

Tutorial #3: RLC Circuit

In this tutorial, we will build and simulate an RLC circuit. Also, we will learn more about the oscilloscope. It is recommended you complete tutorials 1 and 2 before starting. Figure 1 shows a parallel RLC circuit with a current source and switch.

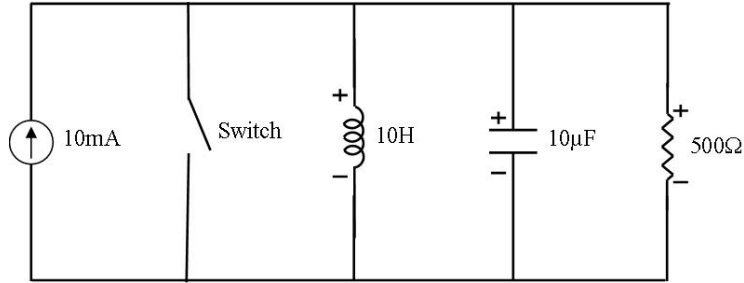


Figure 1: Circuit to be simulated

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

Step 2. Build the circuit as shown in Figure 1. The switch, inductor and capacitor components are found in the “Passive Components” menu and the current source is in 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.

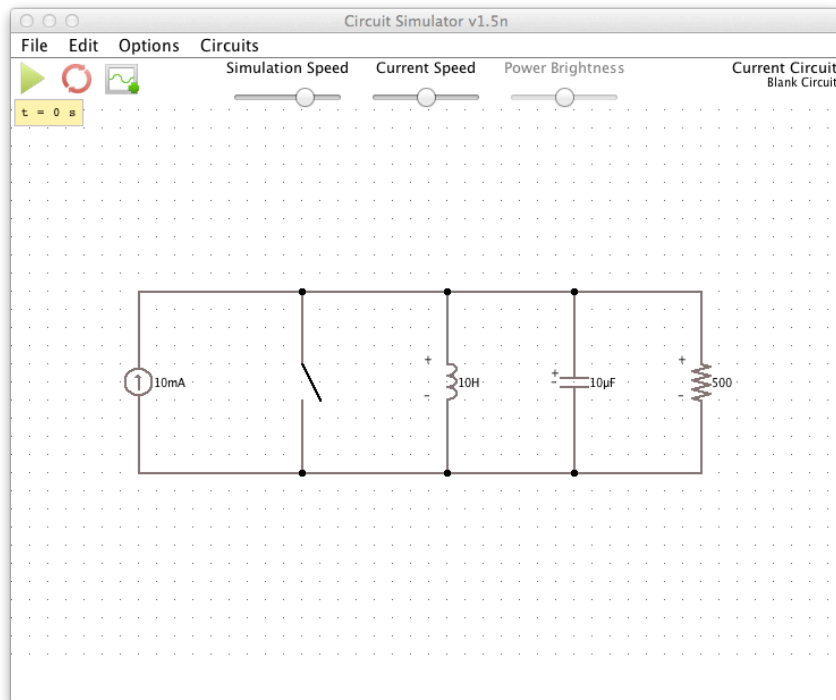


Figure 2: Circuit after placing and connecting all the components

Step 3. If the simulation is not running, click the “Resume Simulation” button to start it. To open an oscilloscope window, right click on the inductor and select “View in scope”. A scope window will open as shown in Figure 3. By default, the oscilloscope shows a voltage vs. time plot for the selected component(s). To see the instantaneous parameters of a component, click on the component’s name and the parameters will appear at the bottom of the window.

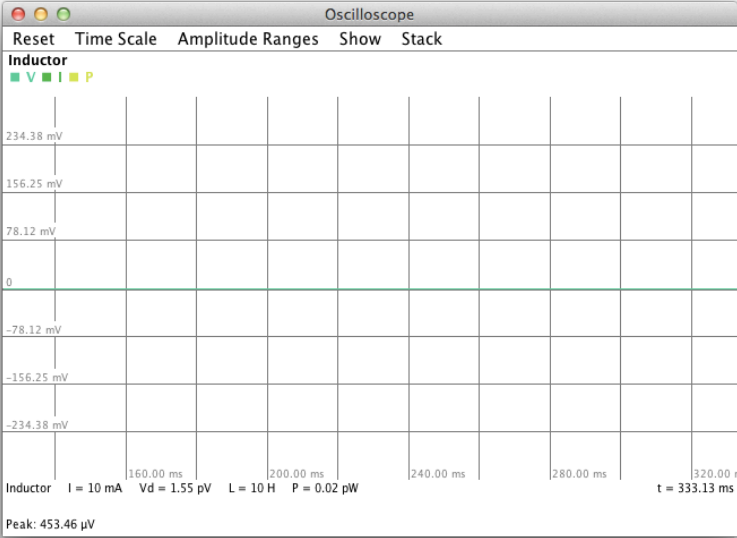


Figure 3: Oscilloscope window showing inductor voltage

Step 4. To plot inductor current vs. time, right click on the component’s name and check “Show Current” as shown in Figure 4. Uncheck voltage from the menu to remove the voltage plot from the oscilloscope.

