EELE 354: Electric Power Applications

Lecture 15: AC Circuits Practice

10/23/2013

1. For the circuit shown in Figure 1, assume the voltage source (V_{in}) is a 120 V, 60 Hz source. Assume the resistance is $R = 5$ kΩ, and the inductance is $L = 10$ H.

   • Draw a phasor diagram for the impedance (consists of resistance, inductor, and total impedance phasors). Use resistance as your reference.

   • What is the total impedance of the circuit from the perspective of the power source? Give in terms of a complex number. Then, convert that number to a magnitude ($|Z|$) and phase (ϕ_Z).

   • What is the magnitude of the current ($|I|$)?

   • What is the magnitude of the voltages across the resistor and the inductor?

   • Draw a phasor diagram for the voltage (consists of the resistance voltage, inductor voltage and input voltage phasors). Use resistance voltage as your reference.

   • What is the real power (P), the reactive power (Q), and the total apparent power (P_{app}) drawn by the circuit?

   • Draw a phasor diagram for the power (consists of the real, reactive, and apparent power phasors). Use the real power phasor as your reference.

   • What is the power factor (PF) of the circuit? Is it leading or lagging?
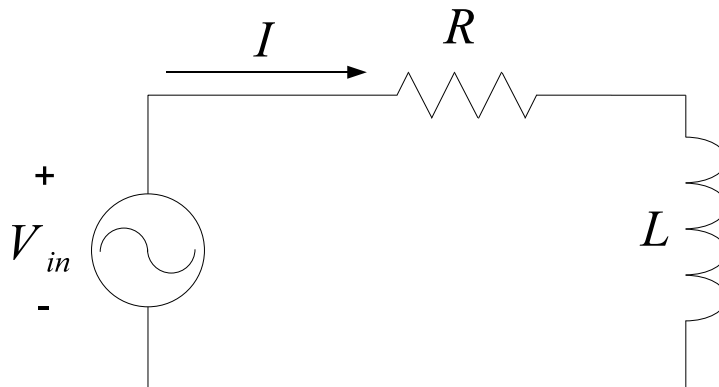

Figure 1: Practice Circuit 1

Show work:

2. For the circuit shown in Figure 2, assume the voltage source (V_{in}) is a 120 V, 60 Hz source. Assume the resistance is $R = 5$ kΩ, and the inductance is $L = 10$ H.

- What is the total impedance of the circuit from the perspective of the power source? Give in terms of a complex number. Then, convert that number to a magnitude ($|Z|$) and phase (ϕ_Z).
- Determine the current magnitudes through the resistor and the inductor.
- Draw a phasor diagram for the current (consists of the resistance, inductor, and total circuit current phasors). Use resistance current as your reference.
- What is the magnitude of the total circuit current ($|I|$)?
- What is the real power (P), the reactive power (Q), and the total apparent power (P_{app}) drawn by the circuit?
- Draw a phasor diagram for the power (consists of the real, reactive, and apparent power phasors). Use the real power phasor as your reference.
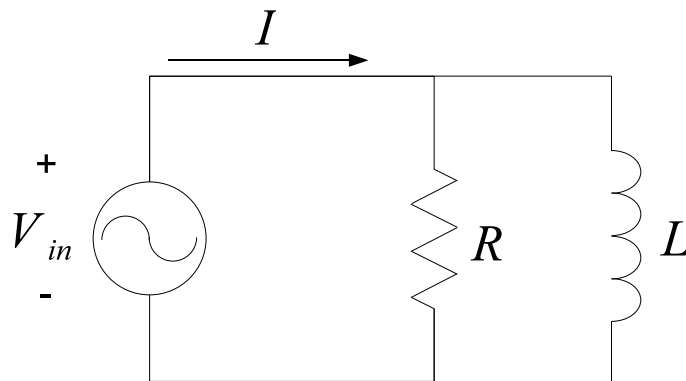- What is the power factor (PF) of the circuit? Is it leading or lagging?

