ECE 3041
Homework Assignment No. 3

Spring 2012 Second Homework for Experiment No. 4

Due Week of Feburary 13

1. An ac voltmeter is being used to measure the rms magnitude of the ac voltage across nodes AA' in the circuit shown below. The source voltage is $e(t) = 30\sqrt{2}\cos(\omega t)$ V. Use SPICE to determine and plot the voltage that would be measured with this voltmeter as a function of the frequency of the sinusoidal source as the frequency of this source varies from $100\,\mathrm{Hz}$ to $10\,\mathrm{kHz}$. The frequency is to be plotted on a log scale and the voltage on a linear scale. The voltmeter is an ideal voltmeter with an infinite input impedance. Verify the SPICE solutions with a hand calculation using complex phasors to analyze the ac circuit at the frequency $f = 322\,\mathrm{Hz}$. The component values are: $R_1 = 12\,\mathrm{k\Omega}$, $R_2 = 12\,\mathrm{k\Omega}$, $R = 30\,\mathrm{k\Omega}$, $L = 3\,\mathrm{H}$, and $C = 10\,\mathrm{nF}$. Also plot (on the same sheet of paper) the voltage that would be measured with a Simpson Meter Model 260-7 set to its 10 V range.

2. Use SPICE to determine and plot the percentage error due to ac voltmeter loading in the measurement of the rms value of the ac voltage measured in Problem 1 when the voltmeter is a Simpson Model 260-7 set to its $10\,\mathrm{V}$ range. The frequency is to be plotted on a log scale and the percentage error on a linear scale. Verify the SPICE solutions with a hand calculation using complex phasors to analyze the ac circuit at the frequency $f = 322\,\mathrm{Hz}$.