

Experiment 2

R-L-C Circuits

Basic Experiment - Physics 517/617

- 1) Design and construct either a high pass or low pass RC filter with a 3 db point of about 600 Hz and a minimum impedance between 5 K Ω and 50 K Ω .
- 2) Measure the frequency response of the filter you built in part 1 to a sine wave. Make measurements over the frequency range 10 Hz - 100 KHz. By frequency response I mean how $V_{R \text{ or } C}$, and its relative phase vary as a function of frequency.
- 3) Design and construct an LRC series circuit with a resonant frequency between 1 KHz and 10 KHz and a Q as large as possible (preferably larger than 5).
- 4) Measure the frequency response of the circuit built in part 3 to a sine wave. Measure V_R as the frequency is varied from 10 Hz to 100 KHz. Measure the phase relationship between the voltage across R and the driving source. Measure the Q of the circuit using the half power points and the resonant frequency, ω_0 . Compare all measurements with design calculations.

Advanced Experiment - Physics 617 or optional

- 5) Calculate and measure the response of the circuit you built in part 1 to a square wave input. Vary the width of the pulse (include the case where RC is close to the size of the pulse width) and measure the response of the circuit. For what frequencies does the circuit differentiate (integrate)?

Useful Reading: Horowitz and Hill pg 29-34