EE215 – Circuits and Systems
Lab 01 - Phase Measurement

Objectives:
• Verify phasor analysis method of AC circuits by both measurement and simulation.

Procedure:
1. Construct the circuit shown in Figure 1.
2. Connect Channel 1 of the scope to measure the function generator output. Connect Channel 2 to measure the voltage across the capacitor.
3. Set the function generator to generate a sinusoid at 1.6 kHz with no DC offset.
4. While observing the function generator output on the scope adjust the peak amplitude of the function generator sinusoid to 5 V. Use the scope to measure and record the peak voltage setting for later calculations. Also measure and record the function generator output voltage using the AC voltmeter.
5. Measure and record the amplitude of the voltage across the capacitor with both the scope and the meter.
6. Using only the voltmeter, measure and record the voltage across the resistor. (It is difficult to measure the voltage across the resistor with the scope because the scope always measures a voltage relative to ground and neither side of the resistor is grounded.)
7. Measure the phase difference between the capacitor voltage and the function generator input. (You will need to observe both channels simultaneously to do this.) Record whether the capacitor voltage leads or lags the input voltage.
8. Repeat steps 3 through 7 at 160 Hz and also at 16 kHz.
9. Verify all results by performing an AC analysis in LTSpice (at each of the three frequencies).
10. Perform a transient analysis in LTSpice (at each of the three frequencies) and plot the function generator output and the voltage across the capacitor over 6 to 8 cycles of the waveform.
11. Use phasor analysis to calculate the capacitor voltage (magnitude and phase) at each of the three frequencies.

Discussion Items:
Do your analysis results agree with measured and LTSpice results? Looking just at your voltmeter measurements at 1.6 kHz, notice that the resistor and capacitor voltages do not add up to equal the function generator voltage. Explain why this is not a violation of Kirchhoff's Voltage Law.

Report:
Your lab report should be completely written on a word processor. Deductions will be made for any handwritten formulas or graphs. All results should be presented in tables or graphs. The report should consist of at least the following sections: Objectives, Procedure, Results, Discussion, Conclusions.