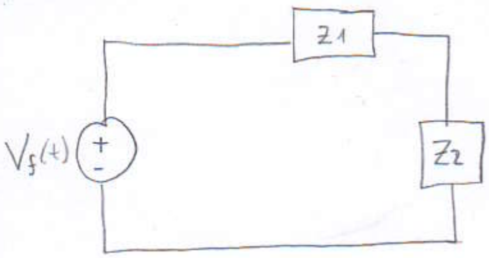
TAREA 3 EL31A OTOÑO 07

PROBLEMA 1



$\omega = 1$

$$Z_1 = R_1 \,//\, L \,//\, C = \left(\frac{1}{R_1} + \frac{1}{jL} + jC_1\right)^{-1} = \left(\frac{1}{5} - \frac{j}{3} + \frac{j}{4}\right)^{-1} = 4{,}6153\angle 22{,}61^\circ$$

$$Z_2 = R_2 + \frac{1}{jC_2} = 4 - j2 = 4{,}4721\angle -26{,}565^\circ$$

$$V_f = 5\angle 45^\circ$$

Luego

$$V_{Z1} = \frac{Z_1 \cdot V_f}{Z_1 + Z_2} \Rightarrow I_{R1} = \frac{V_{Z1}}{R_1} = \frac{Z_1}{R_1(Z_1+Z_2)} V_f = 0{,}5585\angle 69{,}174^\circ \;(1{,}207\,rad)$$

$$= 0{,}198564 + 0{,}52201j$$

$$\Rightarrow I_{R1} = 0{,}5585 \cos(t + 69{,}174^\circ)$$

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PROBLEMA 2

$Z_1 = 50\,\Omega \quad ; \quad Z_2 = -200j\,\Omega \quad , \quad Z_3 = 100j\,\Omega$ 0,5 pto

$\dot V_t = |V_t| \angle 0° \qquad Z_t = a + bj$ 0,5 pto

• Para $Z_1 \Rightarrow V_1 = \dfrac{Z_1}{Z_1+Z_t} V_t \Rightarrow |V_1| = \left|\dfrac{Z_1 V_T}{Z_1+Z_t}\right| = \dfrac{V_T \cdot 50}{\sqrt{(50+a)^2+b^2}} = 25$

$\Rightarrow V_T \cdot 2 = \sqrt{(50+a)^2+b^2}$

$\Rightarrow 4V_T^2 = (50+a)^2 + b^2 \quad (1)$

• Para $Z_2 \Rightarrow |V_2| = \dfrac{|Z_2 V_t|}{|Z_2+Z_t|} = \dfrac{200 V_T}{\sqrt{a^2+(b-200)^2}} = 100 \Rightarrow 4V_t^2 = a^2 + (b-200)^2 \quad (2)$

• Para $Z_3 \Rightarrow |V_3| = \dfrac{|Z_3 V_t|}{|Z_3+Z_T|} = \dfrac{100 V_T}{\sqrt{a^2+(b+100)^2}} = 50 \Rightarrow 4V_T^2 = a^2 + (b+100)^2 \quad (3)$

2 pto

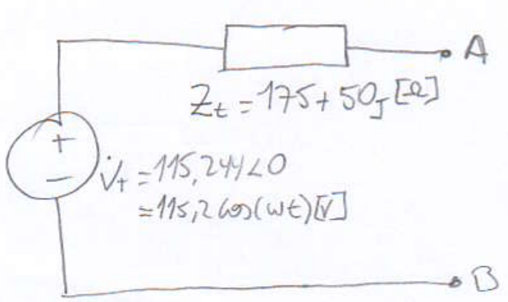
de (2) = (3) $\Rightarrow \cancel{a^2} + (b-200)^2 = \cancel{a^2} + (b+100)^2$

$\Rightarrow (b-200)^2 - (b+100)^2 = 0 \Rightarrow \boxed{b = 50}$

Luego (1) = (2) $\Rightarrow (50+a)^2 + 2500 = a^2 + 22500 \Rightarrow \boxed{a = 175}$ 2,5 pto

en (1) $\Rightarrow V_T^2 = 13281,3 \Rightarrow \boxed{\dot V_T = 115,24\,[V]}$

Luego el equivalente de thévenin es:



0,5 pto

También era válido considerar valores medidos como R.M.S. Si ese era el caso:

