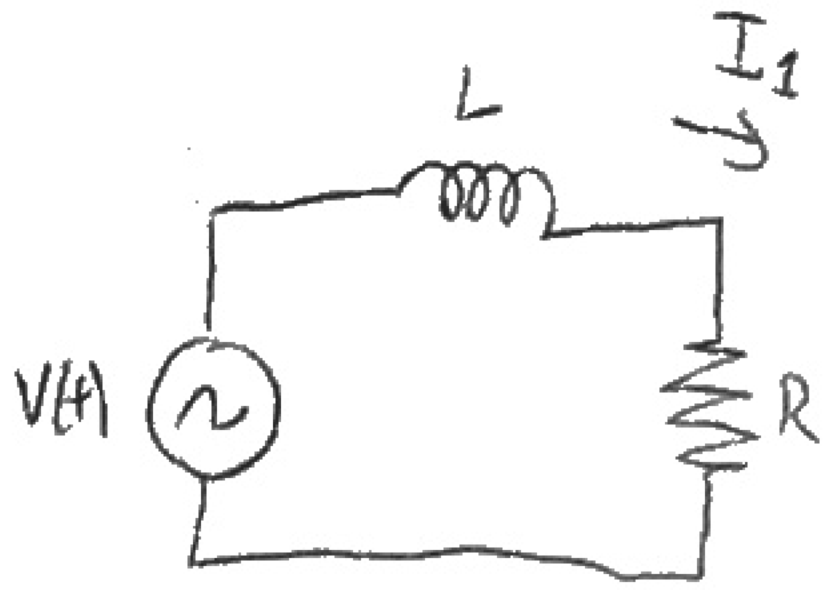
Ejercicio 2

a)



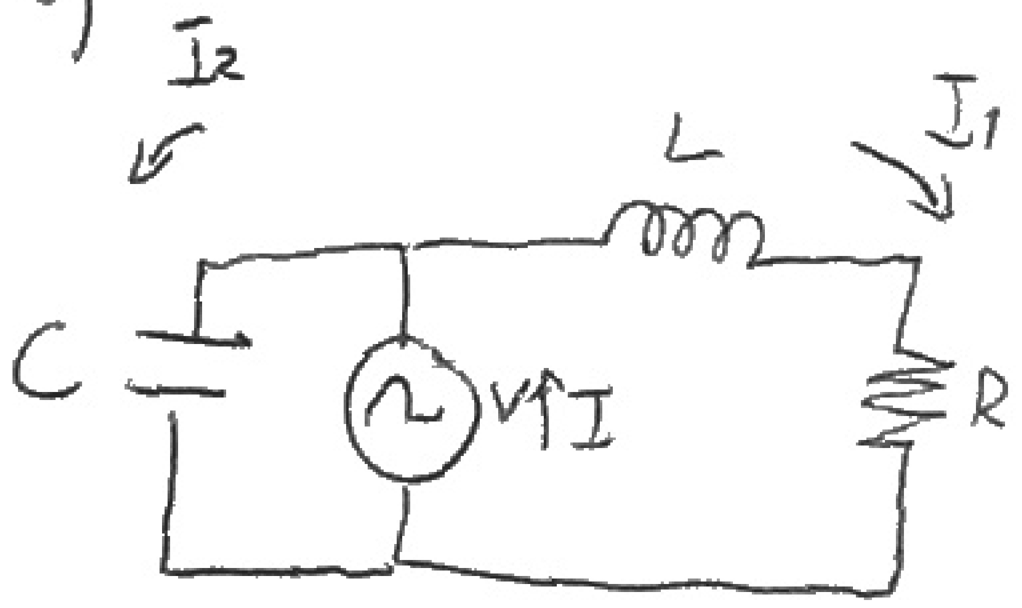
$V(t) = V_0 \cos(\omega t) \rightarrow V(t) = \mathrm{Re}\{ \underbrace{V_0}_{} e^{j\omega t} \}$

"complejo" asociado a la fuente

$I_1 = \dfrac{V_0}{Z_{eq}}$ $\qquad Z_{eq} = R + j\omega L$

$\Rightarrow \boxed{I_1 = \dfrac{V_0}{R + j\omega L}}$ Complejo asociado a la corriente

b)



I_1 continua siendo la de la parte a.

