Physics for Engineers CAM

Presented to James Malebranche

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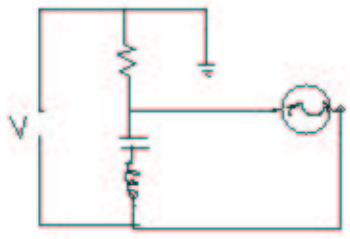
Objective:
The objective of this lab is to verify whether our theory concerning LRC circuits agrees with experimental measurements.

Circuit:



Theory:
In an LRC circuit the inductive and capacitive reactances both depend on frequency. At a frequency called resonance they are equal but opposite in direction and therefore they cancel. The inductive reactance is given by Xl=WL and the capacitive reactance by Xc=1/WC. This implies that at resonance we will have $W^2=1/LC$. The voltage across the resistor as a fraction of the total voltage, as a function of frequency is given by $Vr/Vt = R / (R^2 + (WL - 1/WC)^2)$. This implies that the voltage across the resistor will be at a maximum at resonance. We used the kaleidograph program to fit our data with this function.

Experimental data:

Frequency (Hz)	Vt	Vr	Vr/Vt	Phase Angle
1000	1	0.03	0.03	1.6
2000	1	0.06	0.06	3.44
3000	1	0.1	0.1	5.68
4000	1	0.16	0.16	9.15
5000	1	0.26	0.26	14.77
6000	1	0.46	0.46	27.13
6500	1	0.67	0.67	41.99
6800	1	0.79	0.79	51.81
7000	1	0.8	0.8	53.51
8000	1	0.55	0.55	33.57
9000	1	0.34	0.34	19.94
10000	1	0.24	0.24	14
11000	1	0.19	0.19	10.78
12000	1	0.15	0.15	8.8
13000	1	0.13	0.13	7.24
14000	1	0.11	0.11	6.14
15000	1	0.09	0.09	5.34
16000	1	0.08	0.08	4.59

17000	1	0.07	0.07	4.01
18000	1	0.06	0.06	3.55
19000	1	0.06	0.06	3.15
20000	1	0.05	0.05	2.75

Analysis:
Using kaleidograph we got:
Resistance: 57.3 ohms
Inductance: 5.9 mH
Capacitance: 0.086 μF
The actual values were 47 ohms, 5 mH, and 0.1 μF.

The data obviously fit the function, however the values we found for the resistance, capacitance and inductance did not agree perfectly. However they are reasonably close to what we would expect.
Conclusion:
Our results while not agreeing perfectly with the real values for resistance, inductance and capacitance, do fit the function predicted by theory. This probably indicates that there were sources of experimental uncertainty.