East West University
Department of Computer Science and Engineering

Course: CSE109 Electrical Circuits
Expt No.: 9
Title: AC Circuit Analysis using PSpice Schematics

Objective:
1. To analyze simple AC circuit using PSpice Schematics.

Circuit Diagram:

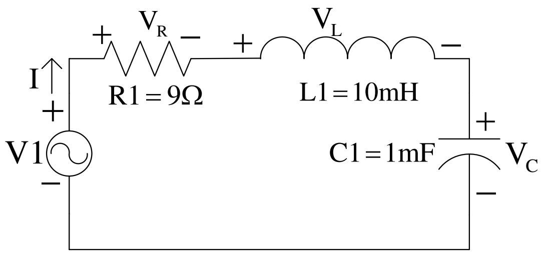

Figure 1. Example circuit.

Pre-Lab Report Question:
1. In Figure 1, $V1 = 10\angle 0^0$V and $\omega = 200\pi$ rad/sec. Calculate the current I, voltage across the resistance V_R, voltage across the inductance V_L, and voltage across the capacitance V_C. Determine the phase difference between the current I and the input voltage V1 and between the current I and the voltages V_R, V_L, and V_C.

Lab Procedure:
1. Draw the circuit as shown in the Figure 1 in PSpice Schematics window. The voltage source V1 in the circuit is VSIN.
2. Double click on the voltage source and set VOFF = 0, VAMPL = 10, and FREQ = 100. Save the settings.
3. Click on Analysis → Setup. Click on Transient. Set Print Step = 1ns and Final Time = 30ms. Click OK then close. Save the circuit setup.
4. Simulate the circuit and observe the input voltage signal (V1) shape. To plot the input signal, click on add trace and select V(V1:+) - V(V1:-).
5. Keep the input voltage signal in the plot. Add the current signal multiplied by 10 (I(R1)*10) in the plot. Multiplication of the current signal by 10 is for better view with the voltage signal. Determine the phase difference between voltage and current. Write it down. Also write which signal is leading. To calculate the phase difference, determine the time difference Δt between the two signal and then obtain the phase difference from $\Delta\theta = 360*\Delta t*f$.
6. Delete both the voltage and current signals from the plot window. Now add the current signal I(R1) in the plot and measure its amplitude. Write it down.
7. Multiply the current signal by 10 (I(R1)*10) and add the voltage signal across the resistance (V(R1:1) - V(R1:2)). Find the phase difference between the two signals and write it down.
8. Remove the voltage signal across the resistance from plot and keep the current signal. Add the voltage signal across the inductance (V(L1:1) - V(L1:2)). Find the phase difference between the two signals and write it down. Also write which signal is leading.

9. Remove both the signals from plot. Now add the current signal I(R1) and the voltage signal across the capacitance (V(C1:1) - V(C1:2)). Find the phase difference between the two signals and write it down. Also write which signal is leading.
10. Remove all the signals from the probe window and add the RMS value of input voltage signal. To plot the RMS value of the input signal, click add trace and select RMS(V(V1:+)-V(V1:-)). Find the RMS value at around 20 ms and write it down.
11. Similarly, determine the RMS values of the voltage across the resistance, voltage across the inductance, voltage across the capacitance, and the current.

Post-Lab Report Questions:

1. Calculate the impedance, both magnitude and phase angle, of the circuit from your readings of steps 5 and 6. Theoretically calculate the impedance and compare the two results.
2. Theoretically calculate the RMS values of current and the voltages across the resistance, across the inductance, and across the capacitance. Compare your calculated values with the readings taken in step 11.
3. Calculate the complex power consumed in the circuit from $S = \frac{Vm\,\mathrm{Im}}{2}\cos(\Delta\theta) + j\frac{Vm\,\mathrm{Im}}{2}\sin(\Delta\theta)$ using your data from steps 5 and 6. Here Vm and Im are the magnitudes of the input voltage and current, respectively and $\Delta\theta$ is the phase difference between the current and the input voltage.
4. Calculate the power dissipated by the resistance from $P = \frac{\mathrm{Im}^2 R}{2}$ using the data of step 6 and compare it with the real part of S calculated in question 3.