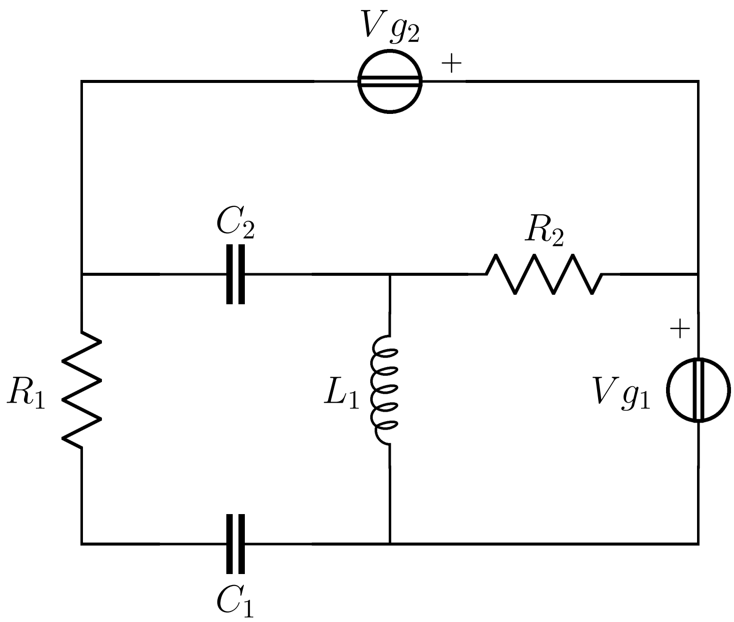
Esercizio c1 risolto 2

Risolvere il circuito in figura



$R_1 = \frac{3}{2}$
$C_1 = \frac{1}{11}$
$L_1 = 2$
$v_{g_1}(t) = 6\sqrt{2}\cos\left(2t + \frac{3\pi}{4}\right)$
$C_2 = \frac{1}{2}$
$R_2 = 2$
$v_{g_2}(t) = \sqrt{5}\cos\left(2t + \arctan(2)\right)$

Fasori

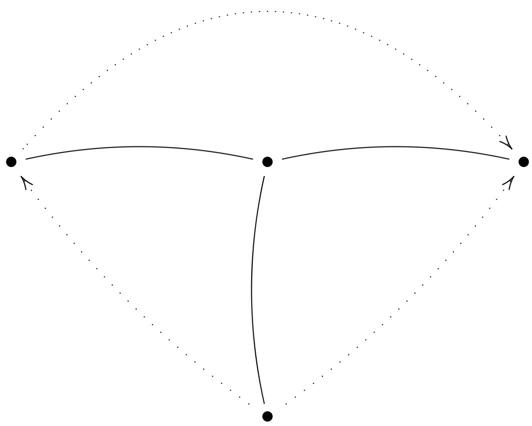
$\mathbf{V_{g_2}} = 1 + 2j$
$\mathbf{V_{g_1}} = -6 + 6j$

Semplificazioni serie/parallelo

$Z_a = R_1 + \frac{1}{j\omega C_1} = \frac{3}{2} - \frac{11}{2}j$
$Y_a = \frac{3}{65} + \frac{11}{65}j$

Risoluzione dell'esercizio con il metodo delle maglie

Albero e coalbero:



Sistema

$$\begin{cases} (Z_a + j\omega L_1 + \frac{1}{j\omega C_2})\mathbf{I_1} & +j\omega L_1 \mathbf{I_2} & -\frac{1}{j\omega C_2}\mathbf{I_3} & = & 0 \\ j\omega L_1 \mathbf{I_1} & +(j\omega L_1 + R_2)\mathbf{I_2} & +R_2\mathbf{I_3} & = & \mathbf{V_{g_1}} \\ -\frac{1}{j\omega C_2}\mathbf{I_1} & +R_2\mathbf{I_2} & +(\frac{1}{j\omega C_2} + R_2)\mathbf{I_3} & = & \mathbf{V_{g_2}} \end{cases}$$

