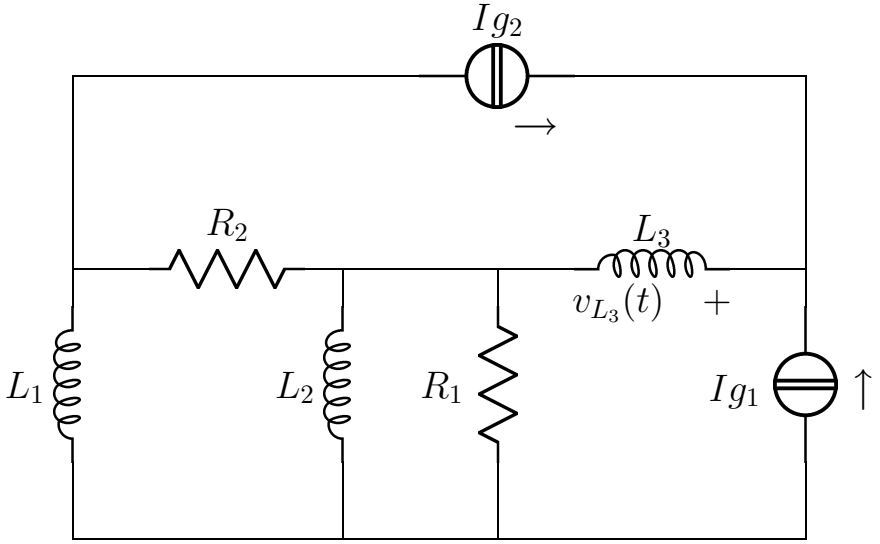
Esercizio ggcesame$_2$016 − 01 − 29$_P$*arallelo*4; *Maglie*

Risolvere il circuito in figura



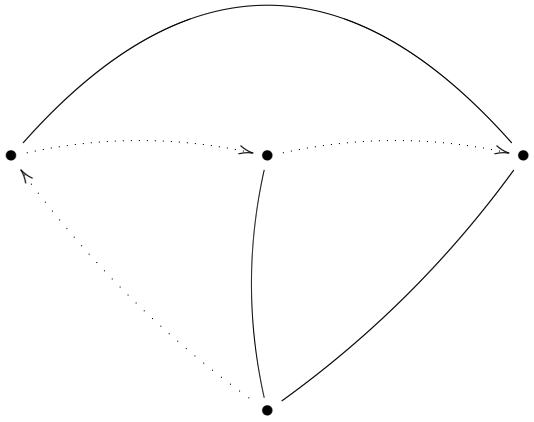
$L_1 = 1$
$R_1 = 1$
$L_2 = \frac{1}{2}$
$\mathbf{I_{g_1}} = -1 + j$
$R_2 = 2$
$L_3 = 2$
$\mathbf{I_{g_2}} = -1 + j$
$\omega = 1$

Semplificazioni serie/parallelo

$Y_a = \frac{1}{R_1} + \frac{1}{j\omega L_2} = 1 - 2j$
$Z_a = \frac{1}{5} + \frac{2}{5}j$

Risoluzione dell'esercizio con il metodo delle maglie

Albero e coalbero:



Sistema

$$\begin{cases} j\omega L_1\mathbf{I_1} & & & = & -\mathbf{V_{x_1}}+\mathbf{V_{x_2}} \\ & (Z_a+R_2)\mathbf{I_2} & -Z_a\mathbf{I_3} & = & \mathbf{V_{x_1}}-\mathbf{V_{x_2}} \\ & -Z_a\mathbf{I_2} & +(Z_a+j\omega L_3)\mathbf{I_3} & = & -\mathbf{V_{x_1}} \\ -\mathbf{I_1} & +\mathbf{I_2} & -\mathbf{I_3} & = & \mathbf{I_{g_1}} \\ \mathbf{I_1} & -\mathbf{I_2} & & = & \mathbf{I_{g_2}} \end{cases}$$

