PHYS 209, 2008/09 Assignment 1

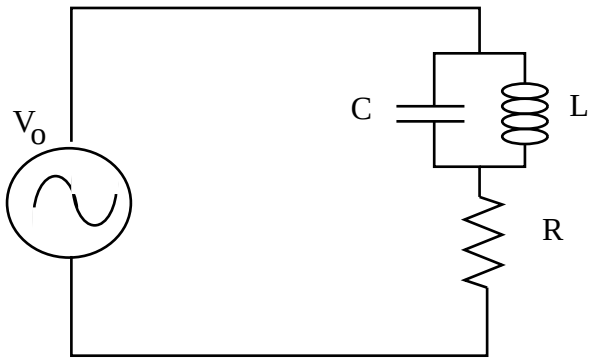
Due 5pm Oct. 17, 2008

Turn in to the box in the hallway outside the lab.

Caution: not all parts will be marked!

Parallel LC circuits

1. Find analytic expressions for the amplitude and phase of the voltage across and current through each of the components in the circuit diagram shown. This should be quick and easy! Recall that the impedance of the inductor is $Z_L = j\omega L$, the impedance of the capacitor is $Z_C = 1/j\omega C$, and for the resistor, $Z_R = R$. You can combine impedances for components in series and parallel just the way you would combine resistances.



2. Make two plots. On the first, plot the amplitude of the voltage across each of the three components as a function of frequency. On the second, plot the amplitude of the current through each of the components (multiply the resistor current by a factor of 100 so it's on a similar scale to the other two currents). Use component values L = 300 μH, C = 15 μF, and R = 1 kΩ, and plot over a frequency range of 2200-2500 Hz. Don't forget that $\omega = 2\pi f$.

3. What is the current in each of the three components when $\omega = 1/\sqrt{LC}$? Why might you measure less than this?

4. Evaluate the current through each of the three devices in the limits of very low and very high frequency.

5. What is the impedance of the parallel LC part of the circuit when $\omega = 1/\sqrt{LC}$? Compare this to the impedance of the inductor-capacitor combination in series when $\omega = 1/\sqrt{LC}$.