ES 31

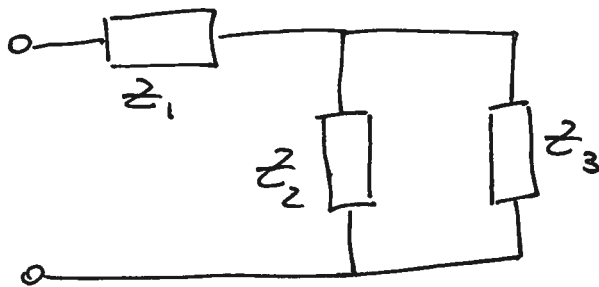$$C_1 = 2\,mF$$
$$R_1 = 20\,\Omega$$
$$C_2 = 4\,mF$$
$$L_1 = 2H$$
$$R_2 = 50\,\Omega$$
$$\omega = 10\,rad/s$$

$$Z_1 = R_1 - j\frac{1}{\omega C_1} = 20 - j50\ \Omega$$
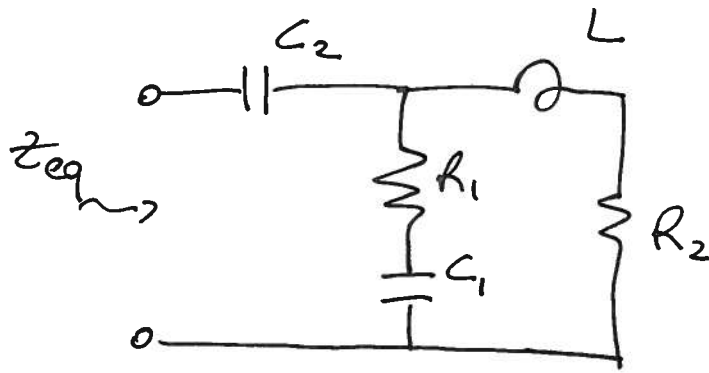
$$Z_2 = -j\frac{1}{\omega C_2} = -j25\ \Omega$$

$$Z_3 = R_2 + j\omega L_1 = 50 + j20\ \Omega$$

$$Z_{eq} = Z_1 + Z_2 \| Z_3 = Z_1 + \frac{Z_2 Z_3}{Z_2 + Z_3}$$

$$= 32,37 - j\,73,76\ \Omega$$

$C_1 = 10\,mF$

$C_2 = 2\,mF$

$L = 0,2\,H$

$R_1 = 3\,\Omega$

$R_2 = 8\,\Omega$

$\omega = 50\,\dfrac{rad}{s}$

$$Z_{C_2} = jX_{C_2} \Rightarrow X_{C_2} = -\frac{1}{\omega C_2} = -10\,\Omega$$

$$Z_{C_1} = jX_{C_1} \Rightarrow X_{C_1} = -\frac{1}{\omega C_1} = -2\,\Omega$$

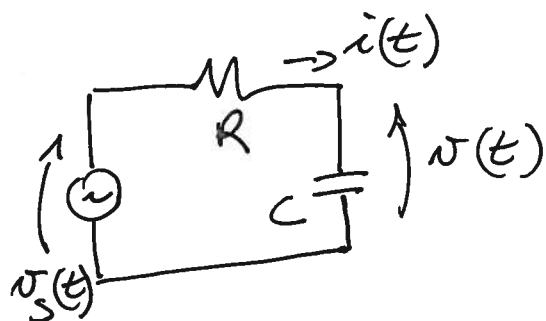$$Z_1 = R_1 + jX_{C_1} = 3 - j2\,\Omega$$

$$Z_L = jX_L \Rightarrow X_L = \omega L = 10\,\Omega$$

$$Z_2 = R_2 + jX_L = 8 + j10\,\Omega$$

$$Z_{eq} = Z_{C_2} + Z_1 // Z_2 = Z_{C_2} + \frac{Z_1 Z_2}{Z_1 + Z_2}$$

$$= 3,22 - j11,07\,\Omega$$

ES 33

$$v_s(t) = 10 \cos(4t) \ [V]$$
$$R = 5 \ \Omega$$
$$C = 0,1 \ F$$

$$i(t) = ?$$
$$v(t) = ?$$

$$v_s(t) \longrightarrow \dot{V_s} = \frac{10}{\sqrt{2}} \ [V] \qquad \omega = 4 \ \frac{rad}{s}$$