Sostituzione

$$\begin{cases} j\mathbf{I_1} & & & = & -\mathbf{V_{x_1}}+\mathbf{V_{x_2}} \\ & (\frac{11}{5}+\frac{2}{5}j)\mathbf{I_2} & +(-\frac{1}{5}-\frac{2}{5}j)\mathbf{I_3} & = & \mathbf{V_{x_1}}-\mathbf{V_{x_2}} \\ & (-\frac{1}{5}-\frac{2}{5}j)\mathbf{I_2} & +(\frac{1}{5}+\frac{12}{5}j)\mathbf{I_3} & = & -\mathbf{V_{x_1}} \\ -\mathbf{I_1} & +\mathbf{I_2} & -\mathbf{I_3} & = & -1+j \\ \mathbf{I_1} & -\mathbf{I_2} & & = & -1+j \end{cases}$$

Soluzione

$$\begin{cases} \mathbf{I_1} & = & j \\ \mathbf{I_2} & = & 1 \\ \mathbf{I_3} & = & 2-2j \\ \mathbf{V_{x_1}} & = & -5-4j \\ \mathbf{V_{x_2}} & = & -6-4j \end{cases}$$

Bilancio di potenza

Potenza complessa erogata dai generatori:

$$\begin{array}{ll} \mathbf{V_{I_{g1}}}=\mathbf{V_{x_g1}}=-5-4j & P_{c_{I_{g1}}}=\frac{1}{2}\mathbf{V_{I_{g1}}}\mathbf{I^*_{g1}}=\frac{1}{2}+\frac{9}{2}j \\ \mathbf{V_{I_{g2}}}=\mathbf{V_{x_g1}}=-6-4j & P_{c_{I_{g2}}}=\frac{1}{2}\mathbf{V_{I_{g2}}}\mathbf{I^*_{g2}}=1+5j \end{array}$$

$P_{c_{tot}}=\frac{3}{2}+\frac{19}{2}j$

Potenza attiva assorbita dai resistori:

$$\begin{array}{ll} \mathbf{I_{R_1}}=\frac{(-\mathbf{I_2}+\mathbf{I_3})Z_a}{R_1}=1 & P_{a_{R_1}}=\frac{1}{2}R_1|\mathbf{I_{R_1}}|^2=\frac{1}{2} \\ \mathbf{I_{R_2}}=\mathbf{I_2}=1 & P_{a_{R_2}}=\frac{1}{2}R_2|\mathbf{I_{R_2}}|^2=1 \end{array}$$

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

Potenza reattiva assorbita dai condensatori e induttori:

$$\begin{array}{ll} \mathbf{I_{L_1}}=\mathbf{I_1}=j & Q_{L_1}=\frac{1}{2}\omega L_1|\mathbf{I_{L_1}}|^2=\frac{1}{2} \\ \mathbf{I_{L_3}}=-\mathbf{I_3}=-2+2j & Q_{L_3}=\frac{1}{2}\omega L_3|\mathbf{I_{L_3}}|^2=8 \\ \mathbf{I_{L_2}}=\frac{(-\mathbf{I_2}+\mathbf{I_3})Z_a}{j\omega L_2}=-2j & Q_{L_2}=\frac{1}{2}\omega L_2|\mathbf{I_{L_2}}|^2=1 \end{array}$$

$Q_{tot} = \frac{19}{2} = \Im m\{P_{c_{tot}}\}$

Calcolo tensioni e correnti

$$\mathbf{V_{L_3}} = -\mathbf{I_3} j\omega L_3 = -4 - 4j$$

$$v_{L_3}(t) = 4\sqrt{2}\cos\left(t + \frac{5\pi}{4}\right)$$

Soluzioni:

$V_{L_1} = 1;$	$I_{L_1} = j;$	$Q_{L_1} = \frac{1}{2}$
$V_{R_1} = V_{L_2} = -1;$	$I_{R_1} + I_{L_2} = 1 - 2j;$	$Pa_{R_1} = \frac{1}{2}$
$Q_{L_2} = 1$		
$V_{g_1} = -5 - 4j;$	$I_{g_1} = -1 + j;$	$Pc_{I_{g1}} = \frac{1}{2} + \frac{9}{2}j$
$V_{R_2} = -2;$	$I_{R_2} = 1;$	$Pa_{R_2} = 1$
$V_{L_3} = -4 - 4j;$	$I_{L_3} = 2 - 2j;$	$Q_{L_3} = 8$
$V_{g_2} = -6 - 4j;$	$I_{g_2} = -1 + j;$	$Pc_{I_{g2}} = 1 + 5j$