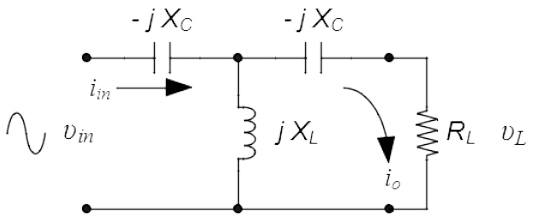
Constant Alternating Current Source



$$Z_{in} = -jX_c + \frac{jX_L(R - jX_C)}{jX_L + (R - jX_C)}$$

Let $X_C = X_L = X$

$$Zin = \frac{X^2}{R}$$

$$i_{in} = \frac{v_{in}}{Z_{in}} = \frac{v_{in}R}{X^2}$$

$$i_o = i_{in}\frac{jX}{R}$$

$$i_o = \frac{jv_{in}}{X}$$

This shows that the output current is independent of the value of load resistance. Load voltage v_L leads input voltage by 90°.

$$X_C = \frac{1}{\omega C} \qquad X_L = \omega L$$

For $X_C = X_L = X$

$$\frac{1}{\omega C} = \omega L$$

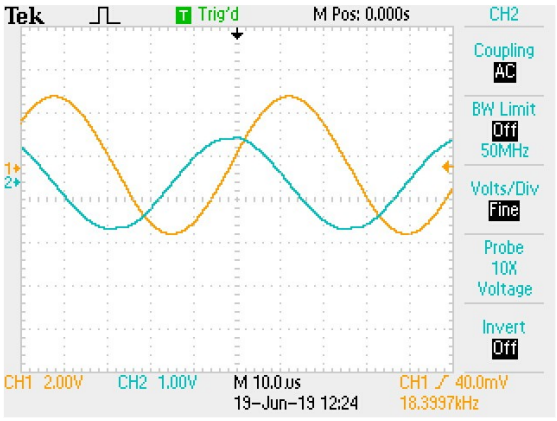
$$\omega^2 = \frac{1}{LC}$$

$$\omega = \sqrt{\frac{1}{LC}} \text{ r/s}$$

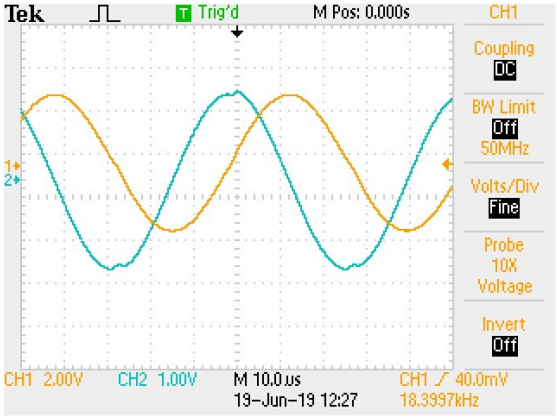
$$f = \frac{\omega}{2\pi} \text{ Hertz}$$

