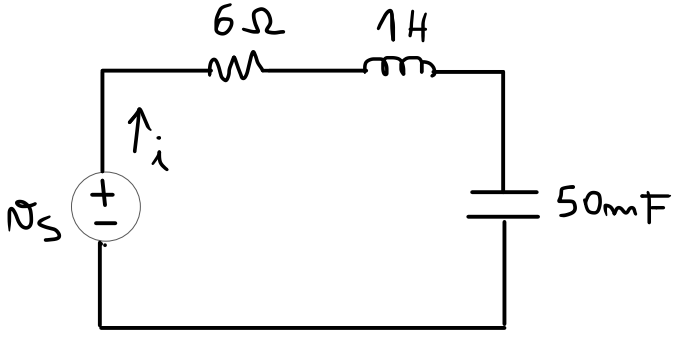
Aula de exercícios.

$\omega = 10$ rad/s $\rightarrow$ $f = 10/2\pi = 1{,}59$ Hz

1)



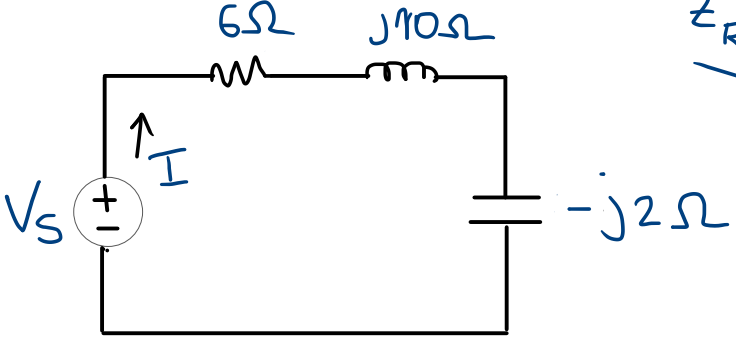
$v_S = 50.\cos(10t)$ (V)

Calcular os fasores:

I, V_R, V_L e V_C

$i(t)$, $v_R(t)$, $v_L(t)$ e $v_c(t)$

$\Rightarrow$ Circuito no domínio da frequência:



$Z_R = 6\Omega$; $Z_L = jX_L$; $Z_C = -jX_C$

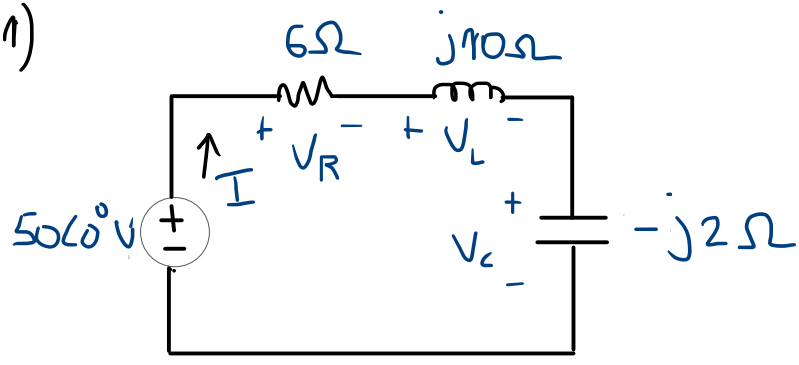
$Z_L = j\omega L$ $\quad$ $Z_C = -j\frac{1}{\omega C}$

$Z_L = j.10.1$ $\quad$ $Z_C = -j\frac{1}{10.50.10^{-3}}$

$Z_L = j10\Omega$ $\quad$ $Z_C = -j2\Omega$

Aula de exercícios.

