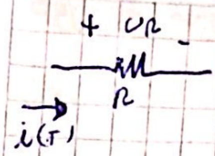
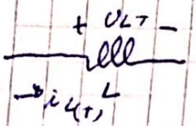
Explicación Práctica 3

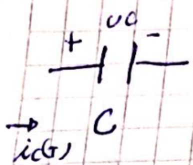
FECHA 20/03/23



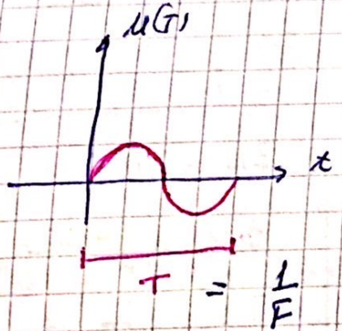
$$u_R(t) = i(t)\,R$$



$$u_L(t) = L\,\frac{d i_L(t)}{dt} \rightarrow i_L(t) = \frac{1}{L}\int u_L(t)\,dt$$

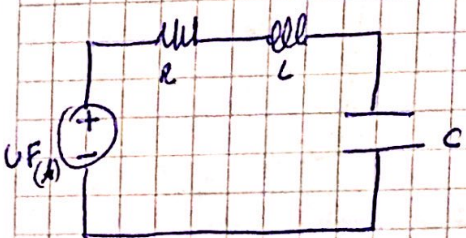


$$u_C(t) = \frac{1}{C}\int i_C(t)\,dt \rightarrow i_C(t) = C\,\frac{d u_C(t)}{dt}$$



$$F(t) = U_{max}\,\text{sen}(\omega + \varphi)$$

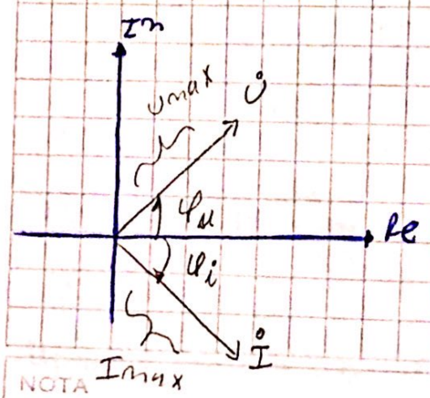
Ejercicio 3



Fasores

$$u(t) = U_{max}\,\text{sen}(\omega T + \varphi_u) \equiv U = U_{max}\,e^{j(\omega t + \varphi}$$

$$i(t) = I_{max}\,\text{sen}(\omega t + \varphi_i) \equiv I = I_{max}\,e^{j(\omega t + \varphi_i)}$$



$$C = a + jb = |C|\,e^{j\varphi}$$

$$\text{Re}\{C\} = a = |C|\cos\varphi$$

$$\text{Im}\{C\} = b = |C|\,\text{sen}\,\varphi$$

NOTA

$T=0$

$\underline{U} = \dot{U}\big|_{T=0} = U_{max}\, e^{j\varphi_u}$

$\underline{I} = \dot{I}\big|_{T=0} = I_{max}\, e^{j\varphi_I}$

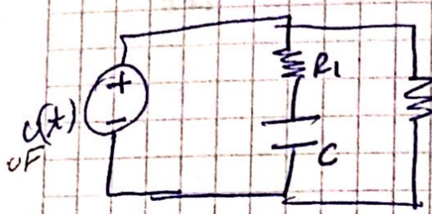
Nro complejo!!

$\underline{Z} = \dfrac{\dot{U}}{\dot{I}} = \dfrac{\underline{U}}{\underline{I}} \Rightarrow \underline{U}_Z = \underline{I}_Z\, \underline{Z}$

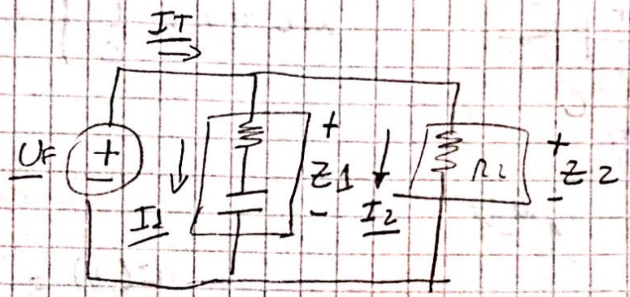
impedancia

En el dominio del tiempo no hay impedancia! Solo existe en el dominio complejo

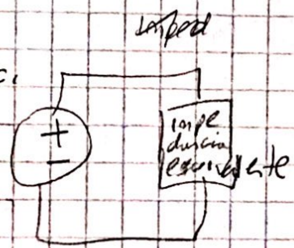
Ejercicio 7



$\Rightarrow$



$\Downarrow$



$\underline{UF} = 50\, e^{j30^\circ}$

$\underline{Z_1} = R1 + \dfrac{1}{j\omega C_1} = Z_{R1} + Z_{C1}$

$\underline{Z_2} = R_2$

Calculo las corrientes

$\underline{I_1} = \dfrac{\underline{U_{Z1}}}{\underline{Z_1}} = \dfrac{\underline{UF}}{\underline{Z_1}}$

