

Phasors & Impedance

Electrical Engineering

Every passive element as one complex number, with the phase it forces.

Sinusoidal steady state at a single angular frequency ω .

Element	Impedance Z	Current against voltage
Resistor R	R	In phase
Inductor L	$j\omega L$	Current lags by 90°
Capacitor C	$1/(j\omega C)$	Current leads by 90°
Series RL	$R + j\omega L$	Lags by $\arctan(\omega L/R)$
Series RC	$R - j/(\omega C)$	Leads by $\arctan(1/\omega RC)$
Any Z	$ Z = \sqrt{R^2 + X^2}$	Phase = $\arctan(X/R)$

Phasors describe steady state at one frequency only. Transients need the time domain or the Laplace domain.