Feng Chia University

Electrical Engineering Fundamentals II Lab

Laboratory 3

AC RL Circuits and Phasor

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I. Introduction
  a. To observe the RL Circuits and Phasor under Alternative Current

II. Materials
  a. Waveform Generator
  b. Digital Oscilloscope
  c. Digital Multimeter
  d. Devices
     Resistors: R = 1 Ω, 10 Ω, 100 Ω, 1kΩ
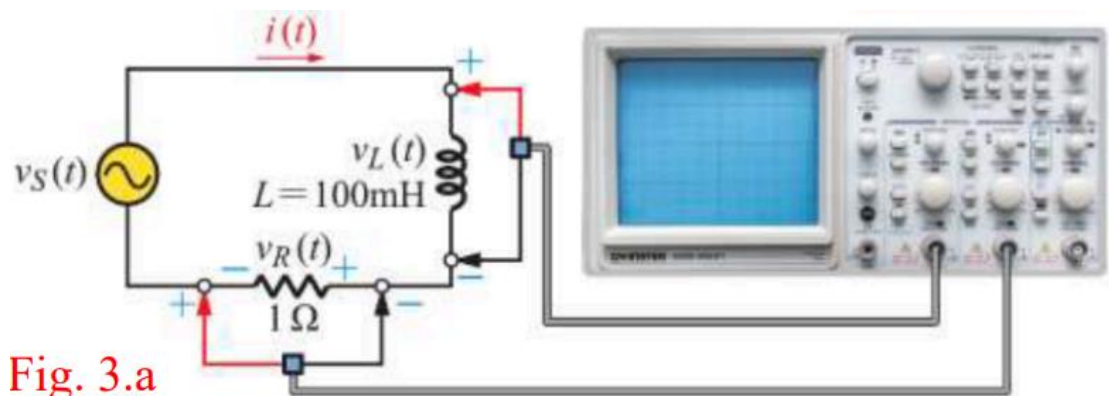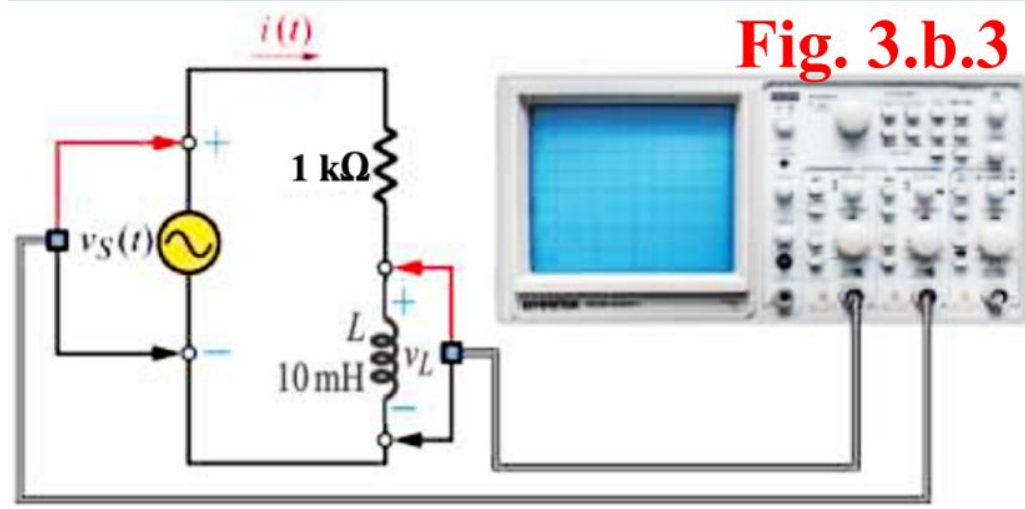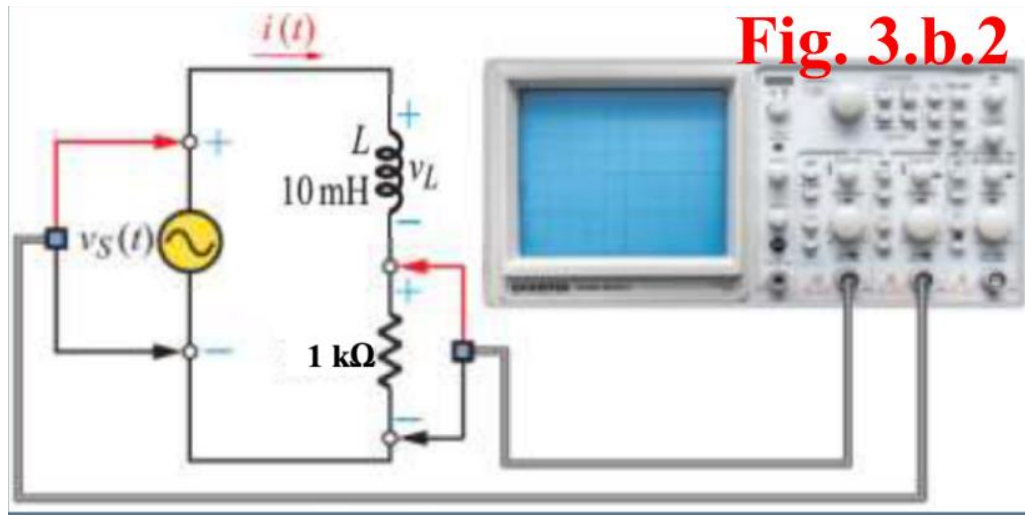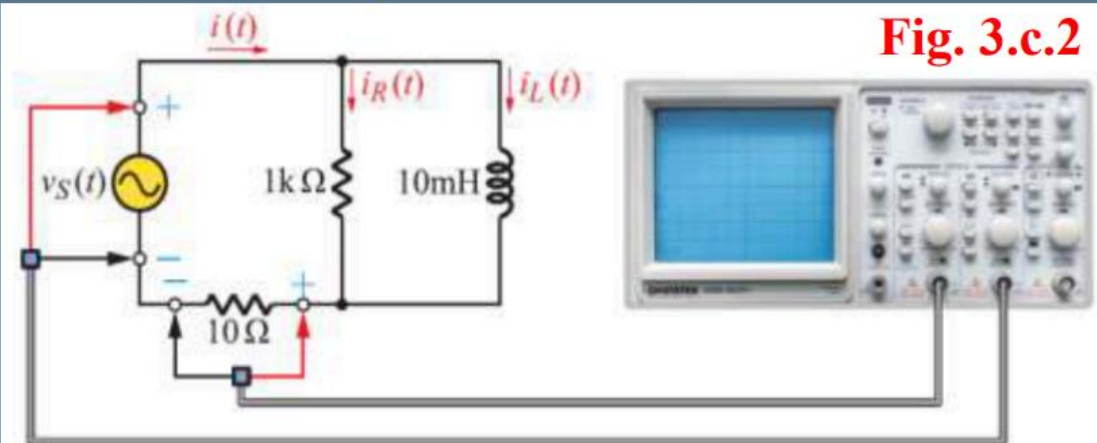   Inductor: L = 1 mH

