

Lab 5: Steady State ac Circuits

Objective: To investigate the steady state sinusoidal response of RC, RL, and RLC circuits.

Equipment Needed: Lab kit, CADET, function generator, oscilloscope

Part I. RC Circuit

Construct the circuit given in Figure 1. Use the oscilloscope to measure the magnitude of the node voltage at node A when V1 is a 2.0 V (peak-to-peak) sinusoidal ac source at each of the following frequencies: 50 Hz, 250 Hz, 600 Hz, 1 kHz, 1.5 kHz, 1.6 kHz, 1.7 kHz, 2 kHz, 2.5 kHz, 5 kHz, 8 kHz, 15 kHz, and 25 kHz. Plot the magnitude of that voltage versus frequency. Determine the cutoff frequency of the circuit from the plot. Verify that result via manual circuit analysis calculations.

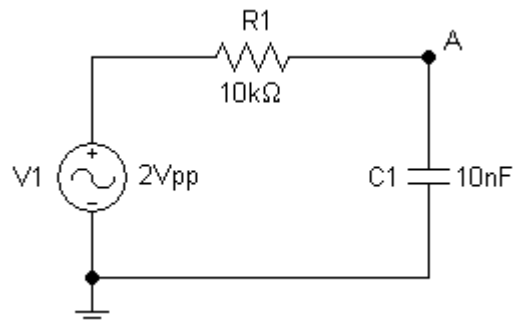


Figure 1. RC Circuit.

Part II. RL Circuit

Construct the circuit given in Figure 2. Use the oscilloscope to measure the magnitude of the node voltage at node B when V1 is a 2.0 V (peak-to-peak) sinusoidal ac source at each of the following frequencies: 100 Hz, 500 Hz, 1 kHz, 2.5 kHz, 2.8 kHz, 3 kHz, 3.1 kHz, 3.2 kHz, 3.3 kHz, 3.5 kHz, 5 kHz, 7 kHz, 10 kHz, and 30 kHz. Plot the magnitude of that voltage versus frequency. Determine the cutoff frequency of the circuit from the plot. Verify that result via manual circuit analysis calculations.

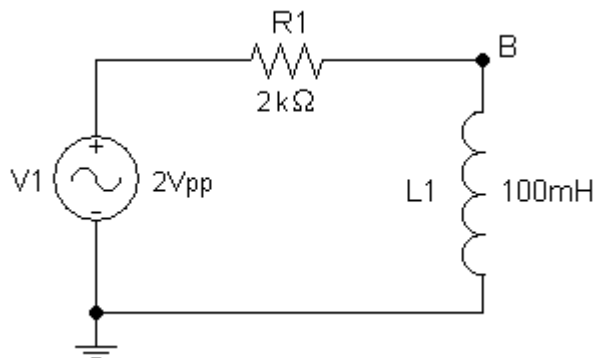


Figure 2. RL Circuit.

Part III. RLC Circuit

Construct the circuit given in Figure 3. Use the oscilloscope to measure the magnitude of the voltage at node C when V1 is a 2.0 mV (peak-to-peak) sinusoidal ac source at each of the following frequencies: 100 Hz, 700 Hz, 2.0 kHz, 3.0 kHz, 3.5 kHz, 5.0 kHz, 6.5 kHz, 6.8 kHz, 7.0 kHz, 7.2 kHz, 7.5 kHz, 8.7 kHz, 10 kHz, 15 kHz, 25 kHz, and 40 kHz. Plot the magnitude of that voltage versus frequency. Determine the center frequency of the circuit from the plot. Verify that result via manual circuit analysis calculations.

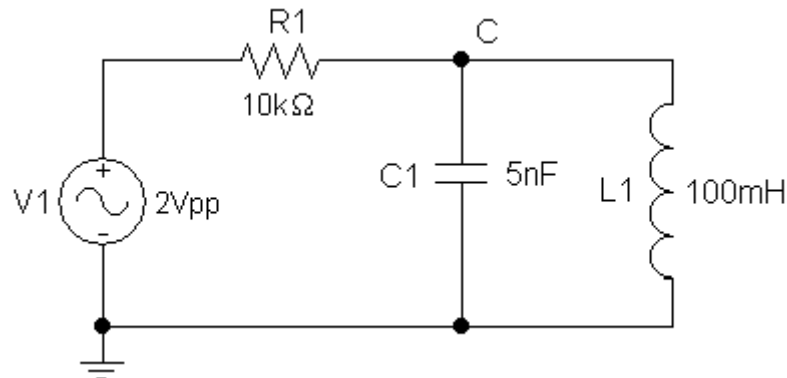


Figure 3. RLC Circuit.

Post Lab Questions:

1. If the resistor and capacitor in the circuit of Part I are interchanged, what type of voltage vs. frequency plot would you expect at node A? Explain.
2. Design a high-pass filter using a resistor and capacitor with the same cutoff frequency you had in Part II. Draw the circuit diagram and include your analytical calculations verifying the circuit's operation.

Report:

Your report should include your data, your three plots, and the calculated-cutoff / center frequencies. Describe the type of filter each circuit represents.