$$X_c = -\frac{1}{\omega C} = -2,5 \ \Omega \qquad Z_c = jX_c$$

$$Z = R + jX_c = 5 - j2,5 \ \Omega$$

$$\dot{I} = \frac{\dot{V_s}}{Z} = 1,131 + j \, 0,566 \ A \qquad I = 1,265$$
$$\qquad \qquad \qquad \qquad \varphi_I = 0,46$$
$$\qquad = 1,265 \, \exp(j0,46) \ A$$

$$i(t) = Re\left\{ \sqrt{2} \, \dot{I} \, \exp(j\omega t) \right\}$$
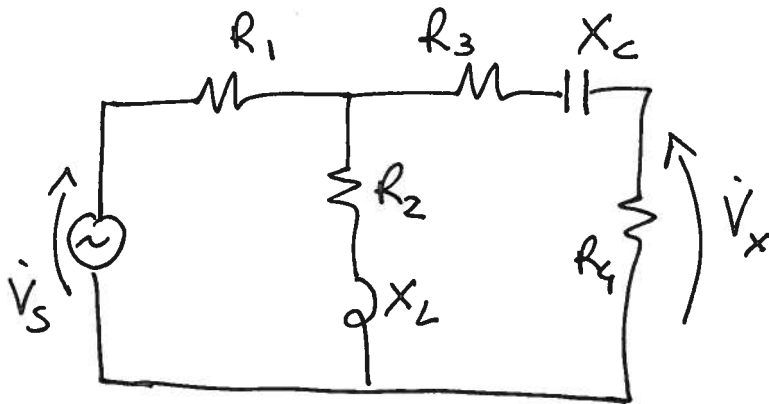$$\qquad = \sqrt{2} \ 1,265 \cos(4t + 0,46) \ A$$
$$\qquad = 1,789 \cos(4t + 0,46) \ A$$

$$\dot{V} = \frac{\dot{I}}{j\omega C} = -j \frac{1}{\omega C} \dot{I} = jX_c \dot{I} = |X_c| \dot{I} \exp\left[j\left(\varphi_I - \frac{\pi}{2}\right)\right]$$

$$v(t) = \frac{\sqrt{2} \, I}{\omega C} \cos\left(\omega t + \varphi_I - \frac{\pi}{2}\right) = \frac{I\sqrt{2}}{\omega C} \sin(\omega t + \varphi_I)$$

$$\qquad = 4,472 \sin(\omega t + 0,46) \ V$$

ES 34

$\dot{V}_S = -j\,20$ V

$R_1 = 5\,\Omega$
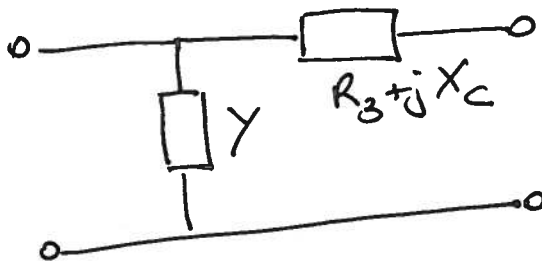
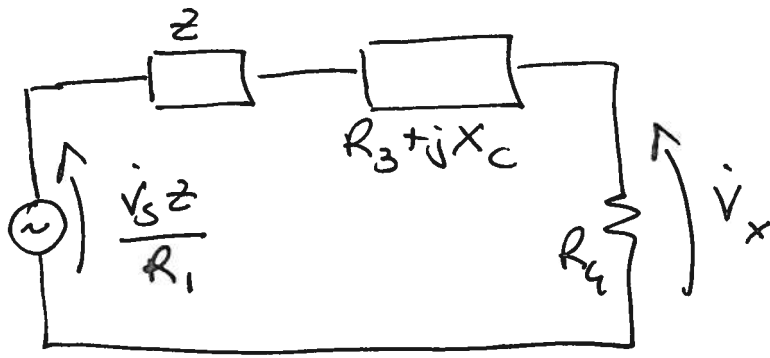$R_2 = 3\,\Omega$