III. Circuit diagram

Fig. 3.a

▲ Figure 1. Circuit of Experiment 3.a Pure Inductive AC Circuit

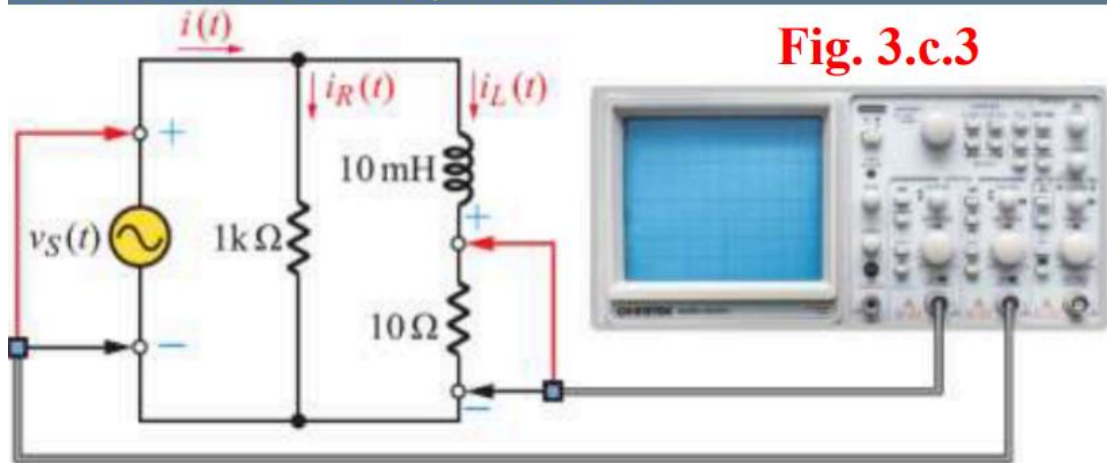Fig. 3.b.2

Fig. 3.b.3

▲ Figure 2. Circuit of Experiment 3.b RL Series Circuit

Measure v_S and i, V_S and I

Fig. 3.c.2

Measure v_S and v_L, V_S and V_L

Fig. 3.c.3

▲ Figure 3. Circuit of Experiment 3.c RL Parallel Circuit

IV. Methods

Using Digital Multimeter to observe current and voltage and Oscilloscope to observe the wave.

V. Experiments data

a. Experiment 3.a Pure Inductive AC Circuit

Table 1: Measurement of Pure Inductive AC Circuit

f	X_L	I		θ
