TH}}{R_{TH}+R_8}$$

Procediamo con il calcolo di E_{TH} e R_{TH}:

$E_{TH} = V_{DC}(0)$

Applico Millmann Tra AD - BC - AB:



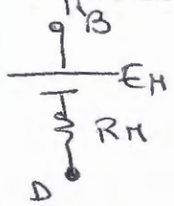
$$E_{H1} = \frac{\frac{E_1}{R_1} - J_1}{\frac{1}{R_1}}$$

$$R_{H1} = R_1$$

$$E_{H2} = \frac{E_2 / R_2}{\frac{1}{R_2} + \frac{1}{R_4}}$$

$$R_{H2} = \frac{1}{\frac{1}{R_2} + \frac{1}{R_4}}$$

Applico Millmann Tra B-D:



$$E_H = \frac{\left(\frac{E_{H1}+E_{H2}}{R_{H1}+R_{H2}}\right) + \frac{E_{H3}}{(R_6+R_7)}}{\frac{1}{R_{H1}+R_{H2}} + \frac{1}{R_5} + \frac{1}{R_6+R_7}}$$

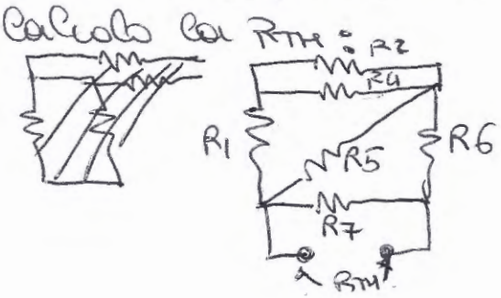
$$V_{BD} = E_H$$

Nota la V_{BD}, mi calcolo la I_7 e poi la V_{DC}:

$$V_{BD} = E_{H3} + I_7(R_6+R_7) \Rightarrow I_7 = \frac{V_{BD} - E_{H3}}{R_6+R_7}$$

$$V_{DC} = -I_7 \cdot R_7 = E_{TH}$$

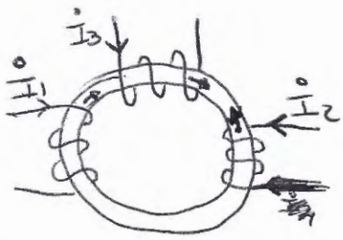
Calcolo la R_{TH}:



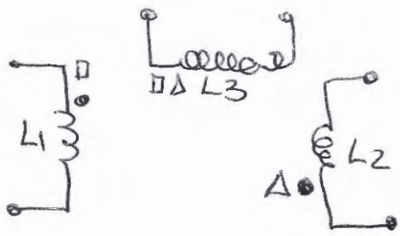
$$R_S = \left[\left(R_2 /\!/ R_4\right) + R_1\right] /\!/ R_5$$

$$R_{TH} = \left(R_S + R_6\right) /\!/ R_7$$

ES. N=2



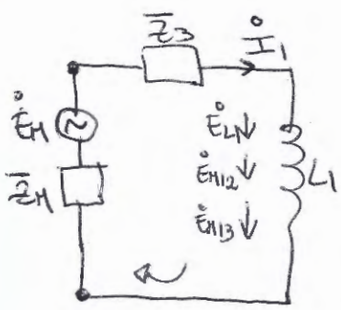
$M_{12} = M_{21}$ (<0)
$M_{13} = M_{31}$ (>0)
$M_{23} = M_{32}$ (<0)

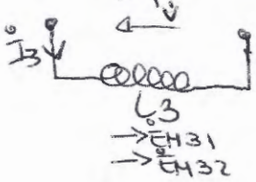


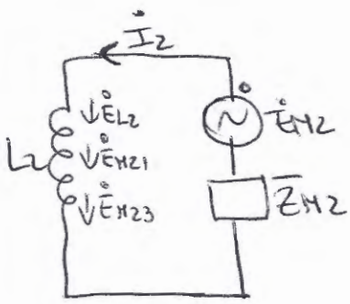
Non è necessario determinare L_3 in quanto il voltmetro si comporta da c.a., essendo ideale, quindi su L_3 non scorre corrente $\dot{I}_3 = 0$.

$$L_1 = \frac{N_1^2}{Reg_1} \qquad L_2 = \frac{N_2^2}{Reg_2} \qquad Reg_1 = Reg_2 = \frac{\pi \ell}{\mu_0 \mu_{rFe} S}$$

$$M_{12} = \sqrt{L_1 L_2} \qquad M_{13} = \frac{N_1 N_3}{Reg_1} \qquad M_{23} = \frac{N_2 N_3}{Reg_2}$$







#1

$$\dot{E}_M = \frac{\dot{E}_1 / \bar{Z}_1}{1/\bar{Z}_1 + 1/\bar{Z}_2} \qquad \bar{Z}_M = \frac{1}{1/\bar{Z}_1 + 1/\bar{Z}_2}$$

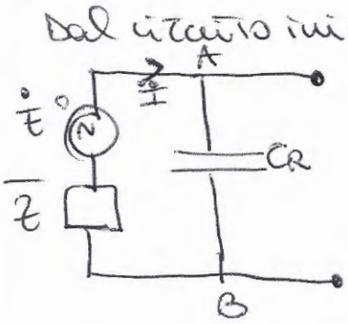
$$\dot{E}_{M2} = \frac{\dot{E}_2 / \bar{Z}_6}{1/\bar{Z}_6 + 1/\bar{Z}_5} \qquad \bar{Z}_{M2} = \frac{1}{1/\bar{Z}_6 + 1/\bar{Z}_5}$$

$$\begin{cases} \dot{E}_M + \dot{E}_{L1} + \dot{E}_{M12} + \dot{E}_{M13} = \dot{I}_1 (\bar{Z}_M + \bar{Z}_3) \\ \dot{E}_{M2} + \dot{E}_{L2} + \dot{E}_{M21} + \dot{E}_{M23} = \dot{I}_2 \bar{Z}_{M2} \\ \dot{V} + \dot{E}_{M31} + \dot{E}_{M32} = 0 \end{cases} \Rightarrow \dot{I}_1 \text{ e } \dot{I}_2$$

Il voltmetro legge il valore eff. della tensione $V = |\dot{V}|$

$\dot{S}_{AB} = \dot{V}_{AB} \cdot \dot{I}$

Dal circuito inviato:



#2

Dal circuito #1 si evince:

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

Dal circuito #2 risulta:

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

Calcolare la potenza complessa $\bar{S}_{AB} = \dot{V}_{AB} \dot{I}^* = P_{AB} + jQ_{AB}$

se $Q_{AB} > 0$ allora si dice che è con $C = \frac{Q_{AB}}{\omega V_{AB}^2}$