RLC Series Circuit

Consider an AC single phase circuit consisting a resistance, inductor and capacitor in series. The voltage drop caused by the inductive reactance of the coil leads the line current by 90^0. The voltage drop caused by the capacitive reactance of the coil lags the line current by 90^0. There fore the net reactance of the circuit is the difference of inductive reactance and capacitive reactance.

Net reactance=X_L-X_C

The impedance of the circuit is the sum of resistance and net reactance.

$$\text{Impedance } Z = \sqrt{R^2 + (X_L - X_C)^2}$$

Voltage drop across RLC circuit:

Let Voltage drop across R = E_R

Voltage drop across L = E_L

Voltage drop across C = E_C

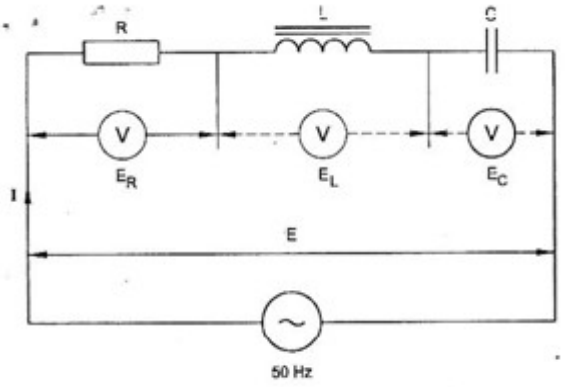
E_R=IR

E_L=IX_L

E_C=IX_C

Where

I - current flow



Current I = Voltage / Impedance = E / Z

In an RLC series circuit, if X_L is greater then the voltage appearing across the inductor is high and that can be found out by IX_L. In the same way if the X_C value is greater in an RLC series circuit, the voltage appearing across the capacitor is more and can be found out by IX_C.

It is clear that the voltage drop across the inductor and capacitor is higher than the supply voltage. Hence while connecting the meter to measure the voltage drop across inductor and capacitor it should be noted that the range of this should be high.

Resonance in RLC series circuit

At a particular value of the frequency of the applied voltage to the combined RLC circuit, the inductive reactance and the capacitive reactance will be equal to each other

(i.e) $X_L = X_{c.}$

(i.e) $wL = 1/w_C$. This means that the impedance becomes minimum at this frequency and it is given by minimum impedance Z = R. This means that only resistance remains in the circuit, with the inductive reactance and the capacitive reactance nullifying each other. Hence the resonant frequency for the circuit $f_0 = 1/2\prod\sqrt{LC}$

Acceptor circui

The series resonant circuit is often called an 'acceptor' circuit. By presenting minimum impedance to current at the resonant frequency it can select or accept a particular frequency among many frequencies.

In radio receivers the resonant frequency of the circuit is tuned to the frequency of the signal to be detected. This tuning is done by varying the capacitance of a capacitor.