		Theoretical	Measurement	
100 Hz	62.8319 Ω	0.0796 A	0.0090 A	9.65°
500 Hz	314.1593 Ω	0.0159 A	0.0067 A	45.98°
1 kHz	628.3185 Ω	0.0080 A	0.0046 A	65.05°
10 kHz	6283.1853 Ω	0.0008 A	0.0018 A	80.14°

b. Experiment 3.b RL Series Circuit

Table 2: Measurement of RL Series Circuit

	V_S	V_R	V_L	I
Theoretical	2 V	1.98 V	0.198 V	1.98 mA
Measurement	1.9203 V	1.9201 V	543 μV	1.839 mA

	X_L	Z	I leads V_S by
Theoretical	99.9 Ω	1004 Ω	lags 5.7°
Measurement	0.2952 Ω	1043.9817 Ω	lags 73.71°

c. Experiment 3.c RL Parallel Circuit
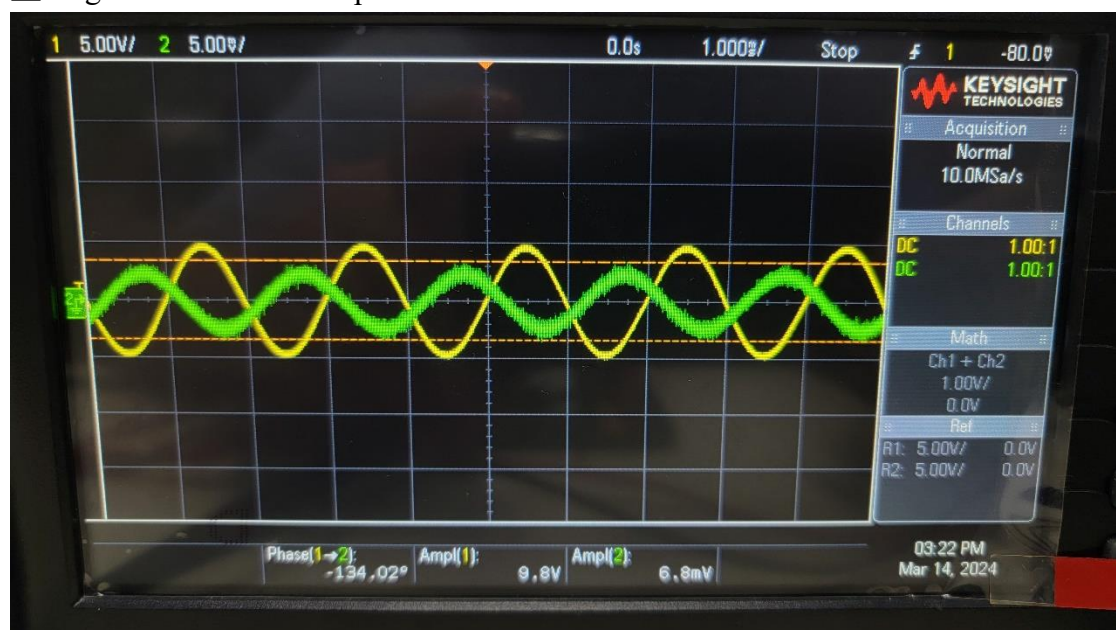
Table 3: Measurement of RL Parallel Circuit

