

Tutorial #4: AC Circuit

In the previous tutorials, we used DC power sources and analyzed the steady state response of components. In this tutorial, we will build and simulate RL and RC circuits with an AC source. This tutorial uses information from the first three, so it is recommended you complete them before proceeding.

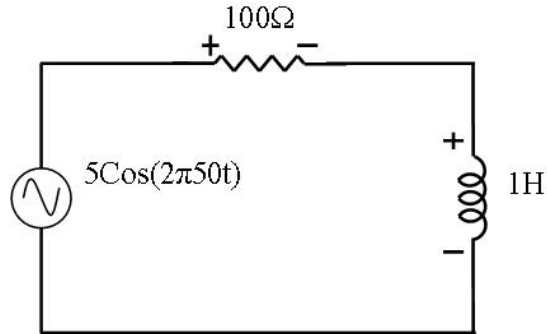


Figure 1: RL circuit to be simulated

Step 1. Open the circuit simulator and create a blank circuit.

Step 2. Build the circuit shown in Figure 1. To add a sinusoidal source, right click on the circuit board and select “Add A/C Source” from the “Inputs/Outputs” menu. The final circuit should look like **Figure 2**.

Note: If you have to move a component or a terminal on the circuit board, right click on the circuit board and select the desired action from the “Other” menu.

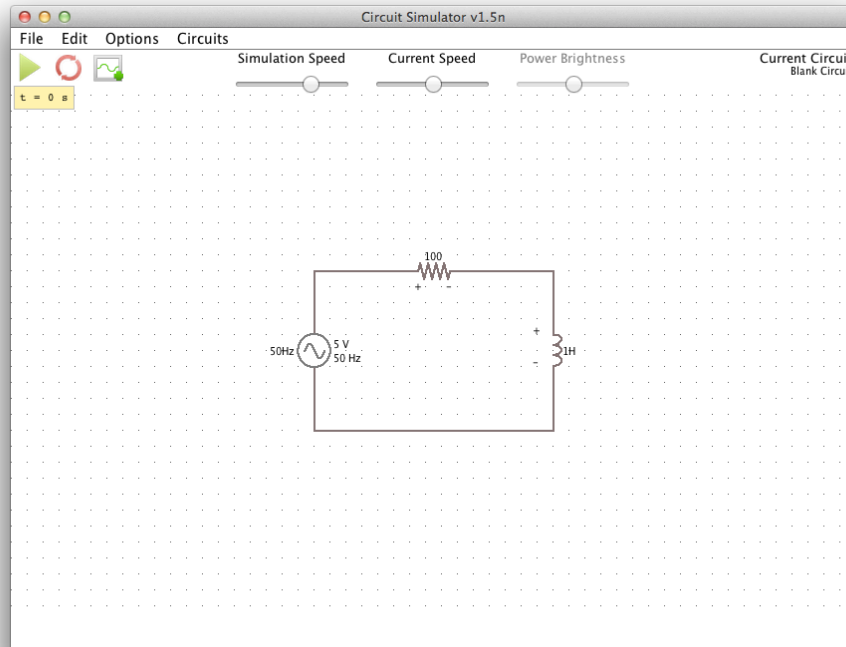


Figure 2: Completed circuit

Step 3. To change the voltage or frequency of AC source, right click on the AC source and select “Edit”. Enter the new parameters as desired. For this tutorial, set Max Voltage to 5 and Frequency to 50. You can leave rest of the boxes at their default value as shown in **Figure 3**.

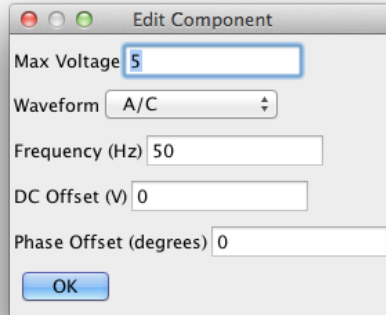


Figure 3: Edit dialog for AC source

Step 4. If the simulation is not running, click the “Resume Simulation” button to start it. View the inductor in an oscilloscope window.

