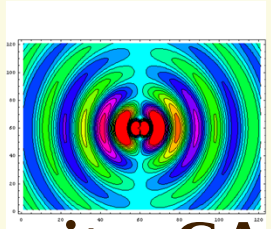


Aula 14: Circuitos CA

14.1. Circuito RLC série

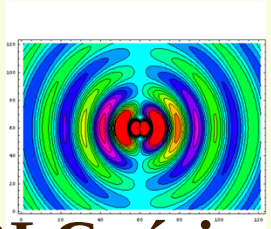
14.2. Circuito RLC paralelo

14.3. Ressonância no circuito RLC

14.4. O factor de qualidade do circuito RLC

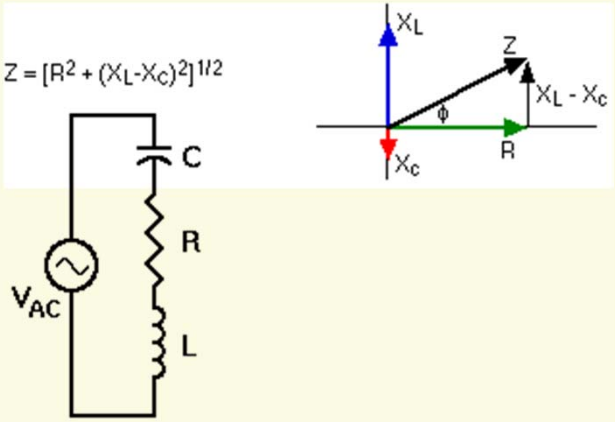
14.5. Impedâncias complexas

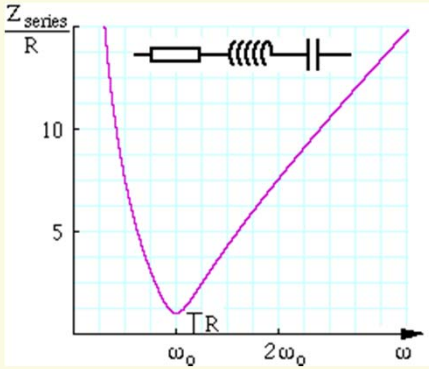
Circuito RLC série: animação

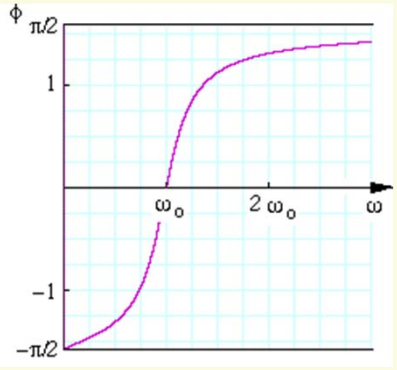


14.1. Circuito RLC série

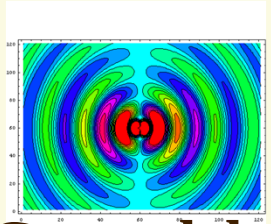
$Z = [R^2 + (X_L - X_C)^2]^{1/2}$



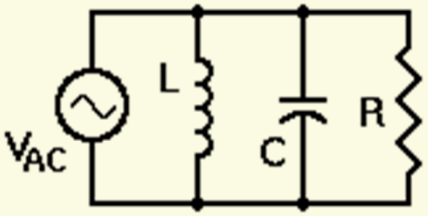


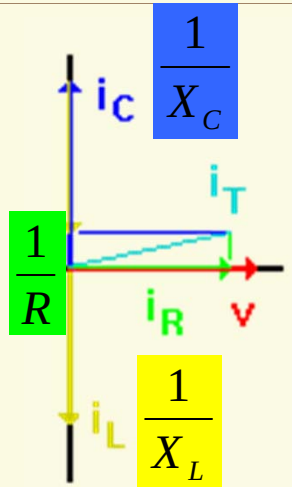


$$Z_{series} = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2} \qquad \phi = \tan^{-1}\frac{\omega L - 1/\omega C}{R}$$



14.2. Circuito RLC paralelo

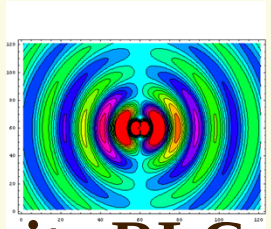




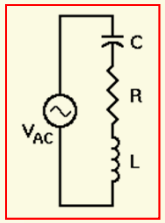
$$\tan\varphi = \frac{\frac{1}{X_C} - \frac{1}{X_L}}{\frac{1}{R}} \qquad \frac{1}{Z} = \sqrt{\frac{1}{R^2} + \left(\frac{1}{X_C} - \frac{1}{X_L}\right)^2}$$

