

Experiment 2 R-L-C Circuits

Lab report due Monday July 13

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. Make Bode plots showing the magnitude and phase shift of the filter's transfer function.
- 3) Design and construct an LRC series circuit with a resonant frequency between 30 KHz and 60 KHz and a Q as large as possible (preferably larger than 5). (Use an inductor between 10 mH and 100 mH).

- 4) Study the frequency dependence of the voltage across the resistor for the circuit built in part 3.

I.e. measure $\left| \frac{V_R}{V_0} \right|$ and the phase shift as the frequency is varied from 10 Hz to 500 KHz. Where

V_0 is the drive voltage and V_R is the voltage across the resistor. Note: the circuit may load the frequency generator so you may will probably need to *measure* V_0 with the circuit in place.

Make Bode plots of $\left| \frac{V_R}{V_0} \right|$ and the phase shift. Estimate the Q of the circuit using 3 dB points.

Compare all measurements with design calculations.

- 5) Repeat part 4 for V_L the voltage across the inductor. Estimate the Q of the circuit using

$Q = \frac{|V_L|}{|V_0|}$ on resonance. Compare measurements made with a 10X probe to those made using

regular RG58 coax into the oscilloscope input. Compare all measurements with design calculations.

Additional for 617/Extra credit

- 6) Design, construct, and characterize a notch filter.