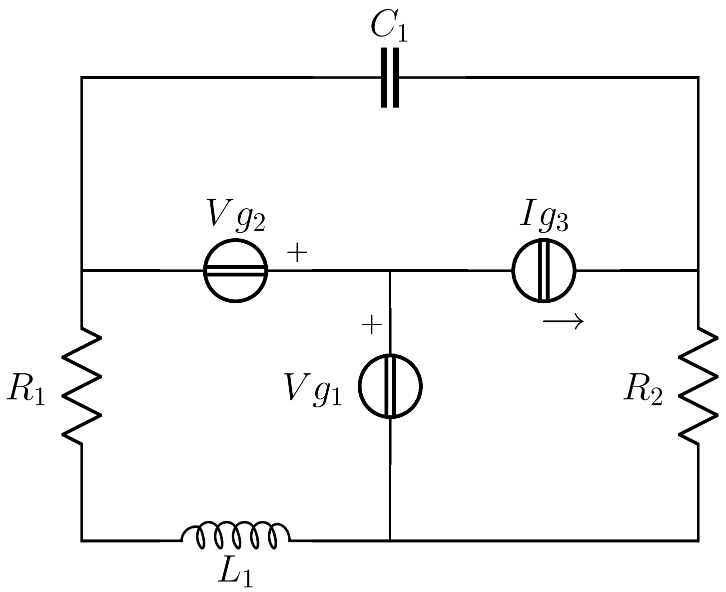
Esercizio ggcesame$_2015-02-10_A1_Maglie$

Risolvere il circuito in figura



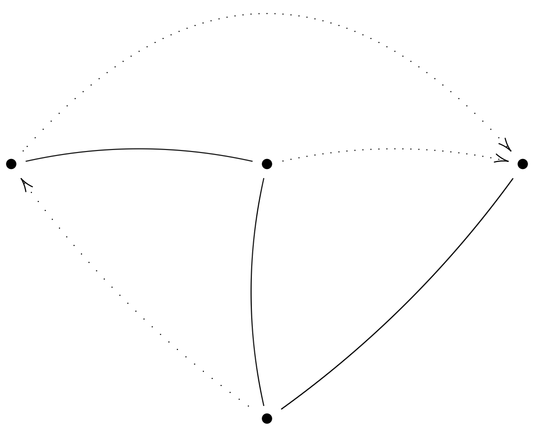
$R_1 = 1$
$L_1 = \frac{1}{2}$
$\mathbf{V_{g_1}} = j$
$R_2 = \frac{1}{2}$
$\mathbf{V_{g_2}} = -1$
$\mathbf{I_{g_3}} = 4 + 6j$
$C_1 = 2$
$\omega = 2$

Semplificazioni serie/parallelo

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

Risoluzione dell'esercizio con il metodo delle maglie

Albero e coalbero:



Sistema

$$\begin{cases} Z_a\mathbf{I_1} & & & = & -\mathbf{V_{g_1}}+\mathbf{V_{g_2}} \\ & R_2\mathbf{I_2} & +R_2\mathbf{I_3} & = & \mathbf{V_{g_1}}+\mathbf{V_{x_3}} \\ & R_2\mathbf{I_2} & +(R_2+\frac{1}{j\omega C_1})\mathbf{I_3} & = & \mathbf{V_{g_1}}-\mathbf{V_{g_2}} \\ & \mathbf{I_2} & & = & \mathbf{I_{g_3}} \end{cases}$$

Sostituzione

$$\begin{cases} (1+j)\mathbf{I_1} & & & = & -1-j \\ & \frac{1}{2}\mathbf{I_2} & +\frac{1}{2}\mathbf{I_3} & = & j+\mathbf{V_{x_3}} \\ & \frac{1}{2}\mathbf{I_2} & +(\frac{1}{2}-\frac{1}{4}j)\mathbf{I_3} & = & 1+j \\ & \mathbf{I_2} & & = & 4+6j \end{cases}$$

Soluzione

$$\begin{cases} \mathbf{I_1} & = & -1 \\ \mathbf{I_2} & = & 4+6j \\ \mathbf{I_3} & = & -4j \\ \mathbf{V_{x_3}} & = & 2 \end{cases}$$

Bilancio di potenza

Potenza complessa erogata dai generatori:

$$\begin{array}{ll} \mathbf{I_{V_{g1}}} = -\mathbf{I_1}+\mathbf{I_2}+\mathbf{I_3} = 5+2j & P_{c_{V_{g1}}} = \frac{1}{2}\mathbf{V_{g1}}\mathbf{I^*_{V_{g1}}} = 1+\frac{5}{2}j \\ \mathbf{I_{V_{g2}}} = \mathbf{I_1}-\mathbf{I_3} = -1+4j & P_{c_{V_{g2}}} = \frac{1}{2}\mathbf{V_{g2}}\mathbf{I^*_{V_{g2}}} = \frac{1}{2}+2j \\ \mathbf{V_{I_{g3}}} = \mathbf{V_{x_2}} = 2 & P_{c_{I_{g3}}} = \frac{1}{2}\mathbf{V_{I_{g3}}}\mathbf{I^*_{g3}} = 4-6j \end{array}$$

$P_{c_{tot}} = \frac{11}{2} - \frac{3}{2}j$

Potenza attiva assorbita dai resistori:

$$\begin{array}{ll} \mathbf{I_{R_1}} = \mathbf{I_1} = -1 & P_{a_{R_1}} = \frac{1}{2}R_1|\mathbf{I_{R_1}}|^2 = \frac{1}{2} \\ \mathbf{I_{R_2}} = -\mathbf{I_2}-\mathbf{I_3} = -4-2j & P_{a_{R_2}} = \frac{1}{2}R_2|\mathbf{I_{R_2}}|^2 = 5 \end{array}$$

$P_{a_{tot}} = \frac{11}{2} = \Re e\{P_{c_{tot}}\}$

Potenza reattiva assorbita dai condensatori e induttori:

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

$Q_{tot} = -\frac{3}{2} = \Im m\{P_{c_{tot}}\}$

Soluzioni:

$V_{R_1} + V_{L_1} = 1 + j;$ $I_{R_1} = I_{L_1} = -1;$ $Pa_{R_1} = \frac{1}{2}$

$Q_{L_1} = \frac{1}{2}$

$V_{g_1} = j;$	$I_{g_1} = 5 + 2j;$	$Pc_{V_{g1}} = 1 + \frac{5}{2}j$
$V_{R_2} = 2 + j;$	$I_{R_2} = -4 - 2j;$	$Pa_{R_2} = 5$
$V_{g_2} = -1;$	$I_{g_2} = -1 + 4j;$	$Pc_{V_{g2}} = \frac{1}{2} + 2j$
$V_{g_3} = 2;$	$I_{g_3} = 4 + 6j;$	$Pc_{I_{g3}} = 4 - 6j$
$V_{C_1} = 1;$	$I_{C_1} = -4j;$	$Q_{C_1} = -2$