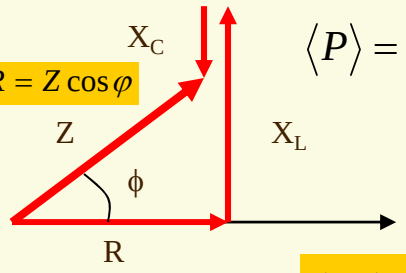
$$I_{max} = \frac{\mathcal{E}_{max}}{Z} = \mathcal{E}_{max}\sqrt{\frac{1}{R^2} + \left(\frac{1}{X_C} - \frac{1}{X_L}\right)^2}$$

Simulação: condição de ressonância

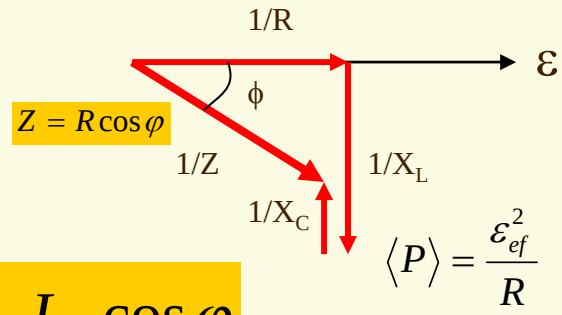


14.3. Ressonância no circuito RLC

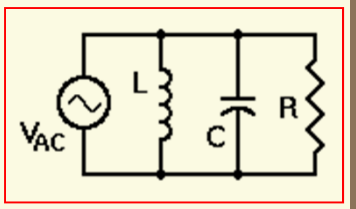




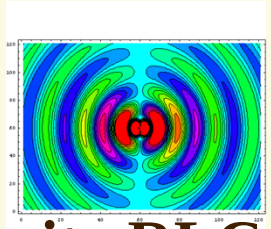
$$\langle P \rangle = RI_{ef}^2$$



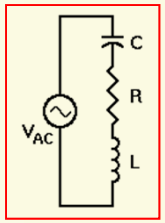
$$\langle P \rangle = \frac{\varepsilon_{ef}^2}{R}$$



$$\langle P \rangle = \mathcal{E}_{ef} I_{ef} \cos\varphi$$



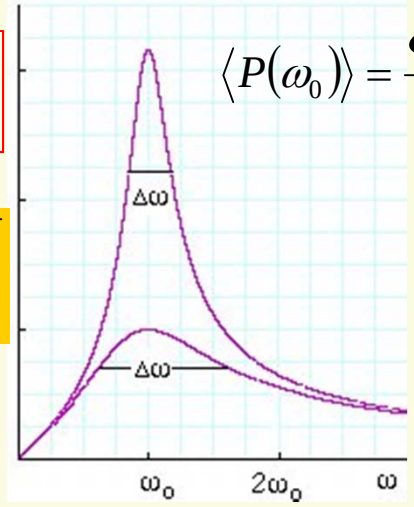
14.4. O factor de qualidade do circuito RLC



$$\langle P(\omega)\rangle = \frac{R\omega^2 \mathcal{E}_{ef}^2}{L^2\left(\omega^2-\omega_0^2\right)^2 + R^2\omega^2}$$

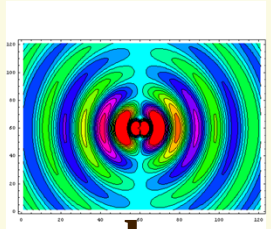
$$\langle P(\omega)\rangle = \frac{1}{2}\langle P(\omega_0)\rangle$$

$$\langle P(\omega_0)\rangle = \frac{\mathcal{E}_{ef}^2}{R}$$

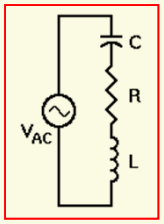


Factor de qualidade: $Q = \dfrac{\omega_0}{\Delta\omega} \Leftrightarrow Q = \dfrac{L\omega_0}{R} = \dfrac{1}{R}\sqrt{\dfrac{l}{C}}$

