

Lab 7: Driven Circuits Student Handout

The Project: Driven Circuits

Alternating current powers the world. Therefore, understanding how electrical components respond to AC is of the utmost importance. Company X wants your team to evaluate a series of circuits and determine their response to AC. Specifically, those involving the simplest electrical components: resistors, capacitors and inductors (RCL).

We ask that you measure the voltage across a resistor in an RCL circuit for a variety of circuit settings.

*You should consult your instructor for additional safety instructions before starting on **ANY** lab. You should cap the current output of your power supply at **.1 A (100 mA)**.*

Equipment:

- CNC
- DC Power Supply
- Function Generator/ Oscilloscope
- Pasco CI- 6512 RLC Circuit Board
- Multimeter/ LCR Meter
- BNC to Alligator Cable
- Banana to Alligator Cables

The Requirements:

We ask that you measure the voltage across the resistor in an RCL circuit for varying values of the driving frequency in the circuit. For each case, vary one component or parameter while keeping the others constant. Determine/demonstrate the following in each:

1. The voltage response across a resistor for a time-dependent voltage
2. The resonant frequency for a series of different RLC Circuits with varying values of resistors, capacitors and inductors

Pre-Lab Organizational Questions:

1. The program provided for you reads the maximum amplitude of the voltage across the resistor for each frequency across a given range. With what you already know about circuits, can you predict which frequency will have the largest maximum amplitude? How can you use this information to choose your frequency range intelligently to reduce the amount of time needed for data acquisition?
2. How does changing the value of the resistor/capacitor/inductor impact the frequency with the largest maximum amplitude?
3. What is the significance of the frequency at which the largest maximum amplitude occurs?

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Presentation of the solution:

Your team must prepare a presentation that will be given to Company X on the approach that your team is using to complete the project. The presentation may be given by the whole team as a group or by a single member of the team chosen by a member of Company X. The presentation must include:

- A description of the basic physics principles used in your project, including equations used to predict the frequency at which the largest maximum amplitude occurs.
- A series of plots showing the voltage across the resistor as a function of time. You should include a minimum of six different circuits. (2 with different resistor values, 2 with different capacitor values, and 2 with different inductor values). You need to include diagrams of your circuits.
- For each circuit, include plots of the maximum amplitude as a function of the frequency. Be sure to comment on the shape of this curve and why the peak occurs where it does.
- How does the peak of the frequency change when you change the resistor? Inductor? Or capacitor? Include a discussion of your results.