$\underline{I_2} = \dfrac{\underline{U_{Z2}}}{\underline{Z_2}} = \dfrac{\underline{UF}}{\underline{Z_2}}$

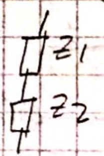
$\underline{Z_{eq}} = \dfrac{\underline{UF}}{\underline{IT}}$

$Z_{eq} = \dfrac{\underline{Z_1} \cdot \underline{Z_2}}{\underline{Z_1} + \underline{Z_2}}$

$Z_R = R$

$Z_L = j\omega L = jX_L$

$Z_C = \dfrac{1}{j\omega C} = -jX_C$



$= Z_e = \underline{Z_1} + \underline{Z_2}$

$\underline{IT} = \underline{I_1} + \underline{I_2}$

ahora [illegible] busco $i(t)$

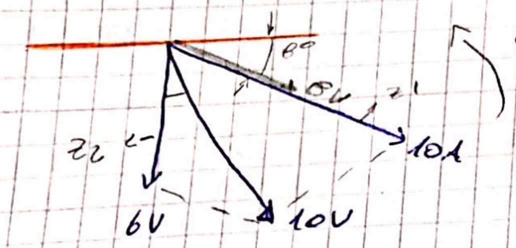
$u(t) \equiv \dot{U} \equiv \underline{U}\big|_{T=0} \equiv \underline{U}\, e^{j\omega T}$

$U_{max} \cos(\omega T + \varphi_u)$

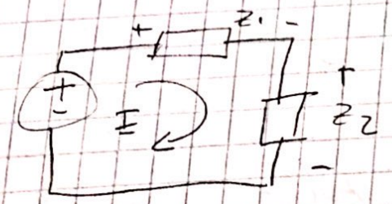
$\leftarrow \times e^{j\omega T}$

~~Recuperación~~

Ejercicio 6



$\omega = 314 \text{ rad/s}$



Asumimos datos son maximos

$\underline{I} = 10\, e^{-j8°}$

$\underline{U}_{z1} = 8\, e^{-j8°}$

$\underline{U}_{z2} = 6\, e^{-j98}$

$10^2 = 8^2 + 6^2$

$= 16$?

$U_{z1} = \underline{I} \cdot \underline{Z}_1 \Rightarrow \underline{Z}_1 = \dfrac{U_{z1}}{\underline{I}} = \dfrac{8\, e^{-j8°}}{10\, e^{-j8}} = \dfrac{8}{10}\,\Omega = \underline{\underline{R_1}}$

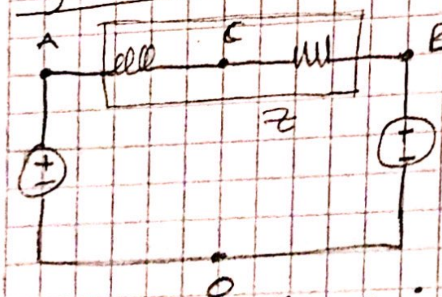
$U_{z2} = \underline{I}\, \underline{Z}_2 \Rightarrow \underline{Z}_2 = \dfrac{U_{z2}}{\underline{I}} = \dfrac{6\, e^{-j98}}{10\, e^{-j8°}} = \dfrac{6}{10}\, e^{-j90} = \dfrac{1}{j\omega C}$

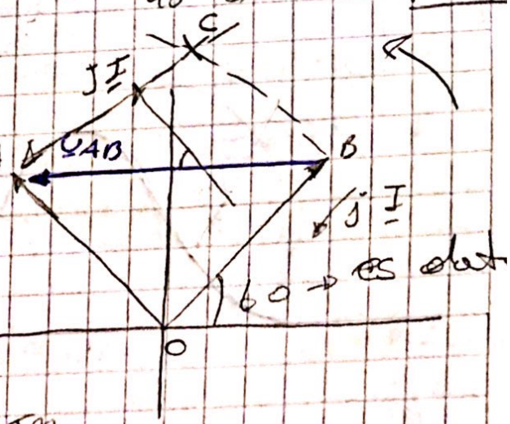
xq atrasa 90°

es un capaci

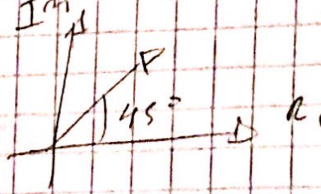
$\Rightarrow Z_2 = \dfrac{1}{j\omega C_2} \Rightarrow C_2 = \dfrac{1}{j\omega Z_2}$

