Tutorial 5

See the Year 1 Notice Board for tutorial groups, tutors, locations and times of tutorials.

Problems

1. An alternating current with an amplitude of 5 A is flowing through a 10 Ω resistor. What power is dissipated in the resistor?

2. An alternating voltage with an amplitude of 30 V and a frequency of 1 kHz is applied in turn across: a) a 50 Ω resistor; b) a 250 mH inductor; and c) a 1.5 µF capacitor. What is the amplitude of the resulting current in each case? What is the power dissipated in each case?

3. The figure below shows the applied voltage $\mathcal{E}$ (solid line) and the current i (dashed line) for a series LCR circuit.

   a. Does the current lead or lag the applied voltage?

   b. Is the circuit acting mainly inductively or mainly capacitively?

   c. Is the frequency of the applied voltage greater or less than the resonant frequency of the circuit?
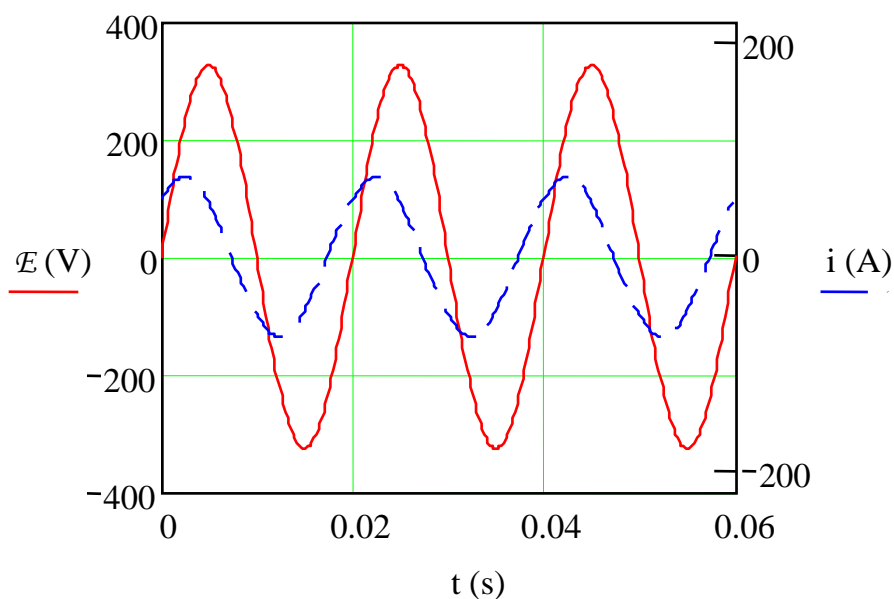
4. A series circuit consists of a capacitor $C = 1$ nF, an inductor $L = 10$ μH, a resistor $R = 10 \, \Omega$ and a variable frequency power supply having a voltage amplitude of 10 V and zero internal resistance. Initially, the angular frequency is set to $\omega_d = 2 \times 10^6$ rad sec^{-1}.

    a. Calculate values for the reactances of both the capacitor and the inductor.

    b. Calculate the phase angle by which the current leads the voltage.

    c. Calculate the magnitude of the impedance of the circuit.

    d. The frequency of the power supply is now varied. Sketch a graph of the current amplitude I against the angular frequency ω_d. At what value of the angular frequency will the current amplitude be a maximum and what is the value of that maximum current amplitude?