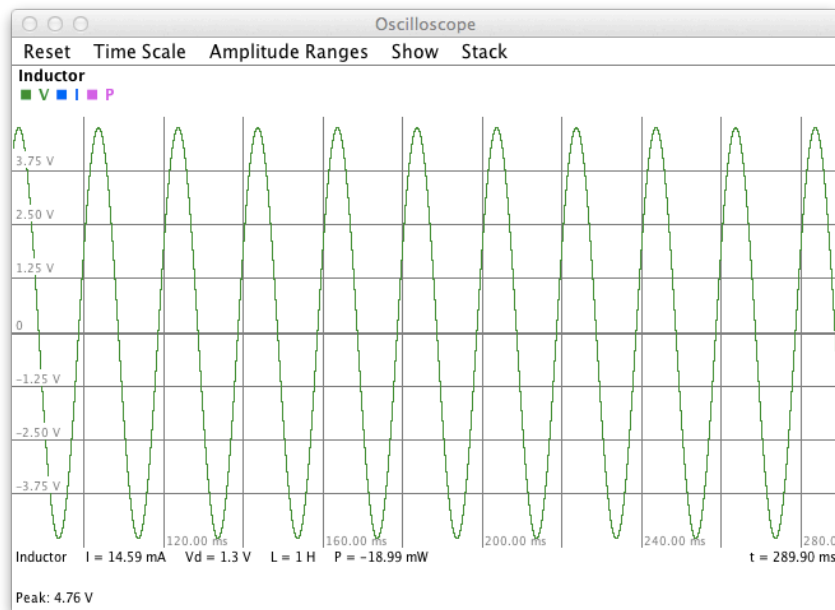


Figure 4: Oscilloscope window showing inductor voltage

Step 5. To plot the inductor’s current along with its voltage, right click on the component’s name and check “Show Current”. If you do not see the current plot, it may be out of range of the oscilloscope window. In this case, select “Fit Ranges” from the “Amplitude Ranges” menu. The

final oscilloscope window will be similar to Figure 5. You can see clearly that the inductor voltage leads inductor current by 90° in phase.

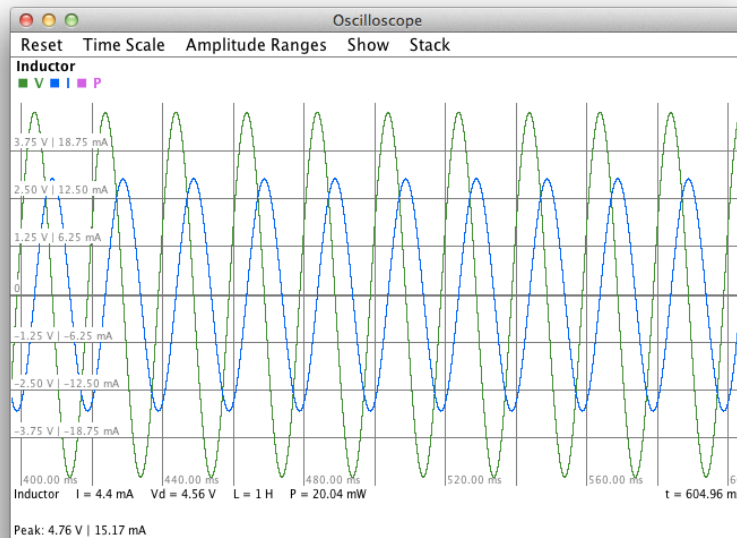


Figure 5: Oscilloscope window with inductor voltage and current vs. time

Step 6. The oscilloscope can also show peak values and resonant frequency. To show these, check the appropriate options in the “Show” menu as shown in **Figure 6**. The information will be displayed at the bottom of the oscilloscope window.