Ejercicio 9





$X_L = R \rightarrow \varphi_z = 45°$ pos porque tiene igual la parte ima y la real



$\underline{U}_1 = 105\, e^{j120}\ V = \underline{U}_{AO}$

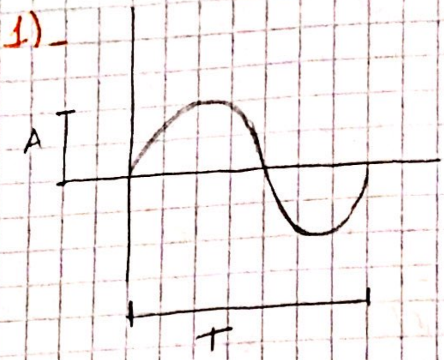
$\underline{U}_2 = 100\, e^{j60}\ V = \underline{U}_{BO}$

$\underline{U}_R = \underline{I} R = U_C - \underline{U}_B$

$U_L = \underline{I}\, j\omega L = \underline{U}_A - U_C$

Práctica 3

1)_



$a(t) = A_{max}\, sen(\omega T + \varphi)$

Fase φ → es lo que mueve la función

• Valor medio: es el area neta bajo la curva

valor medio cuadrático: $\sqrt{\frac{1}{T}\int_0^T a^2(t)\, dT}$

$\omega = 2\pi F$ rad/s

$T = \frac{2\pi}{\omega}$ seg

A = no tiene unidad

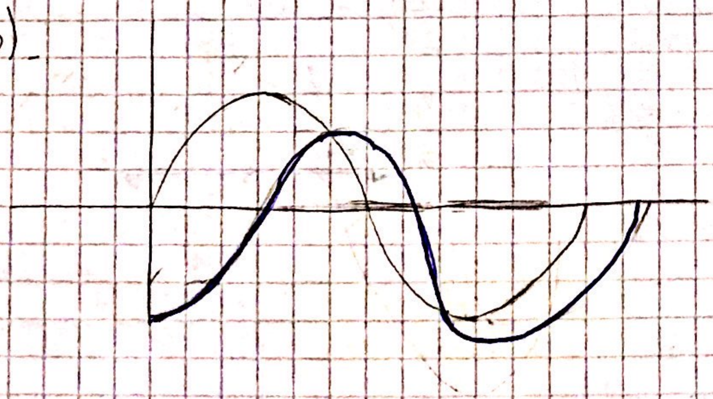
• La frecuencia F indica cuantas alternancias idénticas de la señal en cuestión hay en un segundo

_ El periodo T corresponde al tiempo de duración de dicha alternancia.

_ La pulsación ω, multiplicada por t da un ángulo α variable

_ La fase inicial φ sumada con su signo al ángulo, determina el valor particular

b)_



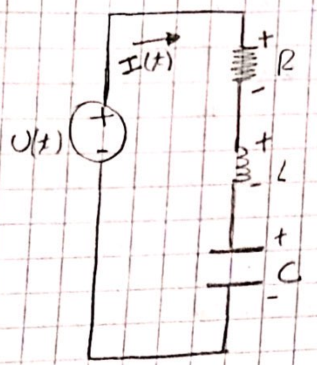
esta adelanta a la azul xq es la que llega primero al cero

HOJA N°

FECHA

3) $U(t) = U_{max}\,\text{sen}(\omega T + \alpha)$

a).



$$U(t) - U_R(t) - U_L(t) - U_C(t) = 0$$

$$U(t) = U_R(t) + U_L(t) + U_C(t)$$

$$U_R(t) = R\,i(t)$$

$$U_L(t) = L\,\frac{di(t)}{dt}$$

$$U_C(t) = \frac{1}{C}\int i(t)\,dt$$

$$\Rightarrow U(t) = R\,i(t) + L\,\frac{di(t)}{dt} + \frac{1}{C}\int i(t)$$

$$\frac{dU(t)}{dt} = R\,\frac{di(t)}{dt} + L\,\frac{d^2 i(t)}{dt^2} + \frac{1}{C}\,i(t)$$

$$U_{max}\cos(\omega T + \alpha)\,\omega = \frac{R\,di(t)}{d(t)} + \frac{L\,d^2 i(t)}{dt^2} + \frac{1}{C}\,i(t)$$

$$\omega \cdot U_{max}\cos(\omega T + \alpha) = L\,y'' + R\,y' + \frac{1}{C}\,y$$

$$y_s = A\cos(\omega T + \alpha) + D\,\text{sen}(\omega T + \alpha)$$

$$y_s' = -A\omega\,\text{sen}(\omega T + \alpha) + D\omega\cos(\omega T + \alpha)$$

