

AC examples

Example 1

The voltage across an AC power supply is given by $V = 100V \cos(120\pi t - 60^\circ)$.

- Draw the voltage phasor at $t = 0$.
- Draw the voltage phasor when V is at a maximum, a minimum, and $0V$.

A 100Ω light bulb is connected to the power supply.

- What is the current through the light bulb? Draw the current phasor at $t = 0$.
- What is the rms current through the light bulb?
- What is power dissipated in the light bulb?
- What is the average power dissipated in the light bulb? Does it depend on the frequency of the power supply?

A 100 mH inductor is added in series to the circuit.

- What is the current through the light bulb?
- Does changing the frequency of the AC power supply change the power dissipated in the light bulb? Plot the average power dissipated versus frequency.

The inductor is replaced by a $100 \mu\text{F}$ capacitor.

- What is the current through the light bulb?
- Does changing the frequency of the AC power supply change the power dissipated in the light bulb? Plot the average power dissipated versus frequency.

Example 2

An inductor ($L = 400 \text{ mH}$), a capacitor ($C = 4.43 \mu\text{F}$), and a resistor ($R = 500 \Omega$) are connected in series to a 50 Hz AC power supply. The peak current in the circuit is 250 mA .

- Calculate the inductive reactance of the circuit, the capacitive reactance of the circuit, and the total impedance of the circuit.
- What is the peak voltage across the power supply?
- Determine the phase angle Φ by which the current leads or lags the voltage of the power supply.
- Draw a phasor diagram showing the voltage phasors of the inductor, capacitor, resistor and power supply. Draw also the current phasor of the circuit.

Example 3

In a series RLC circuit, the applied voltage has a maximum value of 120 V and oscillates at the frequency of 60 Hz . The circuit contains an inductor whose inductance can be varied, a 200Ω resistor and a $4 \mu\text{F}$ capacitor. If the voltage across the capacitor lags the applied voltage by 30° , what is the value of the inductance of the inductor?