Sostituzione

$$\begin{cases} (\frac{3}{2} - \frac{5}{2}j)\mathbf{I_1} & +4j\mathbf{I_2} & +j\mathbf{I_3} & = & 0 \\ 4j\mathbf{I_1} & +(2+4j)\mathbf{I_2} & +2\mathbf{I_3} & = & -6+6j \\ j\mathbf{I_1} & +2\mathbf{I_2} & +(2-j)\mathbf{I_3} & = & 1+2j \end{cases}$$

Soluzione

$$\begin{cases} \mathbf{I_1} & = & 1+j \\ \mathbf{I_2} & = & j \\ \mathbf{I_3} & = & 1 \end{cases}$$

Bilancio di potenza
Potenza complessa erogata dai generatori:

$$\begin{aligned} &\mathbf{I_{V_{g1}}} = \mathbf{I_2} = j \quad P_{c_{V_{g1}}} = \tfrac{1}{2}\mathbf{V_{g1}}\mathbf{I^*_{V_{g1}}} = 3+3j \\ &\mathbf{I_{V_{g2}}} = \mathbf{I_3} = 1 \quad P_{c_{V_{g2}}} = \tfrac{1}{2}\mathbf{V_{g2}}\mathbf{I^*_{V_{g2}}} = \tfrac{1}{2}+j \end{aligned}$$

$P_{c_{tot}} = \frac{7}{2} + 4j$

Potenza attiva assorbita dai resistori:

$$\begin{aligned} &\mathbf{I_{R_1}} = \mathbf{I_1} = 1+j \qquad\qquad P_{a_{R_1}} = \tfrac{1}{2}R_1|\mathbf{I_{R_1}}|^2 = \tfrac{3}{2} \\ &\mathbf{I_{R_2}} = -\mathbf{I_2} - \mathbf{I_3} = -1-j \quad P_{a_{R_2}} = \tfrac{1}{2}R_2|\mathbf{I_{R_2}}|^2 = 2 \end{aligned}$$

$P_{a_{tot}} = \frac{7}{2} = \Re e\{P_{c_{tot}}\}$

Potenza reattiva assorbita dai condensatori e induttori:

$$
\begin{array}{ll}
\mathbf{I_{L_1}} = -\mathbf{I_1} - \mathbf{I_2} = -1 - 2j & Q_{L_1} = \frac{1}{2}\omega L_1 |\mathbf{I_{L_1}}|^2 = 10 \\
\mathbf{V_{C_2}} = (\mathbf{I_1} - \mathbf{I_3})\frac{1}{j\omega C_2} = 1 & Q_{C_2} = -\frac{1}{2}\omega C_2 |\mathbf{V_{C_2}}|^2 = -\frac{1}{2} \\
\mathbf{V_{C_1}} = \frac{\mathbf{I_1}}{j\omega C_1} = \frac{11}{2} - \frac{11}{2}j & Q_{C_1} = -\frac{1}{2}\omega C_1 |\mathbf{V_{C_1}}|^2 = -\frac{11}{2}
\end{array}
$$

$Q_{tot} = 4 = \Im m\{P_{c_{tot}}\}$

Soluzioni:

$$
\begin{array}{lll}
V_{R_1} + V_{C_1} = -7 + 4j; & I_{R_1} = I_{C_1} = 1 + j; & Pa_{R_1} = \frac{3}{2} \\
Q_{C_1} = -\frac{11}{2} & & \\
V_{L_1} = -8 + 4j; & I_{L_1} = -1 - 2j; & Q_{L_1} = 10 \\
V_{g_1} = -6 + 6j; & I_{g_1} = j; & Pc_{V_{g1}} = 3 + 3j \\
V_{C_2} = -1; & I_{C_2} = j; & Q_{C_2} = -\frac{1}{2} \\
V_{R_2} = 2 + 2j; & I_{R_2} = -1 - j; & Pa_{R_2} = 2 \\
V_{g_2} = 1 + 2j; & I_{g_2} = 1; & Pc_{V_{g2}} = \frac{1}{2} + j
\end{array}
$$