

Lab 5 Phasors

Simulate and verify the relation of magnitude and phase of R, L and C for a given source in both series and parallel combination

Step 1: Build a series RLC (assuming reasonable combination - values can't be supplied) circuit much like Lab 2. Use 1KHz 1Vpp Sinusoidal source

Step 2: Compute the impedance of individual elements at that frequency by using following formulas

$$X_L = 2\pi fL; X_C = 1/(2\pi fC) \text{ and } X_R = R$$

Step 3: Calculate Impedance “ $|Z| = \sqrt{R^2 + (X_L - X_C)^2}$ ” and phase = $\tan^{-1}(X_L - X_C) / R$

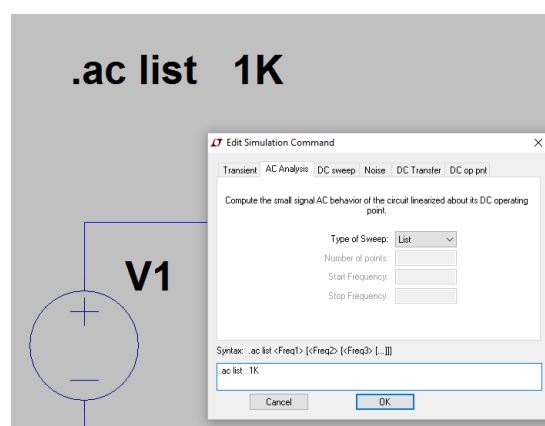
So your “Zeq” in polar format will be $|Z|$, phase format.

Step 4: Since you got the “Zeq”, and you know the source voltage you can compute the current through the loop.

Note: Use both quantities in polar format.

Step 5: Now calculate Voltage drop across each element using the above current and known impedances across each element in the circuit. Keep the calculations as of now.

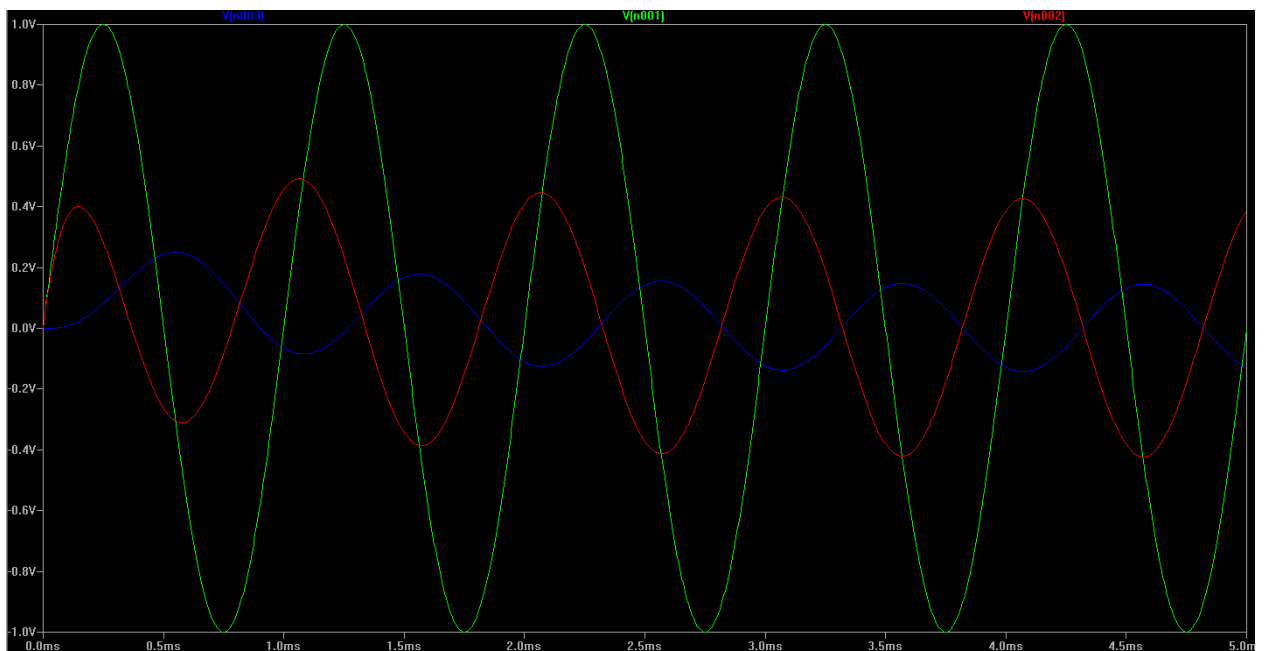
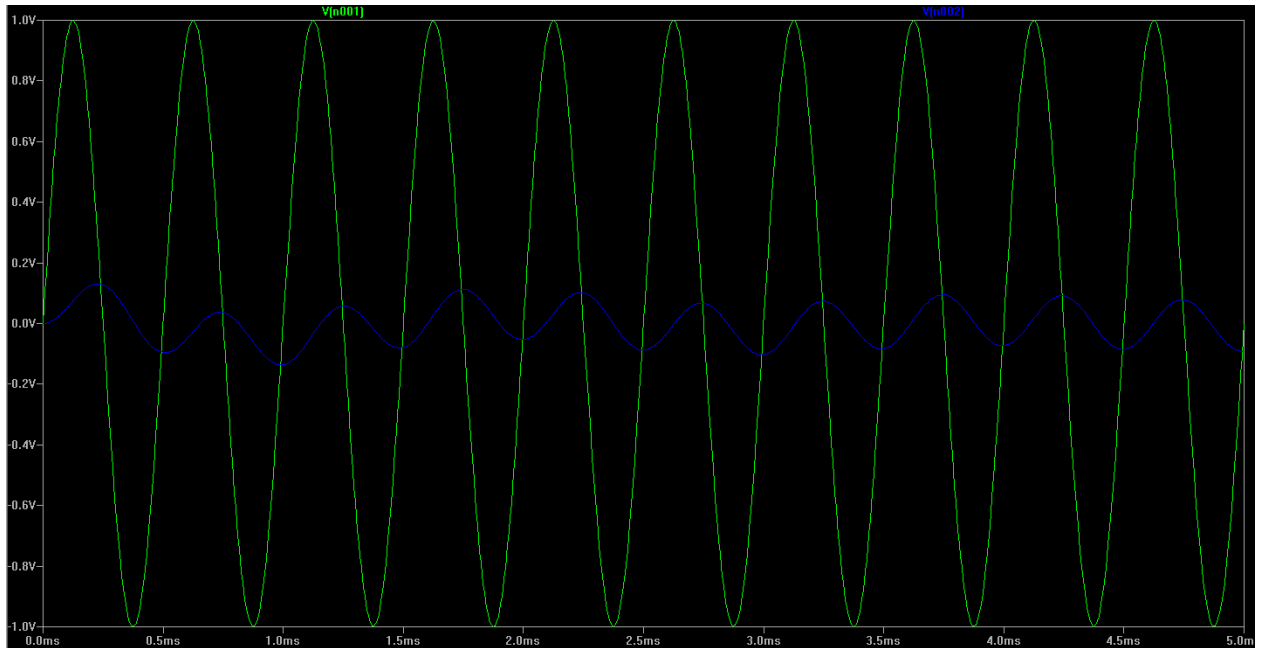
Step 6: Simulate the circuit by keeping the following settings in the EDIT SIMULATION COMMAND

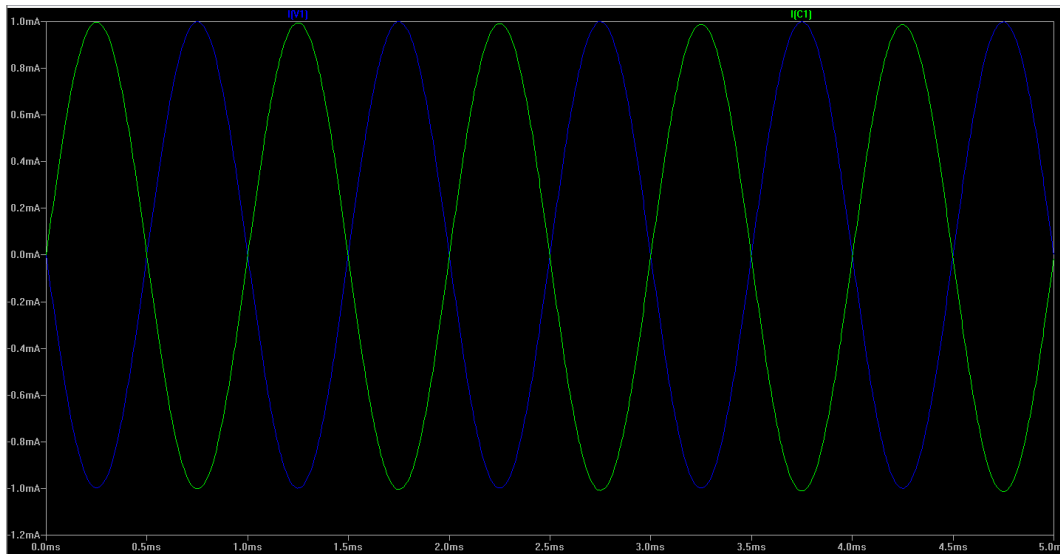


Then a window pops up displaying the values from simulation. It must match your values computed.

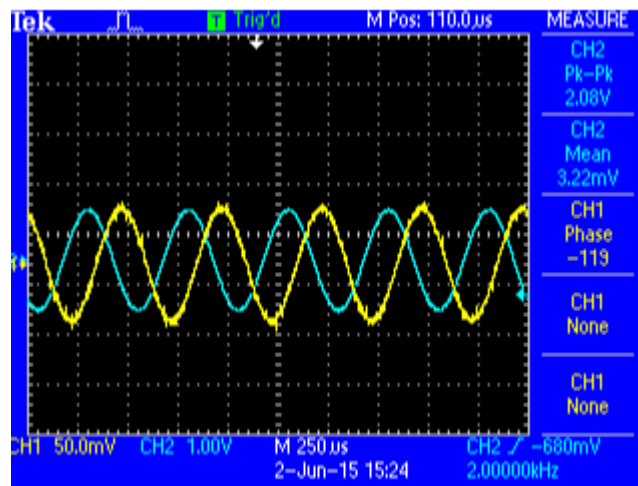
Step 7: Verify this behavior by building the actual circuit. Your output screen shot should contain both input and output in the same screen shot. Something like this

i) Series RLC individual voltage transient responses with reference to input source





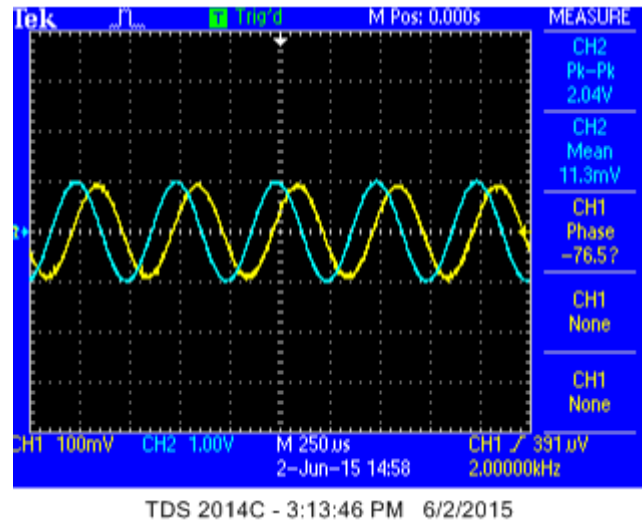
Scope output for Series RLC voltage



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Step 8: Now for parallel combination follow same procedure for parallel circuit. The only change is you should do source transformation using $0.1A$, 0 degrees (current source) with parallel resistor chosen, which gives a certain voltage as a source and that has to be used for simulation and testing. And other subtlety is it here in this configuration voltage remains constant in parallel components so you do the individual current in the parallel elements. Simulate AC list , transient and build.

Step 9: The output from the scope looks something like this.



[Note: Please be specific at each step and precise with explanations and also show your calculations neatly. That makes both our lives happy 😊]