	V_S	X_L	Z	I leads V_S by
Theoretical	2.8 V	99.9 Ω	99.4 Ω	lags 84°
Measurement	2.24 V	99.7284 Ω	66.2820 Ω	lags 111.8°

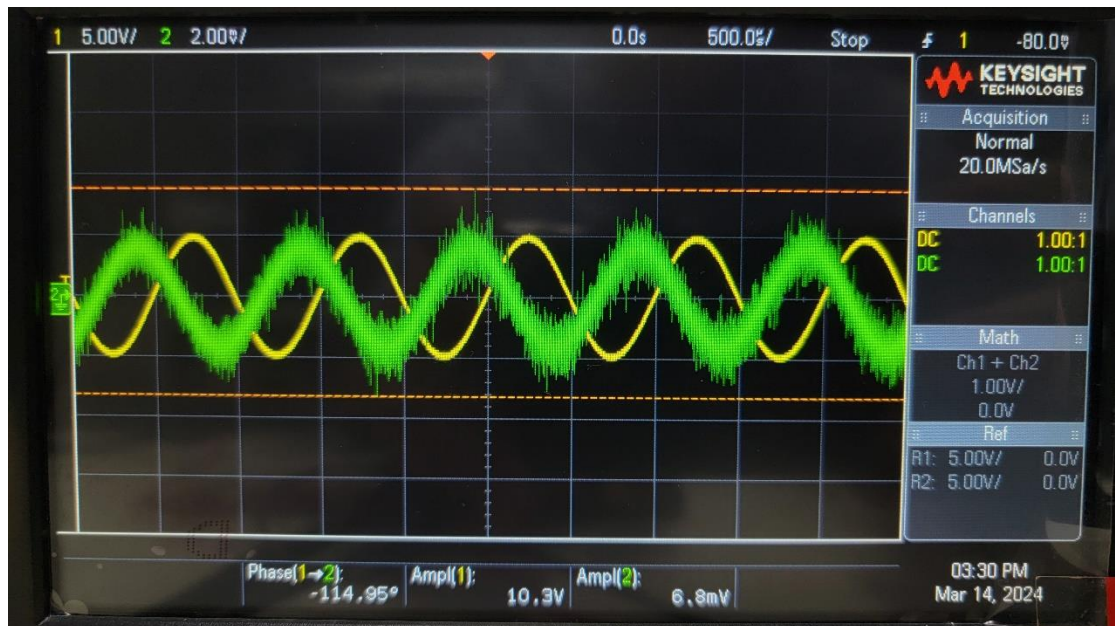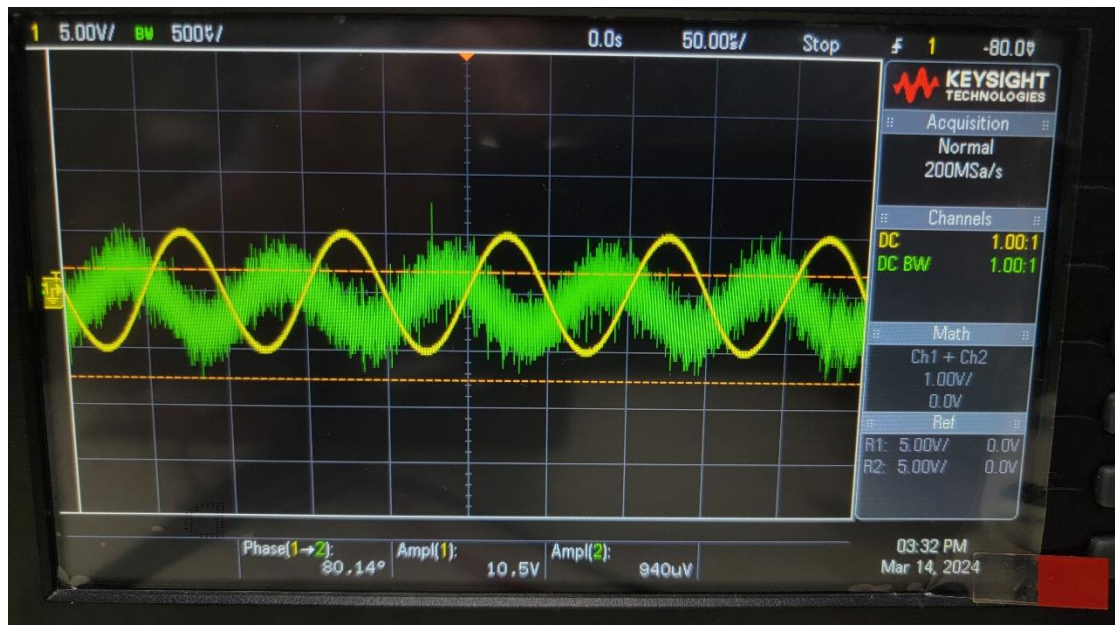|	I	I_R	I_L
Theoretical	0.028 A	2.8 A	0.028 A
Measurement	0.0338 A	0.0113 A	0.0225 A

