Chapter:4

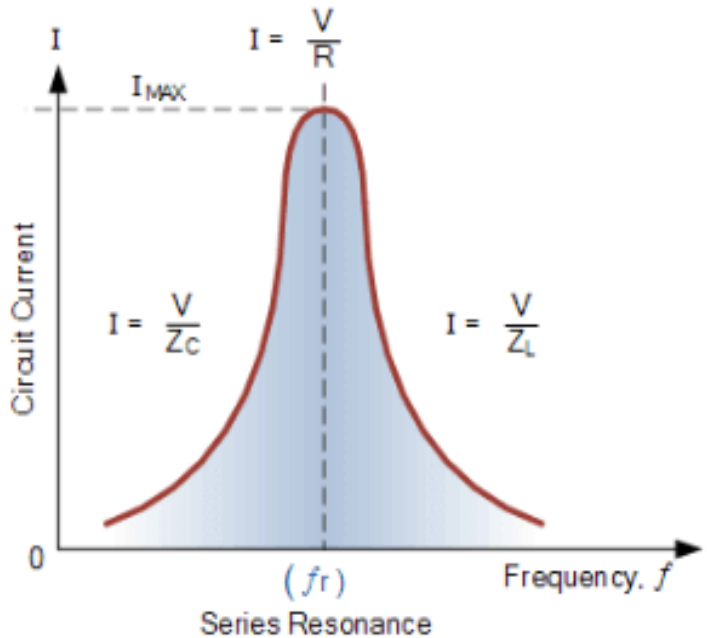
Understand The Effect of Bandwidth & Q-Factor in Series Resonance

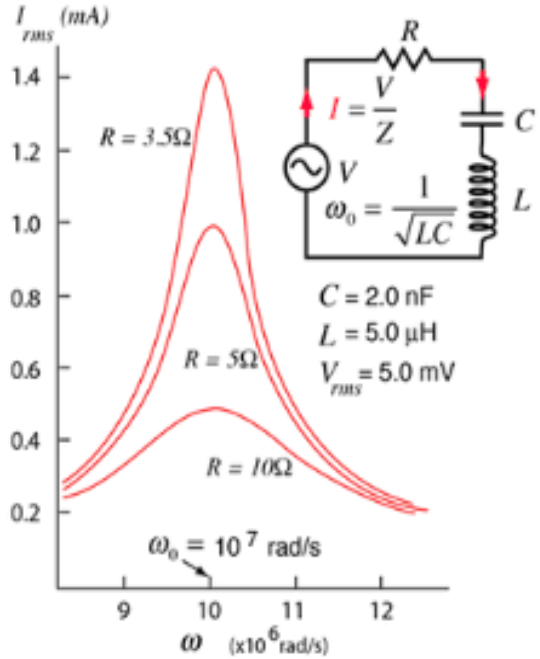
Lecture-1

Definition of Series Resonance:

- Consider a RLC circuit in which resistor, inductor and capacitor are connected in series across a voltage supply. This series RLC circuit has a distinguishing property of resonating at a specific frequency called resonant frequency.

What is the Resonance in Series RLC Circuit?