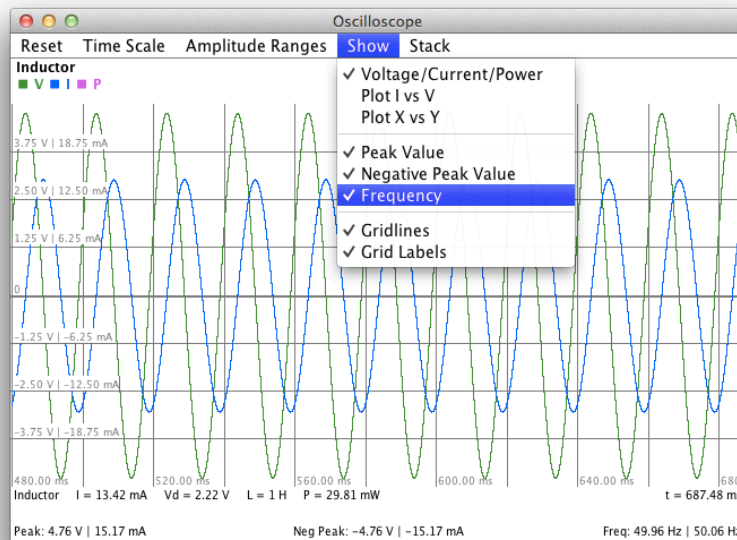


Figure 6: Inductor voltage and current with peak values and frequency

Step 7. To save this circuit, go to the “File” menu, select “Save File, and enter the desired location and file name. Circuits are saved as plain text (.txt) files. You can reload a circuit by selecting “Open” in “File” menu.

Step 8. This exercise can be repeated with an RC circuit. In an RC circuit, the capacitor voltage will lag its current by 90° in phase. Replace the inductor with a capacitor as shown in **Figure 7** and observe capacitor voltage and current on the scope as shown in **Figure 7**.

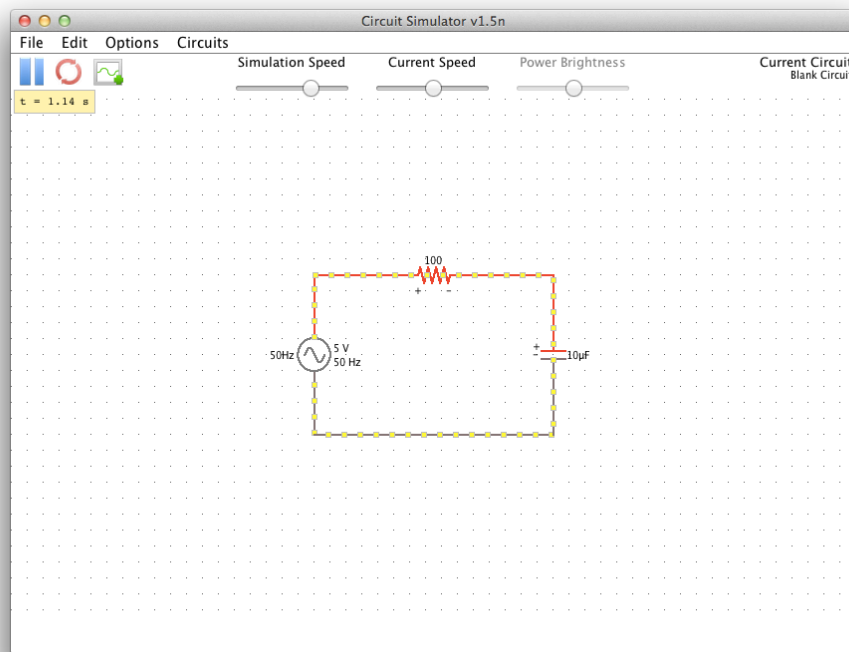


Figure 7: RC circuit

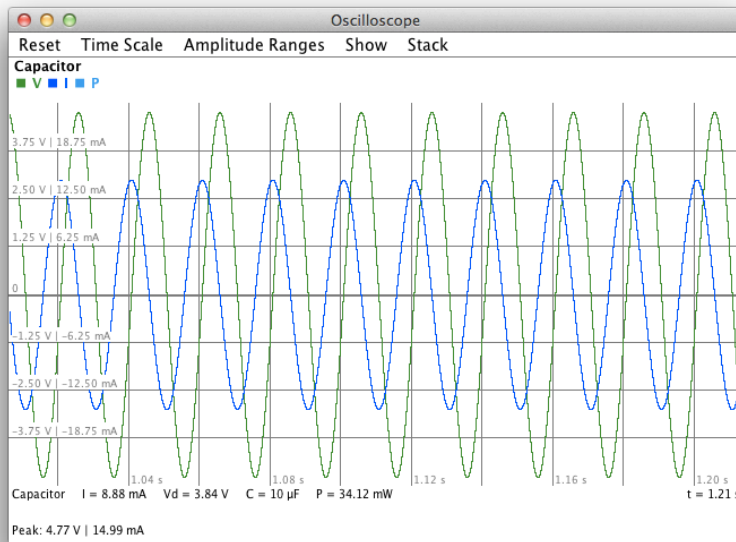


Figure 8: Capacitor voltage and current shown in oscilloscope window