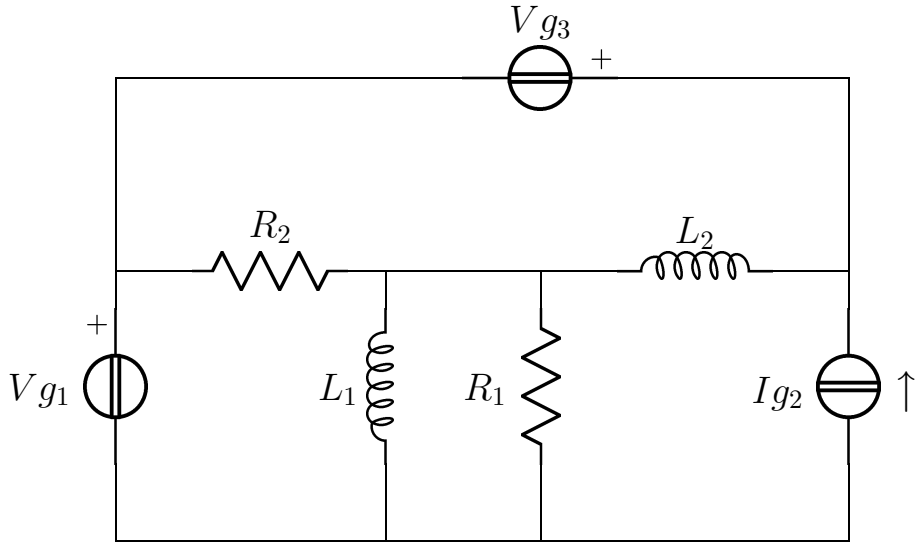
Esercizio 2013-07-02$_{M}aglie_{A}2_{F}asori$

Risolvere il circuito in figura



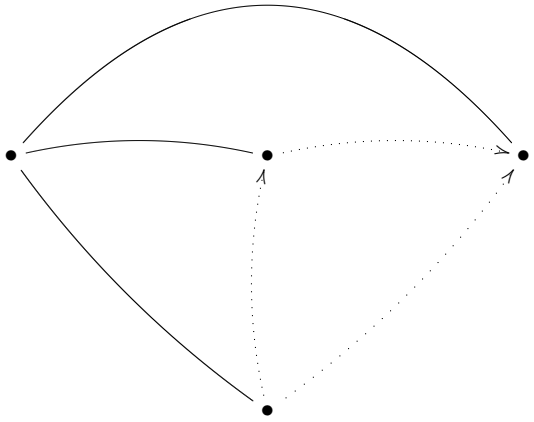
$\mathbf{V_{g_1}} = -5 + 4j$
$R_1 = 1$
$L_1 = \frac{1}{2}$
$\mathbf{I_{g_2}} = j$
$R_2 = 2$
$L_2 = 2$
$\mathbf{V_{g_3}} = 4 - 2j$
$\omega = 1$

Semplificazioni serie/parallelo

$Y_a = \frac{1}{R_1} + \frac{1}{j\omega L_1} = 1 - 2j$
$Z_a = \frac{1}{5} + \frac{2}{5}j$

Risoluzione dell'esercizio con il metodo delle maglie

Albero e coalbero:



Sistema

$$\begin{cases} (Z_a + R_2)\mathbf{I_1} & -R_2\mathbf{I_3} & = & -\mathbf{V_{g_1}} \\ & 0 & = & -\mathbf{V_{g_1}} - \mathbf{V_{g_3}} + \mathbf{V_{x_2}} \\ -R_2\mathbf{I_1} & +(R_2 + j\omega L_2)\mathbf{I_3} & = & -\mathbf{V_{g_3}} \\ \mathbf{I_2} & & = & \mathbf{I_{g_2}} \end{cases}$$

Sostituzione

$$\begin{cases} (\frac{11}{5} + \frac{2}{5}j)\mathbf{I_1} & -2\mathbf{I_3} & = & 5 - 4j \\ & 0 & = & 1 - 2j + \mathbf{V_{x_2}} \\ -2\mathbf{I_1} & +(2 + 2j)\mathbf{I_3} & = & -4 + 2j \\ \mathbf{I_2} & & = & j \end{cases}$$

Soluzione

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

Bilancio di potenza

Potenza complessa erogata dai generatori:

$$\begin{array}{ll} \mathbf{I_{V_{g1}}} = -\mathbf{I_1} - \mathbf{I_2} = -1 + j & P_{c_{V_{g1}}} = \frac{1}{2}\mathbf{V_{g1}}\mathbf{I}^*_{\mathbf{V_{g1}}} = \frac{9}{2} + \frac{1}{2}j \\ \mathbf{V_{I_{g2}}} = \mathbf{V_{x_g 2}} = -1 + 2j & P_{c_{I_{g2}}} = \frac{1}{2}\mathbf{V_{I_{g2}}}\mathbf{I}^*_{\mathbf{g2}} = 1 + \frac{1}{2}j \\ \mathbf{I_{V_{g3}}} = -\mathbf{I_2} - \mathbf{I_3} = 1 - j & P_{c_{V_{g3}}} = \frac{1}{2}\mathbf{V_{g3}}\mathbf{I}^*_{\mathbf{V_{g3}}} = 3 + j \end{array}$$

$P_{c_{tot}} = \frac{17}{2} + 2j$

Potenza attiva assorbita dai resistori:

$$\begin{array}{ll} \mathbf{I_{R_1}} = \frac{\mathbf{I_1} Z_a}{R_1} = 1 & P_{a_{R_1}} = \frac{1}{2}R_1|\mathbf{I_{R_1}}|^2 = \frac{1}{2} \\ \mathbf{I_{R_2}} = -\mathbf{I_1} + \mathbf{I_3} = -2 + 2j & P_{a_{R_2}} = \frac{1}{2}R_2|\mathbf{I_{R_2}}|^2 = 8 \end{array}$$

$P_{a_{tot}} = \frac{17}{2} = \Re e\{P_{c_{tot}}\}$

Potenza reattiva assorbita dai condensatori e induttori:

$$\begin{array}{ll} \mathbf{I_{L_2}} = \mathbf{I_3} = -1 & Q_{L_2} = \frac{1}{2}\omega L_2|\mathbf{I_{L_2}}|^2 = 1 \\ \mathbf{I_{L_1}} = \frac{\mathbf{I_1} Z_a}{j\omega L_1} = -2j & Q_{L_1} = \frac{1}{2}\omega L_1|\mathbf{I_{L_1}}|^2 = 1 \end{array}$$

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

Soluzioni:

$V_{g_1} = -5 + 4j;$	$I_{g_1} = -1 + j;$	$Pc_{V_{g1}} = \frac{9}{2} + \frac{1}{2}j$
$V_{R_1} = V_{L_1} = -1;$	$I_{R_1} + I_{L_1} = 1 - 2j;$	$Pa_{R_1} = \frac{1}{2}$
$Q_{L_1} = 1$		
$V_{g_2} = -1 + 2j;$	$I_{g_2} = j;$	$Pc_{I_{g2}} = 1 + \frac{1}{2}j$
$V_{R_2} = 4 - 4j;$	$I_{R_2} = -2 + 2j;$	$Pa_{R_2} = 8$
$V_{L_2} = 2j;$	$I_{L_2} = -1;$	$Q_{L_2} = 1$
$V_{g_3} = 4 - 2j;$	$I_{g_3} = 1 - j;$	$Pc_{V_{g3}} = 3 + j$