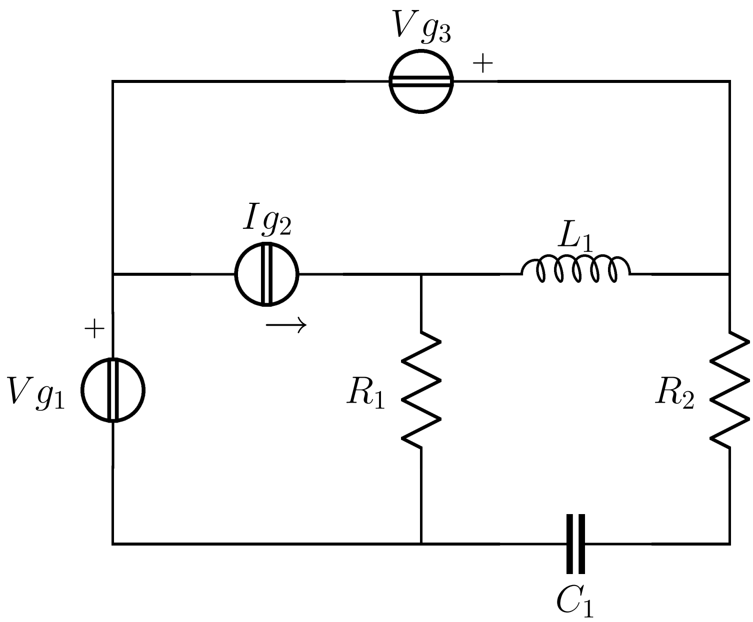
Esercizio A1 risolto maglie

Risolvere il circuito in figura



$v_{g_1}(t) = \frac{5}{2}\cos(2t - \arctan(\frac{4}{3}))$
$R_1 = 2$
$R_2 = \frac{1}{2}$
$C_1 = \frac{1}{5}$
$i_{g_2}(t) = \cos(2t)$
$L_1 = \frac{1}{2}$
$v_{g_3}(t) = \frac{3}{2}\cos(2t)$

Fasori

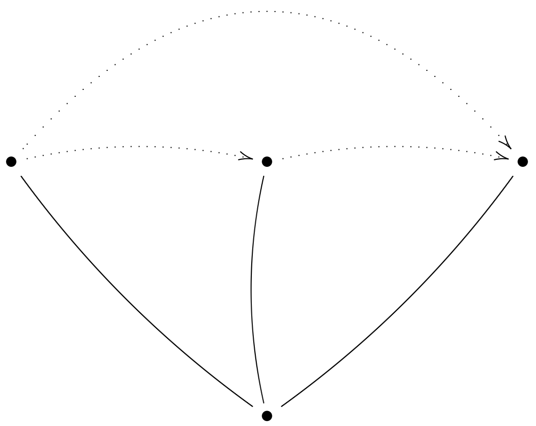
$\mathbf{V_{g_3}} = \frac{3}{2}$
$\mathbf{I_{g_2}} = 1$
$\mathbf{V_{g_1}} = \frac{3}{2} - 2j$

Semplificazioni serie/parallelo

$Z_a = R_2 + \frac{1}{j\omega C_1} = \frac{1}{2} - \frac{5}{2}j$
$Y_a = \frac{1}{13} + \frac{5}{13}j$

Risoluzione dell'esercizio con il metodo delle maglie

Albero e coalbero:



Sistema

$$\begin{cases} R_1\mathbf{I_1} & & -R_1\mathbf{I_2} & & = & \mathbf{V_{g_1}}+\mathbf{V_{x_2}} \\ -R_1\mathbf{I_1} & & +(R_1+Z_a+j\omega L_1)\mathbf{I_2} & +Z_a\mathbf{I_3} & = & 0 \\ & & Z_a\mathbf{I_2} & +Z_a\mathbf{I_3} & = & \mathbf{V_{g_1}}+\mathbf{V_{g_3}} \\ \mathbf{I_1} & & & & = & \mathbf{I_{g_2}} \end{cases}$$