Largura da banda: $\Delta\omega = \dfrac{R}{L}$

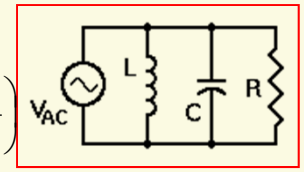


14.5. Impedâncias complexas

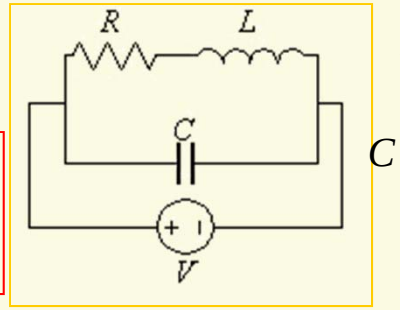


$$Z = R + i\left(L\omega - \frac{1}{C\omega}\right)$$

$$\frac{1}{Z} = \frac{1}{R} + i\left(C\omega - \frac{1}{L\omega}\right)$$

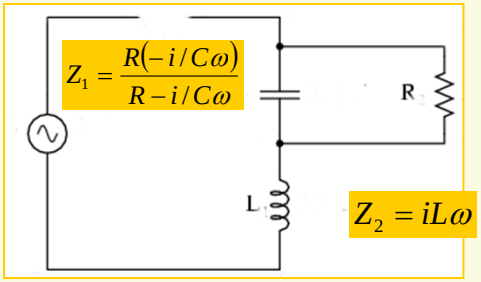


$Z_1 = R + iL\omega$ $Z_2 = -i/C\omega$



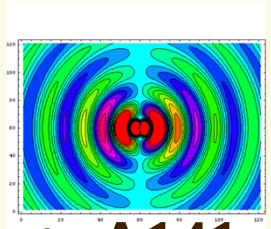
$$Z = \frac{Z_1 Z_2}{Z_1 + Z_2}$$

$$C = \frac{L}{R^2 + L^2\omega^2}$$



$$Z = Z_1 + Z_2 \qquad L = \frac{R^2 C}{R^2 C^2 \omega^2 + 1}$$

Ressonância: $\varphi = 0$



Teste A141

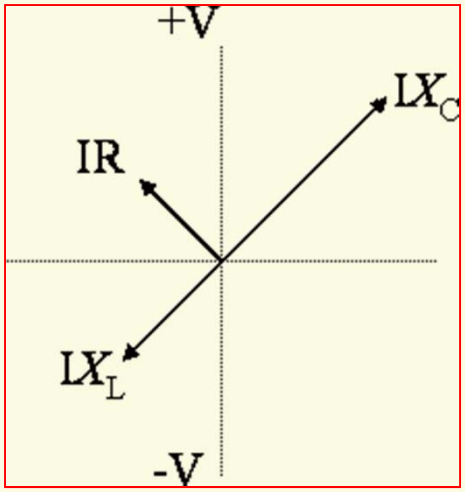
Considere o diagrama vectorial das quedas de potencial nos elementos R, L e C do circuito RLC série representado na Figura.

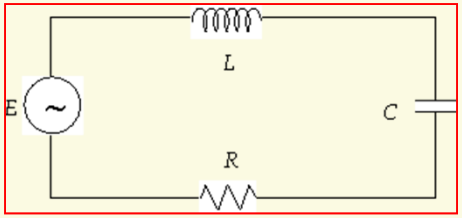
Qual o valor da frequência ω da corrente alternada em relação à frequência de ressonância ω_0 do circuito?

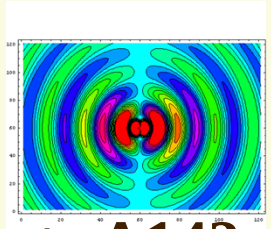
A $\omega > \omega_0$

B $\omega < \omega_0$

C $\omega = \omega_0$







Teste A142

O esquema do circuito colector (pickup) de uma guitarra eléctricaestá representado na Figura.

Qual o valor da impedância Z do circuito pickup para as frequências ω = 0 e ω = ∞ das cordas da guitarra?

A $Z(\omega=0) = 0$ ohms and $Z(\omega=\infty) = 0$ ohms

B $Z(\omega=0) = 0$ ohms and $Z(\omega=\infty) = R$ ohms

C $Z(\omega=0) = R$ ohms and $Z(\omega=\infty) = 0$ ohms