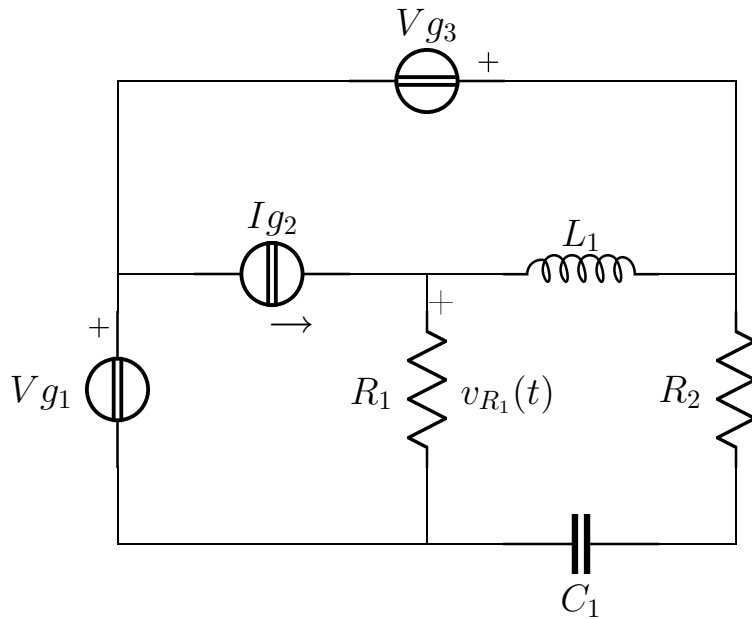


# Esercizio salerno2

Risolvere il circuito in figura



$$\begin{aligned} \mathbf{V}_{g1} &= \frac{3}{2} - 2j \\ R_1 &= 2 \\ R_2 &= \frac{1}{2} \\ C_1 &= \frac{1}{5} \\ \mathbf{I}_{g2} &= 1 \\ L_1 &= \frac{1}{2} \\ \mathbf{V}_{g3} &= \frac{3}{2} \\ \omega &= 2 \end{aligned}$$

## 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 dei nodi

Sistema

$$\left\{ \begin{array}{llll} (\frac{1}{R_1} + \frac{1}{j\omega L_1})\mathbf{E}_1 & -\frac{1}{j\omega L_1}\mathbf{E}_2 & -\frac{1}{R_1}\mathbf{E}_3 & = \mathbf{I}_{g2} \\ -\frac{1}{j\omega L_1}\mathbf{E}_1 & +(Y_a + \frac{1}{j\omega L_1})\mathbf{E}_2 & -Y_a\mathbf{E}_3 & = \mathbf{I}_{x3} \\ -\frac{1}{R_1}\mathbf{E}_1 & -Y_a\mathbf{E}_2 & +(\frac{1}{R_1} + Y_a)\mathbf{E}_3 & = -\mathbf{I}_{x1} \\ & & -\mathbf{E}_3 & = \mathbf{V}_{g1} \\ & \mathbf{E}_2 & & = \mathbf{V}_{g3} \end{array} \right.$$

Sostituzione

$$\left\{ \begin{array}{rcl} (\frac{1}{2} - j)\mathbf{E}_1 & +j\mathbf{E}_2 & -\frac{1}{2}\mathbf{E}_3 = 1 \\ j\mathbf{E}_1 & +(\frac{1}{13} - \frac{8}{13}j)\mathbf{E}_2 & +(-\frac{1}{13} - \frac{5}{13}j)\mathbf{E}_3 = \mathbf{I}_{\mathbf{x}_3} \\ -\frac{1}{2}\mathbf{E}_1 & +(-\frac{1}{13} - \frac{5}{13}j)\mathbf{E}_2 & +(\frac{15}{26} + \frac{5}{13}j)\mathbf{E}_3 = -\mathbf{I}_{\mathbf{x}_1} \\ & & -\mathbf{E}_3 = \frac{3}{2} - 2j \\ & \mathbf{E}_2 & = \frac{3}{2} \end{array} \right.$$

Soluzione

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

### Bilancio di potenza

Potenza complessa erogata dai generatori:

$$\begin{aligned} \mathbf{I}_{\mathbf{V}_{g1}} = \mathbf{I}_{\mathbf{x}_2} = 2 \quad P_{c_{V_{g1}}} &= \frac{1}{2}\mathbf{V}_{g1}\mathbf{I}_{\mathbf{V}_{g1}}^* = \frac{3}{2} - 2j \\ \mathbf{V}_{\mathbf{I}_{g2}} = \mathbf{E}_1 = \frac{1}{2} \quad P_{c_{I_{g2}}} &= \frac{1}{2}\mathbf{V}_{\mathbf{I}_{g2}}\mathbf{I}_{g2}^* = \frac{1}{4} \\ \mathbf{I}_{\mathbf{V}_{g3}} = \mathbf{I}_{\mathbf{x}_2} = 1 \quad P_{c_{V_{g3}}} &= \frac{1}{2}\mathbf{V}_{g3}\mathbf{I}_{\mathbf{V}_{g3}}^* = \frac{3}{4} \end{aligned}$$

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

Potenza attiva assorbita dai resistori:

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

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

Potenza reattiva assorbita dai condensatori e induttori:

$$\begin{aligned} \mathbf{I}_{\mathbf{L}_1} = \frac{\mathbf{E}_2 - \mathbf{E}_1}{j\omega L_1} = -j \quad Q_{L_1} &= \frac{1}{2}\omega L_1|\mathbf{I}_{\mathbf{L}_1}|^2 = \frac{1}{2} \\ \mathbf{V}_{\mathbf{C}_1} = \frac{(\mathbf{E}_2 - \mathbf{E}_3)Y_a}{j\omega C_1} = \frac{5}{2} - \frac{5}{2}j \quad Q_{C_1} &= -\frac{1}{2}\omega C_1|\mathbf{V}_{\mathbf{C}_1}|^2 = -\frac{5}{2} \end{aligned}$$

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

### Calcolo tensioni e correnti

$$\mathbf{V}_{\mathbf{R}_1} = \mathbf{E}_1 - \mathbf{E}_3 = 2 - 2j$$

$$v_{R_1}(t) = 2\sqrt{2} \cos\left(2t - \frac{\pi}{4}\right)$$

**Soluzioni:**

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