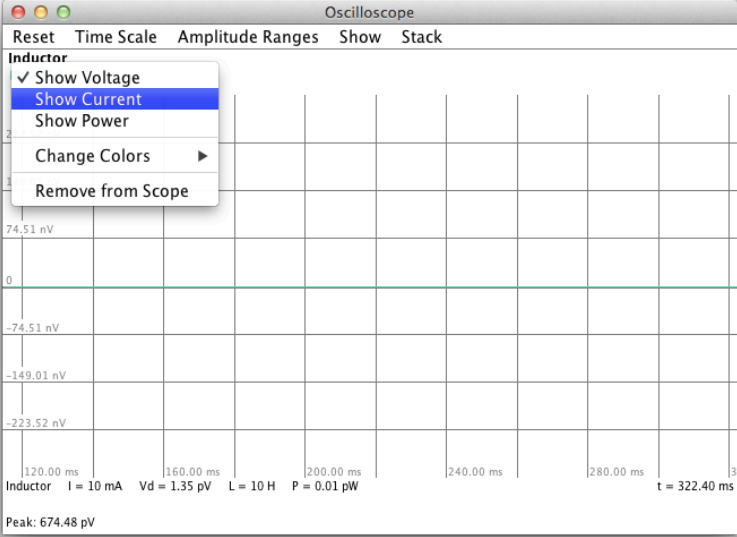


Figure 4: Check “Show Current” to plot current vs. time plot for inductor

Step 5. Go back to the circuit simulator window and open the switch by clicking on it. The inductor current will rise until it stabilizes at 30mA as shown in Figure 5.

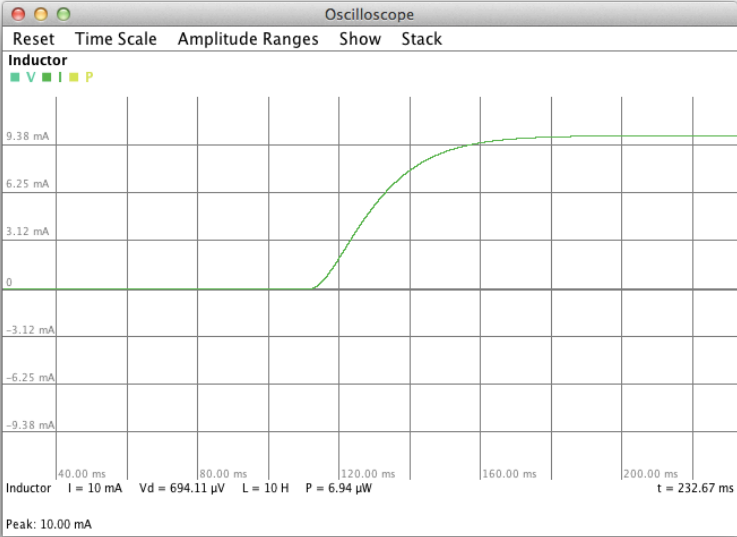


Figure 5: Critically damped response

Step 6. Figure 5 shows the critically damped response for a parallel RLC circuit shown in Figure 1. By changing the resistor value and resetting the circuit, the under-damped and over-damped responses can be observed. To see the under-damped response, change the resistor value to 1KΩ and reset the circuit (Click the “Reset Circuit” button in the top left of the simulator window).

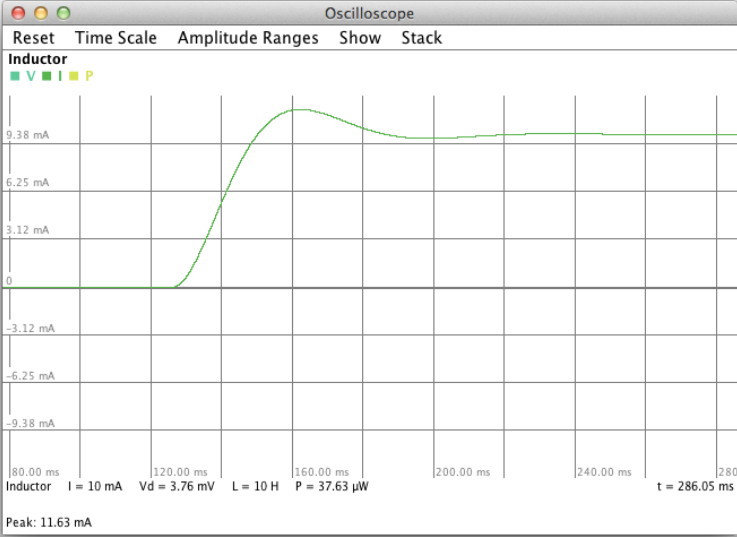


Figure 6: Under-damped response

Note: When you reset the circuit, all components are reset to their initial conditions as though you had just placed them on the circuit board. For capacitors and inductors, this clears any energy stored in the component.

Step 7. To see the over-damped response as shown in Figure 7, change the resistor value to 100Ω and reset the circuit.

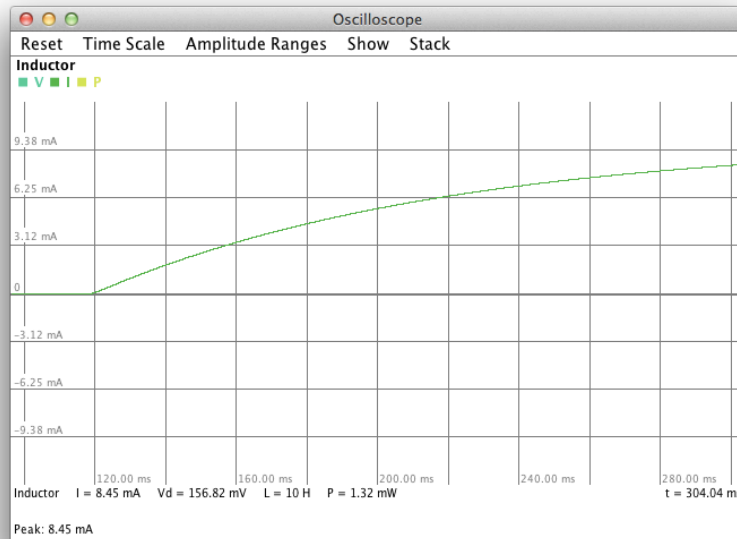


Figure 7: Over-damped response

Step 8. 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.