Busco C / $\mathrm{Arg}(I) = 0$ ya que la fuente tiene $\mathrm{Arg}(V) = 0$.

$I = I_1 + I_2$

$I_2 = \dfrac{V_0}{Z_C} = j\omega C V_0$

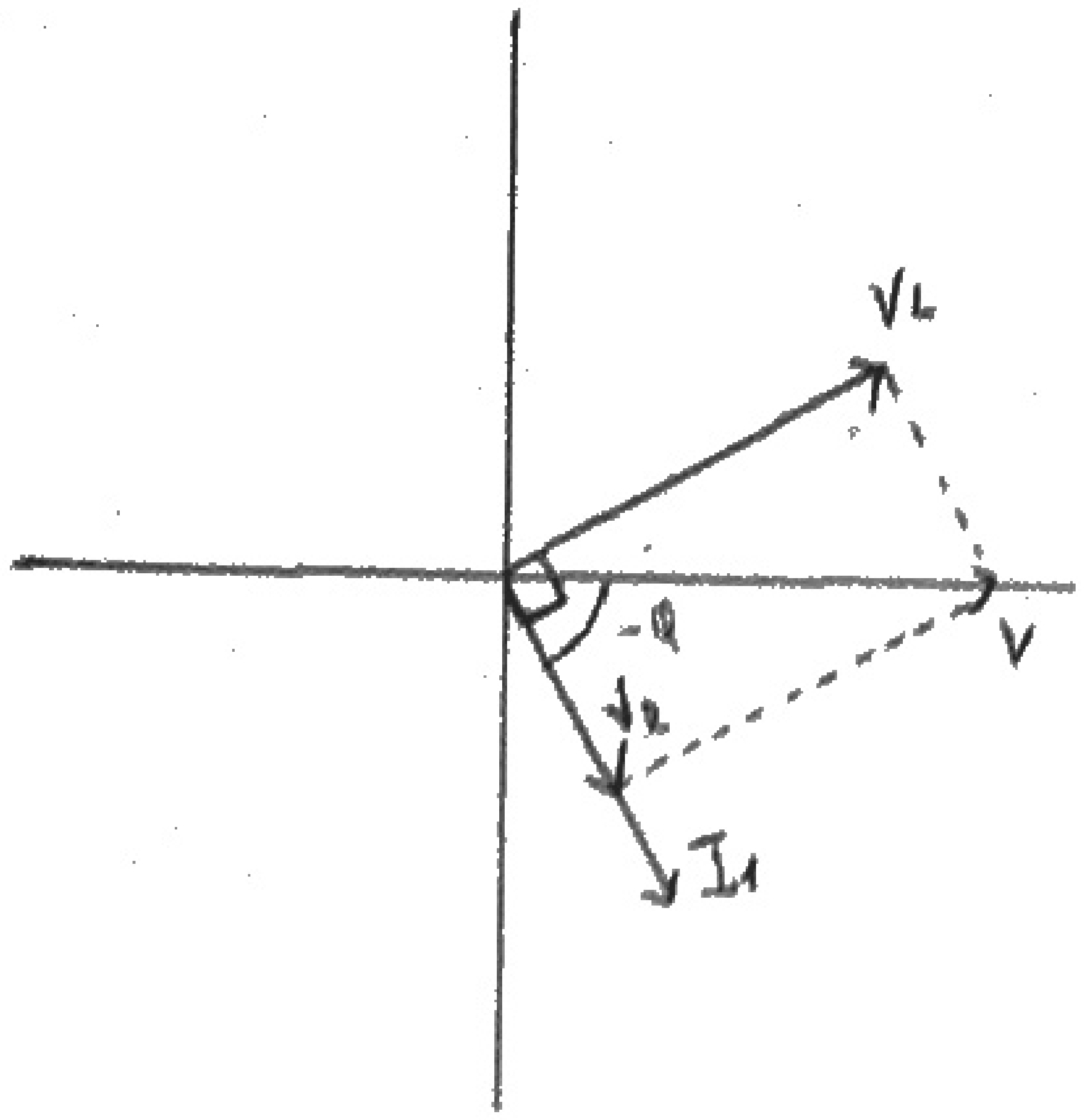
$I = \dfrac{V_0}{R + j\omega L} + j\omega C V_0 = \left(\dfrac{1 - \omega^2 LC + j\omega RC}{R + j\omega L} \right) V_0$

