Compito di Elettrotecnica

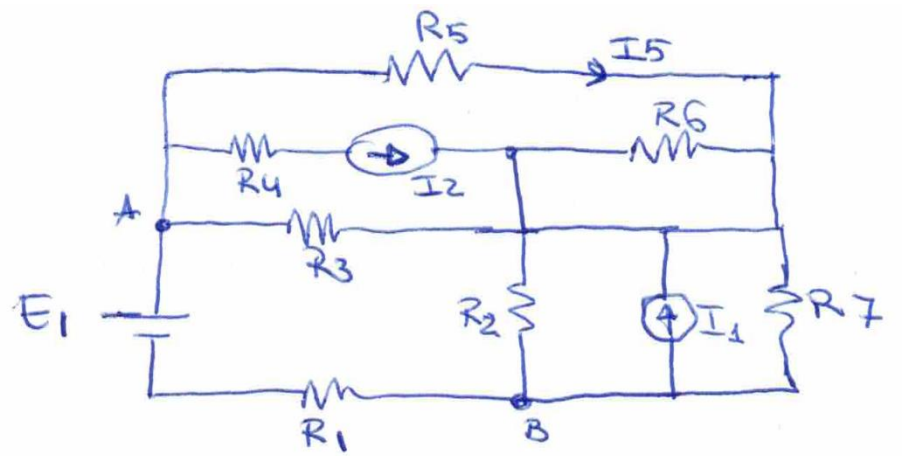
20 Settembre 2024

Nome e Cognome …… Matricola……

Corso di Laurea……

ES.1 – Dato il circuito in figura a regime, determinare la V_{AB}, la potenza generata da I_1, I_2 e la corrente I_5 **.**

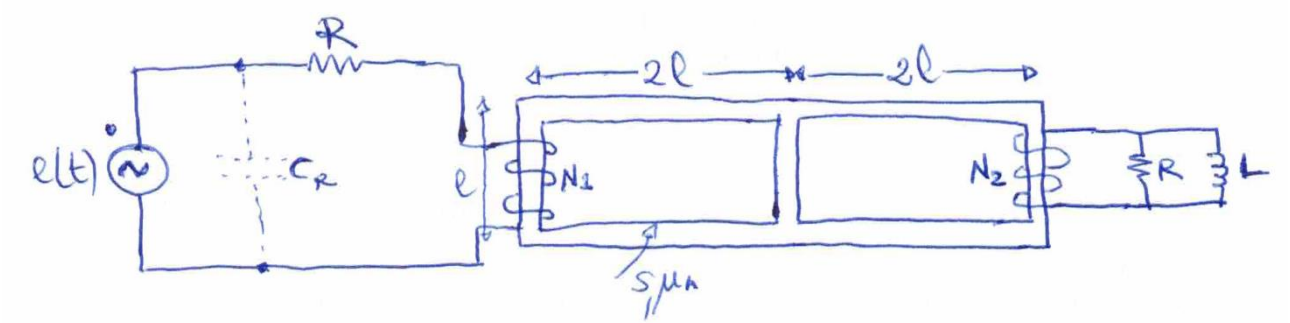
$\mathbf{E_1 = 10\ V}$; $\mathbf{I_1 = 3.5\ A}$; $\mathbf{I_2 = 1\ A}$; $\mathbf{R_1 = 3\ \Omega}$; $\mathbf{R_2 = 4\ \Omega}$; $\mathbf{R_3 = 5\ \Omega}$; $\mathbf{R_4 = 1\ \Omega}$; $\mathbf{R_5 = 3\Omega}$; $\mathbf{R_6 = 7\ \Omega}$; $\mathbf{R_7 = 1\ \Omega}$.



