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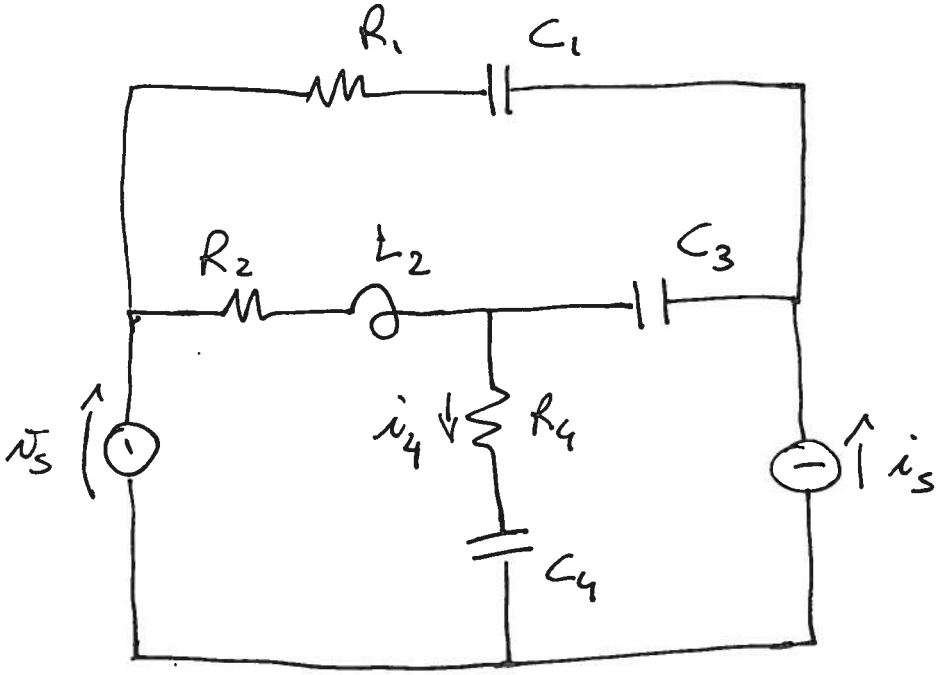


$R_1 = R_2 = R_4 = 1\,\Omega$

$L_2 = 1\,H$

$C_1 = C_3 = C_4 = 1\,F$

$\omega_1 = 1\ rad/s$

$\omega_2 = 2\ rad/s$

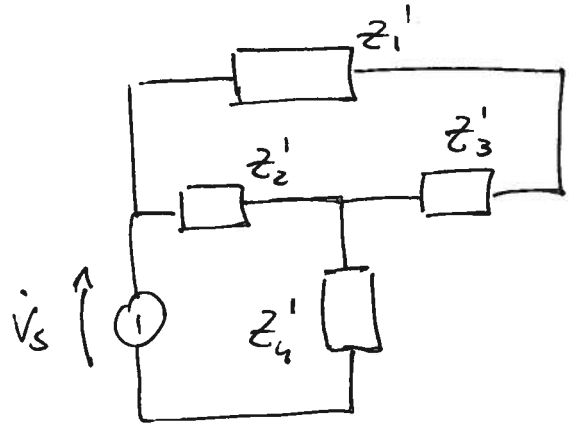
$$v_s(t) = 4\sqrt{2}\cos\left(\omega_1 t + \frac{\pi}{4}\right) V$$

$$i_s(t) = 5\cos\left(\omega_2 t + \frac{\pi}{2}\right) A$$

Calcolare la potenza erogata da R_4.