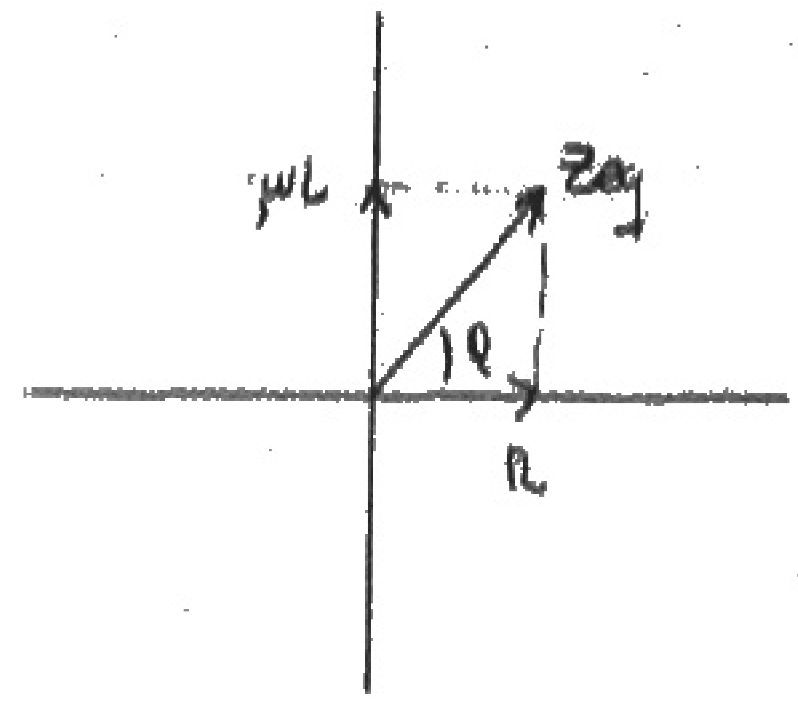
$\mathrm{Arg}(I) = \mathrm{arctg}\left(\dfrac{\omega RC}{1 - \omega^2 LC} \right) - \mathrm{arctg}\left(\dfrac{\omega L}{R} \right) = 0 \Rightarrow \dfrac{\omega RC}{1 - \omega^2 LC} = \dfrac{\omega L}{R}$

$\Rightarrow CR^2 = L - \omega^2 L^2 C \rightarrow \boxed{C = \dfrac{L}{R^2 + \omega^2 L^2}}$

c) Antes de colocar C:

$$I_1 = \frac{V_0}{Z_{eq}} \rightarrow \operatorname{Arg}(I_1) = -\operatorname{Arg}(Z_{eq})$$





$I_1 = I_R = I_L$

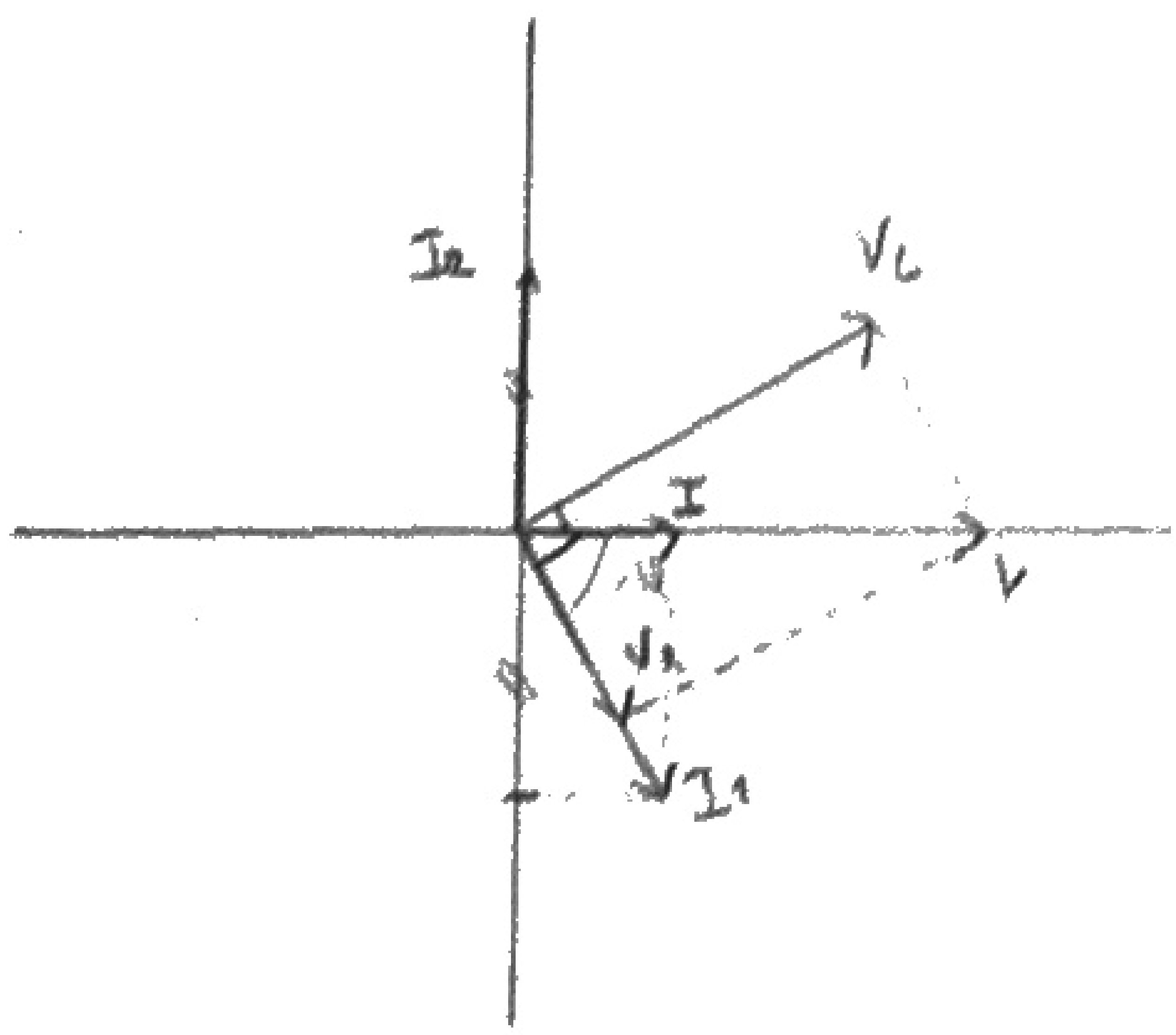
$V = V_L + V_R$

Después de colocar C:

V_L, V_R, V, I_1 iguales

$I_2 = I_C$ $\qquad$ $I = I_1 + I_2$

$V = V_C$



Se puede verificar que:

$|I_1| \operatorname{sen} \varphi = |I_2|$

De esta manera I_2 compensa la parte imaginaria de I_1 de forma que I se encuentre en fase con V.

$$\left.\begin{aligned} |I_1| &= \frac{V_0}{\sqrt{R^2+\omega^2 L^2}} \\ \operatorname{sen}\varphi &= \frac{\omega L}{\sqrt{R^2+\omega^2 L^2}} \\ |I_2| &= \omega C V_0 \end{aligned}\right\} \quad \frac{V_0}{\sqrt{R^2+\omega^2L^2}} \frac{\omega L}{\sqrt{R^2+\omega^2L^2}} = \omega C V_0 \rightarrow C = \frac{L}{R^2+\omega^2 L^2} \checkmark$$

(Otra forma de resolver parte ⓑ)