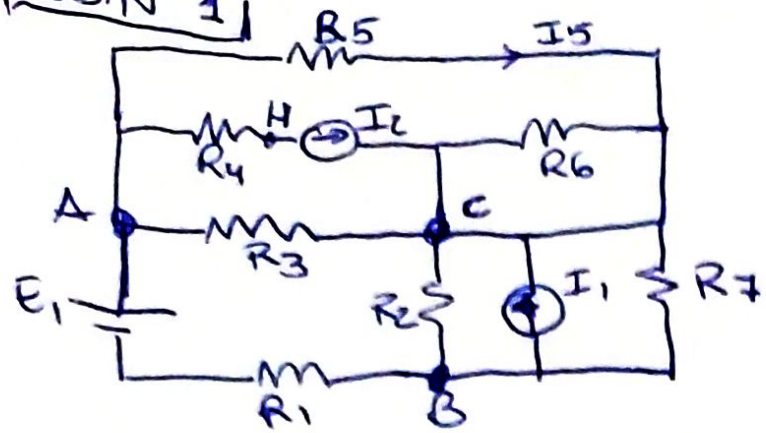
ES.2 – Dato il seguente circuito a regime, determinare il valore della capacità C_R atta a rifasare totalmente il sistema. Calcolare inoltre l'espressione temporale della corrente erogata dal generatore dopo il rifasamento.

$$e(t) = 2\sqrt{2}\cos\left(\omega t + \frac{\pi}{4}\right)\ \mathrm{V};\ \mu_r = 800; f = 50Hz;$$

$$\mathbf{L = 10\ mH};\ \mathbf{R = 10\ \Omega};\ \mathbf{N_1 = 100}; N_2 = 200; l = 0.2cm, S = 2cm^2$$



ES. N° 1

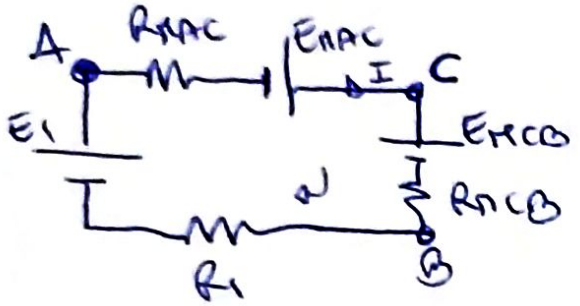


R6 Trascurabile poiché in // C.C.

Applico Millmann Tra A e C e C e B:

$$E_{MAC} = \frac{I_2}{\frac{1}{R_3} + \frac{1}{R_5}} \qquad R_{MAC} = \frac{1}{\frac{1}{R_3} + \frac{1}{R_5}}$$

$$E_{MCB} = \frac{I_1}{\frac{1}{R_2} + \frac{1}{R_7}} \qquad R_{MCB} = \frac{1}{\frac{1}{R_2} + \frac{1}{R_7}}$$



$$I = \frac{E_1 + E_{MAC} - E_{MCB}}{R_{MAC} + R_{MCB} + R_1}$$

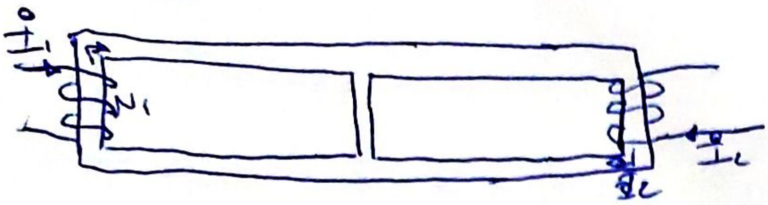
$$V_{AB} = E_1 - R_1 I_1 = 5.20\ V$$

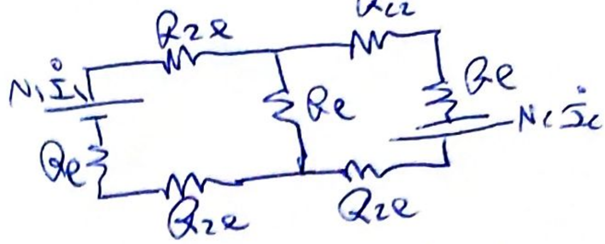
$$P_{gI_1} = V_{CB} \cdot I_1 = (E_{MCB} + R_{MCB} I) \cdot I_1 = 14.27\ W$$

$$P_{gI_2} = V_{HC} \cdot I_2 = (V_{AC} - V_{AH}) \cdot I_2 = ((-E_{MAC} + R_{MAC} \cdot I) - R_4 I_2) \cdot I_2 = 0.12\ W$$

