CORRIENTE ALTERNA y RESONANCIA

L , R y C

RLC serie $\rightarrow$ oscilador amortiguado

$$\left(\frac{R}{2L}\right)^2 \qquad \frac{1}{LC}$$

$L \rightarrow \sim$ masa , $V_L = L\frac{dI}{dt}$

$C \rightarrow \sim k$ elástica $\frac{1}{C}$, $V_c = \frac{q}{C}$

$R \rightarrow$ disipación $V_R = I.R$

- $V = V_0 \cos(\omega t)$

R) $I_R = \frac{V_0}{R}\cos(\omega t)$

L) $V_L = L\frac{dI}{dt} \longrightarrow \int \frac{V}{L}\,dt = \int dI$

$$\frac{V_0}{L\omega}\sin(\omega t) = I$$

$$\frac{V_0}{L\omega}\cos\left(\omega t - \frac{\pi}{2}\right) = I$$

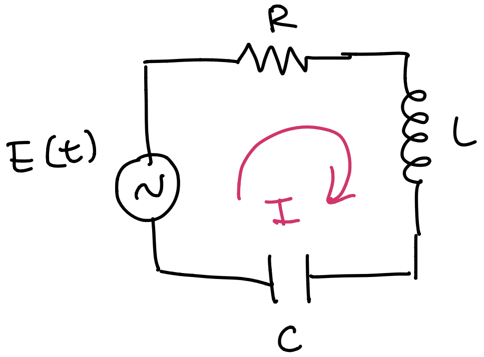
C) $V_c = \frac{q}{C} \longrightarrow \frac{dV}{dt} = \frac{dq}{dt}\frac{1}{C} = \frac{I}{C}$

$$I = C\frac{dV}{dt} = C\frac{d}{dt}\left(V_0\cos(\omega t)\right)$$

$$= -C\omega V_0 \sin(\omega t)$$

$$I_c = \underbrace{C\omega V_0}_{I_0(\omega)} \cos\left(\omega t + \frac{\pi}{2}\right)$$

$V = $ cte $\rightarrow V$ con $\omega \ll 1$



$$E(t) = E_0 \cdot \cos(\omega t)$$

$$IR + L\frac{dI}{dt} + \frac{q}{C} = E(t)$$

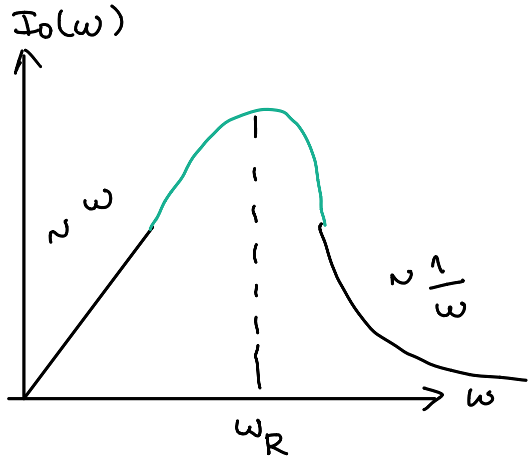
sol. homogénea $\longrightarrow 0$

$$\tau \sim \frac{2L}{R}$$

sol. particular

$$I(t) = I_0 \cos(\omega t + \phi)$$

$$\begin{cases} I_0 = I_0(\omega) \longleftarrow \\ \phi = \phi(\omega) \end{cases}$$



$$I_0 = \frac{E_0}{\sqrt{R^2 + (\omega L - \frac{1}{\omega C})^2}}$$

$$tg\phi = \frac{\omega L - 1/\omega C}{R}$$

$$I_{max} = I_0(\omega_R) \Rightarrow \omega L - \frac{1}{\omega C} = 0$$

$$\omega L = \frac{1}{\omega C}$$

$$\omega^2 = \frac{1}{LC} \equiv \omega_0^2$$

$$\hookrightarrow I_{max} = \frac{E_0}{R}$$

$$tg\phi(\omega_R) = 0 \rightarrow \phi = 0$$

ancho a mitad de altura de la potencia

$P_{max} \propto I^2$ busco ω tq $P = \frac{P_{max}}{2} \propto \frac{I^2}{2}$

$$\Rightarrow I_0(\omega) = \frac{I_{max}}{\sqrt{2}}$$

I_{max}

$$I_0 = \frac{E_0}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}} = \frac{E_0}{R\sqrt{1 + \frac{1}{R^2}\left(\omega L - \frac{1}{\omega C}\right)^2}}$$

$$\Rightarrow \quad \frac{I_0}{I_{max}} = \frac{1}{\sqrt{2}}$$

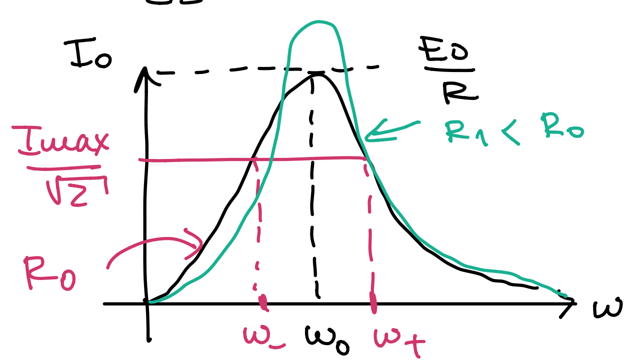
$$\Rightarrow \quad 1 + \frac{1}{R^2}\left(\omega L - \frac{1}{\omega C}\right)^2 = 2$$

$$R^2 = \left(\omega L - \frac{1}{\omega C}\right)^2$$

$$\hookrightarrow \quad \left|\omega L - \frac{1}{\omega C}\right| = R$$

$\omega > 0$

- $\omega_+ = \frac{R}{2L} + \sqrt{\left(\frac{R}{2L}\right)^2 + \omega_0^2}$
- $\omega_- = -\frac{R}{2L} + \sqrt{\left(\frac{R}{2L}\right)^2 + \omega_0^2}$



ancho

$$\Delta\omega = \omega_+ - \omega_- = \frac{R}{2L} - \left(-\frac{R}{2L}\right)$$

$$\Delta\omega = \frac{R}{L}$$

radio AM 1000 kHz

RLC $\rightarrow f_0 = \frac{1}{2\pi\sqrt{LC}}$

$\frac{1}{\sqrt{LC}} = \omega_0$, $f_0 = \frac{1}{2\pi}\omega_0 = \frac{1}{2\pi\sqrt{LC}} = 1000$ kHz $\leftarrow$

$\Delta\omega = 100$ kHz

1050 kHz $\leftarrow$