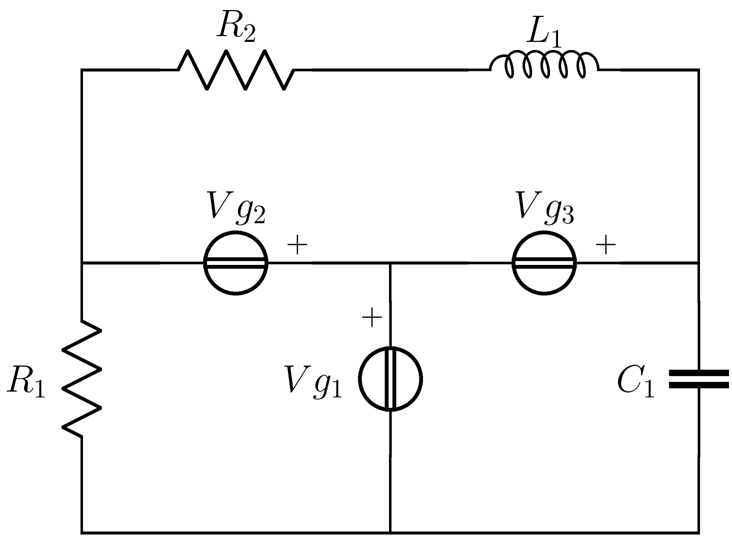
Esercizio d1 risolto 2

Risolvere il circuito in figura



$R_1 = 1$
$v_{g_1}(t) = \cos(t + \pi)$
$C_1 = 1$
$v_{g_2}(t) = \cos(t + \frac{\pi}{2})$
$v_{g_3}(t) = 2\cos(t)$
$R_2 = 2$
$L_1 = 1$

Fasori

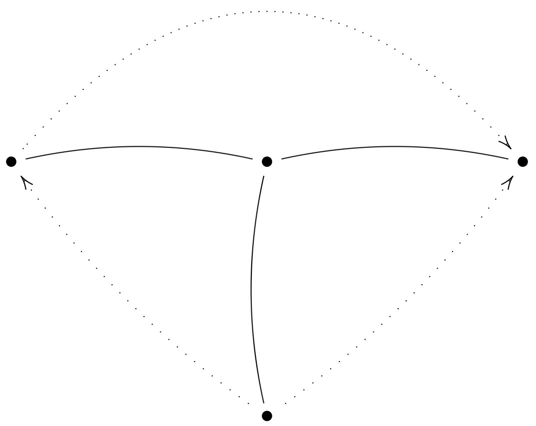
$\mathbf{V_{g_3}} = 2$
$\mathbf{V_{g_2}} = j$
$\mathbf{V_{g_1}} = -1$

Semplificazioni serie/parallelo

$Z_a = R_2 + j\omega L_1 = 2 + j$
$Y_a = \frac{2}{5} - \frac{1}{5}j$

Risoluzione dell'esercizio con il metodo delle maglie

Albero e coalbero:



Sistema

$$\begin{cases} R_1\mathbf{I_1} & & & = & -\mathbf{V_{g_1}}+\mathbf{V_{g_2}} \\ & \frac{1}{j\omega C_1}\mathbf{I_2} & & = & -\mathbf{V_{g_1}}-\mathbf{V_{g_3}} \\ & & Z_a\mathbf{I_3} & = & -\mathbf{V_{g_2}}-\mathbf{V_{g_3}} \end{cases}$$

Sostituzione

$$\begin{cases} \mathbf{I_1} & & & = & 1+j \\ & -j\mathbf{I_2} & & = & -1 \\ & & (2+j)\mathbf{I_3} & = & -2-j \end{cases}$$

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:

$$\begin{array}{ll} \mathbf{I_{V_{g1}}} = -\mathbf{I_1}-\mathbf{I_2} = -1 & P_{c_{V_{g1}}} = \frac{1}{2}\mathbf{V_{g1}}\mathbf{I^*_{V_{g1}}} = \frac{1}{2} \\ \mathbf{I_{V_{g2}}} = \mathbf{I_1}-\mathbf{I_3} = 2+j & P_{c_{V_{g2}}} = \frac{1}{2}\mathbf{V_{g2}}\mathbf{I^*_{V_{g2}}} = \frac{1}{2}+j \\ \mathbf{I_{V_{g3}}} = -\mathbf{I_2}-\mathbf{I_3} = 1+j & P_{c_{V_{g3}}} = \frac{1}{2}\mathbf{V_{g3}}\mathbf{I^*_{V_{g3}}} = 1-j \end{array}$$

$P_{c_{tot}} = 2$

Potenza attiva assorbita dai resistori:

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

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

Potenza reattiva assorbita dai condensatori e induttori:

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

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

Soluzioni:

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