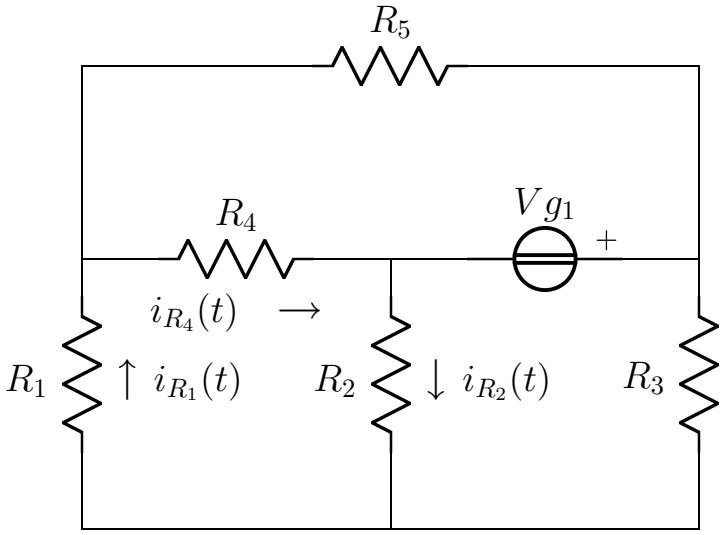
Esercizio resistori

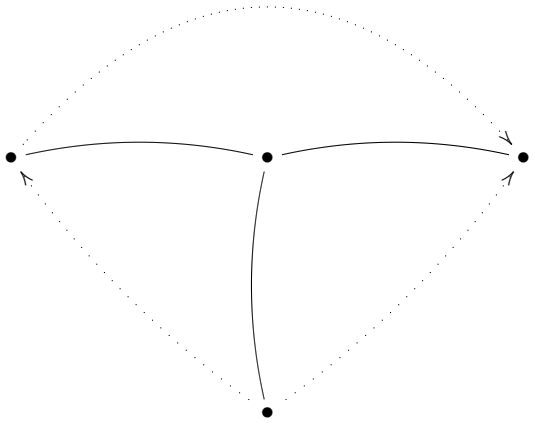
Risolvere il circuito in figura



$R_1 = 1$
$R_2 = \frac{1}{5}$
$R_3 = \frac{1}{2}$
$R_4 = 2$
$V_{g_1} = 3$
$R_5 = \frac{1}{2}$

Risoluzione dell'esercizio con il metodo delle maglie

Albero e coalbero:



Sistema

$$\begin{cases} (R_1+R_2+R_4)\mathbf{I_1} & +R_2\mathbf{I_2} & -R_4\mathbf{I_3} & = & 0 \\ R_2\mathbf{I_1} & +(R_2+R_3)\mathbf{I_2} & & = & -\mathbf{V_{g_1}} \\ -R_4\mathbf{I_1} & & +(R_4+R_5)\mathbf{I_3} & = & -\mathbf{V_{g_1}} \end{cases}$$

Sostituzione

$$\begin{cases} \frac{16}{5}\mathbf{I_1} & +\frac{1}{5}\mathbf{I_2} & -2\mathbf{I_3} & = & 0 \\ \frac{1}{5}\mathbf{I_1} & +\frac{7}{10}\mathbf{I_2} & & = & -3 \\ -2\mathbf{I_1} & & +\frac{5}{2}\mathbf{I_3} & = & -3 \end{cases}$$

Soluzione

$$\begin{cases} \mathbf{I_1} & = & -1 \\ \mathbf{I_2} & = & -4 \\ \mathbf{I_3} & = & -2 \end{cases}$$

Bilancio di potenza

Potenza complessa erogata dai generatori:

$$\mathbf{I_{V_{g1}}} = -\mathbf{I_2} - \mathbf{I_3} = 6 \quad P_{c_{V_{g1}}} = \frac{1}{2}\mathbf{V_{g1}}\mathbf{I}^*_{\mathbf{V_{g1}}} = 9$$

$P_{c_{tot}} = 9$

Potenza attiva assorbita dai resistori:

$$\begin{array}{ll} \mathbf{I_{R_1}} = \mathbf{I_1} = -1 & P_{a_{R_1}} = \frac{1}{2}R_1|\mathbf{I_{R_1}}|^2 = \frac{1}{2} \\ \mathbf{I_{R_2}} = \mathbf{I_1} + \mathbf{I_2} = -5 & P_{a_{R_2}} = \frac{1}{2}R_2|\mathbf{I_{R_2}}|^2 = \frac{5}{2} \\ \mathbf{I_{R_3}} = \mathbf{I_2} = -4 & P_{a_{R_3}} = \frac{1}{2}R_3|\mathbf{I_{R_3}}|^2 = 4 \\ \mathbf{I_{R_4}} = \mathbf{I_1} - \mathbf{I_3} = 1 & P_{a_{R_4}} = \frac{1}{2}R_4|\mathbf{I_{R_4}}|^2 = 1 \\ \mathbf{I_{R_5}} = \mathbf{I_3} = -2 & P_{a_{R_5}} = \frac{1}{2}R_5|\mathbf{I_{R_5}}|^2 = 1 \end{array}$$

$P_{a_{tot}} = 9 = \Re e\{P_{c_{tot}}\}$

Potenza reattiva assorbita dai condensatori e induttori:

$Q_{tot} = 0 = \Im m\{P_{c_{tot}}\}$

Calcolo tensioni e correnti

$\mathbf{I_{R_1}} = \mathbf{I_1} = -1$

$i_{R_1}(t) = \cos(t + \pi)$

$\mathbf{I_{R_2}} = \mathbf{I_1} + \mathbf{I_2} = -5$

$i_{R_2}(t) = 5\cos(t + \pi)$

$\mathbf{I_{R_4}} = \mathbf{I_1} - \mathbf{I_3} = 1$

$i_{R_4}(t) = \cos(t)$

Soluzioni:

$V_{R_1} = 1; \quad I_{R_1} = -1; \quad Pa_{R_1} = \frac{1}{2}$
$V_{R_2} = -1; \quad I_{R_2} = 5; \quad Pa_{R_2} = \frac{5}{2}$
$V_{R_3} = 2; \quad I_{R_3} = -4; \quad Pa_{R_3} = 4$
$V_{R_4} = -2; \quad I_{R_4} = 1; \quad Pa_{R_4} = 1$
$V_{g_1} = 3; \quad I_{g_1} = 6; \quad Pc_{V_{g1}} = 9$
$V_{R_5} = 1; \quad I_{R_5} = -2; \quad Pa_{R_5} = 1$