1)



$V_S = 50\angle 0^\circ \ V$

* Cálculo de I:

$$I = \frac{V_S}{Z_{eq}} \rightarrow I = \frac{50\angle 0^\circ}{6 + j8} = (3 - j4)\,A \quad \text{ou}$$

$$\underline{I = 5\angle -53{,}13^\circ \ A}$$

$$Z_{eq} = Z_R + Z_L + Z_C$$

$$Z_{eq} = 6 + j10 - j2$$

$$Z_{eq} = (6 + j8)\,\Omega$$

* Cálculo de V_R, V_L e V_C:

$$V_R = Z_R \cdot I = 6\angle 0^\circ \cdot 5\angle -53{,}13^\circ$$

$$V_R = 30\angle -53{,}13^\circ \ V$$

$$V_L = Z_L \cdot I = j10 \cdot 5\angle -53{,}13^\circ$$

$$V_L = 10\angle 90^\circ \cdot 5\angle -53{,}13^\circ = 50\angle 36{,}87^\circ V$$

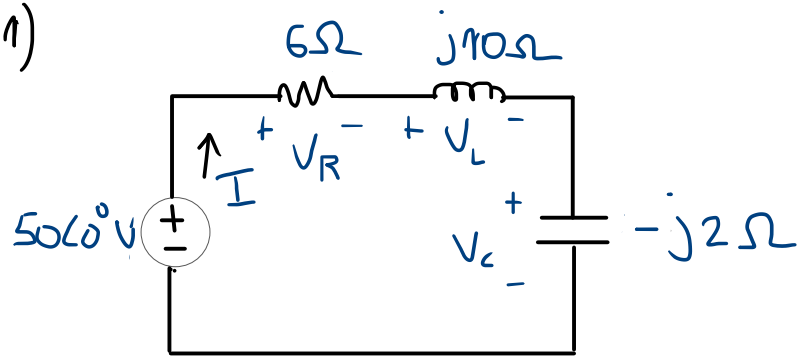
$$V_L = Z_C \cdot I = -j2 \cdot 5\angle -53{,}13^\circ$$

$$V_C = 2\angle -90^\circ \cdot 5\angle -53{,}13^\circ$$

$$V_C = 10\angle -143{,}10^\circ \ V$$

Aula de exercícios.

1)



$V_S = 50\angle 0^\circ \ V$

→ $i(t) = 5.\cos(10t - 53{,}13^\circ)\ (A)$

→ $v_R(t) = 30.\cos(10t - 53{,}13^\circ)\ (V)$

→ $v_L(t) = 50.\cos(10t + 36{,}87^\circ)\ (V)$

→ $v_c(t) = 10.\cos(10t - 143{,}10^\circ)\ (V)$

+ Cálculo de V_R, V_L e V_c:

$V_R = Z_R . I = 6\angle 0^\circ . 5\angle -53{,}13^\circ$

$V_R = 30\angle -53{,}13^\circ \ V$

$V_L = Z_L . I = j10 . 5\angle -53{,}13^\circ$

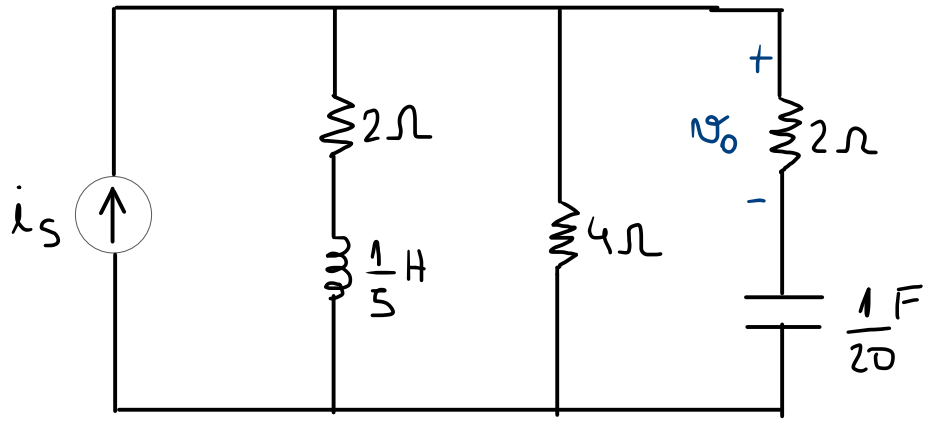
$V_L = 10\angle 90^\circ . 5\angle -53{,}13^\circ = 50\angle 36{,}87^\circ V$