$$y_s'' = -A\omega^2\cos(\omega T + \alpha) - D\omega^2\,\text{sen}(\omega T + \alpha)$$

$$\omega U_{max}\cos(\omega T + \alpha) = L\left(-A\omega^2\cos(\omega T + \alpha) - D\omega^2\,\text{sen}(\omega T + \alpha)\right) + R\left(D\omega\cos(\omega T + \alpha) - A\omega\,\text{sen}(\omega T + \alpha)\right) + \frac{1}{C}\left(A\cos(\omega T + \alpha) + D\,\text{sen}(\omega T + \alpha)\right)$$

$$= -LA\omega^2\cos(\omega T + \alpha) - LD\omega^2\,\text{sen}(\omega T + \alpha) + RD\omega\cos(\omega T + \alpha) - \omega RA\,\text{sen}(\ldots$$

$$+ \frac{A}{C}\,A\cos(\omega T + \alpha) + \frac{D}{C}\,\text{sen}(\omega T + \alpha)$$

$$= \cos(\omega T + \alpha)\left(-L\omega^2 A + RD\omega + \frac{A}{C}\right) + \text{sen}(\omega T + \alpha)\left(-LD\omega^2 - RA\omega + \frac{D}{C}\right)$$

max

$$\Rightarrow \omega U_{max} = \frac{A}{C} + RD\omega - L\omega^2 A$$

$$= \omega\left(\frac{A}{\omega C} + RD - L\omega A\right)$$

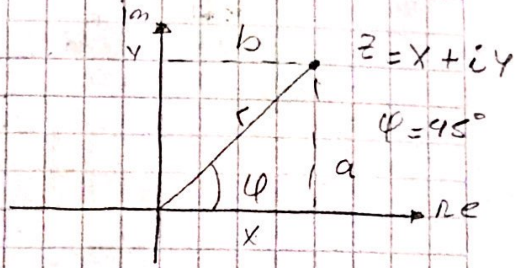
NOTA

4)_ a)_ Se entiende por nro complejo a la combinación de nros reales e imaginarios

se representa $z = a + ib$

a → parte real

b → parte imaginaria



$i^2 = -1$

$|z| = \sqrt{Real^2 + Im^2}$

$e^{i\varphi} = \cos\varphi + i\,sen\,\varphi$

$\varphi = Arctg\left(\frac{y}{x}\right)$

polar : $z = re^{i\varphi}$

en análisis de circuito se utiliza la j en vez de la i, ya que la i representa la corriente!

b)_ Toda función senoidal dependiente del tiempo puede describirse mediante una función compleja equivalente.

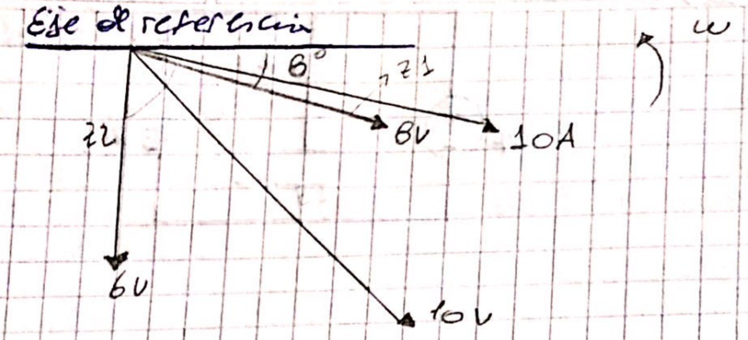
⇒ Fasor : $\hat{U} = U_{max} \cdot e^{j\omega T}$ ⇒ $u(t) = U_{max}\, sen(\omega T)$

Si la fase $\neq 0$

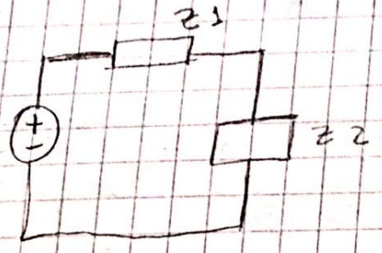
$$\Rightarrow \hat{U} = U_{max}\, e^{j(\omega T + \varphi)}$$
$$= U_{max}\, e^{j\omega T}\, e^{j\varphi}$$
$$= \underline{U}\, e^{j\omega T}$$

$U_{max} \cdot e^{j\varphi} = \underline{U}$

6)_ Eje de referencia



Asumo que todos los valores son máximos



$\underline{I} = 10 \cdot e^{-j8^\circ}$

$\underline{U_{Z1}} = 8 \cdot e^{-j8^\circ}$

$\underline{U_{Z2}} = 6 \cdot e^{-j98^\circ}$ → es 98° xq respecto al eje de referencia tenemos 90° y le tengo que sumar los otros 8° ?? preguntar!