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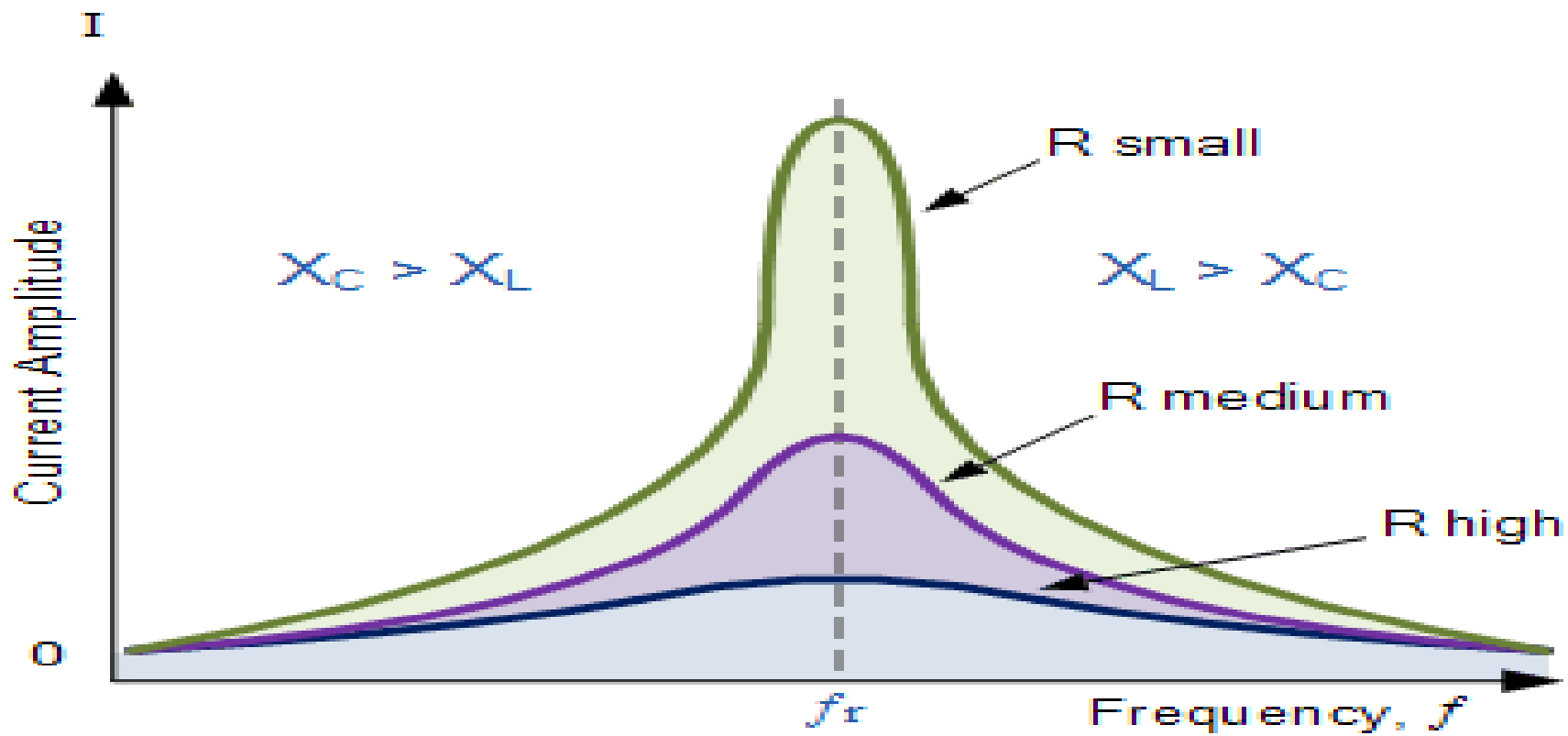
Properties of Series Resonant Circuit:

- Since resonance in series RLC circuit occurs at particular frequency, so it is used for filtering and tuning purpose as it does not allow unwanted oscillations that would otherwise cause signal distortion, noise and damage to circuit to pass through it.
- Summary
- For a series RLC circuit at certain frequency called resonant frequency, the following points must be remembered. So at resonance:

- Inductive reactance XL is equal to capacitive reactance XC.
- Total impedance of circuit becomes minimum which is equal to R i.e Z = R.
- Circuit current becomes maximum as impedance reduces, I = V / R.
- Voltage across inductor and capacitor cancels each other, so voltage across resistor Vr = V, supply voltage.
- Since net reactance is zero, circuit becomes purely resistive circuit and hence the voltage and the current are in same phase, so the phase angle between them is zero.
- Power factor is unity.
- Frequency at which resonance in series RLC circuit occurs is given .


I
Current Amplitude
0
R small
$X_C > X_L$
$X_L > X_C$
R medium
R high
f_r
Frequency, f