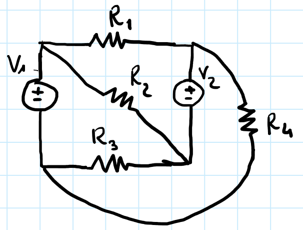


$V_1 = 10\,[V]$ $\quad R_1 = 5\,[\Omega]$

$V_2 = 15\,[V]$ $\quad R_2 = 3\,[\Omega]$

$R_3 = 10\,[\Omega]$

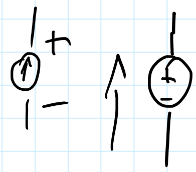
$R_4 = 2\,[\Omega]$

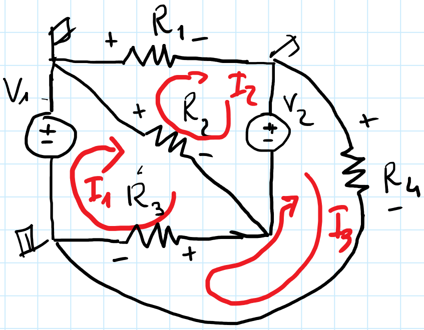
CALCOLARE LE POTENZE ASSORBITE DALLE RESISTENZE E LE CORRENTI NEI GENERATORI DI TENSIONE

PER RISOLVERE IL PROBLEMA mi basta calcolare le correnti degli anelli

Nel circuito ci sono 3 ANELLI => AVRÒ BISOGNO DI SCRIVERE UN SISTEMA RISOLUTIVO A 3 INCOGNITE

I_1, I_2, I_3





$$\left.\begin{aligned} V_{R_1} &= I_2 R_1 \\ V_{R_2} &= (I_1 - I_2) R_2 \\ V_{R_3} &= (I_1 - I_3) R_3 \\ V_{R_4} &= I_3 R_4 \end{aligned}\right\}$$

$$P_{R_1} = \frac{V_{R_1}^2}{R_1} = I_{R_1}^2 R_1$$

$$P_{R_1} = I_2^2 R_1$$

$$P_{R_2} = (I_1 - I_2)^2 R_2$$

$$P_{R_3} = (I_1 - I_3)^2 R_3$$

$$P_{R_4} = I_3^2 R_4$$

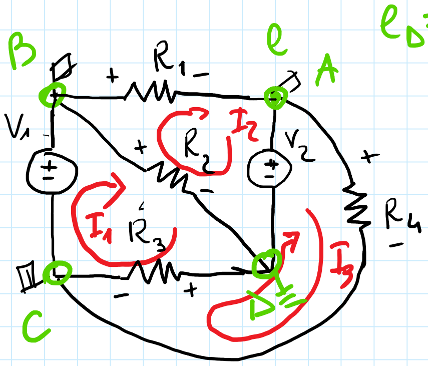
ANELLO (I) = KVL $\quad -V_1 + V_{R_2} + V_{R_3} = 0 \Rightarrow (I_1 - I_2) R_2 + (I_1 - I_3) R_3 = V_1$

ANELLO (II) = KVL $\quad V_{R_1} + V_2 - V_{R_2} = 0 \Rightarrow I_2 R_1 - (I_1 - I_2) R_2 = -V_2$

(III) $\quad V_{R_4} - V_{R_3} - V_2 = 0 \Rightarrow I_3 R_4 \underbrace{- (I_1 - I_3)}\, R_3 = V_2$

$$P_{R_K} = (e_J - e_K)^2 G_K$$

$e_D = 0 \quad e_A = V_2 \quad e_B = V_1 + e_C \quad e_B - e_C = V_1$



(I) $\; -V_1 + (I_1 - I_2) R_2 + (I_1 - I_3) R_3 = 0$

(II) $\; I_2 R_1 + V_2 + (I_2 - I_1) R_2 = 0$

(III) $\; I_3 R_4 + (I_3 - I_1) R_3 - V_2 = 0$

$$\begin{bmatrix} R_2 + R_3 & -R_2 & -R_3 \\ -R_2 & R_1 + R_2 & 0 \\ -R_3 & 0 & R_3 + R_4 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} V_1 \\ -V_2 \\ V_2 \end{bmatrix}$$

