EEE Final Lecture

Class-1: Complex numbers

Exercise: *14.15-14.26* | *Page: 600*

Rectangular	$: a \pm jb$
Trigonometrical	$: E(\cos\theta \pm \sin\theta)$
Exponential	$: E \cdot e^{j\theta}$
Polar	$: E \angle \pm \theta$

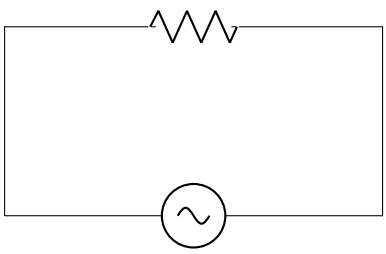
$$E = \sqrt{a^2 + b^2} \qquad a = E\cos\theta$$

$$\theta = \tan^{-1}\frac{b}{a} \qquad b = E\sin\theta$$

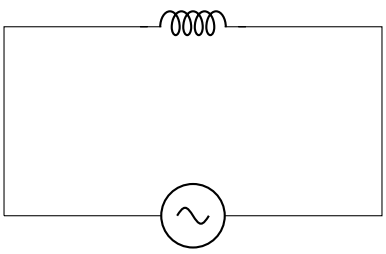
- Use Rectangular form for : $+, -$
- Use Polar form for : $\times, \div$

Class-2: Sinusoidal Expression

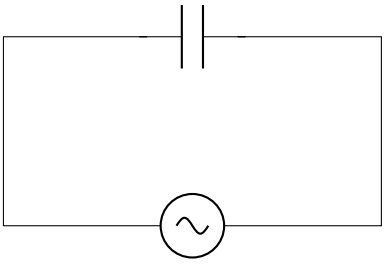
Exercise: *14.2-14.7* | *Page: 584*



Pure Resistive



Pure Inductive



Pure Capacitive

$$v = V_m \sin\omega t$$

$$i = I_m \sin\omega t$$

$$I_m = \frac{V_m}{R}$$

$$v = V_m \sin\omega t$$

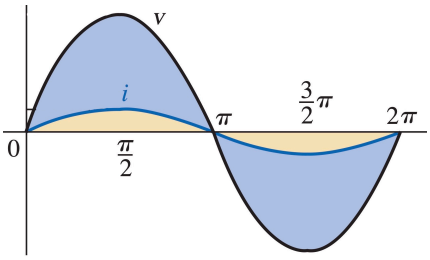
$$i = I_m \sin(\omega t - 90^\circ)$$

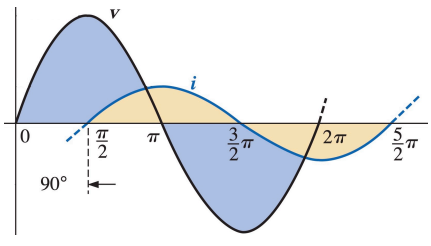
$$I_m = \frac{V_m}{X_L} = \frac{V_m}{\omega L}$$

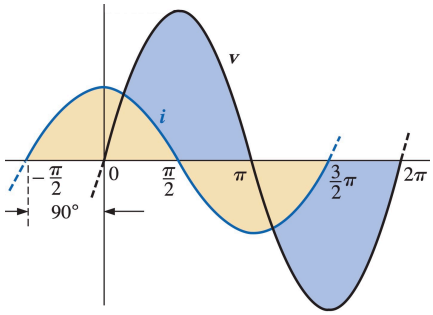
$$v = V_m \sin\omega t$$

$$i = I_m \sin(\omega t + 90^\circ)$$

$$I_m = \frac{V_m}{X_C} = \frac{V_m}{\frac{1}{\omega C}}$$







Class-3: Impedance

Exercise: *16.1, 16.2, 16.3*

Impedance (z): The ratio of the phasor voltage (V) to the phasor current (I) in ohms.

- In pure resistive circuit, volatge (v) and current (i) stay in phase.
- In pure inductive circuit, voltage (v) leads the current (i) by 90°.
- In pure capacitive circuit, current (i) leads the voltage (v) by 90°.

Element	**Impedance** in Rectangular form	**Impedance** in Polar form
(Resistor) R	$Z_R = R$	$Z_R \angle 0^\circ$
(Inductor) L	$Z_L = j X_L = j\omega L$	$Z_L \angle 90^\circ$
(Capacitor) C	$Z_C = -j X_C = -j\frac{1}{\omega C}$	$Z_C \angle -90^\circ$

Class-4: Power Factor

P.f is a measure of how effectively electrical equipment converts electric power into useful power.

1. Pf is the ratio of active power to the total power.

$$P.f = \frac{\text{Active power}}{\text{Total power}} = \frac{P}{S} = \frac{P}{P+Q}$$

2. The cosine angle between the current and the voltage is called pf.

$$\text{Pf} = \cos\theta$$

$$\text{P} = \text{VI}\cos\theta \ \ (watt)$$

$$\text{Q} = \text{VI}\sin\theta \ \ (VAR)$$