$\Rightarrow \underline{U_{Z1}} = \underline{Z_1}\,\underline{I} \Rightarrow \underline{Z_1} = \frac{\underline{U_{Z1}}}{\underline{I}} \Rightarrow \underline{Z_1} = \frac{8\,\cancel{e^{-j8^\circ}}}{10\,\cancel{e^{-j8^\circ}}} = \frac{8}{10} = 0{,}8$

Como no dio un nro complejo puedo decir que es una resistor!!

$\underline{U_{Z2}} = \underline{Z_2}\,\underline{I} \Rightarrow \underline{Z_2} = \frac{\underline{U_{Z2}}}{\underline{I}} \Rightarrow \underline{Z_2} = \frac{6\,e^{-j98^\circ}}{10 \cdot e^{-j8^\circ}} \Rightarrow \underline{Z_2} = \frac{6}{10}\,e^{-j90^\circ}$

Es un capacitor xq?

$\underline{Z_2} = \frac{6}{10}\,e^{-j90^\circ} = \frac{1}{j\omega C} \Rightarrow C = \frac{1}{j\omega \underline{Z_2}}$

NOTA

7) _ **Datos**

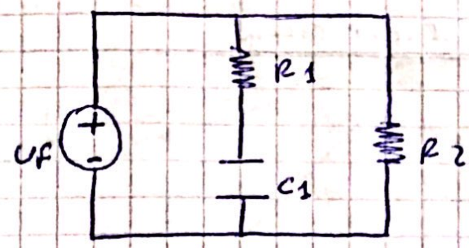
$v_f(t) = 50\ \text{sen}(\omega T + 30^\circ)\ V$

$R1 = 3\Omega$

$R2 = 10\Omega$

$C1 = 800\mu F = 800 \times 10^{-6}\ F$

$w = 314\ rad/s$



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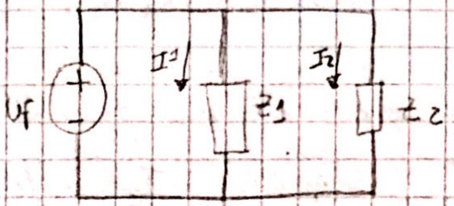


a) _ $\underline{U} = 50\ e^{j30^\circ}$

$\underline{Z1} = Z_{R1} + Z_{C1}$

$\underline{Z1} = R1 + \frac{1}{j\omega C} \cdot \frac{+j}{j}$

$\underline{Z1} = R1 - j\frac{1}{\omega C}$

$\underline{Z1} = 3\Omega - j\,4\Omega$

$\alpha_1 = \text{arctg}\left(\frac{-\frac{1}{\omega C}}{R_1}\right)$

$\alpha 1 = -53^\circ$

$|\underline{Z1}| = 5$

$\underline{Z2} = R2$

$\underline{Z2} = 10\Omega$

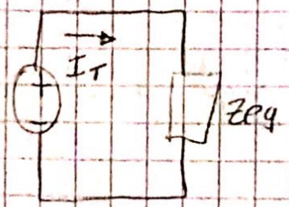
$\alpha_2 = 0^\circ$

Saco las corrientes

$\underline{I1} = \frac{\underline{U}}{|\underline{Z1}|} = \frac{50e^{j30}}{5e^{-53^\circ}} = 10\angle 83^\circ$

$\underline{I2} = \frac{\underline{U}}{|\underline{Z2}|} = \frac{50e^{j30}}{10} = 5\angle 30$

b) _



$Zeq = \frac{\underline{U}}{\underline{I_T}}$

$= \frac{50\angle 30^\circ}{13,60\angle -5,93^\circ}$

$\boxed{Zeq = 3,67\angle -36}$

$\underline{I_T} = \underline{I1} + \underline{I2}$

$\underline{I_T} = 10\angle 83^\circ + 5\angle 30^\circ$

$\boxed{\underline{I_T} = 13,60\angle 65.93^\circ}$

$Zeq = \frac{\underline{Z1}\cdot\underline{Z2}}{\underline{Z1}+\underline{Z2}} = \frac{5\angle -53 \cdot 10\angle 0^\circ}{5\angle -53^\circ + 10\angle 0^\circ} = 3,67\angle -36$

