LCR Resonant Circuit

Group 12

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Aim:

To study resonance effect in series and parallel LCR circuits.

Apparatus:

Oscillator (1 to 1 M Hz), resistors, capacitors, inductors, AC milli-ammeter.

Procedure:

1. The connections of the series LCR circuit were made appropriately and the values of L and C were chosen such that the value of the resonant frequency was of the order a few kHz.
2. The frequency of the oscillator was varied in steps and the voltage across the resistor was noted.
3. The values of L, C and R were changed and the experiment was repeated.
4. The connections of the parallel LCR circuit were made appropriately and four set of readings with various values of L, C and R were taken by varying the frequency in steps.
5. Graphs were plotted according to the readings.

Observations:

Experiment 1
Part 1(a)

	r=100ohm	c=1microF	l=15mH
frequency(Hz)	current (mA)		
345	1.192		
445	1.458		
545	1.658		
645	1.904		
745	3.03		
845	3.327		
945	3.58		
1045	3.785		
1145	3.917		
1245	3.983		
1300	3.99		
1345	3.983		
1445	3.931		
1545	3.841		
1645	3.726		
1745	3.598		
1845	3.462		
1945	3.324		
2045	3.191		
2145	3.058		
2245	2.941		
2345	2.821		
2445	2.716		

Graph part 1(a)

Part 1(b)

frequency(Hz)	r=100ohm current (mA)	c=10microf	l=15mH
300	4.084		
310	4.097		
320	4.107		
330	4.116		
340	4.123		
350	4.131		
360	4.135		
370	4.138		
380	4.142		
390	4.143		
400	4.144		
410	4.144		
420	4.143		
430	4.141		
440	4.138		
450	4.137		
460	4.136		
470	4.129		
480	4.124		
490	4.119		
500	4.114		
510	4.109		
520	4.103		
530	4.097		
540	4.089		

Graph part1(b)

Part 1 (c)

frequency(Hz)	R=47 ohm current (mA)	c=1microF	l=15mH
500	2.541		
600	3.039		
700	3.479		
800	3.908		
900	4.388		
1000	4.907		
1050	5.128		
1100	5.346		
1150	5.524		
1200	5.662		
1250	5.746		
1300	5.78		
1350	5.764		
1400	5.713		
1500	5.51		
1600	5.226		
1700	4.924		
1800	4.618		
1900	4.321		
2000	4.052		
2100	3.811		
2200	3.585		
2300	3.383		
2400	3.194		
2500	3.039		

Graph part 1(c)

Part 1(d)

frequency(Hz)	r=100ohm current (mA)	c=1microF	l=2mH
2500	4.233		
2600	4.246		
2700	4.257		
2800	4.264		
2900	4.268		
2950	4.27		
3000	4.27		
3050	4.271		
3100	4.27		
3150	4.269		
3200	4.268		
3250	4.266		
3300	4.264		
3350	4.263		
3400	4.261		
3500	4.26		
3600	4.254		
3700	4.244		
3800	4.234		
3900	4.233		

Graph part 1(d)

Experiment 2

Part 2(a)

frequency(Hz)	r=100ohm current (mA)	c=10microf	l=15mH
300	3.921		
310	3.859		
320	3.79		
330	3.709		
340	3.62		
350	3.506		
360	3.394		
370	3.256		
380	3.104		
390	2.947		
400	2.782		
410	2.616		
420	2.454		
430	2.323		
440	2.218		
450	2.19		
460	2.285		
470	2.419		
480	2.576		
490	2.733		
500	2.888		
510	3.027		
520	3.163		
530	3.285		
540	3.396		
550	3.487		

Graph part 2(a)

Part 2(b)

	r=100ohm	c=1microF	l=15mH
frequency(Hz)	current (mA)		
500	3.641		
600	3.536		
700	3.406		
800	3.209		
900	2.912		
1000	2.543		
1100	2.173		
1150	1.996		
1200	1.293		
1250	1.156		
1300	1.066		
1350	1.024		
1400	1.066		
1500	1.382		
1600	1.642		
1700	1.844		
1800	2.874		
1900	3.081		
2000	3.281		
2100	3.44		
2200	3.561		
2300	3.671		
2400	3.76		

