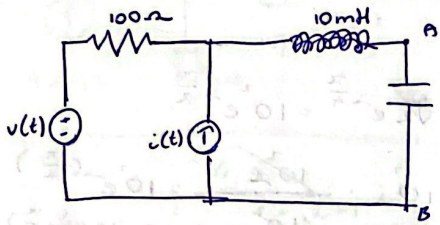
Ejercicios: Circuitos Corriente Alterna

22.- $v(t) = \sqrt{2}\cos(10^4 t + \frac{\pi}{4})\ V \Longrightarrow V = \sqrt{2}e^{j\frac{\pi}{4}}$

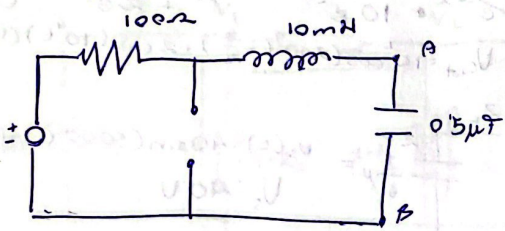
$i(t) = \sqrt{2}\cos(2\cdot10^4 t + \frac{\pi}{4})\ mA \Longrightarrow \mathcal{I} = \sqrt{2}e^{j\frac{\pi}{4}}$



$\dot{v}_c(t)$?

Por superposición:

①



$$Z = 100 + \frac{1}{0'5\cdot10^{-6}\omega j}^{10^4} + \frac{1}{10\cdot10^{-3}\omega j}^{10^4}$$

$$Z = 100 + 2\cdot10^2(-j) + 100j$$

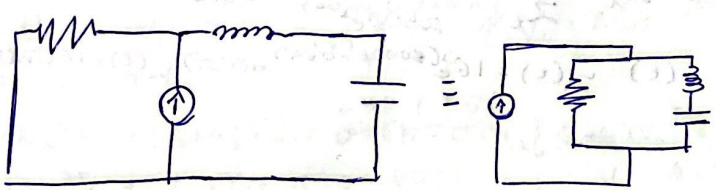
$$Z = 100 + 100j = 100\sqrt{2}e^{-j\frac{\pi}{4}}$$

$$i_1(t) = \frac{v(t)}{Z} = \frac{100\sqrt{2}e^{j\frac{\pi}{4}}}{100\sqrt{2}e^{-j\frac{\pi}{4}}}$$

$$\mathcal{I} = \frac{V}{Z} = \frac{\sqrt{2}e^{j\frac{\pi}{4}}}{100\sqrt{2}e^{-j\frac{\pi}{4}}} = 10^{-2}e^{j\frac{\pi}{2}}$$

$$V_{AB} = V_C = \mathcal{I}Z_C = 10^{-2}e^{j\frac{\pi}{2}}\cdot10^2\cdot2e^{-j\frac{\pi}{2}} = 2V \Longrightarrow v_c(t) = 2e^{j10^4 t}$$

②



$$Z^{-1} = \frac{1}{100} + \frac{1}{Z_c + Z_L} = \frac{1}{100} + \frac{1}{10^2 i} = \frac{1+i}{100 i} = 10^{-2}(1-i)$$

$$10^{-2}\sqrt{2}\, e^{-i\frac{\pi}{4}}$$

$$* Z_c + Z_L = \frac{1}{i\omega C} + i\omega L = \frac{1}{i \cdot 10^4 \cdot 0{,}5 \cdot 10^{-6}} + i 2 \cdot 10^4 \cdot 10^{-2} =$$

$$= -10^2 i + 2 \cdot 10^2 i = 10^2 i = 10^2 e^{i\frac{\pi}{2}}$$

$$Z = 10^2 \frac{1}{\sqrt{2}} e^{i\frac{\pi}{4}}$$

~~$V(t)$~~ $\Rightarrow$ $V = Z\mathcal{I} = \frac{10^2}{\sqrt{2}} e^{i\frac{\pi}{4}} \sqrt{2}\, e^{i\frac{\pi}{4}} = 10^2 e^{i\frac{\pi}{2}}$

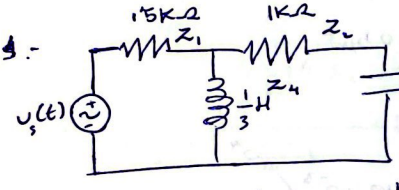
$$V_c = Z_c \mathcal{I} = Z_c \frac{V}{Z_L + Z_c} = -10^2 i \cdot \frac{10^2 e^{i\frac{\pi}{2}}}{10^2 i} = 10^2 e^{i(-\frac{\pi}{2})}$$

$v_c(t) = 10^2 e^{i(2\cdot 10^4 t - \frac{\pi}{2})}$

Solución: $V_{c\,tot} = 10^2 e^{-i\frac{\pi}{2}} + 10^2 e^{i(2\cdot 10^4 t - \frac{\pi}{2})} + 2 e^{i 10^4 t}$ (V)

$V_{c\,tot} = 10^2 \cos(2\cdot 10^4 t - \frac{\pi}{2}) + 2\cos(10^4 t)$ (V)