$V_1 = 10$

$V_2 = 15$

$R = 5, 3, 10, 2$

$[\hat{R}]$ $\quad |\hat{R}| = (R_2 + R_3)(R_1 + R_2)(R_3 + R_4) + 0 + 0$

$$- R_3^2(R_1+R_2) - R_2^2(R_3+R_4) - 0$$

$$= (13)(8)(12) - 100(8) - 9(12)$$

$$156 \cdot 8 - 800 - 108$$

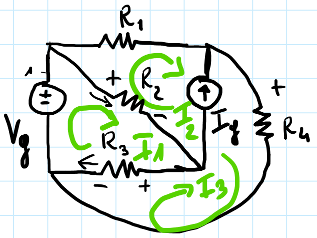
$$1248 - 908 = 340$$

$I_1 =$

$$I_1 = \frac{\begin{vmatrix} 10 & -3 & -10 \\ -15 & 8 & 0 \\ 15 & 0 & 12 \end{vmatrix}}{340} = \frac{960 + 0 + 0 + 1200 - 540 - 0}{340} = \frac{1620}{340} \text{ [A]}$$

$$I_{V_1} = I_1 \Rightarrow P^{GEN.}_{V_1} = V_1 \cdot I_1 = \frac{1620}{340} \cdot 10 \quad \frac{1620}{34} \text{ [W]}$$

$$I_{V_2} = I_3 - I_2$$



$V_g = 10\,[V]$ $\quad R_1 = 5\,[\Omega]$

$I_g = 2\,[A]$ $\quad R_2 = 3\,[\Omega]$

$R_3 = 10\,[\Omega]$

$R_4 = 2\,[\Omega]$

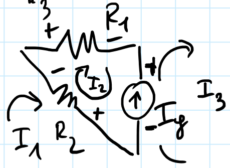
CALCOLARE LE POTENZE ASSORBITE DALLE RESISTENZE E LE CORRENTI NEI GENERATORI DI TENSIONE

$$I_g = I_3 - I_2 \qquad \text{VINCOLO}$$

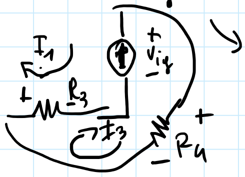
$$I_3 = I_g + I_2$$

KVL ① $(I_1 - I_2)R_2 + (I_1 - \underset{\uparrow}{\overset{I_g+I_2}{I_3}})R_3 = V_g = V_{R_2} + V_{R_3}$

KVL ② $I_2 R_1 + V_{I_g} + (I_2 - I_1)R_2 = 0$



KVL ③ $I_3 R_4 + (I_3 - I_1)R_3 = V_{I_g}$



$$V_{I_g} = (I_g + I_2)R_4 + (I_g + I_2 - I_1)R_3$$

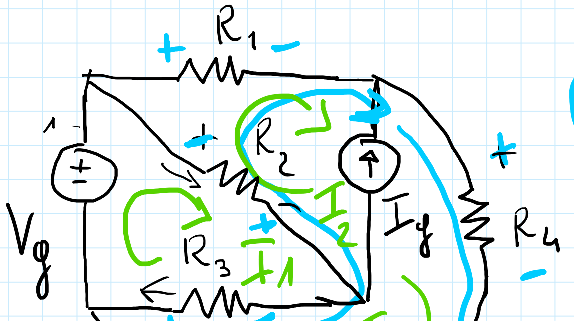
① $\quad (I_1 - I_2)R_2 + (I_1 - I_g - I_2)R_3 = V_g$

② $\quad I_2 R_1 + (I_g + I_2)R_4 + (I_g + I_2 - I_1)R_3 + (I_2 - I_1)R_2 = 0$

$$I_1(R_2 + R_3) - I_2(R_2 + R_3) = V_g + I_g R_3$$

$$-I_1(R_2 + R_3) + I_2(R_1 + R_4 + R_3 + R_2) = -I_g(R_4 + R_3)$$

$$\begin{bmatrix} R_2 + R_3 & -(R_2 + R_3) \\ -(R_2 + R_3) & R_1 + R_2 + R_3 + R_4 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} V_g + I_g R_3 \\ -I_g(R_4 + R_3) \end{bmatrix}$$