$V_c = Z_c . I = -j2 . 5\angle -53{,}13^\circ$

$V_c = 2\angle -90^\circ . 5\angle -53{,}13^\circ$

$V_c = 10\angle -143{,}10^\circ \ V$

2)

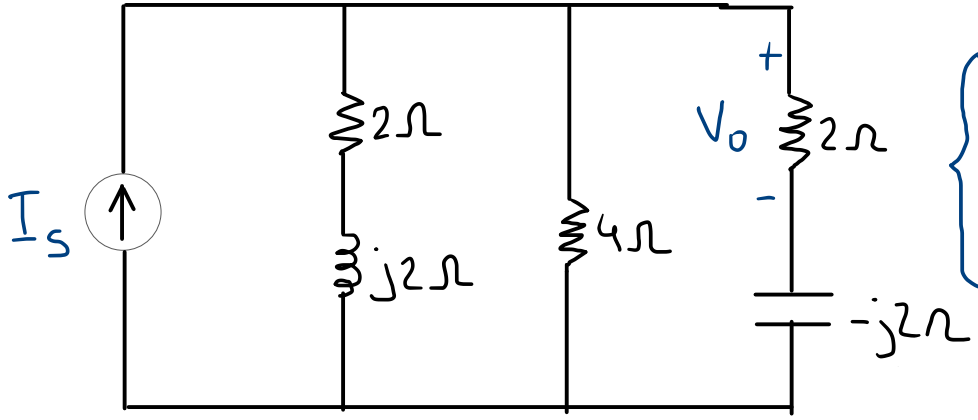


$i_s = 15\cos(10t + 45°)$ A

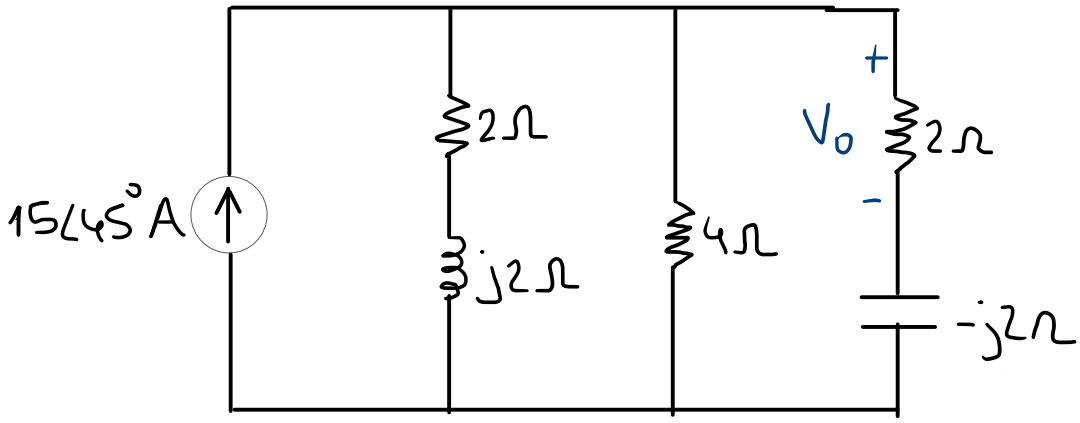
$v_o = ?$

→ Circuito no domínio da frequência:

$\omega = 10$ rad/s;

