Expirement 8:-

Impedence & Reactance

→ A measure of how much the element opposes current flow (it's a complex number)

→ An expression of the extent to which an electric component Release or stores energy (exists only in AC)

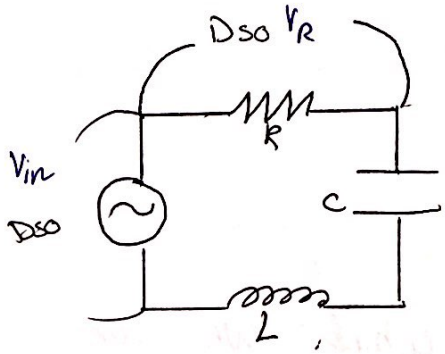
- We use the sine Wave

In An RLC Circuit :- → equation ①

$$I(t) = \frac{\mathcal{E}(t)}{Z_{eq}} = I_o \sin(\omega t - \phi)$$

$$Z_R + Z_C + Z_L$$

- Z_R ↑ Resistive impedence
- Z_C ↑ capacitive impedence
- Z_L ↑ inductive impedence



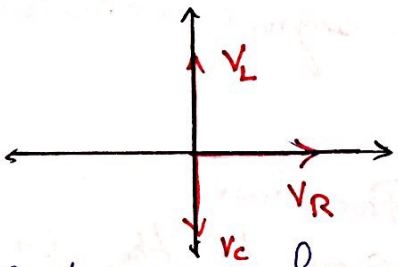
$$V_R = I_o R \sin(\omega t - \phi)$$

V_R is 90° ahead of V_C.

$\phi = \omega \Delta t$

$$V_C = X_C I_o \sin(\omega t - \phi - \frac{\pi}{2})$$

X_C ↑ Capacitive Reactance $= \frac{1}{\omega C}\ \Omega$



If it gives you f and wants ϕ

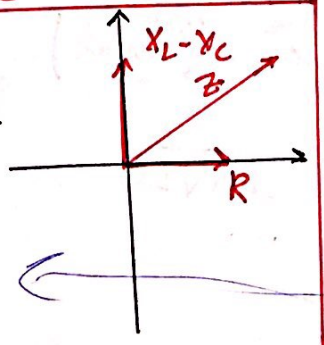
$$V_L = X_L I_o \sin(\omega t - \phi + \frac{\pi}{2})$$

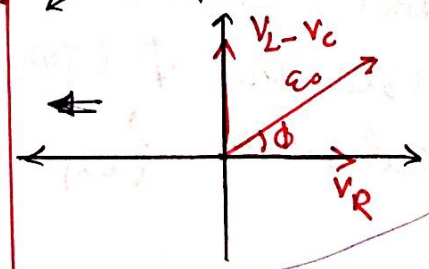
X_L ↑ inductive Reactance $= \omega L\ \Omega$

Intuitive

$$Z_{eq} = \sqrt{R^2 + (X_L - X_C)^2}$$

$$\tan\theta = \frac{X_L - X_C}{R}$$





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- Using equation 1 :-

$$I_0 = \frac{\mathcal{E}_0}{\sqrt{R^2 + (X_L - X_C)^2}}$$

I_0 is Maximum when :- $X_L = X_C$

$$\omega L = \frac{1}{\omega C}$$

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

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

$I_0 = \frac{\mathcal{E}_0}{R}$

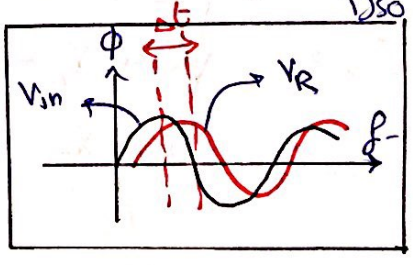
- What we use
  - a Capacitor
  - an inductor
  - a Resistance
  - signal Generator and Dso

- ثم توصل الدارة كما هو مبين في الصفحة الأولى
- ثم توصل جهاز الـ Dso مع R ، مع signal Generator
- ثم تغير التردد في المدى (0.1 — 100) KHz
- وقس Δt من شاشة الـ Dso لكل حالة

- Procedure
- Connect the Circuit As shown
- Connect the Dso with R and signal Generator
- Change frequency in the Range (0.1 — 100) KHz and measure Δt

→ Calculate Φ (phase difference) :- $\Phi = 2\pi f \Delta t$

→ Calculate $f_{exp} = \frac{1}{2\pi\sqrt{LC}}$



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