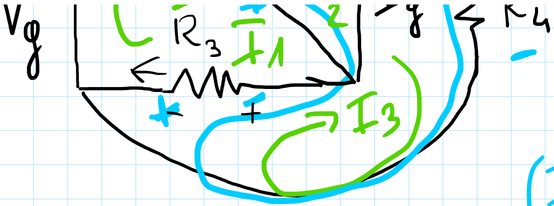


(2+3) KVL

$$V_{R_4} + V_{R_3} + V_{R_2} + V_{R_1} = 0 \qquad I_3 = I_2 + I_g$$

$$\parallel$$

$$I_3 R_4 + (I_3 - I_1)R_3 + (I_2 - I_1)R_2 + I_2 R_1$$



$$= I_3R_4 + (I_3 - I_1)R_3 + (I_2 - I_1)R_2 + I_2R_1$$

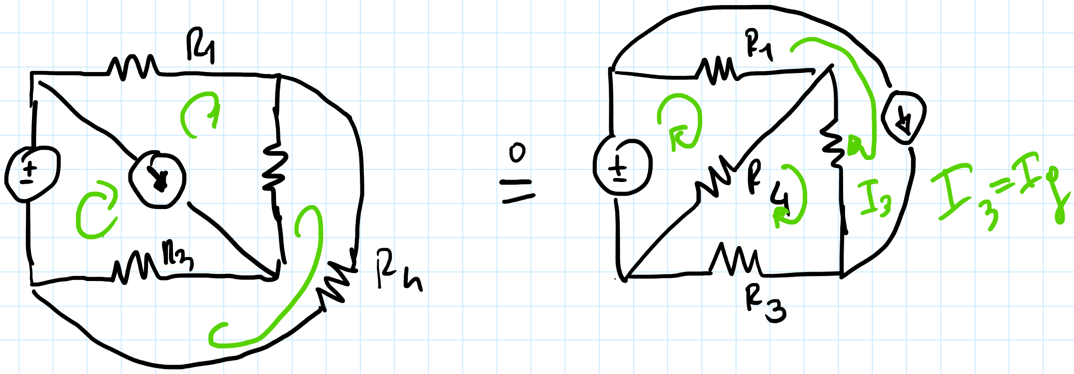
$$(I_2+I_g)R_4 + (I_2+I_g-I_1)R_3 + (I_2-I_1)R_2 + I_2R_1 = 0$$

$$I_2R_1 + (I_g+I_2)R_4 + (I_g+I_2-I_1)R_3 + (I_2-I_1)R_2 = 0$$

$$(I_2+I_g)R_4 + (I_2+I_g-I_1)R_3 + (I_2-I_1)R_2 + I_2R_1 = 0$$

$$I_2(R_1+R_2+R_3+R_4) - I_1(R_2+R_3) = -I_g(R_3+R_4)$$

$$-I_1(R_2+R_3) \quad + I_2(R_1+R_4+R_3+R_2) = -I_g(R_4+R_3)$$



TEOREMA TELLEGHEN

$$\vec{V}\begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ \vdots \\ V_n \end{bmatrix}, \quad \begin{bmatrix} i_1 \\ i_2 \\ i_3 \\ \vdots \\ i_R \end{bmatrix}\vec{i}$$

CONV. UTILIZZATORI

$$\vec{V}^T \cdot \vec{i} = 0$$

$$\vec{V}^T \cdot \vec{i} = V_1 i_1 + V_2 i_2 + V_3 i_3 + \dots + V_R i_R = \sum P_R = 0$$

$$\vec{V} = \begin{bmatrix} \vec{V}_A \\ \vec{V}_C \end{bmatrix} \cdot \quad \vec{i}\begin{bmatrix} \vec{i}_A \\ \vec{i}_C \end{bmatrix}$$

$$\vec{i}_A = -[A]\,\vec{i}_C$$

$$\vec{V}_C = -[B]\cdot\vec{V}_A$$

$$\vec{V}^T \cdot \vec{i} = \begin{bmatrix} V_A^T & V_C^T \end{bmatrix} \cdot \begin{bmatrix} i_A \\ i_C \end{bmatrix} = V_A^T i_A + V_C^T i_C$$

$$-V_A^T A i_C + -V_A^T B^T i_C$$

$$B = -A^T$$

$$B^T = -A$$

$$-V_A^T A i_C + V_A^T A i_C = 0$$