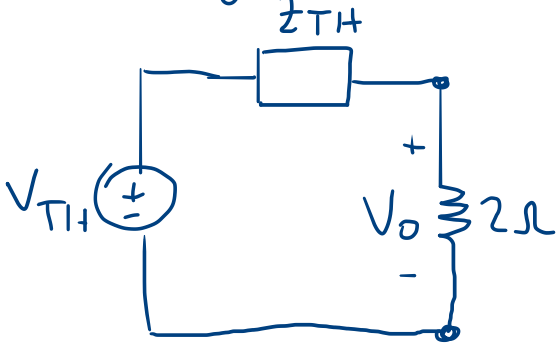


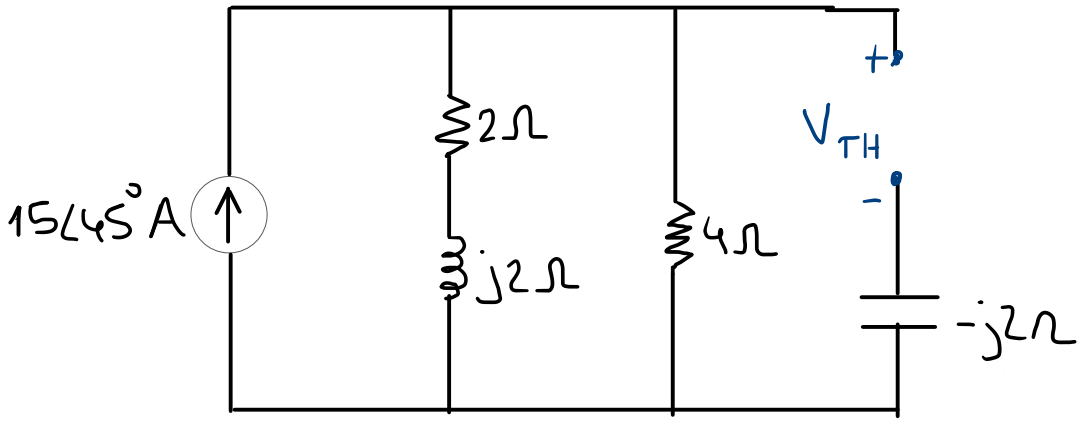
$$\begin{cases} Z_L = j\omega L \rightarrow Z_L = j10 \cdot \frac{1}{5} = j2\,\Omega \\ Z_C = -j\frac{1}{\omega C} \rightarrow Z_C = -j\frac{1}{10 \cdot \frac{1}{20}} = -j2\,\Omega \end{cases}$$



Vo pelo Teorema de Thevenin.

Circuito eq. Thevenin:





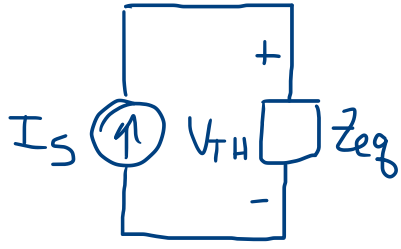
Cálculo de V_{TH}.

$$\begin{cases} Z_1 = 4\Omega \\ Z_2 = (2 + j2)\Omega \end{cases}$$

$$Z_1 \,||\, Z_2 = Z_{eq}$$

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

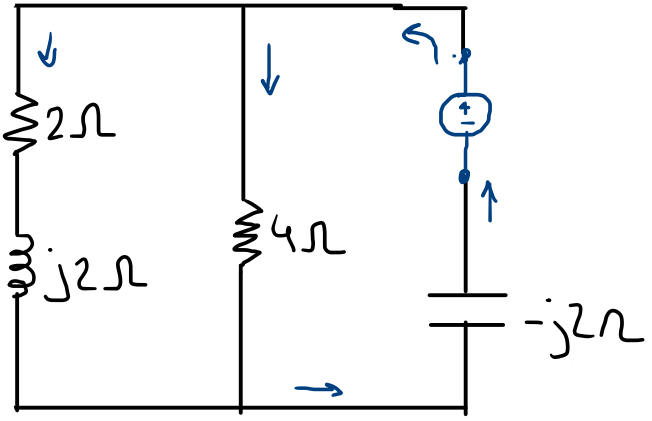
$$Z_{eq} = \frac{4 \cdot (2+j2)}{4 + 2 + j2} = (1{,}6 + j0{,}8)\Omega$$



$$V_{TH} = Z_{eq} \cdot I_S$$

$$V_{TH} = (1{,}6 + j0{,}8) \cdot 15\angle 45°$$

$$V_{TH} = 26{,}83\angle 71{,}57° \ V$$

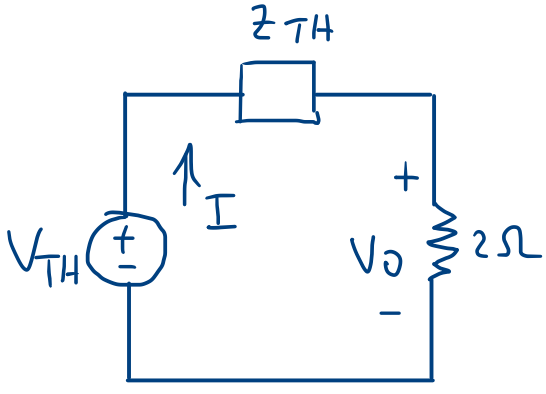


Cálculo de Z_{TH}.