$R_3 = 4\,\Omega$

$R_4 = 10\,\Omega$

$X_L = 4\,\Omega$

$X_C = -13\,\Omega$

$\dot{V}_x = ?$
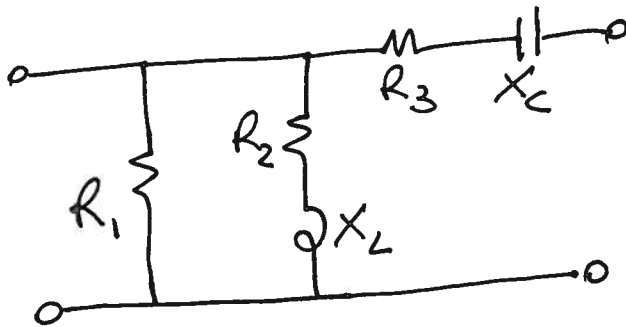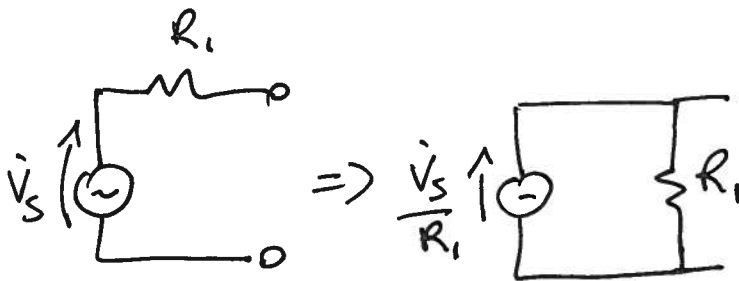
$Y = \dfrac{1}{R_1} + \dfrac{1}{R_2 + j\,X_L}$
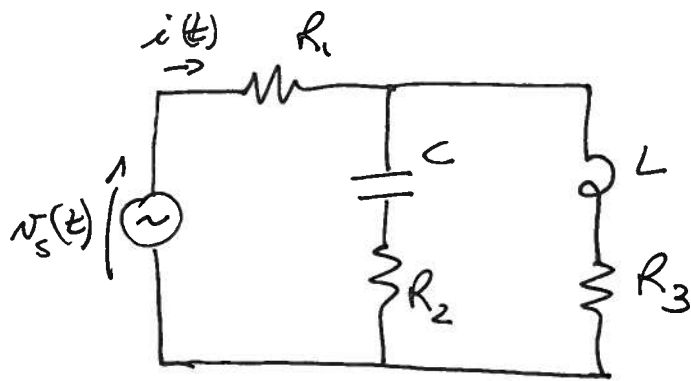$\qquad Z = \dfrac{1}{Y} = 2{,}5 + j\,1{,}25\,\Omega$

$$\frac{\dot{V_s}\,z}{R_i} = 5 - j10 \text{ V}$$

$$\dot{V_x} = \frac{\dot{V_s}z}{R_1} \cdot \frac{R_4}{z + R_3 + jX_c + R_4}$$

$$= 5,519 \exp\left(-j0,488\right) \text{ V}$$

$$= 4,874 - j\,2,59 \text{ V}$$

ES 35

$$\nu_s(t) = \sqrt{2} \cos(100t) \text{ V}$$

$$R_1 = 3\,\Omega$$

$$R_2 = 2\,\Omega$$

$$R_3 = 5\,\Omega$$

$$L = 0,1 \text{ H}$$

$$C = 1 \text{ mF}$$

$$i(t) = ?$$

$$\omega = 100 \frac{\text{rad}}{\text{s}}$$

$$Z_C = j X_C, \quad X_C = -\frac{1}{\omega C} = -10\,\Omega$$

$$Z_L = j X_L, \quad X_L = \omega L = 10\,\Omega$$

$$\nu_s(t) \rightarrow \dot{V}_S = 1 \text{ V}$$
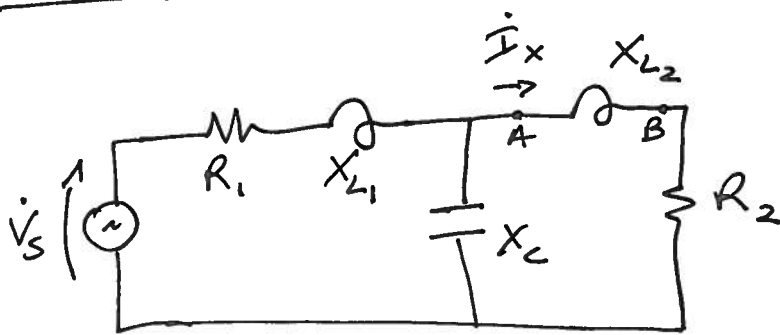
$$Z_1 = R_2 + j X_C = 2 - j10 \,\Omega$$

$$Z_2 = R_3 + j X_L = 5 + j10 \,\Omega$$

$$Z_{eq} = R_1 + \frac{Z_1 Z_2}{Z_1 + Z_2}$$

$$\dot{I} = \frac{\dot{V}_S}{Z_{eq}} = 5,209 \times 10^{-2} \exp(j\,0,2251)$$

$$i(t) = \text{Re}\left\{ \sqrt{2}\, \dot{I} \exp(j\omega t) \right\} = 7,36 \times 10^{-2} \cos(100t + 0,2251) \text{ A}$$

