

Single Device in AC Circuit: Inductor



Voltage of ac source : $\mathcal{E} = \mathcal{E}_{max} \cos \omega t$

Current through device: $I = I_{max} \cos(\omega t - \delta)$

Inductor

$$V_L = L \frac{dI}{dt} = \mathcal{E}_{max} \cos \omega t \Rightarrow I = \frac{\mathcal{E}_{max}}{\omega L} \sin(\omega t)$$

amplitude: $I_{max} = \frac{\mathcal{E}_{max}}{\omega L}$, phase angle: $\delta = \frac{\pi}{2}$

impedance: $X_L \equiv \frac{\mathcal{E}_{max}}{I_{max}} = \omega L$ (inductive reactance)