$$I_5 = \frac{V_{AC}}{R_5} = \frac{-E_{MAC} + R_{MAC} \cdot I}{R_5} = 0.375\ A$$

ES. N°2



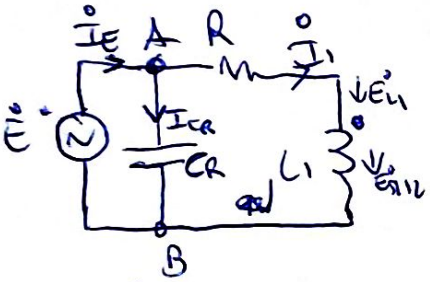


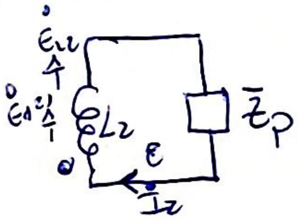
$$R_{eq1} = \left[(2R_{2e}+R_e) // R_e\right] + 2R_{2e} + R_e = R_{eq2} = R_{eq} = 5,80 \cdot 10^4 \; H^{-1}$$

dove: $R_e = \dfrac{l}{\mu_0 \mu_r S'}$ $\qquad R_{2e} = \dfrac{2 \cdot l}{\mu_0 \mu_r S'}$

$$L_1 = \frac{N_1^2}{R_{eq}} = 0.1729 \; H \qquad L_2 = \frac{N_2^2}{R_{eq}} = 0.6894 \; H$$

$$M_{12} = \alpha_{12} \cdot \frac{N_1 N_2}{R_{eq}} = \frac{1}{6} \cdot \frac{N_1 N_2}{R_{eq}} = M_{21} \qquad (>0)$$





$$\bar{Z}_p = \frac{R \cdot j\omega L}{R + j\omega L}$$

$$\begin{cases} \dot{E} + \dot{E}_{L1} + \dot{E}_{M12} = \dot{I}_1 R \\ \dot{E}_{L2} + \dot{E}_{M21} = \dot{I}_2 \bar{Z}_p \end{cases} \Rightarrow \begin{cases} \dot{E} - j\omega L_1 \dot{I}_1 - j\omega M_{12} \dot{I}_2 = \dot{I}_1 R \\ -j\omega L_2 \dot{I}_2 - j\omega M_{21} \dot{I}_1 = \dot{I}_2 \bar{Z}_p \end{cases}$$

$$e(t) = 2\sqrt{2}\cos\left(\omega t + \frac{\pi}{4}\right) \Rightarrow \dot{E} = 2 e^{j\pi/4} = 2\left(\cos\left(\frac{\pi}{4}\right) + j\sin\left(\frac{\pi}{4}\right)\right) = \sqrt{2} + j\sqrt{2}$$

$$\dot{I}_1 = -0,6237 + j0.3423 \; A \qquad \dot{I}_2 = -0,0687 - j0.10 \; A$$

$$\bar{S}_{AB} = \dot{V}_{AB} \check{I}_1 = \dot{E} \check{I}_1 = P_{AB} + j Q_{AB} = 0.039 + j0.073 \; [VAC]$$

$$Q_{RIF} = Q_{AB} \Rightarrow \omega C_R (V_{AB})^2 = Q_{AB} \Rightarrow C_R = \frac{Q_{AB}}{\omega C_R (V_{AB})^2} = 0.58 \, \mu F$$

$$\dot{I}_E = \dot{I}_{CR} + \dot{I}_1 = \frac{\dot{V}_{AB}}{\frac{-j}{\omega C_R}} + \dot{I}_1$$

$$\dot{I}_E = \mathrm{Re}\{I_E\} + j\,\mathrm{Im}\{I_E\} = 0.0059 + j0.0059$$

$$i_E(t) = \sqrt{2}\,|I_E| \cdot \cos\left(\omega t + \arctan\frac{\mathrm{Im}\{I_E\}}{\mathrm{Re}\{I_E\}}\right) = 0.0080\sqrt{2}\cos(\omega t + 45^\circ)$$