VI. Results
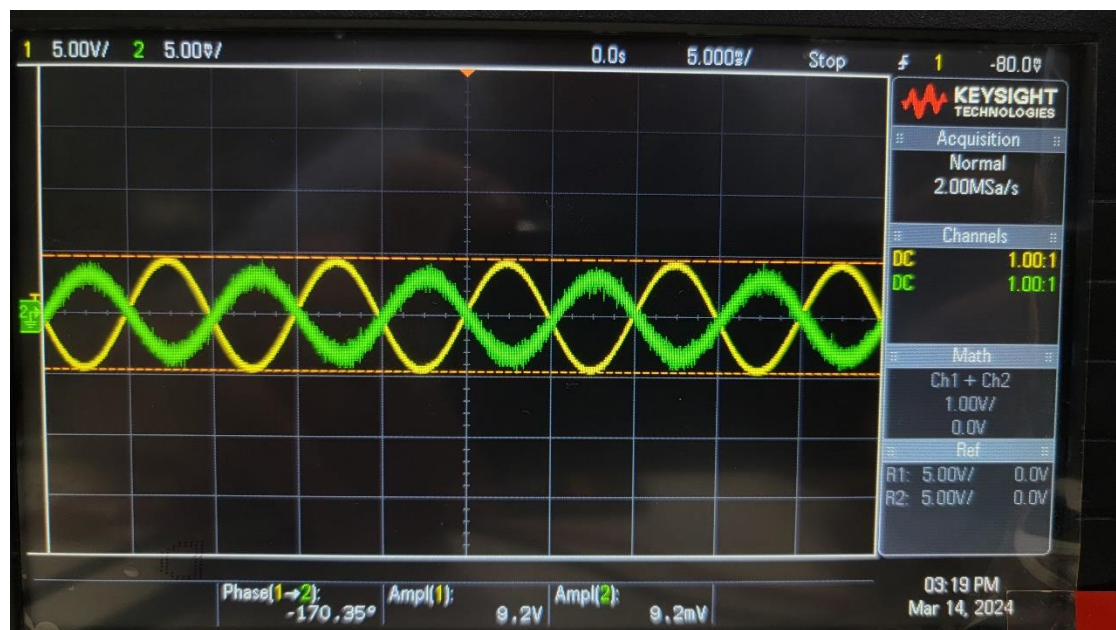
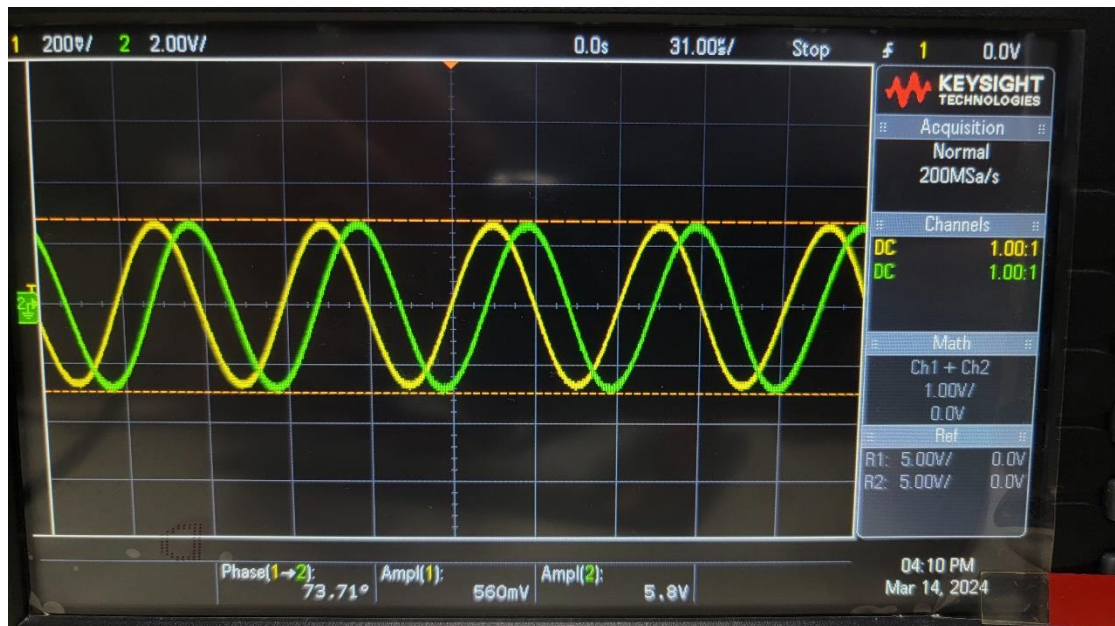▲ Figure 4. Results of Experiment 3.a 100 Hz

