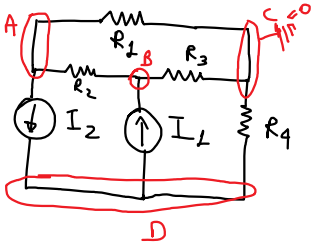
Esercitazione IV - 16 Aprile

venerdì 16 aprile 2021 16:06

CASO 1 · SOLO GEN. CORRENTE



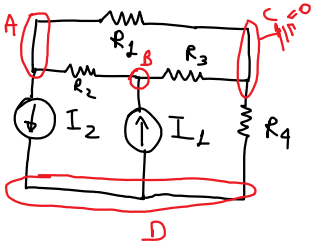
$I_1 = 1\,[A]$ $\quad I_2 = 3A$

$R_1 = R_2 = 1\,[\Omega] \rightarrow G_1, G_2 = 1\,[\Omega^{-1}]$

$R_3 = R_4 = 2\,[\Omega] \rightarrow G_3 = G_4 = \frac{1}{2}\,[\Omega^{-1}]$

C = NODO DI RIFERIMENTO

$e_C = 0\,[V] \Rightarrow e_A, e_B, e_D = ?$ 3 INCOGNITE



A: $(e_A - e_C)\cdot G_1 + (e_A - e_B)\cdot G_2 + I_2 = 0$ ($e_C = 0$)

B: $(e_B - e_A)\cdot G_2 + (e_B - e_C)\cdot G_3 - I_1 = 0$ ($e_C = 0$)

D: $(e_D - e_C)\cdot G_4 + I_1 - I_2 = 0$ ($e_C = 0$)

$$\begin{cases} e_A(G_1+G_2) + e_B(-G_2) = -I_2 \\ e_A(-G_2) + e_B(G_2+G_3) = I_1 \\ e_D \cdot G_4 = I_2 - I_1 \end{cases} \Rightarrow \underbrace{\begin{bmatrix} (G_1+G_2) & -G_2 & 0 \\ -G_2 & G_2+G_3 & 0 \\ 0 & 0 & G_4 \end{bmatrix}}_{\hat{G}} \underbrace{\begin{bmatrix} e_A \\ e_B \\ e_D \end{bmatrix}}_{\vec{e}} = \underbrace{\begin{bmatrix} -I_2 \\ +I_1 \\ I_2 - I_1 \end{bmatrix}}_{\vec{I}} \Rightarrow \begin{bmatrix} 2 & -1 \\ -1 & 3/2 \end{bmatrix} \begin{bmatrix} e_A \\ e_B \end{bmatrix} = \begin{bmatrix} -I_2 \\ +I_1 \end{bmatrix}$$

$\Delta_G = 3 - 1 = 2$

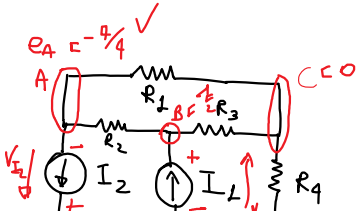
$e_D = \frac{I_2 - I_1}{G_4} = \frac{[3-1]\,A}{1/2} = 4\,V$

$$e_A = \frac{\begin{vmatrix} -I_2 & -1 \\ +I_1 & 3/2 \end{vmatrix}}{\Delta_G} = \frac{\begin{vmatrix} -3 & -1 \\ 1 & 3/2 \end{vmatrix}}{2} = \frac{-9/2 + 1}{2} = \frac{-7/2}{2} = -\frac{7}{4}\,[V]$$

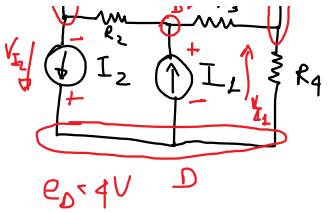
$e_D = 4\,V$; $\quad e_A = -\frac{7}{4}\,V$; $\quad e_C = 0\,[V]$; $\quad e_B = -\frac{1}{2}\,[V]$;

$$e_B = \frac{\begin{vmatrix} 2 & -I_2 \\ -1 & +I_1 \end{vmatrix}}{\Delta_G} = \frac{\begin{vmatrix} 2 & -3 \\ -1 & 1 \end{vmatrix}}{2} = \frac{2-3}{2} = -\frac{1}{2}\,[V]$$

$e_A = -7/4\ V$



$\sum P_{EROGATA\,GEN} = \sum P_{ASS,\,RESISTORE}$



GEN ... ASS, RESISTORE

$$P_{R_1} = \frac{(e_A - e_C)^2}{R_1} = \frac{(e_C - e_A)^2}{R_1} = \frac{49}{16}\ [W]$$

$$P_{R_2} = \frac{(e_A - e_B)^2}{R_2} = \frac{(-7/4 + 1/2)^2}{1} = \frac{25}{16}\ [W]$$

$$P_{R_3} = \frac{(e_B - e_C)^2}{R_3} = 1/8\ [W]$$

$$P_{R_4} = \frac{(e_C - e_D)^2}{R_4} = \frac{16}{2} = 8\ [W]$$

$$\sum_{i=1}^{4} P_{ASS,R_i} = P_{R_1} + P_{R_2} + P_{R_3} + P_{R_4} = \frac{51}{4}\ [W]$$

$$V_{I_1} = e_B - e_D = -\frac{1}{2} - 4$$

$$V_{I_1} = -9/2\ [V]$$

$$P^{g}_{I_1} = V_{I_1} \cdot I_1 = -\frac{9}{2} \cdot 1 = -\frac{9}{2}\ [W]$$

$$V_{I_2} = e_D - e_A = 4 + 7/4 = \frac{23}{4}\ [V] \rightarrow P_{I_2} = V_{I_2} \cdot I_2 = \frac{23}{4} \cdot 3 = \frac{69}{4}\ [W]$$

$$\sum P^{I_i}_{EROGATE} = \sum P^{R_i}_{ASSORBITE} \stackrel{?}{=} 0$$

$$\frac{69}{4} - \frac{9}{2} = \frac{51}{4}\ [W]$$

$$[W] \quad \frac{51}{4} = \frac{51}{4}\ [W]$$