$i_s(t) = 0$

$$v_s(t) \rightarrow \dot{V}_s = 4\exp\left(j\frac{\pi}{4}\right) V = 2\left(\sqrt{2} + j\sqrt{2}\right) V$$

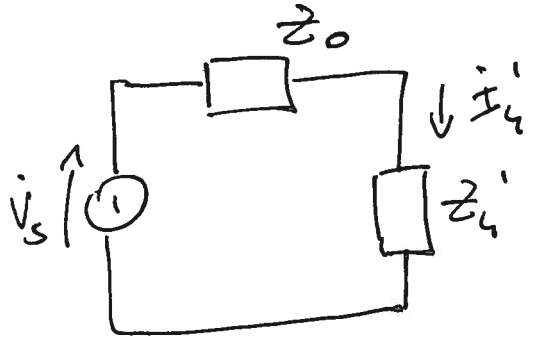


$$Z_1' = R_1 - j\frac{1}{\omega_1 C_1} = 1 - j\,\Omega$$

$$Z_2' = R_2 + j\omega_1 L_2 = 1 + j\,\Omega$$

$$Z_3' = -j\frac{1}{\omega_1 C_3} = -j\,\Omega$$

$$Z_4' = R_4 - j\frac{1}{\omega_1 C_4} = 1 - j\,\Omega$$



$$Z_0 = (Z_1' + Z_3') \parallel Z_2'$$

$$= \frac{Z_2''(Z_1' + Z_3')}{Z_1' + Z_2' + Z_3'} = \frac{7+j}{5}\ \Omega$$

$$\dot{I}_4' = \frac{\dot{V}_s}{Z_0 + Z_4'} = \frac{4+j4}{\sqrt{2}} \cdot \frac{1}{\frac{7+j}{5} + 1 - j} \text{ A} = \frac{1+j2}{\sqrt{2}}\ \text{A}$$

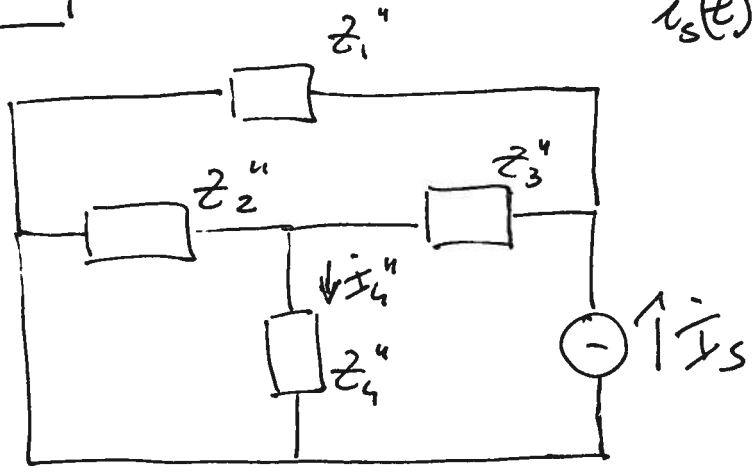
$$|\dot{I}_4'^{A'}| = \frac{\sqrt{5}}{\sqrt{2}}$$

$$\arg(\dot{I}_4') = \operatorname{atan}\left(\frac{2}{1}\right) = 1{,}11\ \text{rad}$$

$$i_{L_4}'(t) = \sqrt{5}\cos(\omega_1 t + 1{,}11)$$

$v_s(t) = 0$

$$i_s(t) \rightarrow \dot{I}_s = j\frac{5}{\sqrt{2}}\ \text{A}$$

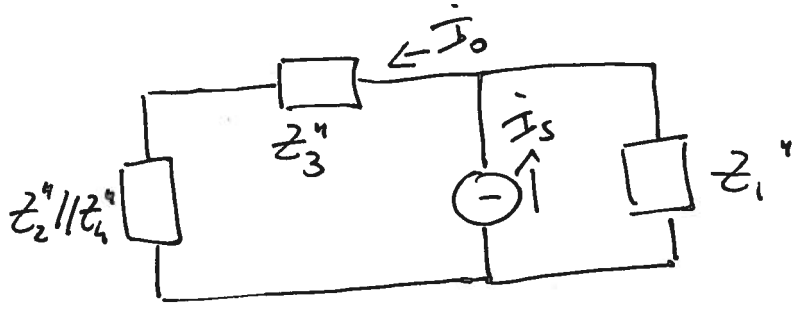


$$Z_1'' = R_1 - j\frac{1}{\omega_2 C_1} = 1 - j\frac{1}{2}\ \Omega$$

$$Z_2'' = R_2 + j\omega_2 L_2 = 1 + j2\ \Omega$$

$$Z_3'' = -j\frac{1}{\omega_2 C_3} = -j\frac{1}{2}\ \Omega$$

$$Z_4'' = R_4 - j\frac{1}{\omega_2 C_4} = 1 - j\frac{1}{2}\ \Omega$$



$$Z_0'' = Z_2''//Z_4'' + Z_3 = 1 - j\frac{1}{2}\ \Omega$$

$$\dot{I}_0'' = \dot{I}_S \frac{\frac{1}{Z_0''}}{\frac{1}{Z_0''} + \frac{1}{Z_1''}} = j\frac{5}{2\sqrt{2}}\ A$$