24.-



$v_s(t) = 40\sin(3000\,t)$ V

$V_s = 40$ V

$$Z_{23} = 1K\Omega + \frac{1}{i\omega C} = \frac{1}{i 3000 \cdot 10^{-6} \frac{1}{6}} + 1K\Omega = \frac{6\cdot 10^3}{3i} + 1K\Omega = 2\cdot 10^3(-i) + 10^3$$

$$10^3(1 + 2(-i))$$

$$(Z_{234})^{-1} = \frac{1}{Z_4} + \frac{1}{Z_{23}} = \frac{1}{i 10^3} + \frac{1}{2\cdot 10^3(-i) + 10^3}$$

$$Z_{234} = \left(\frac{1 + 2(-i) + i}{10^3(2+i)}\right)^{-1} = \frac{10^3(2+i)}{1-i} = 500(1+3i)$$

$$Z_t = 1500 + 500 + 1500 i = 500(4 + 3i) = 500(5 e^{i 0'64})$$

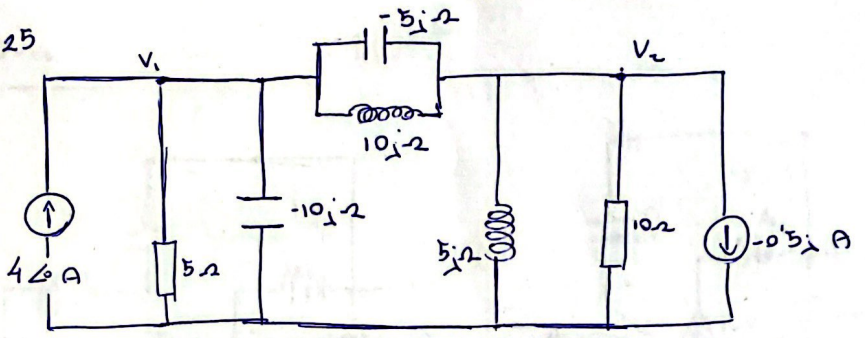
$$2500\, e^{i 0'64}\ \Omega$$

$$\mathcal{I} = \mathcal{I}_{Z_1} = \frac{V_s}{Z_t} = \frac{40}{2500 e^{i 0'64}} = 16\, m e^{-i 0'64}\ mA$$

$$i(t) = i_{Z_1}(t) = 16 e^{i(3000 t - 0'64)}\ mA \Rightarrow i_{Z_1}(t) = 16\sin(3000 t - 0'64)\ mA$$

$\frac{1}{-5j} + \frac{1}{10j} = \frac{-j}{10j}$ $\quad -10j\,\Omega$

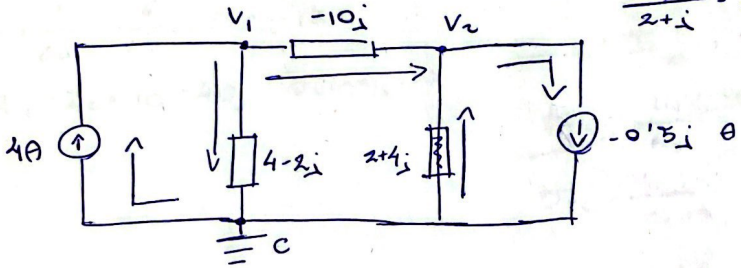
25



$\frac{1}{5} + \frac{1}{-10j} = \frac{-j2+1}{-10j} \Rightarrow \frac{10j}{-1+2j} = 4-2j$

$\frac{1}{5j} + \frac{1}{10} = \frac{2+j}{10j}$

$\frac{10j}{2+j} = 2+4j$



C: $4A + \mathcal{I}_{cV_2} = \mathcal{I}_{V_1C} - 0'5j\,A \Rightarrow \mathcal{I}_{cV_2} - \mathcal{I}_{V_1C} = -4-0'5j$

V_1: $4A = \mathcal{I}_{V_1C} + \mathcal{I}_{V_1V_2} \Rightarrow 4 = \frac{V_1}{4-2j} + \frac{V_1 - V_2}{-10j}$

V_2: $-0'5j = \mathcal{I}_{V_1V_2} + \mathcal{I}_{cV_2}$

$10jV_1 + (4-2j)V_1 - (4-2j)V_2$

$80+160j = (4+8j)V_1 - (4-2j)V_2$

$\begin{cases} \mathcal{I}_{cV_2} - \mathcal{I}_{V_1C} = -4-0'5j \\ \mathcal{I}_{V_1C} + \mathcal{I}_{V_1V_2} = 4 \end{cases}$ $\quad \mathcal{I}_{cV_2} + \mathcal{I}_{V_1V_2} = -0'5j$

$v_1(t) = 19'10\cos(\omega t + 0'10)\,V \quad // \quad V_1 = 19'10\,e^{j0'10}\,V$

