RLC Resonance

KEY PRINCIPLES TO BE DEMONSTRATED:

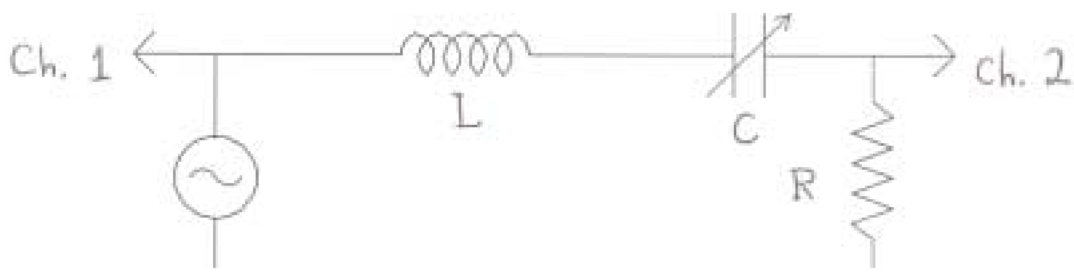
Resonance and phase relationships of an RLC circuit

EQUIPMENT (LOCATION):

Pasco function generator (Cabinet #1, Shelf #3)
47mH inductor (Cabinet #1, Shelf #3)
Connection board[with attached tunable capacitor] (Cabinet #1, Shelf #3)
.001μF capacitor (Cabinet #1, Shelf #3)
Various resistors[~100Ω - 22MΩ] (Cabinet #1, Shelf #3)
Dual trace oscilloscope (Cabinet #1, Shelf #1)

SET-UP/PROCEDURE:

- Set up the circuit as shown below with the oscilloscope on dual trace and auto trigger.



can also find it by watching the phase shifts. At resonance the reactance switches between being capacitive or inductive.

- Show that below resonance, $f < f_o$, the reactance is capacitive; ie. v_x lags v_r. Above resonance, $f > f_o$, the reactance is inductive; ie. v_x leads v_r. Recall that in a capacitor the current leads the voltage and in an inductor the reverse is true. Furthermore, the current through these reactive elements is the same current that is flowing through the resistor which is in phase with the resistor voltage.

<u>THINGS TO NOTE</u>:

- The tunable capacitor varies from 50 to 295pF. In a circuit with a 100Ω resistor and the 47mH inductor, this capacitor yields resonant frequencies between 67kHz and 80kHz.
- Substituting a megohm resistor unfortunately varies the resonant frequency as well as the bandwidth.
- Insure proper grounding of the oscilloscope probes to prevent rather large 60Hz waves from dominating the screen.

<u>DIAGRAMS/EQUATIONS</u>: