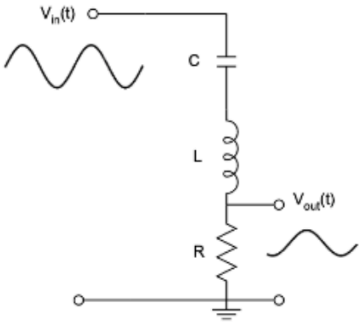
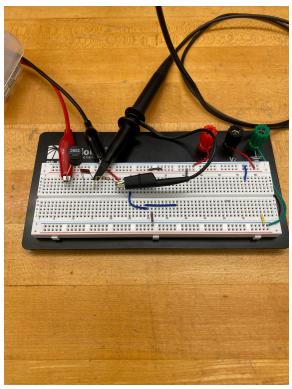
Measure the response of a series LRC circuit to an applied sinusoidal voltage.
From your data, determine:

1. the complex admittance of the LRC circuit as a function of frequency, in the amplitude/phase form.
2. Estimate the quality factor Q and the resonance frequency from the experimentally determined admittance data.

Compare these data to the models we've been discussing in class.
Some things to think about:

1. Investigate this system for a V_{in} at a series of frequencies from well below to well above the resonance frequency.
2. For each voltage applied, record the frequency and amplitude of the external (applied) voltage or V_in. Don't try to keep the amplitude absolutely constant - it is OK if it varies a few percent because you will scale the output to the input voltage.
3. Also record the resulting voltage across the resistor V_R or V_{out}. Note the output signal amplitude, frequency, and time shift (could be behind or ahead of the driving voltage, and you have to think carefully about this!).
4. Record your data clearly and logically in tabular form. Make sure columns are labeled, have units, and the appropriate number of significant figures.
5. You should record a few traces so that you can illustrate what you saw in your report. You can either sketch the traces or take photos.
6. From your data, determine the complex admittance of the LRC circuit as a function of frequency, in the amplitude/phase form. Estimate the quality factor Q and the resonance frequency from the admittance data.
7. Assess the results in the context of the idealized model we are discussing in class. There is a fairly straightforward non-ideality that is present in the physical circuit. Can you identify it? Can you modify our model? Can you make further predictions.





Additional Guidance

- The number one rule is PATIENCE! Response times when the computer is involved can be 5 to 10 seconds every time you change a setting. Please, please be patient.
- There may be a person who has taken PH411 or PH415 in your group. That person can help by assuming a tutor role. That person will learn more from guiding a novice through mistakes, and from remembering what things were hard on first encounter with an oscilloscope, etc. Part of the exercise is to learn to operate the controls.
- Get a feel for the system response over the whole frequency range before starting to write down final results. You must know what frequency range to explore, and how closely spaced your points should be. About 15 readings should be enough, with more clustered near the resonance where the response changes faster.
- Make a quick consistency check with the model BEFORE you start writing up. You may need more data than you originally thought.
- Each person should record data individually. You'll have the same measurements as the rest of your group, but each person must decide how to organize, analyze and manipulate the data independently. In my view, this is an even more important aspect of the lab than getting "good numbers."
- The next couple of homework assignments will ask you for some paragraphs, some tables, and some graphs. The intent is to encourage you to write everything down while it is fresh, while you are still learning so that you have material for your writeup in place. The homework set is your place to draft your results and write down your questions. It is not expected to be in final, pretty form.