$$Z_{TH} = \frac{4.(2+j2)}{4+2+j2} - j2 = 1,6 + j0,8 - j2$$

$$Z_{TH} = (1,6 - j1,2)\Omega$$

→ Circuito equivalente:



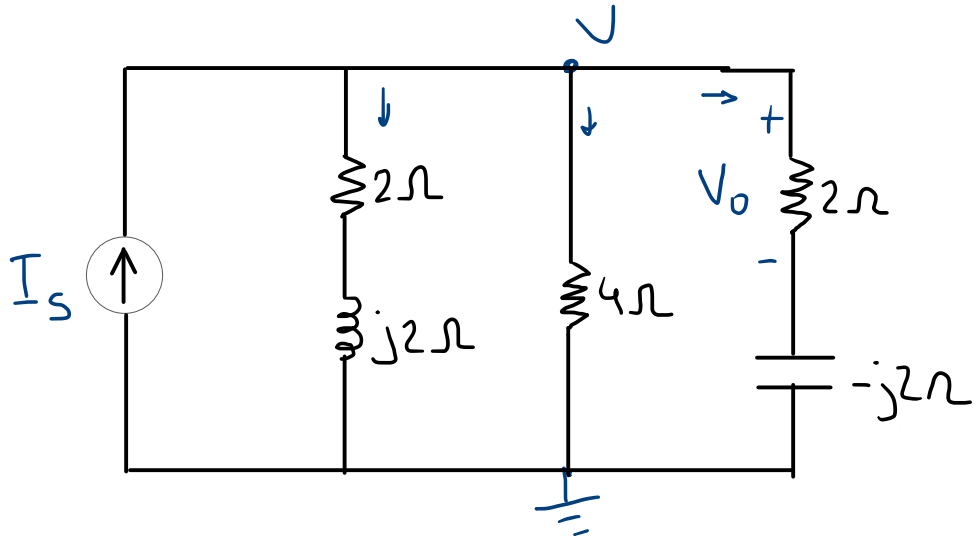
$V_0 = 2 \cdot I$; $I = \dfrac{V_{TH}}{Z_{TH} + 2}$

$Z_{TH} + 2 = (3{,}6 - j\,1{,}2)\,\Omega$

$$V_0 = 2 \cdot \left(\frac{26{,}83 \angle 71{,}57^\circ}{3{,}6 - j\,1{,}2} \right) = 10\sqrt{2} \angle 90^\circ \text{ V}$$

$$\boxed{v_0(t) = 10\sqrt{2} \cdot \cos(10t + 90^\circ) \text{ V}}$$

2)



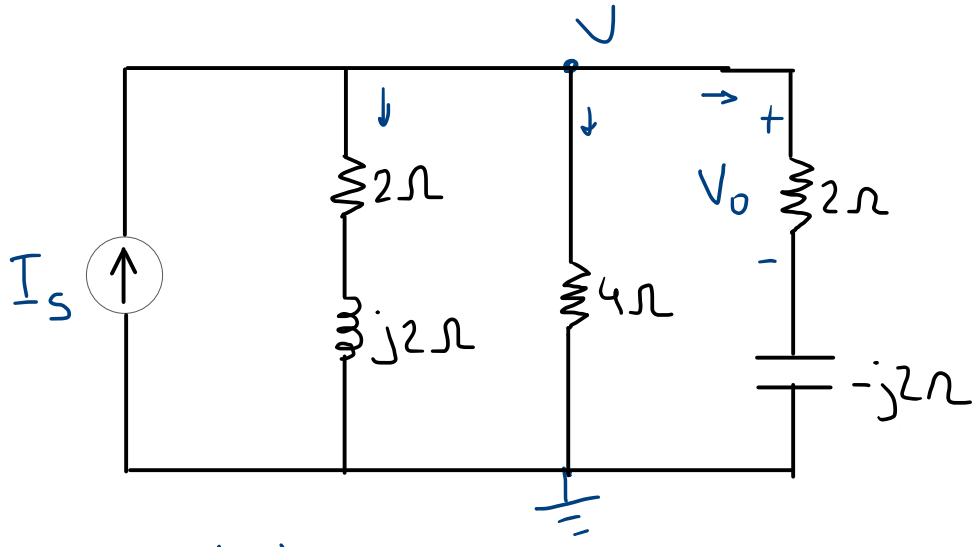
Análise Nodal.

