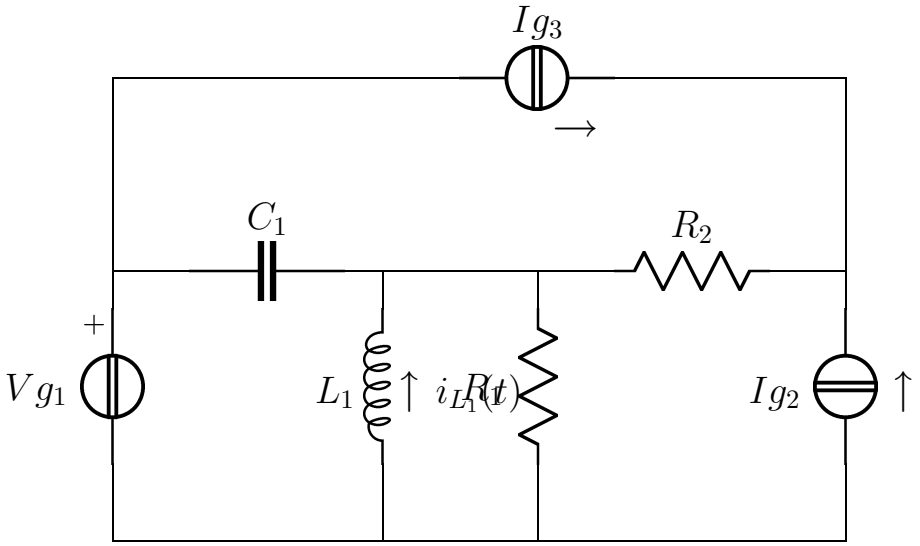
Esercizio ggcesame$_2$016$-$01$-$29$_P$arallelo5; $NodiRif4$

Risolvere il circuito in figura



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

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

Risoluzione dell'esercizio con il metodo dei nodi
Sistema

$$\begin{cases} j\omega C_1\mathbf{E_1} & -j\omega C_1\mathbf{E_2} & & = & -\mathbf{I_{g_3}} + \mathbf{I_{x_1}} \\ -j\omega C_1\mathbf{E_1} & +(Y_a + j\omega C_1 + \frac{1}{R_2})\mathbf{E_2} & -\frac{1}{R_2}\mathbf{E_3} & = & 0 \\ & -\frac{1}{R_2}\mathbf{E_2} & +\frac{1}{R_2}\mathbf{E_3} & = & \mathbf{I_{g_2}} + \mathbf{I_{g_3}} \\ \mathbf{E_1} & & & = & \mathbf{V_{g_1}} \end{cases}$$

Sostituzione

$$\begin{cases} j\mathbf{E_1} & -j\mathbf{E_2} & & = & 1 + j + \mathbf{I_{x_1}} \\ -j\mathbf{E_1} & +2\mathbf{E_2} & -\mathbf{E_3} & = & 0 \\ & -\mathbf{E_2} & +\mathbf{E_3} & = & -1 - 2j \\ \mathbf{E_1} & & & = & 2 - 2j \end{cases}$$

Soluzione

$$\begin{cases} \mathbf{E_1} &= 2-2j \\ \mathbf{E_2} &= 1 \\ \mathbf{E_3} &= -2j \\ \mathbf{I_{x_1}} &= 1 \end{cases}$$

Bilancio di potenza

Potenza complessa erogata dai generatori:

$$\begin{array}{ll} \mathbf{I_{V_{g1}}} = \mathbf{I_{x_g 2}} = 1 & P_{c_{V_{g1}}} = \frac{1}{2}\mathbf{V_{g1}}\mathbf{I^*_{V_{g1}}} = 1-j \\ \mathbf{V_{I_{g2}}} = \mathbf{E_3} = -2j & P_{c_{I_{g2}}} = \frac{1}{2}\mathbf{V_{I_{g2}}}\mathbf{I^*_{g2}} = 1 \\ \mathbf{V_{I_{g3}}} = \mathbf{E_3} - \mathbf{E_1} = -2 & P_{c_{I_{g3}}} = \frac{1}{2}\mathbf{V_{I_{g3}}}\mathbf{I^*_{g3}} = 1-j \end{array}$$

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

Potenza attiva assorbita dai resistori:

$$\begin{array}{ll} \mathbf{I_{R_1}} = \frac{\mathbf{E_2}}{R_1} = 1 & P_{a_{R_1}} = \frac{1}{2}R_1|\mathbf{I_{R_1}}|^2 = \frac{1}{2} \\ \mathbf{I_{R_2}} = \frac{\mathbf{E_3}-\mathbf{E_2}}{R_2} = -1-2j & P_{a_{R_2}} = \frac{1}{2}R_2|\mathbf{I_{R_2}}|^2 = \frac{5}{2} \end{array}$$

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

Potenza reattiva assorbita dai condensatori e induttori:

$$\begin{array}{ll} \mathbf{V_{C_1}} = \mathbf{E_2} - \mathbf{E_1} = -1+2j & Q_{C_1} = -\frac{1}{2}\omega C_1|\mathbf{V_{C_1}}|^2 = -\frac{5}{2} \\ \mathbf{I_{L_1}} = \frac{-\mathbf{E_2}}{j\omega L_1} = j & Q_{L_1} = \frac{1}{2}\omega L_1|\mathbf{I_{L_1}}|^2 = \frac{1}{2} \end{array}$$

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

Calcolo tensioni e correnti

$$\mathbf{I_{L_1}} = \frac{-\mathbf{E_2}}{j\omega L_1} = j$$

$$i_{L_1}(t) = \cos\left(2t + \frac{\pi}{2}\right)$$

Soluzioni:

$V_{g_1} = 2 - 2j;$	$I_{g_1} = 1;$	$Pc_{V_{g1}} = 1 - j$
$V_{R_1} = V_{L_1} = 1;$	$I_{R_1} + I_{L_1} = -1 + j;$	$Pa_{R_1} = \frac{1}{2}$
$Q_{L_1} = \frac{1}{2}$		
$V_{g_2} = -2j;$	$I_{g_2} = -j;$	$Pc_{I_{g2}} = 1$
$V_{C_1} = -1 + 2j;$	$I_{C_1} = 2 + j;$	$Q_{C_1} = -\frac{5}{2}$
$V_{R_2} = -1 - 2j;$	$I_{R_2} = 1 + 2j;$	$Pa_{R_2} = \frac{5}{2}$
$V_{g_3} = -2;$	$I_{g_3} = -1 - j;$	$Pc_{I_{g3}} = 1 - j$