Title of the experiment:

RESONANCE OF SERIES AND PARALLEL RLC CIRCUIT

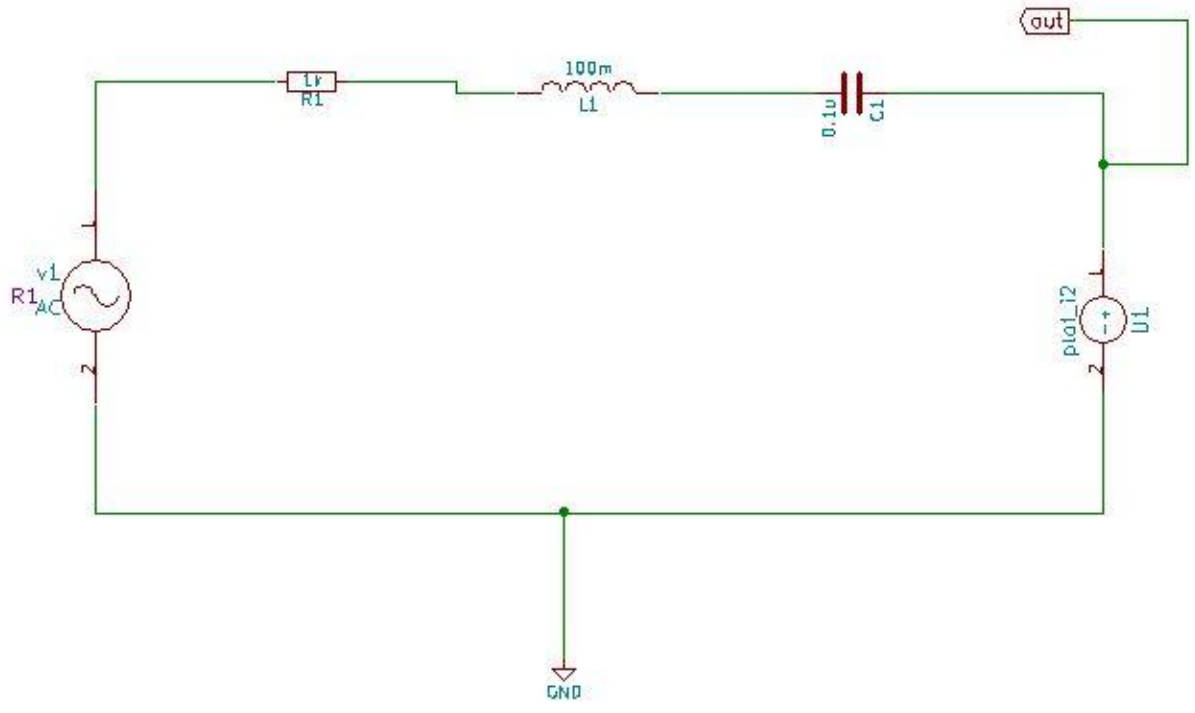
THEORY: An **RLC circuit** is an electrical circuit consisting of a resistor (R), an inductor (L), and a capacitor (C), connected in series or in parallel. The name of the circuit is derived from the letters that are used to denote the constituent components of this circuit, where the sequence of the components may vary from RLC.

An important property of this circuit is its ability to resonate at a specific frequency, the resonance frequency, f_0. Frequencies are measured in units of hertz. In this article, however, angular frequency, ω_0, is used which is more mathematically convenient. This is measured in radians per second. They are related to each other by a simple proportion,