$$X = L\sqrt{\frac{1}{LC}}$$

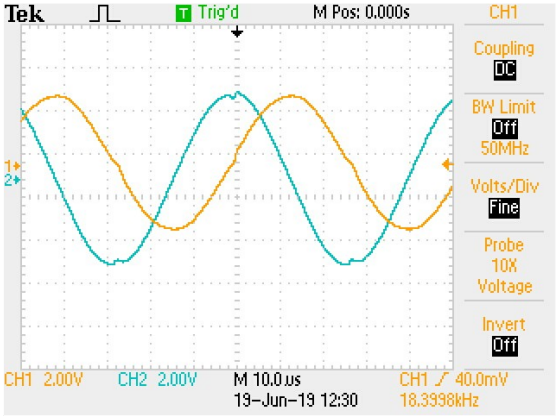
$$X = \sqrt{\frac{L}{C}} \text{ ohm}$$



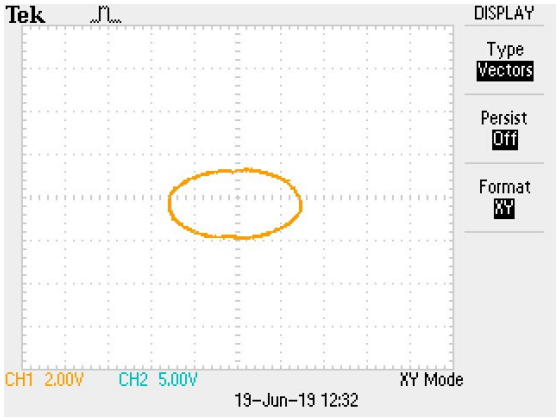
Test 1
Load resistor 50Ω
Load voltage about 2V peak-to-peak
Measured υ_L = 0.384V
Calculated i_L = 7.68mA



Test 2
Load resistor 100Ω
Load voltage about 4V peak-to-peak
Measured υ_L = 0.773V
Calculated i_L = 7.73mA



Test 3
Load resistor 200Ω
Load voltage about 8V peak-to-peak
Measured υ_L = 1.495V
Calculated i_L = 7.475mA



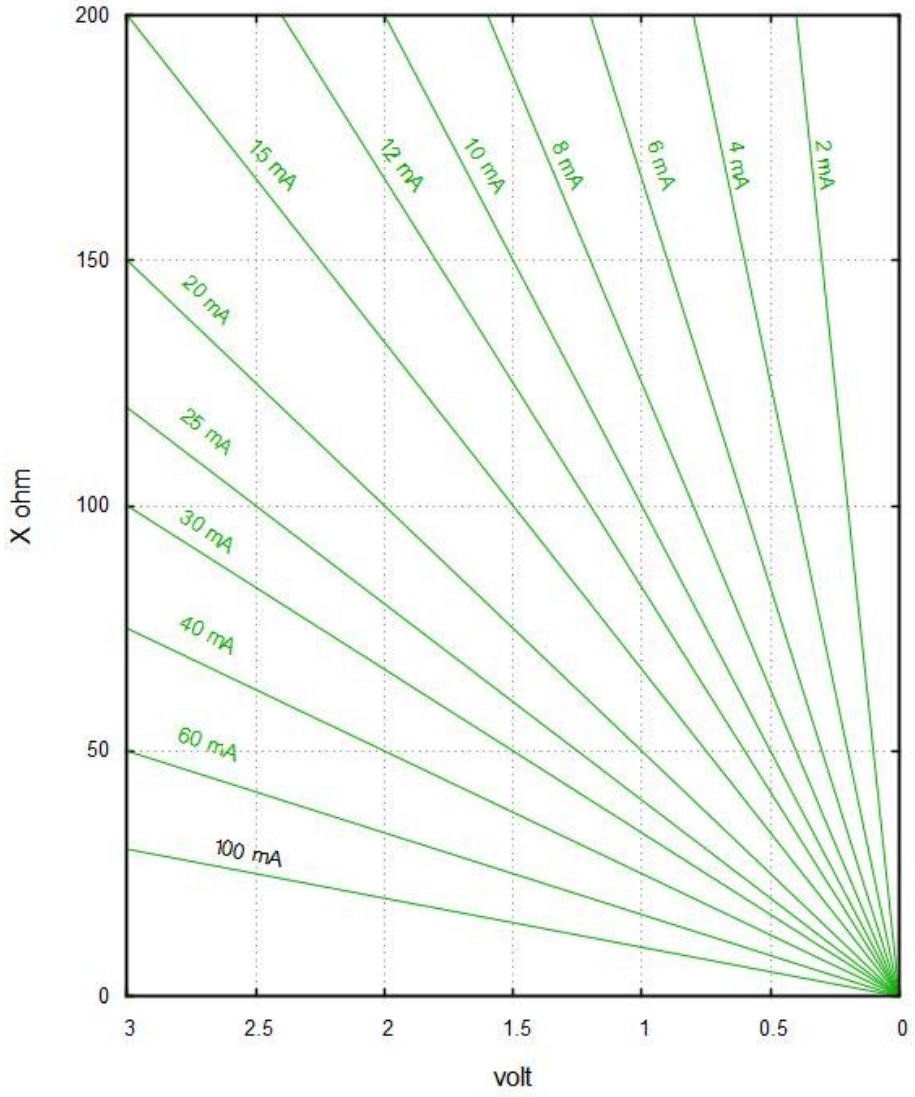
Test 4
Load resistor 100Ω
X/Y plot (ch1 X axis, ch2 Y axis)

This Lissasjous pattern shows that input and load voltages are at 90° to each other, as expected from the theory.

