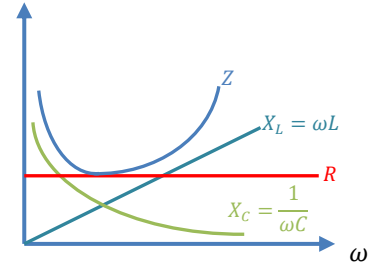


CONCEPT: RESONANCE IN SERIES LRC CIRCUITS

- The impedance of an LRC circuit depends on the frequency of the AC source:
 - The impedance is large at small ω and at large ω
- Recall that the impedance is $Z = \sqrt{R^2 + (X_L - X_C)^2}$
 - The SMALLEST value of impedance, $Z = R$, occurs when $X_C = X_L$
 - When this occurs, the circuit is said to be in RESONANCE



- The RESONANT FREQUENCY of an LRC circuit is

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

- Since resonance occurs when the impedance is SMALLEST, the current is LARGEST in resonance for series LRC

EXAMPLE: An AC circuit is composed of a $10\ \Omega$ resistor, a $2\ \text{H}$ inductor, and a $1.2\ \text{mF}$ capacitor. If it is connected to a power source that operates at a maximum voltage of $120\ \text{V}$, what frequency should it operate at to produce the largest possible current in the circuit? What would the value of this current be?

- In a series LRC circuit, the current is the same through the inductor and the capacitor
 - In resonance, since $X_L = X_C \rightarrow$ The voltage across the inductor and the capacitor is the same

PRACTICE: VOLTAGES IN A SERIES LRC CIRCUIT IN RESONANCE

A series LRC circuit is formed with a power source operating at $V_{\text{RMS}} = 100 \text{ V}$, and is formed with a $15 \text{ } \Omega$ resistor, a 0.05 H inductor, and a $200 \text{ } \mu\text{F}$ capacitor. What is the voltage across the inductor in resonance? The voltage across the capacitor?