ES 36

$$\dot{V}_S = 30 \exp\left(j \frac{\pi}{9}\right) \text{ V}$$
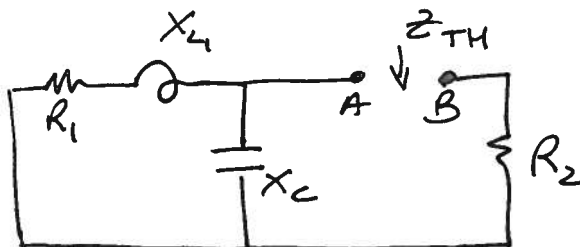
$$R_1 = 6\,\Omega$$

$$R_2 = 10\,\Omega$$

$$X_{L_1} = 2\,\Omega$$

$$X_{L_2} = 1\,\Omega$$

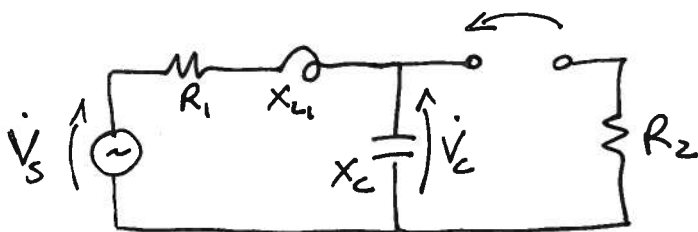$$X_c = -4\,\Omega$$

$$\dot{I}_x = ?$$

CIRCUITO EQ. DI THÉVENIN AI MORSETTI A-B
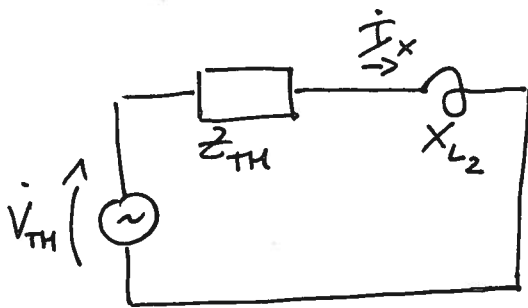
$\dot{Z}_{TH}$

$$\dot{Z}_{TH} = R_2 + \frac{jX_c(R_1 + jX_{L_1})}{R_1 + j(X_{L_1} + X_c)} = 12,4 - j\,3,2 \ \Omega$$
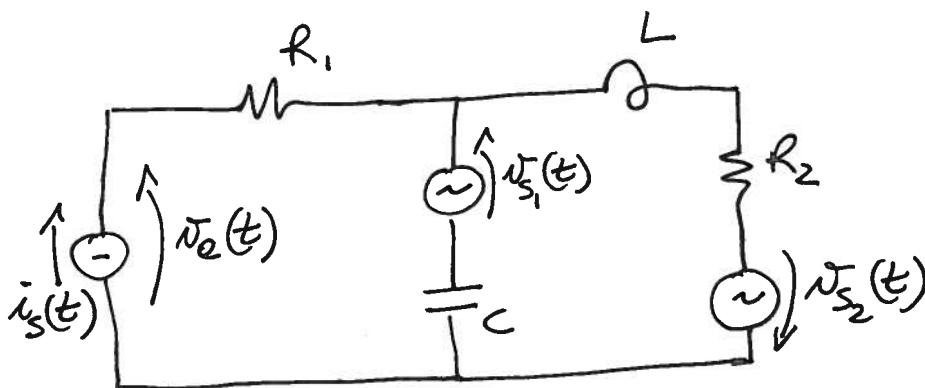
$\dot{V}_{TH}$

$$\dot{V}_{TH} = \dot{V}_c = \dot{V}_S \frac{jX_c}{R_1 + j(X_{L_1} + X_c)} = 11,79 - j\,14,86$$