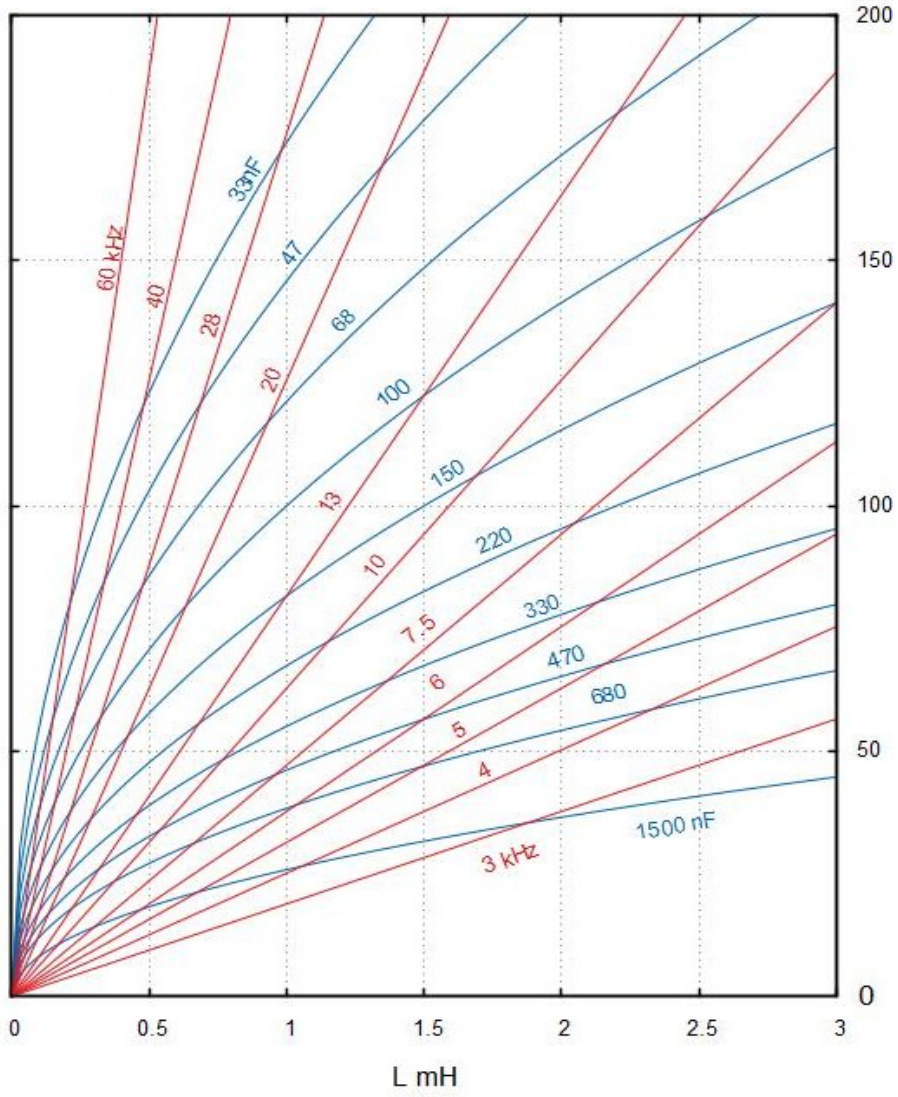
Appendix A

Constant Current Design Graphs

gnuplot software was used to generate these graphs (www.gnuplotting.org)



Impedance *X ohms* and the driving *voltage* determine the RMS value of the current.



Circuit components *L* and *C* determine impedance *X ohms* and the *frequency* of the input signal.