$\dot V_T = 115,24 \cdot \sqrt{2}\,[V]$

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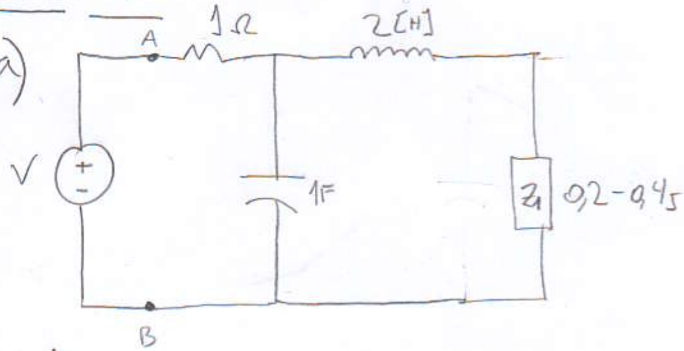
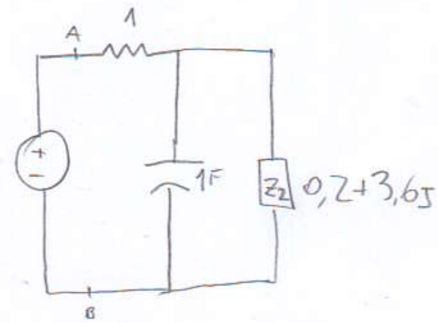
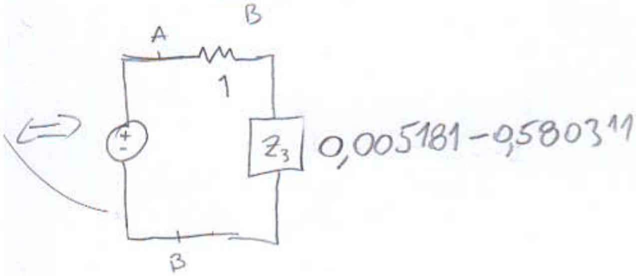
PROBLEMA 3

a)



$\Longleftrightarrow$

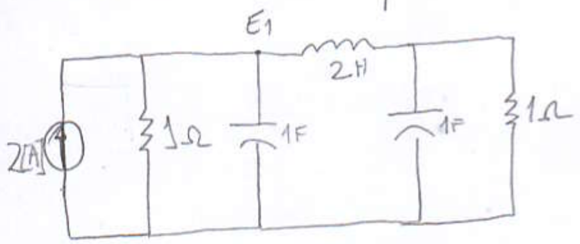




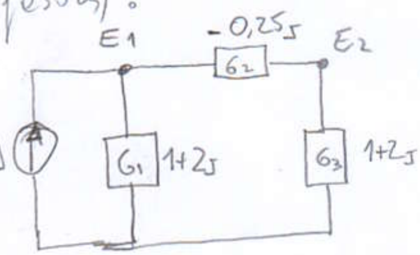
$$\Rightarrow Z_{AB} = 1{,}00518 - 0{,}58031j = \left(\frac{97}{130} + \frac{28}{65}j\right)^{-1}$$

$$\Rightarrow \boxed{Y_{AB} = 0{,}746154 + 0{,}4307j = 0{,}86157\angle 29{,}998°}$$

b) Convirtiendo a fuentes de corriente: (en fasores):



usando admitancias $\Longleftrightarrow$ I_f = 2[A]



Los ecuaciones nodales son:

$$\text{L.C.K } 1 \Rightarrow I_f = (1+2j)E_1 - 0{,}25j(E_1 - E_2)$$ 1 pto

$$\text{L.C.K } 2 \Rightarrow -0{,}25j(E_1 - E_2) = (1+2j)E_2$$ 1 pto

matricialmente

$$\begin{bmatrix} (1+2j)-0{,}25j & 0{,}25j \\ 0{,}25j & 1+2j-0{,}25j \end{bmatrix} \begin{bmatrix} E_1 \\ E_2 \end{bmatrix} = \begin{bmatrix} 2 \\ 0 \end{bmatrix}$$