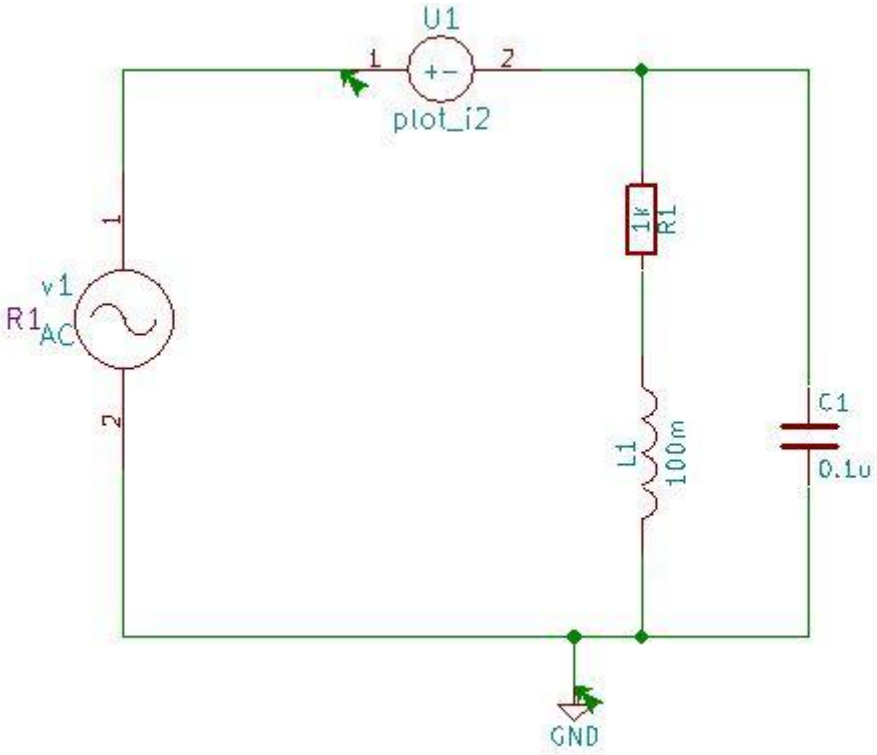
Resonance occurs because energy is stored in two different ways: in an electric field as the capacitor is charged and in a magnetic field as current flows through the inductor. Energy can be transferred from one to the other within the circuit and this can be oscillatory. A mechanical analogy is a weight suspended on a spring which will oscillate up and down when released. This is no passing metaphor; a weight on a spring is described by exactly the same second order differential equation as an RLC circuit and for all the properties of the one system there will be found an analogous property of the other. The mechanical property answering to the resistor in the circuit is friction in the spring–weight system. Friction will slowly bring any oscillation to a halt if there is no external force driving it. Likewise, the resistance in an RLC circuit will "damp" the oscillation, diminishing it with time if there is no driving AC power source in the circuit.

The resonance frequency is defined as the frequency at which the impedance of the circuit is at a minimum. Equivalently, it can be defined as the frequency at which the impedance is purely real (that is, purely resistive). This occurs because the impedances of the inductor and capacitor at resonance are equal but of opposite sign and cancel out. Circuits where L and C are in parallel rather than series actually have a maximum impedance rather than a minimum impedance. For this reason they are often described as antiresonators, it is still usual, however, to name the frequency at which this occurs as the resonance frequency.

Schematic Diagram:

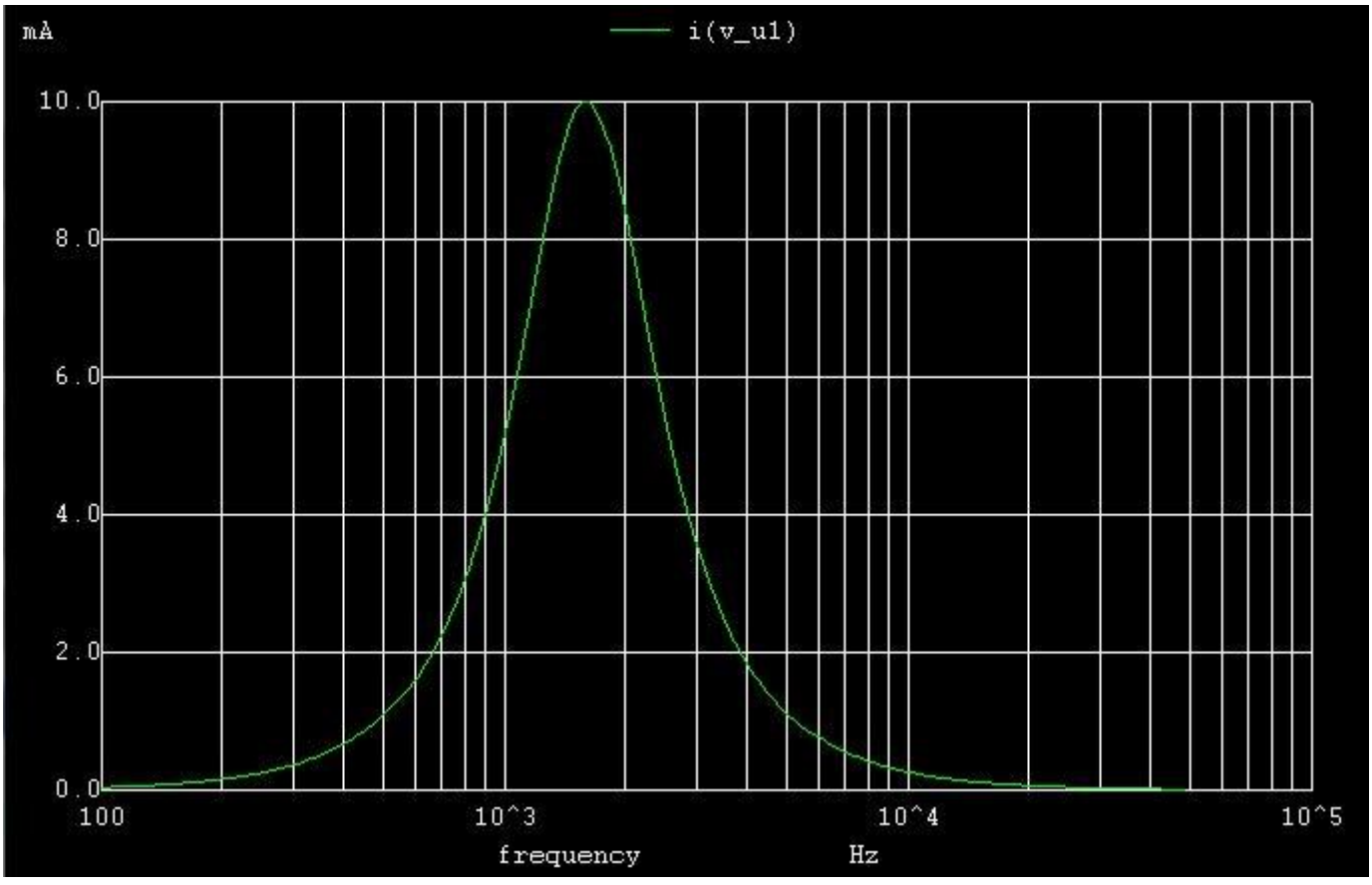


RLC SERIES RESONANT CIRCUIT