c) _ $i_1(t) = 10\ \text{sen}(\omega T + 83^\circ)\ A$

$i_2(t) = 5\ \text{sen}(\omega T + 30^\circ)\ A$

$i_T(t) = 13,69\ \text{sen}(\omega T + 66^\circ)\ A$

NOTA

B)_ Datos

$I_F = 2A \angle 20° A$

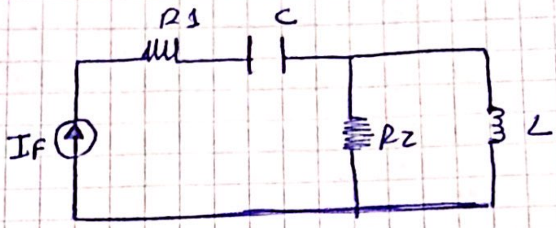
$F = 50\ Hz$

$R1 = 1\Omega$

$R2 = 4\Omega$

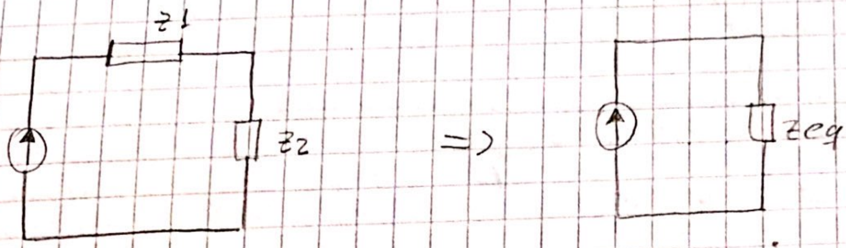
$C = 1,6 mF = 1,6 \times 10^{-3} F$

$L = 6,4 mH = 6,4 \times 10^{-3} H$



$\omega = 2\pi F$
$\omega = 314,16\ r/s$

a).



$\underline{Z1} = \underline{Z}_{R1} + \underline{Z}_C = R1 + \frac{1}{j\omega C} = R1 - \frac{j}{\omega C} = 1\Omega - \frac{j2}{1,98} = \sqrt{5}$

$\alpha_1 = \operatorname{arctg}\left(\frac{\omega L - \frac{1}{\omega C}}{R1}\right) = -63,31° \times -63,43°$

$\underline{Z2} = \frac{\underline{Z}_{R2} \cdot \underline{Z}_L}{\underline{Z}_{R2} + \underline{Z}_L} = \frac{R_2 j\omega L}{R_2 + j\omega L} = \frac{R2\, j\omega L}{(R2 + j\omega L)} \cdot \frac{(R2 - j\omega L)}{(R2 - j\omega L)}$

$= \frac{R_2^2 j\omega L + R_2(\omega L)^2}{R^2 - R_2 j\omega L + R_2 j\omega L + (\omega L)^2} = \frac{R_2^2 j\omega L + R_2(\omega L)^2}{R_2^2 + (\omega L)^2}$

$= j1,60 + 0,80 = 1,79 \rightarrow 63,31$

$\alpha_2 = \operatorname{arctg}\left(\frac{\omega L}{R2}\right) = 26.68° \quad * \quad 1 \angle 36.86°$

$Zeq = Z_1 + Z_2 = 1\Omega - 2j + 0,80\Omega + 1.60j = 1,8 - 0,4$

$\Rightarrow \underline{Zeq} = 1,84 \angle -12,52° \quad * \quad 2,28 \angle -37.87$

NOTA

b)_ $\underline{U}_{iF} = \underline{Z}_{eq} \cdot \underline{I}_F$

$\underline{U}_{R1} = I_F R_1$

$\underline{U}_{R1} = 2 \angle 20° \; V \rightarrow 1,87 + 0,68i$

$\underline{U}_{iF} = 3,6 \angle 7,5°$

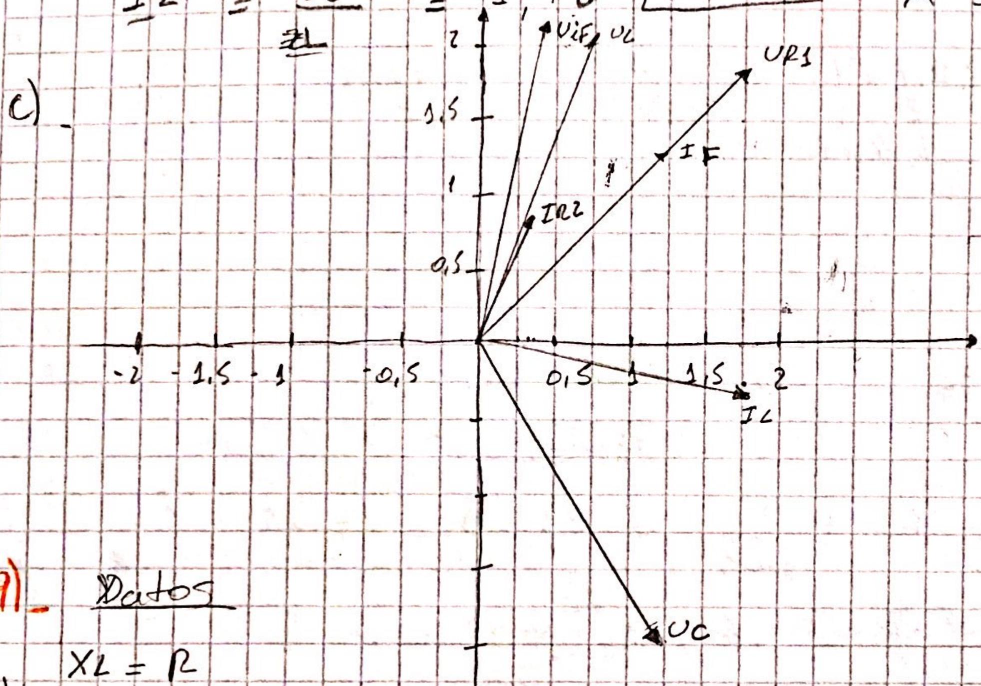
$\underline{U}_L = \underline{U}_{R2} = \underline{I}_F \cdot \underline{Z}_2 = 3,57 \angle 83,43° \; V \rightarrow 0,40 + 3,54i$