$$\Rightarrow \boxed{E_1 = 0{,}50769 - 0{,}86153j = 1\angle -59{,}4898°}$$ 1 pto

$$E_2 = -0{,}107692 + 0{,}06153j$$

$$1\angle -1{,}03829 \text{ rad}$$

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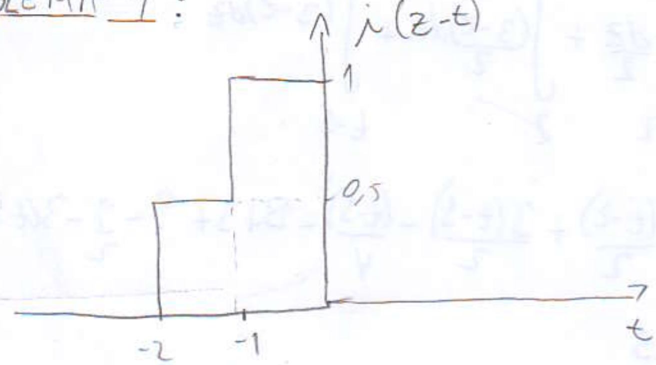
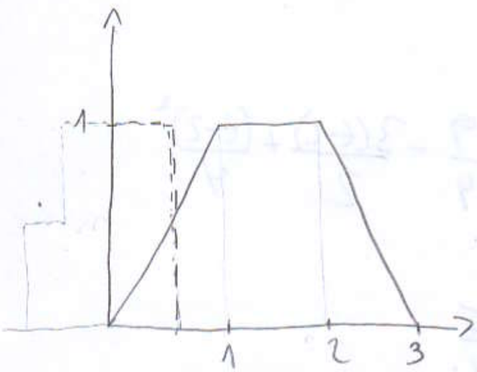
PROBLEMA 4:



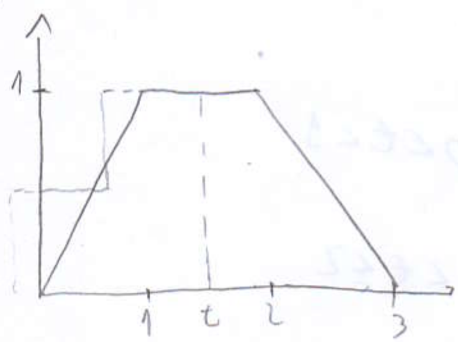
$$Z_o = \int_0^t h(z-t)\cdot i_s(z)\,dz$$

Para $0<t<1$:



$$Z_o(i_s) = \int_0^t z\,dz = \frac{t^2}{2}$$

para $1<t<2$



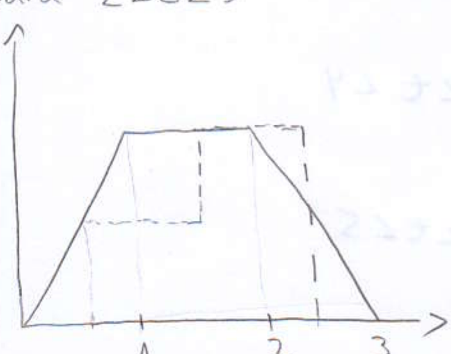
$$Z_o(i_s) = \int_0^{t-1} \frac{z}{2}\,dz + \int_{t-1}^{1} z\,dz + \int_1^t dz = \frac{(t-1)^2}{4} + \frac{1}{2} - \frac{(t-1)^2}{2} + (t-1)$$

$$= t - \frac{1}{2} - \frac{(t-1)^2}{4}$$

$$= t - \frac{1}{2} - \frac{t^2}{4} + \frac{t}{2} - \frac{1}{4}$$

$$= -\frac{t^2}{4} + \frac{3}{2}t - \frac{3}{4}$$

para $2<t<3$



$$Z_o(i_s) = \int_{t-2}^{1} \frac{z}{2}\,dz + \int_{1}^{t-1} \frac{dz}{2} + \int_{t-1}^{2} dz + \int_2^t (3-t)\,dz$$

$$= \frac{1}{4} - \frac{(t-2)^2}{4} + \frac{(t-1)}{2} - \frac{1}{2} + 2 - (t-1) + 3t - \frac{t^2}{2} - 6 + 2$$

$$= -\frac{3}{4}t^2 + \frac{7t}{2} - \frac{11}{4}$$

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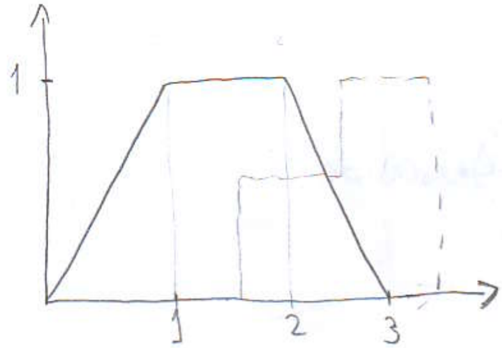
para $3<t<4$

