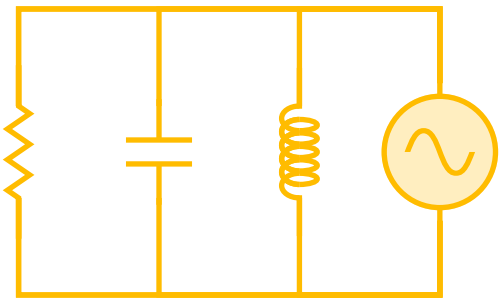
Electric Circuits



→ Rules : AC circuits

instantaneous voltage: $$v(t) = V_{max}\sin(\omega t + \theta_v) = V_{rms}\angle\theta_V = \frac{V_{max}}{\sqrt{2}}\angle\theta_v$$

instantaneous current: $$i(t) = I_{max}\sin(\omega t + \theta_i) = I_{rms}\angle\theta_i = \frac{I_{max}}{\sqrt{2}}\angle\theta_i$$

impedance — reactance — phase shift

$$Z = \frac{v(t)}{i(t)} = R + Xj = R + (X_L - X_C)j = |Z|\angle\hat{Z} = |Z|\angle(\theta_v - \theta_i)$$

Resistor

$$Z = R$$

$$X = 0$$

zero reactance

Inductor

$$Z = j\omega L$$

$$X_L = \omega L$$

inductive reactance

Capacitor

$$Z = \frac{1}{j\omega C}$$

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

capacitive reactance

Power Calculations

instantaneous power: $$p = vi = V_{max}I_{max}\sin(\omega t + \theta_v)\sin(\omega t + \theta_i)$$

average →

active power: $$P = V_{rms}I_{rms}\cos(\hat{Z})$$

reative power: $$Q = V_{rms}I_{rms}\sin(\hat{Z})$$

apparent power: $$|S| = V_{rms}I_{rms}$$

complex power: $$S = P + Qj$$

power factor: $$P.F. = \cos(\hat{Z}) = \frac{P}{|S|}$$