$\underline{U}_C = \frac{1}{Z_C} \cdot \underline{I}_F = 3,98 \angle -70° \; V \rightarrow 1,36 - 3,73i$

$\underline{I}_{R2} = \frac{\underline{U}_{R2}}{Z_{R2}} = 0,9 \angle 83,43° \; A \rightarrow 0,10 + 0,9i$

$\underline{I}_L = \frac{\underline{U}_L}{\underline{Z}_L} = 1,78 \angle -6,57° \; A \rightarrow 1,76 - 0,20i$

c)_



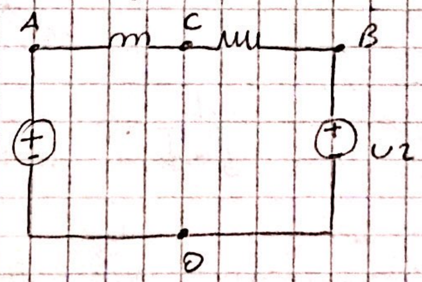
9)_ Datos

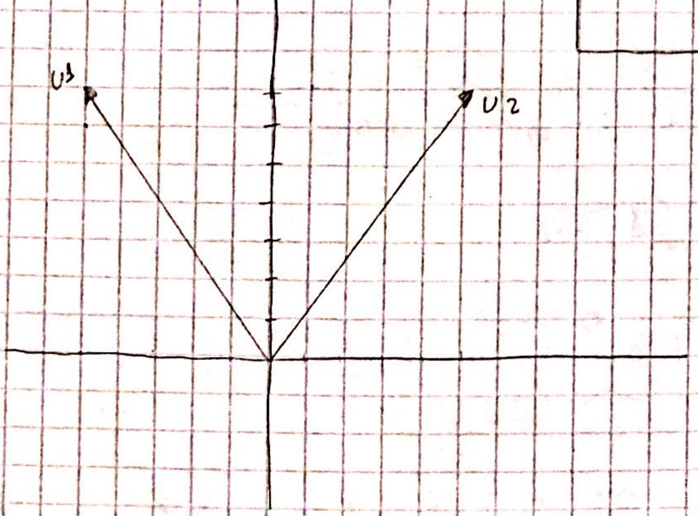
$X_L = R$

a)_ U_{CO}

1)_ $100e^{j120°} = \underline{U}_1 \rightarrow -50 + 86,60i$

$100e^{j60°} = U_2 \quad 50 + 86,60i$





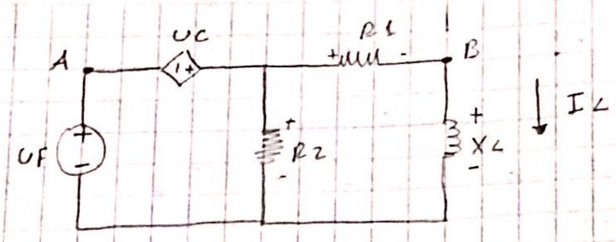
10)_ Datos

$UC = 4e^{j30}\,\Omega\, IL$

$R1 = 2\Omega$

$R2 = 4\Omega$

$XL = 4\Omega$



a)_ $UAB = 20e^{j90}\,V$

Calculo UF para eso utilizo el potencial de UAB.

$$UA + UC - UR1 = UB$$

$$UA - UB + UC - UR1 = 0$$

$$UAB + 4e^{j30}\,\Omega\, IL - IL\,R1 = 0$$

$$UAB = IL\,R1 - 4e^{j30}\,\Omega\, IL$$

$$UAB = IL(R1 - 4e^{j30}\,\Omega)$$

$$\frac{UAB}{R1 - 4e^{j30}\,\Omega} = IL$$

$$\boxed{8{,}06\angle -143{,}8^\circ = IL}$$

Para sacar el valor de UF utilizo la malla grande.