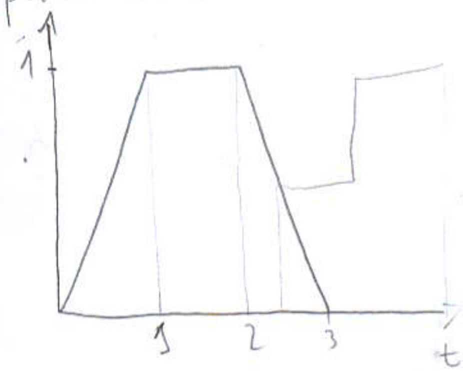


$$Z_o(i_s) = \int_{t-2}^{2} \frac{dz}{2} + \int_{2}^{t-1} \frac{(3-z)}{2} dz + \int_{t-1}^{3} (3-z) dz$$

$$= 1 - \frac{(t-2)}{2} + \frac{3(t-1)}{2} - \frac{(t-1)^2}{4} - 3 + 1 + 9 - \frac{9}{2} - 3(t-1) + \frac{(t-1)^2}{2}$$

$$= \frac{t^2}{4} - \frac{5}{2}t + \frac{25}{4}$$

para $4<t<5$



$$Z_o(i_s) = \int_{t-2}^{3} \frac{(3-z)}{2} dz = \frac{9}{2} - \frac{9}{4} - \frac{3(t-2)}{2} + \frac{(t-2)^2}{4}$$

$$= \frac{t^2}{4} - \frac{5t}{2} + \frac{25}{4}$$

Luego

$$Z_o(i_s) = \begin{cases} \frac{t^2}{2} & 0<t<1 \\ -\frac{t^2}{4} + \frac{3}{2}t - \frac{3}{4} & 1<t<2 \\ -\frac{3}{4}t^2 + \frac{7}{2}t - \frac{11}{4} & 2<t<3 \\ \frac{t^2}{4} - \frac{5t}{2} + \frac{25}{4} & 3<t<4 \\ \frac{t^2}{4} - \frac{5t}{2} + \frac{25}{4} & 4<t<5 \\ 0 & t>5 \end{cases}$$

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PROBLEMA 5

a) $\dot{S}_1 = 40000 \angle 31{,}78°$ $\qquad \dot{S}_2 = \frac{1}{2} V I^* = \frac{1}{2} |I_2|^2 \cdot Z_2$

$Z_2 = 1 - J$ y $I_2 = \frac{V_R}{R} = 268{,}7 \angle 45°$

$$\Rightarrow S_2 = \frac{1}{2}(268{,}7)^2 \cdot (1-J) = 51052{,}9 \angle -45°$$

$$\Rightarrow S_{1,2} = \dot{S}_1 + \dot{S}_2 = 70099{,}9 - 15028{,}6J$$

$$\therefore \boxed{S_T = 71692{,}7 \angle -12{,}1004°}$$

b) De la parte anterior obtenemos el voltaje entre los terminales del consumo equivalente.

$$V_2 = I_2 \cdot Z_2 = (268{,}7 \angle 45°) \cdot (1-J) = 379{,}999 \angle 0 \simeq 380 \angle 0$$

Luego $S_T = \frac{1}{2} V_2 I_T^* \Rightarrow I_T^* = \frac{2 S_T}{V_2} = 377{,}33 \angle -12{,}1004$

$$\Rightarrow I_T = 377{,}33 \angle 12{,}1004$$

La impedancia de la línea de trans. es $Z_L = 0{,}3 + J0{,}2$

Luego $V_L = I_T \cdot Z_L = 136{,}048 \angle 45{,}7905$

Luego $\dot{V}_f = V_L + V_2 = 484{,}774 \angle 11{,}605°$

$$\Rightarrow \boxed{V_f(t) = 484{,}774 \cos(2t + 11{,}605°)}$$

$= \quad '' \quad '' \quad '' + 0{,}20254\ [rad]$

El consumo en la línea es $S_L = \frac{1}{2} V_L \cdot I_T^* = 25667{,}5 \angle 33{,}6901$

$\Rightarrow S_{AB} = S_L + S_T = \boxed{91459{,}9 \angle -0{,}495°} \rightarrow$ capacitivo

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