Sostituzione

$$\begin{cases} 2\mathbf{I_1} & -2\mathbf{I_2} & & = & \frac{3}{2}-2j+\mathbf{V_{x_2}} \\ -2\mathbf{I_1} & +(\frac{5}{2}-\frac{3}{2}j)\mathbf{I_2} & +(\frac{1}{2}-\frac{5}{2}j)\mathbf{I_3} & = & 0 \\ & (\frac{1}{2}-\frac{5}{2}j)\mathbf{I_2} & +(\frac{1}{2}-\frac{5}{2}j)\mathbf{I_3} & = & 3-2j \\ \mathbf{I_1} & & & = & 1 \end{cases}$$

Soluzione

$$\begin{cases} \mathbf{I_1} & = & 1 \\ \mathbf{I_2} & = & j \\ \mathbf{I_3} & = & 1 \\ \mathbf{V_{x_2}} & = & \frac{1}{2} \end{cases}$$

Bilancio di potenza

Potenza complessa erogata dai generatori:

$$\begin{array}{ll} \mathbf{I_{V_{g1}}}=\mathbf{I_1}+\mathbf{I_3}=2 & P_{c_{V_{g1}}}=\frac{1}{2}\mathbf{V_{g1}}\mathbf{I}^*_{\mathbf{V_{g1}}}=\frac{3}{2}-2j \\ \mathbf{V_{I_{g2}}}=\mathbf{V_{x_2}}=\frac{1}{2} & P_{c_{I_{g2}}}=\frac{1}{2}\mathbf{V_{I_{g2}}}\mathbf{I}^*_{\mathbf{g2}}=\frac{1}{4} \\ \mathbf{I_{V_{g3}}}=\mathbf{I_3}=1 & P_{c_{V_{g3}}}=\frac{1}{2}\mathbf{V_{g3}}\mathbf{I}^*_{\mathbf{V_{g3}}}=\frac{3}{4} \end{array}$$

$P_{c_{tot}}=\frac{5}{2}-2j$

Potenza attiva assorbita dai resistori:

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

$P_{a_{tot}} = \frac{5}{2} = \Re e\{P_{c_{tot}}\}$

Potenza reattiva assorbita dai condensatori e induttori:

$$\begin{array}{ll} \mathbf{I_{L_1}} = \mathbf{I_2} = j & Q_{L_1} = \frac{1}{2} \omega L_1 |\mathbf{I_{L_1}}|^2 = \frac{1}{2} \\ \mathbf{V_{C_1}} = \frac{-\mathbf{I_2} - \mathbf{I_3}}{j\omega C_1} = -\frac{5}{2} + \frac{5}{2} j & Q_{C_1} = -\frac{1}{2} \omega C_1 |\mathbf{V_{C_1}}|^2 = -\frac{5}{2} \end{array}$$

$Q_{tot} = -2 = \Im m\{P_{c_{tot}}\}$

Soluzioni:

$$\begin{array}{lll} V_{g_1} = \frac{3}{2} - 2j; & I_{g_1} = 2; & Pc_{V_{g1}} = \frac{3}{2} - 2j \\ V_{R_1} = 2 - 2j; & I_{R_1} = -1 + j; & Pa_{R_1} = 2 \\ V_{R_2} + V_{C_1} = 3 - 2j; & I_{R_2} = I_{C_1} = -1 - j; & Pa_{R_2} = \frac{1}{2} \\ Q_{C_1} = -\frac{5}{2} & & \\ V_{g_2} = \frac{1}{2}; & I_{g_2} = 1; & Pc_{I_{g2}} = \frac{1}{4} \\ V_{L_1} = 1; & I_{L_1} = j; & Q_{L_1} = \frac{1}{2} \\ V_{g_3} = \frac{3}{2}; & I_{g_3} = 1; & Pc_{V_{g3}} = \frac{3}{4} \end{array}$$