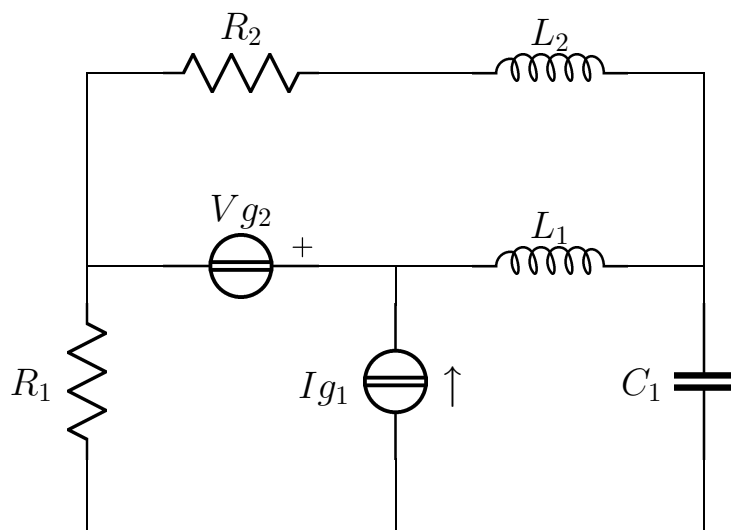


Esercizio A2 risolto 2

Risolvere il circuito in figura



$$\begin{aligned} R_1 &= 1 \\ i_{g1}(t) &= \sqrt{10} \cos(t - \arctan(\frac{1}{3})) \\ C_1 &= 1 \\ v_{g2}(t) &= \cos(t + \pi) \\ L_1 &= 1 \\ R_2 &= 1 \\ L_2 &= 1 \end{aligned}$$

Fasori

$$\mathbf{V}_{g2} = -1$$

$$\mathbf{I}_{g1} = 3 - j$$

Semplificazioni serie/parallelo

$$Z_a = R_2 + j\omega L_2 = 1 + j$$

$$Y_a = \frac{1}{2} - \frac{1}{2}j$$

Risoluzione dell'esercizio con il metodo dei nodi

Sistema

$$\left\{ \begin{array}{llll} (\frac{1}{R_1} + Y_a)\mathbf{E}_1 & -Y_a\mathbf{E}_2 & -\frac{1}{R_1}\mathbf{E}_3 & = -\mathbf{I}_{x2} \\ -Y_a\mathbf{E}_1 & +(j\omega C_1 + \frac{1}{j\omega L_1} + Y_a)\mathbf{E}_2 & -j\omega C_1\mathbf{E}_3 & = 0 \\ -\frac{1}{R_1}\mathbf{E}_1 & -j\omega C_1\mathbf{E}_2 & +(\frac{1}{R_1} + j\omega C_1)\mathbf{E}_3 & = -\mathbf{I}_{g1} \\ -\mathbf{E}_1 & & & = \mathbf{V}_{g2} \end{array} \right.$$

Sostituzione

$$\left\{ \begin{array}{llll} (\frac{3}{2} - \frac{1}{2}j)\mathbf{E}_1 & +(-\frac{1}{2} + \frac{1}{2}j)\mathbf{E}_2 & -\mathbf{E}_3 & = & -\mathbf{I}_{\mathbf{x}_2} \\ (-\frac{1}{2} + \frac{1}{2}j)\mathbf{E}_1 & +(\frac{1}{2} - \frac{1}{2}j)\mathbf{E}_2 & -j\mathbf{E}_3 & = & 0 \\ -\mathbf{E}_1 & -j\mathbf{E}_2 & +(1+j)\mathbf{E}_3 & = & -3+j \\ -\mathbf{E}_1 & & & = & -1 \end{array} \right.$$

Soluzione

$$\left\{ \begin{array}{ll} \mathbf{E}_1 & = & 1 \\ \mathbf{E}_2 & = & -j \\ \mathbf{E}_3 & = & j \\ \mathbf{I}_{\mathbf{x}_2} & = & -2+j \end{array} \right.$$

Bilancio di potenza

Potenza complessa erogata dai generatori:

$$\begin{aligned} \mathbf{V}_{\mathbf{I}_{g1}} = -\mathbf{E}_3 = -j & \quad P_{c_{I_{g1}}} = \frac{1}{2}\mathbf{V}_{\mathbf{I}_{g1}}\mathbf{I}_{g1}^* = \frac{1}{2} - \frac{3}{2}j \\ \mathbf{I}_{\mathbf{V}_{g2}} = \mathbf{I}_{\mathbf{x}_1} = -2+j & \quad P_{c_{V_{g2}}} = \frac{1}{2}\mathbf{V}_{g2}\mathbf{I}_{V_{g2}}^* = 1 + \frac{1}{2}j \end{aligned}$$

$$P_{c_{tot}} = \frac{3}{2} - j$$

Potenza attiva assorbita dai resistori:

$$\begin{aligned} \mathbf{I}_{\mathbf{R}_1} = \frac{\mathbf{E}_1 - \mathbf{E}_3}{R_1} = 1-j & \quad P_{a_{R_1}} = \frac{1}{2}R_1|\mathbf{I}_{\mathbf{R}_1}|^2 = 1 \\ \mathbf{I}_{\mathbf{R}_2} = \frac{\mathbf{E}_2 - \mathbf{E}_1}{Z_a} = -1 & \quad P_{a_{R_2}} = \frac{1}{2}R_2|\mathbf{I}_{\mathbf{R}_2}|^2 = \frac{1}{2} \end{aligned}$$

$$P_{a_{tot}} = \frac{3}{2} = \Re\{P_{c_{tot}}\}$$

Potenza reattiva assorbita dai condensatori e induttori:

$$\begin{aligned} \mathbf{V}_{\mathbf{C}_1} = \mathbf{E}_2 - \mathbf{E}_3 = -2j & \quad Q_{C_1} = -\frac{1}{2}\omega C_1|\mathbf{V}_{\mathbf{C}_1}|^2 = -2 \\ \mathbf{I}_{\mathbf{L}_1} = \frac{\mathbf{E}_2}{j\omega L_1} = -1 & \quad Q_{L_1} = \frac{1}{2}\omega L_1|\mathbf{I}_{\mathbf{L}_1}|^2 = \frac{1}{2} \\ \mathbf{I}_{\mathbf{L}_2} = \frac{\mathbf{E}_2 - \mathbf{E}_1}{Z_a} = -1 & \quad Q_{L_2} = \frac{1}{2}\omega L_2|\mathbf{I}_{\mathbf{L}_2}|^2 = \frac{1}{2} \end{aligned}$$

$$Q_{tot} = -1 = \Im\{P_{c_{tot}}\}$$

Soluzioni:

$$\begin{array}{lll} V_{R_1} = 1 - j; & I_{R_1} = -1 + j; & Pa_{R_1} = 1 \\ V_{g_1} = -j; & I_{g_1} = 3 - j; & Pc_{I_{g_1}} = \frac{1}{2} - \frac{3}{2}j \\ V_{C_1} = -2j; & I_{C_1} = -2; & Q_{C_1} = -2 \\ V_{g_2} = -1; & I_{g_2} = -2 + j; & Pc_{V_{g_2}} = 1 + \frac{1}{2}j \\ V_{L_1} = -j; & I_{L_1} = 1; & Q_{L_1} = \frac{1}{2} \\ V_{R_2} + V_{L_2} = -1 - j; & I_{R_2} = I_{L_2} = 1; & Pa_{R_2} = \frac{1}{2} \\ Q_{L_2} = \frac{1}{2} \end{array}$$