$ZL = j\omega L = jXL = j4\Omega$

$$UF + UAB - UL = 0$$

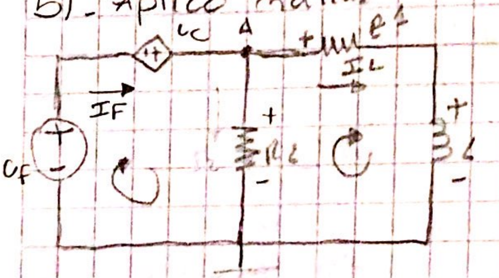
$$UF = UL - UAB$$

$$UF = IL\,ZL - UAB$$

$$UF = 8{,}06\angle -143{,}8^\circ \cdot j4\Omega - 20e^{j90}\,V$$

$$\boxed{UF = 49{,}8\angle -67.52^\circ\ V}$$

b)_ Aplico mallas



$$IF = I2 + IL$$

$$UF + UC - R2(IF - IL) = 0$$

$$UF + UC + R2\,IL - R2\,IF = 0$$

$$UF + UC + R2\,IL = R2\,IF$$

$$\frac{UF + UC + R2\,IL}{R2} = IF$$

$$\boxed{24{,}16\angle -101.93\ A = IF}$$

$I_2 = I_F - I_L = 18,93 \angle -85.4$ } estos están en fase

$U_{R2} = I_2 R_2 = 75.75 \angle -85.4$

$U_{R1} = I_L R_1 = 16,12 \angle -143.8$ → esta está a fase con I_L

$U_C = 4 e^{j30} \Omega \, I_L = 32,24 \angle -113.8$ → [illegible]

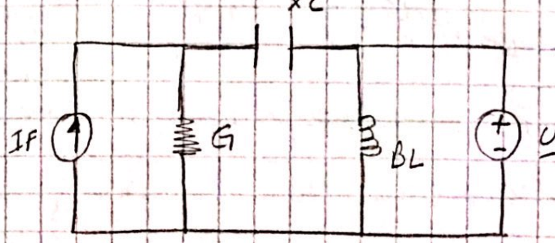
$U_L = I_L Z_L = I_L \, j X_L = 32,24 \angle -53,8$ →

G = conductancia

$R = \frac{1}{G}$

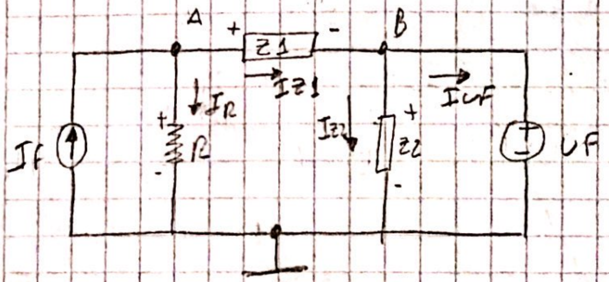
11)- Datos

$G = 0,25 S$
$X_C = 2\Omega$
$B_L = 0,333 S$
$I_F = 2A$
$U_F = 10V \angle -45°$



$\boxed{R = \frac{1}{G} = 4\Omega}$

a)- Aplico nodos



$B_L = \frac{1}{X_L} \Rightarrow X_L = \frac{1}{B_L}$

$Z_1 = -j X_C = 2 \angle 90$

$Z_2 = j X_L = 3,003 \angle 90$

$I_F = I_R + I_{Z1}$

$= \frac{U_A}{R} + \frac{U_A - U_B}{Z_1}$

$U_B = U_F$

$\Rightarrow \frac{U_B}{Z_2} = I_{Z2}$

$I_F = \frac{U_A}{R} + \frac{U_A}{Z_1} - \frac{U_B}{Z_1}$

$\frac{10V \angle -45°}{3,003\Omega \angle 90} = I_{Z2}$

$I_F + \frac{U_B}{Z_1} = U_A \left(\frac{1}{R} + \frac{1}{Z_1} \right)$

$\boxed{3,33 \angle -135 A = I_{Z2} = I_L}$

$\frac{I_F + \frac{U_B}{Z_1}}{\frac{1}{R} + \frac{1}{Z_1}} = U_A$ } $0,5590 \angle 63,434$

$I_{Z1} = \frac{U_C}{Z_1}$

$I_{Z1} \cdot Z_1 = U_C$

$0,8 \angle -160.9 \, V = U_C$

$11,75V \angle -30.87 = U_A$

$\Rightarrow I_{Z1} = \frac{U_A - U_B}{Z_1}$

$U_A - U_B = U_C$
$U_A - U_F = U_C$

$I_{Z1} = 1,6A \angle 109,1°$

$3,19 \angle 19,07 \, V = U_C$