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

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

& $$Q = -\frac{E_0}{\omega\sqrt{R^2+\left(\frac{1}{\omega C}-\omega L\right)^2}}\cos(\omega t+\phi)$$

i.e $$I = \frac{dQ}{dt} = \frac{E_0}{\sqrt{R^2+\left(\frac{1}{\omega C}-\omega L\right)^2}}\sin(\omega t+\phi)$$

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

The following cases arise

$\frac{1}{\omega C} > \omega L \Rightarrow \phi = +ve$ = current leads the emf.

& when $\frac{1}{\omega C} < \omega L \Rightarrow \phi = -ve.$

current lags behind the emf

$\omega L = \frac{1}{\omega C} \Rightarrow \phi = 0$

Current & emf are in phase i.e no lag or lead.

The impedance of the circuit is minm and equal to R. because impedance (Z)

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

This is the case electrical resonance.

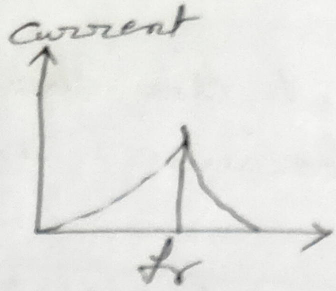
In this case $\omega^2 = \frac{1}{LC}$

$$\omega = \frac{1}{\sqrt{LC}} = 2\pi f$$

$$\Rightarrow f = \frac{1}{2\pi\sqrt{LC}} = \text{resonance frequency}$$

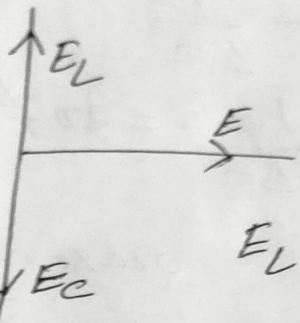
& the corresponding circuit is series resonant circuit. This circuit is very useful in radio receivers. By offering minimum impedance to current at resonant frequency, it is able to select most readily the current of this particular frequency from among those of many frequencies that is why it is also known as acceptor circuit.

The process of tuning in wireless receivers Consists in adjusting the resonant frequency to Correspond with frequency of desired wave.



where:-
f_r = Resonance frequency

fig ② Graphically



$$E_L = L\frac{dI}{dt}, \quad E_C = \frac{Q}{C} \ \& \ E = \mathcal{E}_0 \sin\omega t.$$

At this frequency inductive reactance = Capacitative reactance.

Thus

Emf induced over inductor = – Emf induced over Capacitor

$\therefore \ \mathcal{E}_{Rms} = I_{Rms} \times R$

Thus, Q Factor (quality factor) $= \dfrac{\text{The p.d. across inductance}}{\text{Applied emf}}$

$$= \frac{\omega L \times I_{Rms}}{R \times I_{Rms}}$$

$$= \frac{\omega L}{R} = \text{much larger than unity.}$$

This series resonant circuit shows selectivity. So, called selector or accepter circuit.