$v_2(t) = 4'47\cos(\omega t + 0'46) \quad // \quad V_2 = 4'47\,e^{j0'46}\,V$

$\frac{-V_2}{2+4j} - \frac{V_1}{4-2j} = -4-0'5j$

$(4-2j)V_2 + (2+4j)V_1 = 0'145 - 0'124j \quad +58 + 56j$

$-(2+4j)V_1 + (2-j)V_2 = (40+80j)$

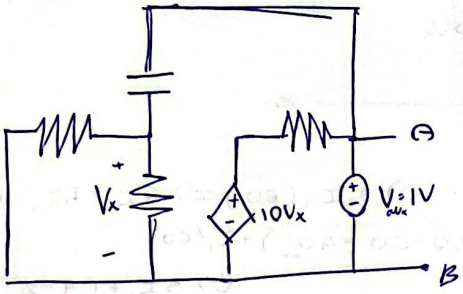
$(6+3j)V_2 = 18-24j$

$V_2 = 4-2j\,\Omega$

$V_1 - V_2 = 15V$

$V_1 = 19-2j\,\Omega$

Z_{th} :



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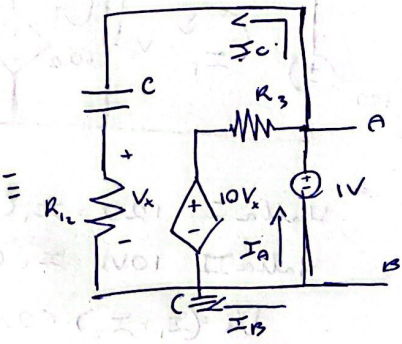


$\frac{1}{12}+\frac{1}{60}=\frac{6}{60} \Rightarrow R_{12}=10\Omega$

$R_{12}+Z_C=10-40j=10(1-4j)\Omega$

$I_A+I_B=I_C$

$I_B=\frac{10V_x-V_A}{R_3}=\frac{V_x}{12}$

$I_C=\frac{V_A-V_B^{\to 0}}{Z_C+R_{12}}$

$I_B=\frac{10V_x-V_A^{\to 1}}{120}$

$I_C=\frac{1}{10(1-4j)}\Omega$

$I_A=10^{+}$

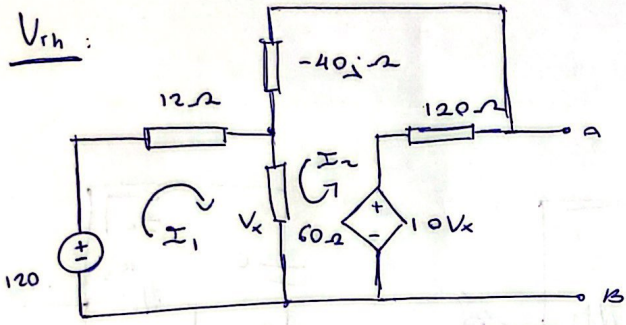
$I_C=\frac{1}{10-40j}\Omega=0'00588+0'02353j=24'25e^{j1'326}\ mA$

$V_x=I_C\cdot(R_1+R_2)=0'242e^{j1'326}V \Rightarrow I_B=20'16e^{j1'326}\ mA$

$I_A=I_C-I_B=4'09e^{j1'326}\ mA \Rightarrow \frac{1}{R_{Th}}=4'09e^{j1'326}\cdot 10^{-3}$

$R_{Th}=89'9e^{-j0'326}$

V_{Th} :



Malla I: $120 = I_1(12+60) + I_2(60) \Rightarrow 6I_1 + 5I_2 = 10$

Malla II: $10V_x = I_2(120+60-40j) + I_1(60)$

$V_x = (I_1 + I_2)\cdot 60\,\Omega$ ↳ $3I_1 + (9-2j)I_2 = \frac{1}{2}V_x$

$6I_1 + (18-4j)I_2 = V_x$

$$\begin{cases} 6I_1 + 5I_2 = 10 \\ -6I_1 - (18-4j)I_2 = -V_x \\ V_x = (13-4j)I_2 \end{cases}$$

$$\begin{cases} 6I_1 + 5I_2 = 10 \\ 6I_1 + (18-4j)I_2 = V_x \end{cases} \quad 60I_1 + 60I_2$$

$$54I_1 + (42+4j)I_2 = 0$$

$$22I_1 + (21+2j)I_2 = 0$$

$$\begin{cases} 6I_1 + 5I_2 = 10 \\ 22I_1 + (21+2j)I_2 = 0 \end{cases}$$

$$\begin{cases} -54I_1 - 45I_2 = -90 \\ 54I_1 + 9^2(21+2j)I_2 = 0 \end{cases}$$

$$9^2(21+2j)I_2 - 45I_2 = -90$$

$$(-3+2j)I_2 = -90$$

$$I_2 = -\frac{90}{-3+2j}$$

$$I_2 = 20'22 + 13'85j$$

$$I_1 = -12'69 - 11'54j$$

$$V_x = 302'8 + 138'9j$$

$V_{Th} = 120I_2 + 10V_x$

$V_{Th} = 5520'4 + 3048j$

$V_{Th} = 6349'28 e^{j0'5}$