Figure 2: Practice Circuit 2

Show work:

3. For the circuit shown in Figure 3, assume the voltage source (V_{in}) is a 277 V, 60 Hz source. Assume the resistance is $R = 1$ kΩ, and the capacitance is $C = 4$ μF.

- Draw a phasor diagram for the impedance (consists of resistance, capacitor, and total impedance phasors). Use resistance as your reference.

- What is the total impedance of the circuit from the perspective of the power source? Give in terms of a complex number. Then, convert that number to a magnitude ($|Z|$) and phase (ϕ_Z).

- What is the magnitude of the current ($|I|$)?

- What is the magnitude of the voltages across the resistor and the capacitor?

- Draw a phasor diagram for the voltage (consists of the resistance voltage, capacitor voltage and input voltage phasors). Use resistance voltage as your reference.

- What is the real power (P), the reactive power (Q), and the total apparent power (P_{app}) drawn by the circuit?

- Draw a phasor diagram for the power (consists of the real, reactive, and apparent power phasors). Use the real power phasor as your reference.

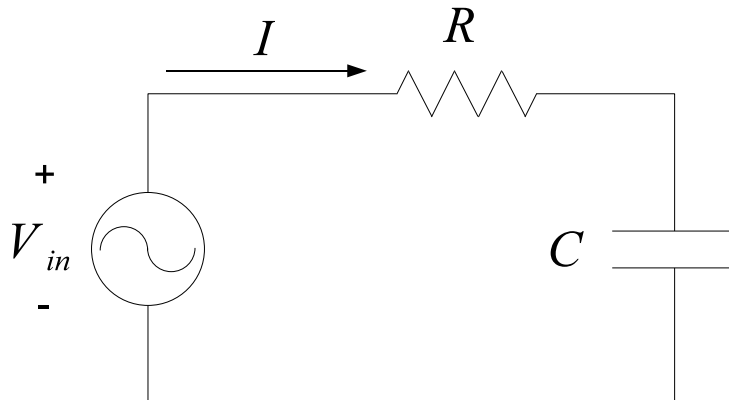- What is the power factor (PF) of the circuit? Is it leading or lagging?

Figure 3: Practice Circuit 3

Show work:

4. For the circuit shown in Figure 4, assume the voltage source (V_{in}) is a 277 V, 60 Hz source. Assume the resistance is $R = 1$ kΩ, and the capacitance is $C = 4$ μF.

- What is the total impedance of the circuit from the perspective of the power source? Give in terms of a complex number. Then, convert that number to a magnitude ($|Z|$) and phase (ϕ_Z).

- Determine the current magnitudes through the resistor and the capacitor.

- Draw a phasor diagram for the current (consists of the resistance, capacitor, and total circuit current phasors). Use resistance current as your reference.

- What is the magnitude of the total circuit current ($|I|$)?

- What is the real power (P), the reactive power (Q), and the total apparent power (P_{app}) drawn by the circuit?

- Draw a phasor diagram for the power (consists of the real, reactive, and apparent power phasors). Use the real power phasor as your reference.

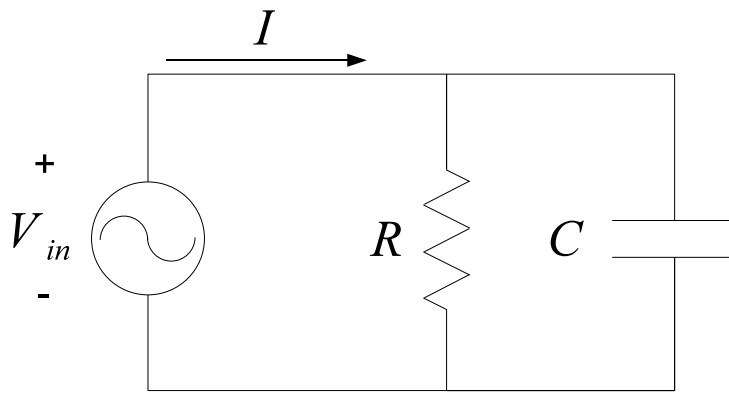- What is the power factor (PF) of the circuit? Is it leading or lagging?