$I_s = 15\angle 45° A$

$$\frac{V}{2+j2} + \frac{V}{4} + \frac{V}{2-j2} = 15\angle 45°$$

$$\frac{V}{2+j2}\cdot\frac{(2-j2)}{(2-j2)} + \frac{V}{4} + \frac{V}{2-j2}\cdot\frac{(2+j2)}{(2+j2)} = 15\angle 45°$$

2)



Análise Nodal.

$I_s = 15\angle 45^\circ A$

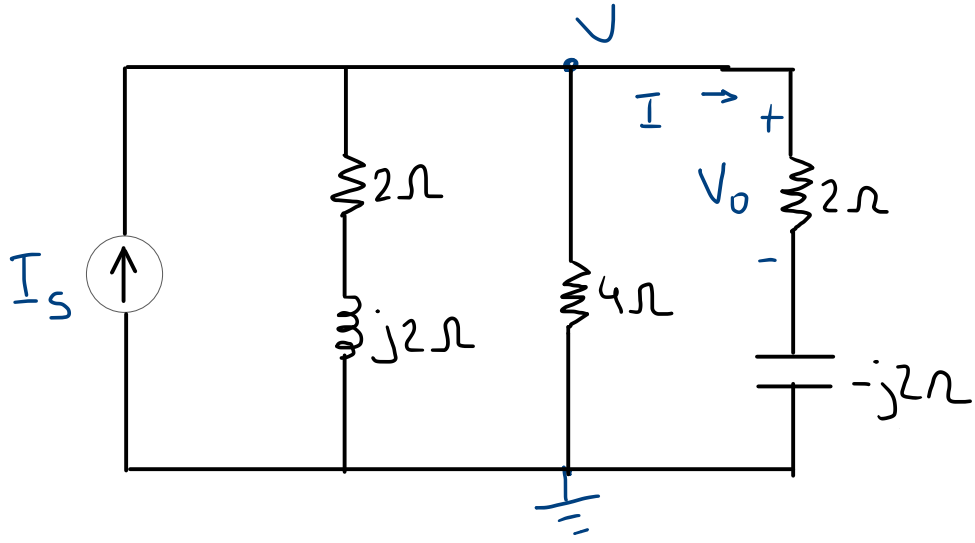
$$\frac{V}{2+j2}\cdot\frac{(2-j2)}{(2-j2)} + \frac{V}{4} + \frac{V}{2-j2}\cdot\frac{(2+j2)}{(2+j2)} = 15\angle 45^\circ$$

$$\frac{2V - j2V}{8} + \frac{V}{4} + \frac{2V + j2V}{8} = 15\angle 45^\circ$$

$$\frac{2V}{8} + \frac{V}{4} = 15\angle 45^\circ \rightarrow \frac{3V}{4} = 15\angle 45^\circ \rightarrow 3V = 60\angle 45^\circ$$

$$V = 20\angle 45^\circ\ (V)$$

2)



Análise Nodal.

$I_S = 15\angle 45° A$

→ Cálculo de V_0:

$$V_0 = 2 \cdot I = 2 \cdot \frac{V}{2 - j2} = 2 \cdot \frac{20\angle 45°}{2 - j2} = \frac{40\angle 45°}{2 - j2}$$

$$V_0 = \frac{40\angle 45°}{\sqrt{8}\angle -45°} = \frac{40\angle 45°}{2\sqrt{2}\angle -45°} = 10\sqrt{2}\angle 90° \ V$$