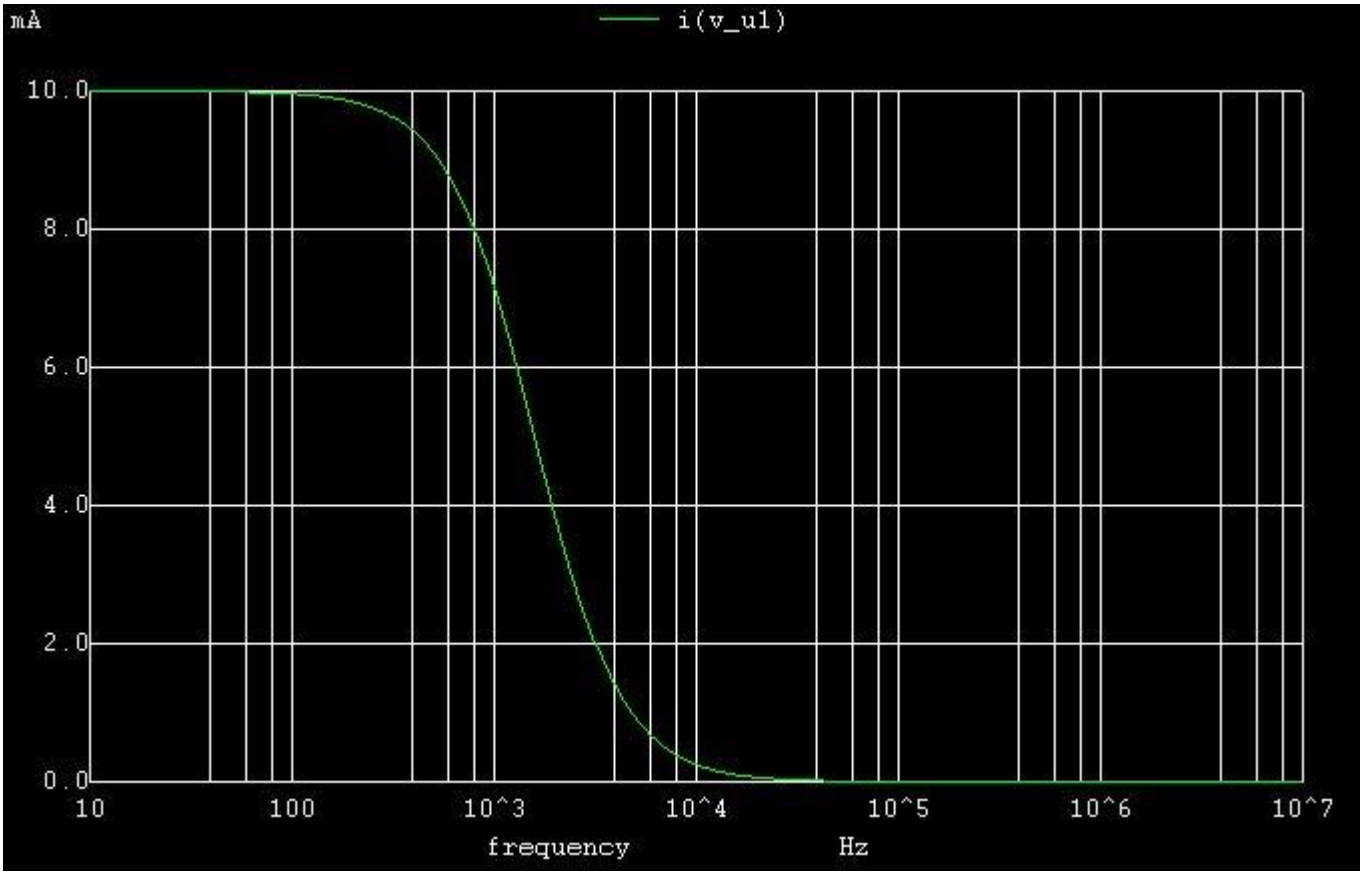


RLC PARALLEL RESONANT CIRCUIT

Simulation Results(NgSpice result) :