$$\dot{I}_4'' = \dot{I}_0'' \frac{Z_2''}{Z_2'' + Z_4''} = \frac{-1 + j2}{\sqrt{2}}\ A$$

$$|\dot{I}_4''| = \frac{\sqrt{5}}{\sqrt{2}}\ A \qquad i_4''(t) = \sqrt{5}\cos(\omega_2 t + 2{,}03)$$

$$\arg(\dot{I}_4'') = 2{,}03\ rad$$

$$i_4(t) = \sqrt{5}\cos(\omega_2 t + 1{,}11) + \sqrt{5}\cos(\omega_2 t + 2{,}03)$$

$$= \sqrt{5}\left[\cos(t + 1{,}11) + \cos(2t + 2{,}03)\right]$$

$$P_4' = R_4|\dot{I}_4'|^2 = \frac{5}{2}\ W$$

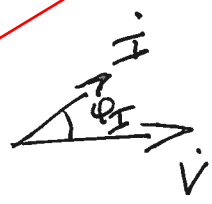
$$P_4'' = R_4|\dot{I}_4''|^2 = \frac{5}{2}\ W$$

$$P_4 = P_4' + P_4'' = 5\ W$$

BIPOLO OHMICO-CAPACITIVO

corrente in anticipo sulle Tensione

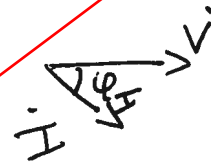
$\varphi_I = 0{,}9272$ rad



BIPOLO OHMICO-INDUTTIVO

corrente è in ritardo sulle Tensione

$\varphi_I = -0{,}9272$ rad



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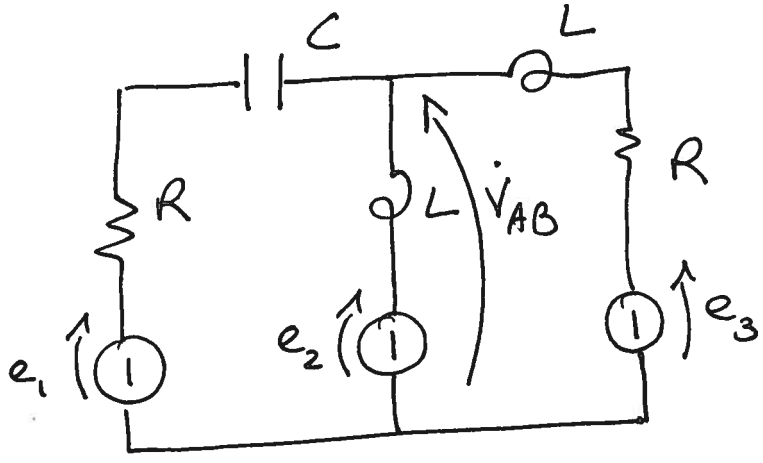


Calcolare le potenze erogate dai generatori.

$R = 1\,\Omega$

$X_L = \omega L = 1\,\Omega$

$X_C = -\frac{1}{\omega C} = -1\,\Omega$

$\dot{E}_1 = 2\,V$

$\dot{E}_2 = \sqrt{2}\exp\left(-j\frac{\pi}{4}\right) V$

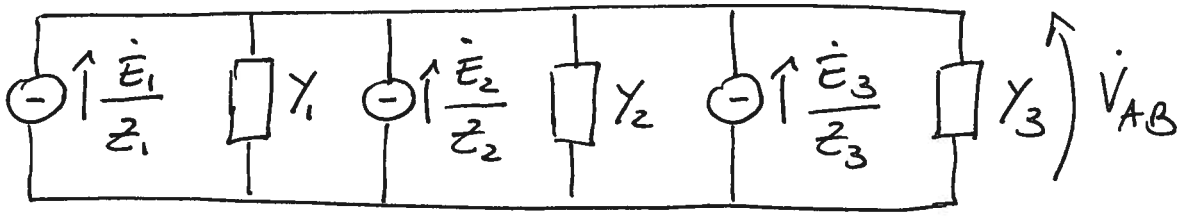
$= 1 - j\,V$

$\dot{E}_3 = 2\exp\left(j\frac{\pi}{2}\right) V = j2\,V$

$\dot{Z}_1 = R + jX_C = 1 - j\,\Omega$

$\dot{Z}_2 = j\omega L = jX_L = j\,\Omega$

$\dot{Z}_3 = R + jX_L = 1 + j\,\Omega$

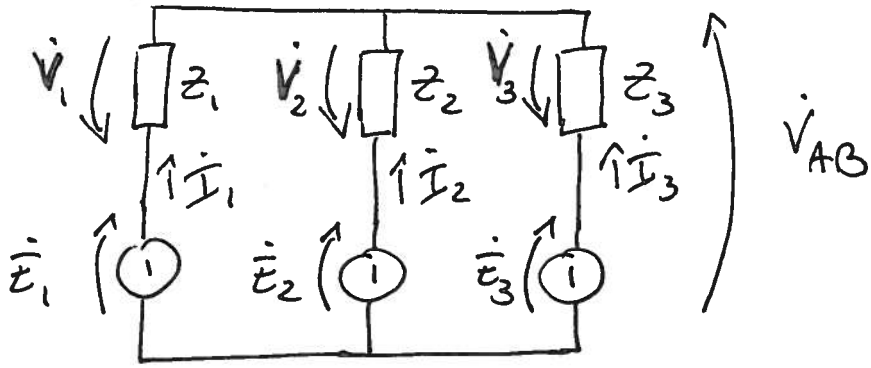


$$Y_1 = \frac{1}{Z_1} = \frac{1}{2} + j\frac{1}{2}\ S$$

$$Y_2 = \frac{1}{Z_2} = -j\ S$$

$$Y_3 = \frac{1}{Z_3} = \frac{1}{2} - j\frac{1}{2}\ S$$

$$\dot{V}_{AB} = \frac{\frac{\dot{E}_1}{Z_1} + \frac{\dot{E}_2}{Z_2} + \frac{\dot{E}_3}{Z_3}}{Y_1 + Y_2 + Y_3} = j\ V$$



$$\dot{V}_1 = \dot{E}_1 - \dot{V}_{AB} = 2 - j\ V$$

$$\dot{V}_2 = \dot{E}_2 - \dot{V}_{AB} = 1 - j2\ V$$

$$\dot{V}_3 = \dot{E}_3 - \dot{V}_{AB} = j\ V$$

$$\dot{I}_1 = Y_1 \dot{V}_1 = \frac{3}{2} + j\frac{1}{2}\ A$$

$$\dot{I}_2 = Y_2 \dot{V}_2 = -2 - j\ A$$

$$\dot{I}_3 = Y_3 \dot{V}_3 = \frac{1}{2} + j\frac{1}{2}\ A$$

$$\bar{A}_1 = \dot{E}_1 \dot{I}_1^* = 3 - j \text{ VA}$$

$$\bar{A}_2 = \dot{E}_2 \dot{I}_2^* = -1 + j3 \text{ VA}$$

$$\bar{A}_3 = \dot{E}_3 \dot{I}_3^* = 1 + j \text{ VA}$$

$$P_1 = \text{Re}\{\bar{A}_1\} = 3 \text{ W}$$
$$Q_1 = \text{Im}\{\bar{A}_1\} = -1 \text{ VAr}$$
$$P_2 = \text{Re}\{\bar{A}_2\} = -1 \text{ W}$$
$$Q_2 = \text{Im}\{\bar{A}_2\} = 3 \text{ VAr}$$
$$P_3 = \text{Re}\{\bar{A}_3\} = 1 \text{ W}$$
$$Q_3 = \text{Im}\{\bar{A}_3\} = 1 \text{ VAr}$$

