Problem Set # 7

Conceptual Questions

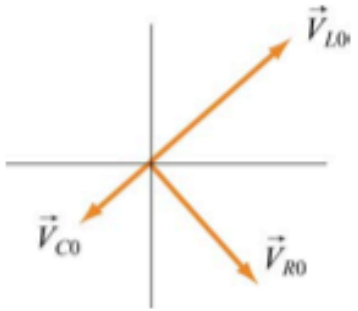
1. Consider a purely capacitive circuit (a capacitor connected to an AC source).

(a) How does the capacitive reactance change if the driving frequency is doubled? halved?

(b) Are there any times when the capacitor is supplying power to the AC source?

2. If the applied voltage leads the current in a series *RLC* circuit, is the frequency above or below resonance?

3. Consider the phasor diagram shown in Figure 12.10.1 for an *RLC* circuit.



(a) Is the driving frequency above or below the resonant frequency?

(b) Draw the phasor $\vec{V}_0$ associated with the amplitude of the applied voltage.

(c) Give an estimate of the phase ϕ between the applied AC voltage and the current.

4. How does the power factor in an *RLC* circuit change with resistance R, inductance L and capacitance C?

Exercises and Problems:

Chapter 36: 36.58, 36.59, 36.60, 36.71

Problem 7.1

An AC voltage source is connected to a "black box" which contains a circuit, as shown in Figure 12.11.3.

Figure 12.11.3 A "black box" connected to an AC voltage source.

The elements in the circuit and their arrangement, however, are unknown. Measurements outside the black box provide the following information:

$$V(t) = (80\ \text{V})\sin\omega t$$
$$I(t) = (1.6\ \text{A})\sin(\omega t + 45°)$$

(a) Does the current lead or lag the voltage?

(b) Is the circuit in the black box largely capacitive or inductive?

(c) Is the circuit in the black box at resonance?

(d) What is the power factor?