Graph part 2(b)

Part 2(c)

frequency(Hz)	R=47 ohm current (mA)	c=10microf	l=15mH
300	5.443		
310	5.33		
320	5.2		
330	5.048		
340	4.88		
350	4.71		
360	4.512		
370	4.306		
380	4.082		
390	3.858		
400	3.627		
410	3.411		
420	3.199		
430	3.015		
440	2.86		
450	2.777		
460	2.906		
470	3.099		
480	3.32		
490	3.52		
500	3.708		
510	3.92		
520	4.107		
530	4.292		
540	4.468		
550	4.64		

Graph part 2(c)

Part 2(d)

	r=100ohm	c=10microf	l=2mH
frequency(Hz)	current (mA)		
500	4.35		
600	4.355		
700	4.347		
800	4.293		
900	4.173		
950	4.055		
1000	3.86		
1050	3.567		
1100	3.137		
1150	2.795		
1200	2.929		
1250	3.305		
1300	3.636		
1400	3.989		
1500	4.149		
1600	4.236		
1700	4.282		
1800	4.311		

Graph part 2(d)
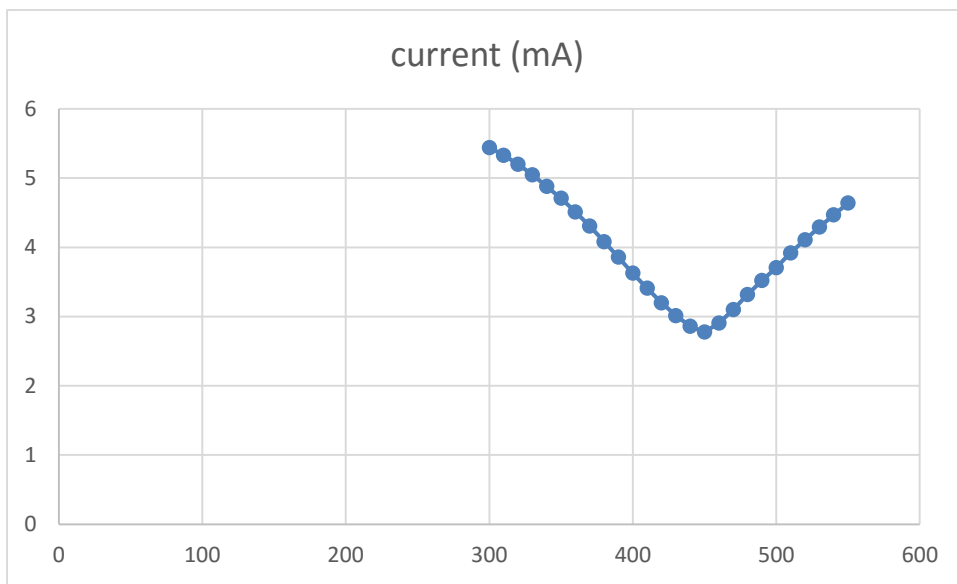
Graphs:

Part 1(a)
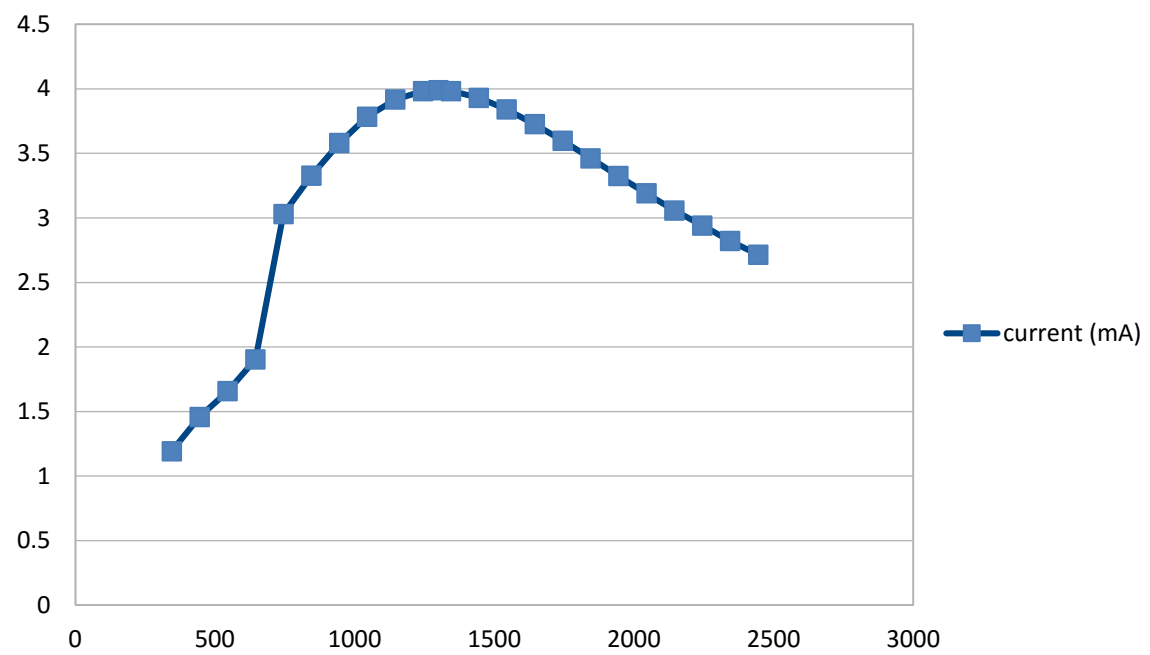
Part 1(b)
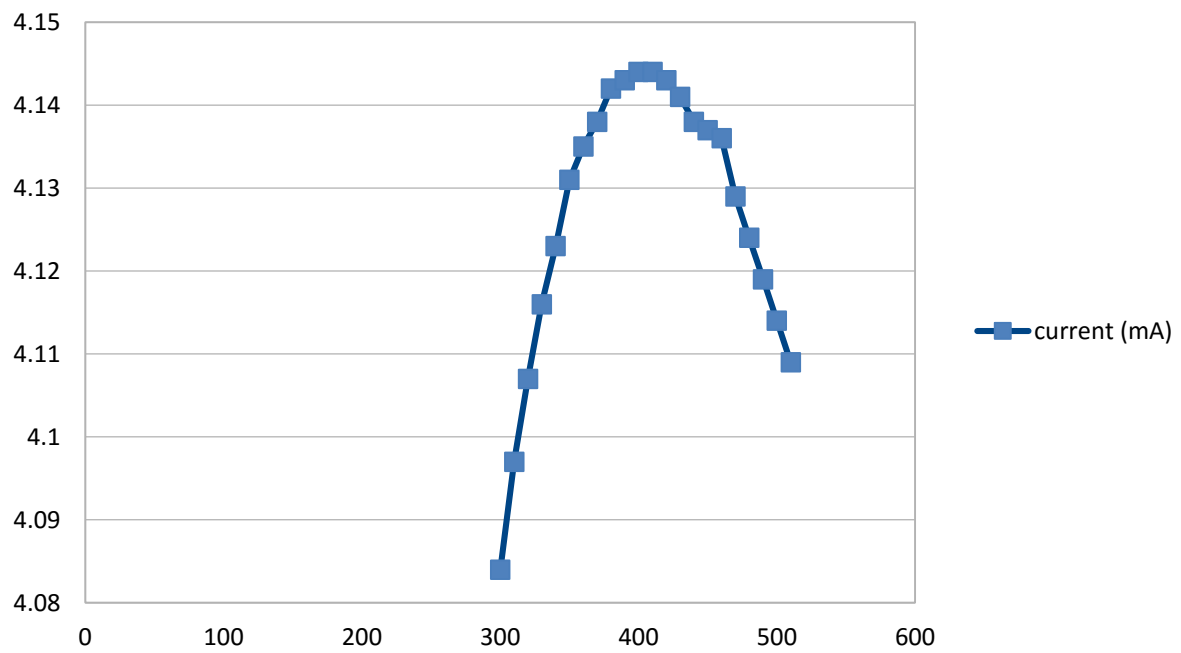
part 1(c)
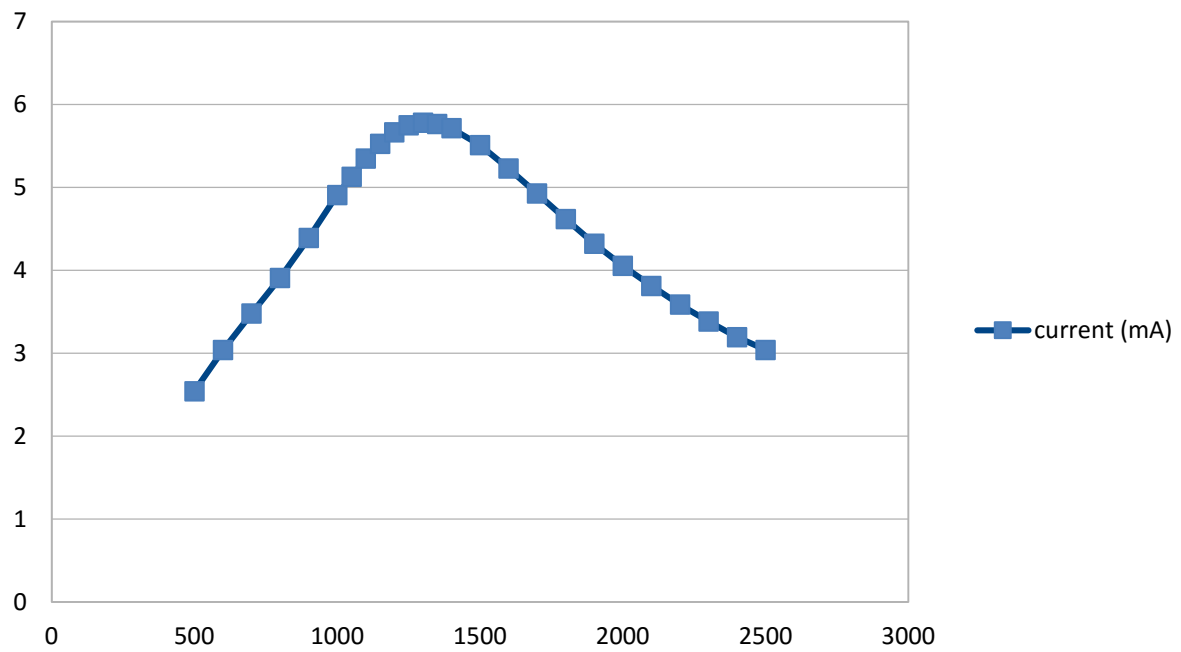
Part 1(d)
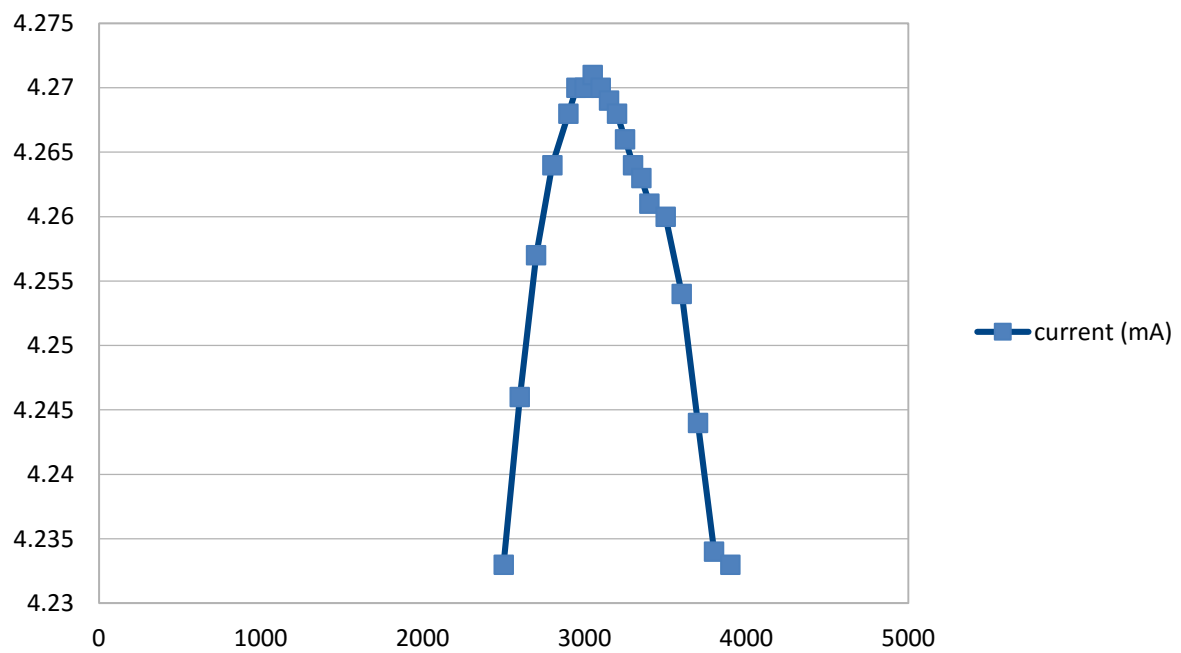
Part 2(a)
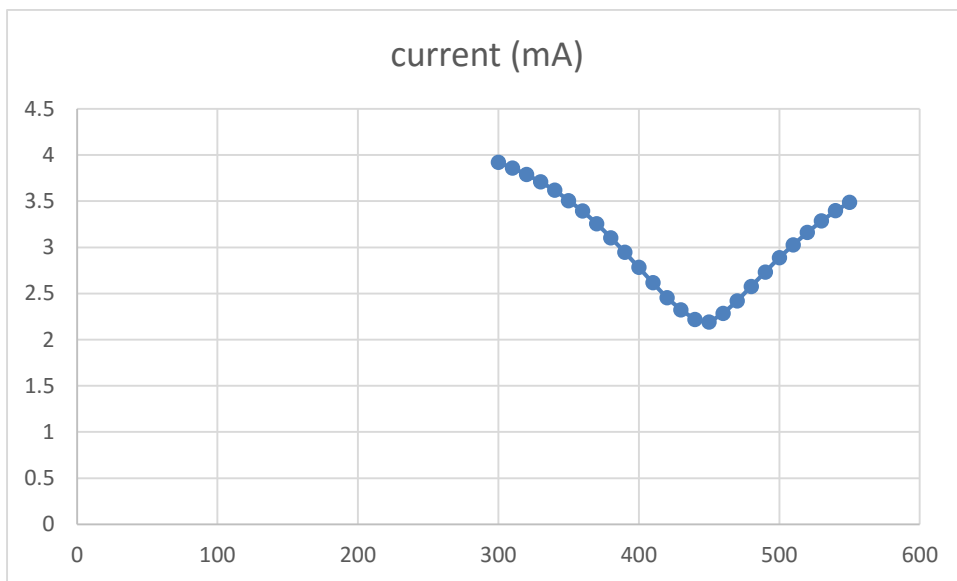
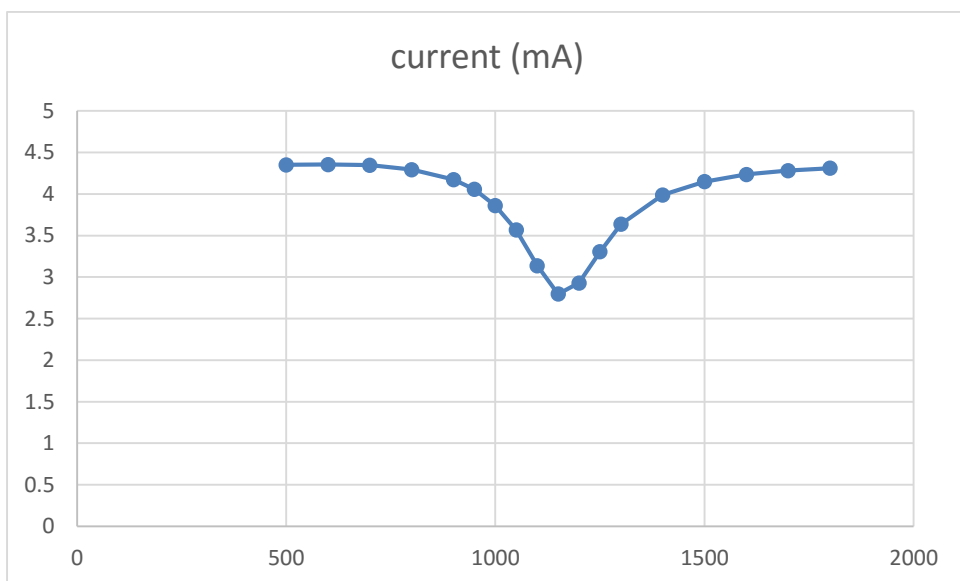Part 2(b)
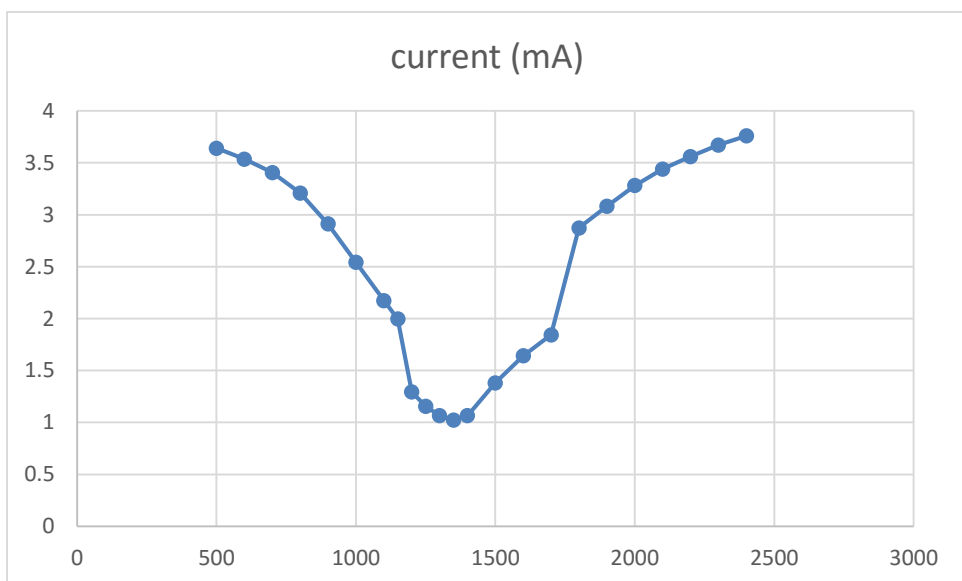
Part 2(c)

Part 2(d)

Error analysis:

1. Error in measuring current is **±0.01 mA.**
2. Error in measuring frequency is **±0.1 Hz.**
3. Other sources of error are human error which can be taken into account.

Precautions:

1. Calculate the expected resonance frequency before beginning to take readings, and make sure to take sufficient number of readings in the vicinity of this frequency to be able to draw the shape of the resonance curve.
2. Make sure the range of readings you take is sufficient to go beyond the half-power points on both sides of resonance.
3. Make the connections correctly.

Result:

Experiment 1 (maximum point on graph)

Part 1(a) natural frequency = 1300Hz

Part 1(b) natural frequency = 410Hz

Part 1(c) natural frequency = 1300Hz

Part 1(d) natural frequency = 3050Hz

Experiment 2 (minimum point on graph)

Part 2(a) natural frequency = 450Hz

Part 2(b) natural frequency =1350Hz

Part 2(c) natural frequency = 450Hz

Part 2(d) natural frequency = 1150Hz

All the graphs are bell curves as expected

Theoretically natural frequency can be calculated by

f= 1/ [(2*π)(L*C)^0.5] Hz