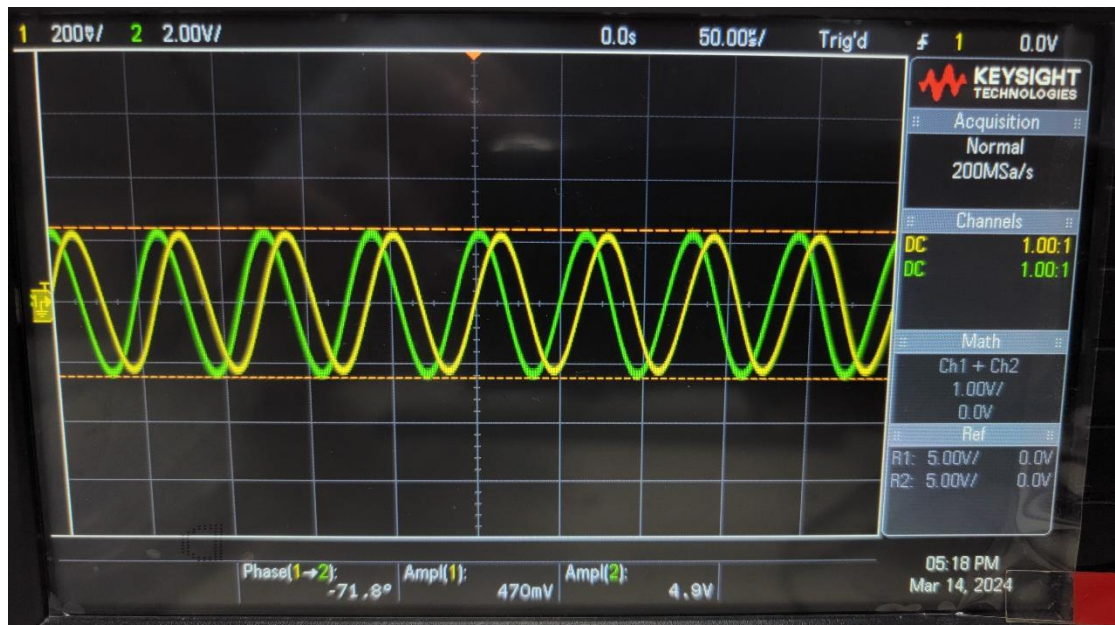▲ Figure 5. Results of Experiment 3.a 500 Hz
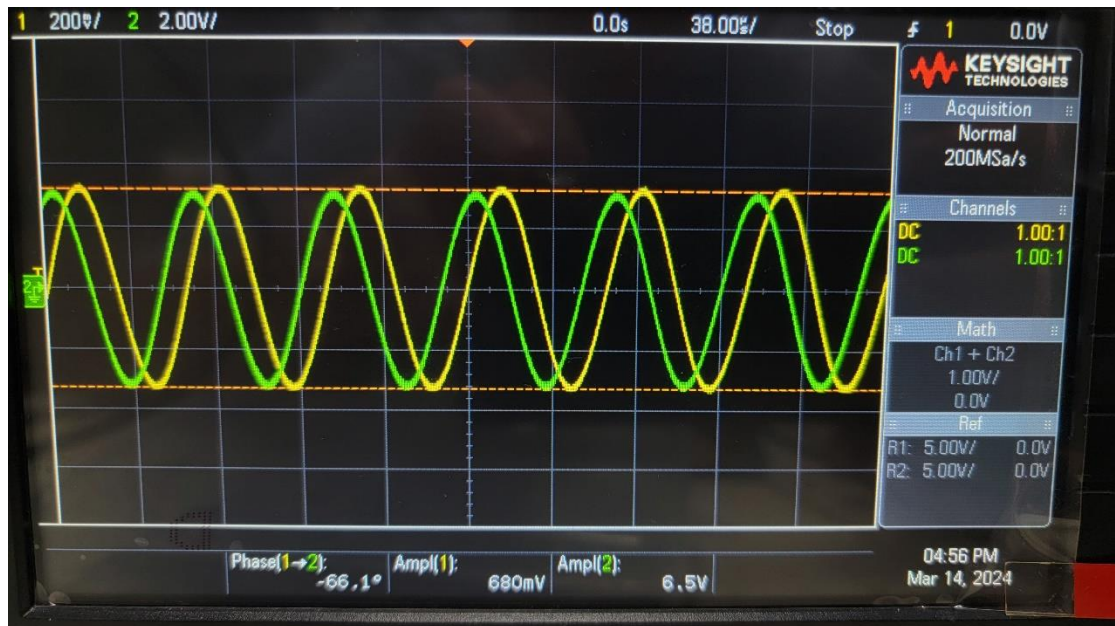
▲ Figure 6. Results of Experiment 3.a 1 kHz

▲ Figure 7. Results of Experiment 3.a 10 kHz

▲ Figure 8. Results of Experiment 3.b.2

▲ Figure 9. Results of Experiment 3.b.3

▲ Figure 10. Results of Experiment 3.c.2

▲ Figure 11. Results of Experiment 3.c.3

VII. Discussion

Explain why the phase lag between current and voltage for the inductor is not 90°?

Because of the impedance and resistance involved, the phase lag will not be exact 90°. But the higher the frequency is, the phase lag will be more close to 90°.

VIII. Conclusion

From the graphs above, current will lag voltage.