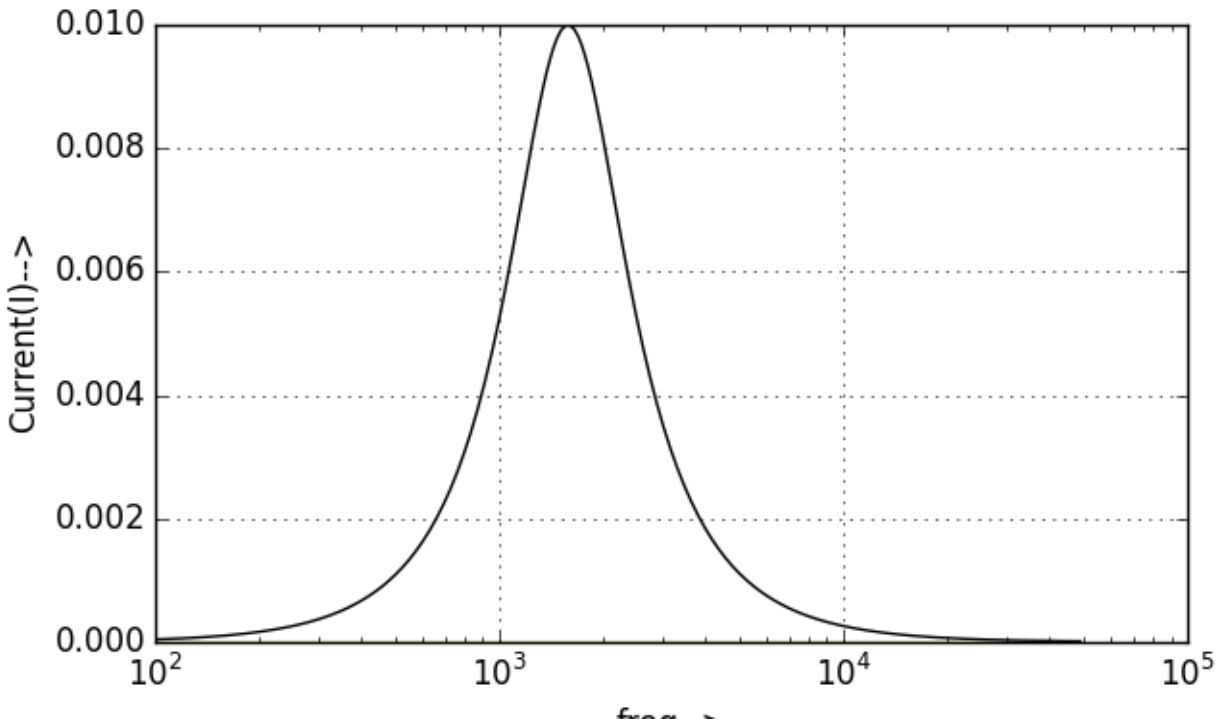


FREQ Vs CURRENT PLOT FOR RLC SERIES

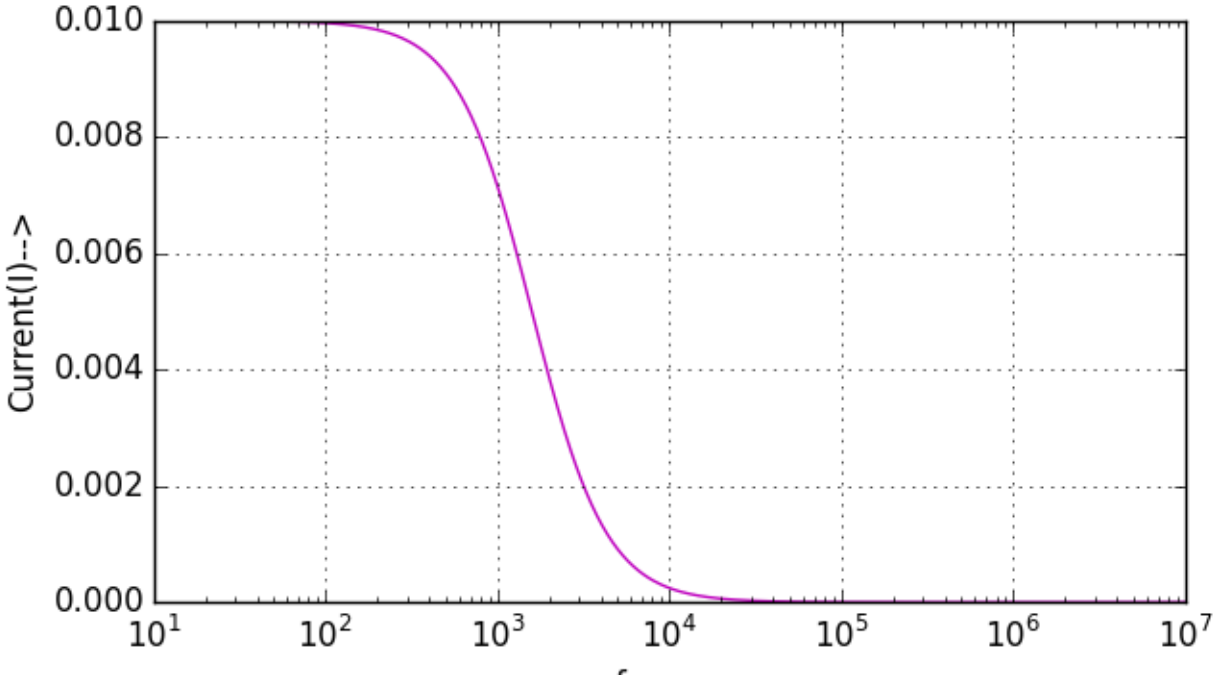


FREQ Vs CURRENT PLOT FOR RLC PARALLEL

Simulation Results(Python results) :



FREQ Vs CURRENT PLOT FOR RLC SERIES



FREQ Vs CURRENT PLOT FOR RLC PARALLEL

References:

http://www.electronics-tutorials.ws/accircuits/series-resonance.html

http://hyperphysics.phy-astr.gsu.edu/hbase/electric/serres.html