$$\dot{I}_x = \frac{\dot{V}_{TH}}{Z_{TH} + jX_{L_2}} = 1,128 - j0,998 \ A$$

ES 37

$R_1 = 5\,\Omega$

$R_2 = 10\,\Omega$

$L = 20 \ mH$

$C = 100\,\mu F$

$v_e(t) = ?$

$$v_{S_1}(t) = \sqrt{2}\ 100\ \sin(500t) \ V$$

$$v_{S_2}(t) = \sqrt{2}\ 300\ \cos(500t) \ V$$

$$i_S(t) = \sqrt{2}\ 10\ \sin\left(500t - \frac{\pi}{4}\right) \ A$$

$$v_{S_1} = \sqrt{2}\ 100\ \cos\left(500t - \frac{\pi}{2}\right) \ V$$

$$i_S = \sqrt{2}\ 10\ \cos\left(500t - \frac{\pi}{4} - \frac{\pi}{2}\right) \ A$$
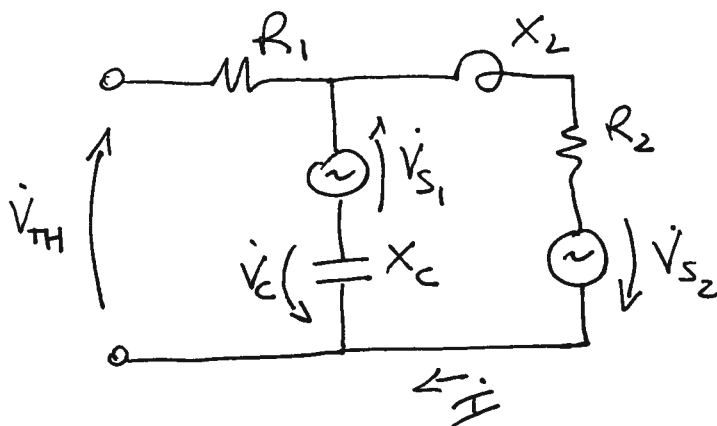
$$\dot{V}_{S_1} = -j\,100 \ V \qquad \dot{V}_{S_2} = 300 \ V \qquad \dot{I}_S = 10 \exp\left[-j\left(\frac{\pi}{4} + \frac{\pi}{2}\right)\right] \ A$$

$$\omega = 500 \ \frac{rad}{s}$$
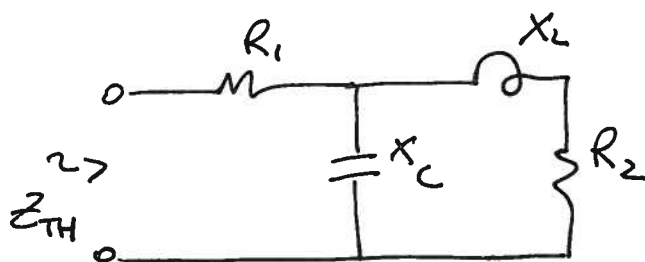
$$X_L = \omega L = 10\,\Omega$$

$$X_C = -\frac{1}{\omega C} = -20\,\Omega$$
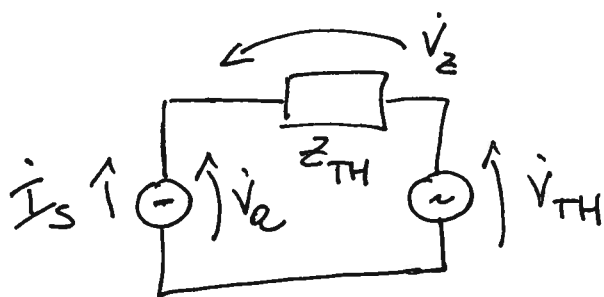
CIRCUITO EQ. DI THÉVENIN

$$\dot{I} = \frac{\dot{V}_{S_1} + \dot{V}_{S_2}}{R_2 + j(X_c + X_L)}$$

$$\dot{V}_{TH} = \dot{V}_{S_1} - \dot{V}_c = \dot{V}_{S_1} - jX_c \dot{I} = -200 + j\,300 \; V$$

$$Z_{TH} = R_1 + \frac{jX_c(R_2 + jX_L)}{R_2 + j(X_L + X_c)} = 25\,\Omega$$

$$\dot{V}_Z = Z_{TH}\,\dot{I}_S$$

$$\dot{V}_e = \dot{V}_{TH} + \dot{V}_Z$$

$$= 396,41\,\exp(j\,2,825)\;V$$

$$v_e(t) = Re\left\{\sqrt{2}\,\dot{V}_e \exp(j\omega t)\right\} =$$

$$= 560,62\,\cos(500t + 2,825)\;V$$