} potenze EROGATE

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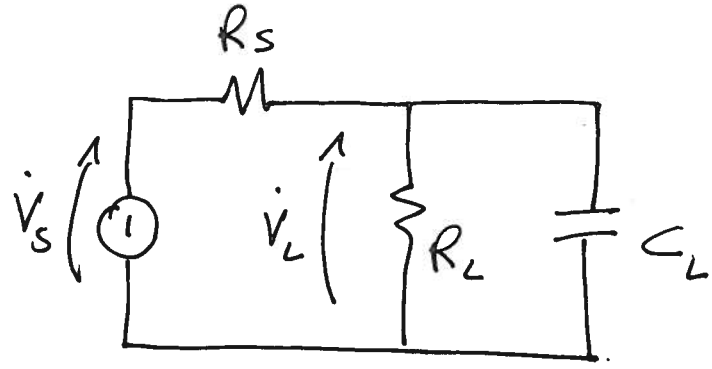


$V_S = 220 \text{ V rms}$

$R_S = 2 \Omega$

$R_L = 16 \Omega$

$C = 100 \mu\text{F}$

$f = 50 \text{ Hz}$

Calcolare le potenze attive assorbite dal carico $R_L \| C_L$

$$Z_L = \left(-j \frac{1}{\omega C_L}\right) \| R_L = \frac{-j \frac{R_L}{\omega C_L}}{R_L - j \frac{1}{\omega C_L}} = 12{,}27 - j\, 6{,}42 \ \Omega$$

$$\dot{V}_L = \dot{V}_S \frac{Z_L}{R_S + Z_L} = 194,9 - j\,10,88\ V$$

$$= 195,25 \exp(-j\,0,0558)\ V$$

$$\dot{I}_L = \frac{\dot{V}_S}{R_S + Z_L} = 12,52 + j\,5,444\ A$$

$$= 13,658 \exp(j\,0,41)\ A$$

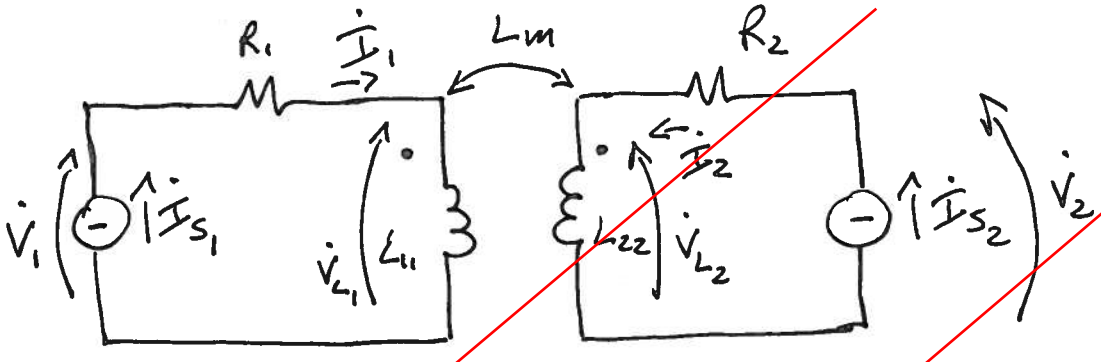
$$P_L = Re\{\dot{V}_L \dot{I}_L^*\} = 2,3827\ kW$$

oppure

$$\varphi_V - \varphi_I = \varphi = -0,0558 - 0,41 = -0,4658\ rad$$

$$P_L = V_L I_L \cos\varphi = 2,3827\ kW$$

ES 48



$L_{11} = 0,5\ H$ $\quad R_1 = 2\ \Omega$ $\quad \dot{I}_{S_1} = 4\ A$

$L_{22} = 1\ H$ $\quad R_2 = 4\ \Omega$ $\quad \dot{I}_{S_2} = 5 \exp(-j\frac{\pi}{2})\ A$

$L_m = 0,3\ H$ $\quad \omega = 3\ rad/s$

Calcolare $\dot{V}_1$ e $\dot{V}_2$