Figure 4: Practice Circuit 4

Show work:

5. For the circuit shown in Figure 5, assume the voltage source (V_{in}) is a 480 V, 60 Hz source. Assume the resistance is $R = 100\ \Omega$, the inductance is $L = 0.5$ H, and the capacitance is $C = 10\ \mu$F.

- Draw a phasor diagram for the impedance (consists of resistance, inductor, capacitor, and the resulting total impedance phasors). Use resistance as your reference.

- What is the total impedance of the circuit from the perspective of the power source? Give in terms of a complex number. Then, convert that number to a magnitude ($|Z|$) and phase (ϕ_Z).

- What is the magnitude of the current ($|I|$)?

- Draw a phasor diagram for the voltage (consists of the resistance voltage, inductor voltage, capacitor voltage and input voltage phasors). Use resistance voltage as your reference.

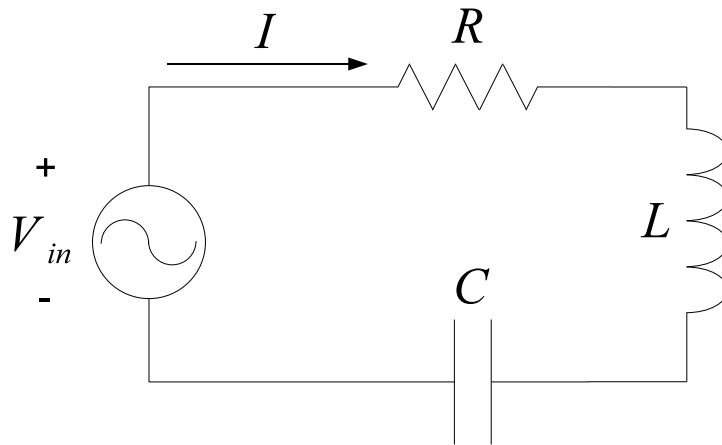- What is the power factor (PF) of the circuit? Is it leading or lagging?

Figure 5: Practice Circuit 5

Show work:

6. For the circuit shown in Figure 6, assume the voltage source (V_{in}) is a 480 V, 60 Hz source. Assume the resistance is $R = 100\ \Omega$, the inductance is $L = 0.5$ H, and the capacitance is $C = 10\ \mu F$.

- What is the total impedance of the circuit from the perspective of the power source? Give in terms of a complex number. Then, convert that number to a magnitude ($|Z|$) and phase (ϕ_Z).

- What is the magnitude of the current ($|I|$)?

- Draw a phasor diagram for the current (consists of the resistance current, inductor current, capacitor current and input current phasors). Use resistance current as your reference.

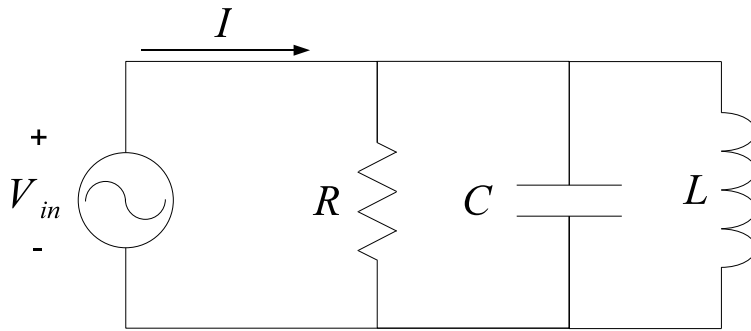- What is the power factor (PF) of the circuit? Is it leading or lagging?

Figure 6: Practice Circuit 6

Show work: