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Abstract
In this lab, …

Learning Objectives

- Test the current versus frequency response of an inductor
- Test the current versus frequency response of a capacitor
- Calculate inductive reactance
- Calculate capacitive reactance

Notes:
1. Took all voltage measurements relative to ground (unless otherwise stated)
2. Record relevant measurements and calculation results in data tables
3. Record all measured values on the circuit schematics
4. Use all available precision in calculations, round off answers to 3 significant figures

Materials

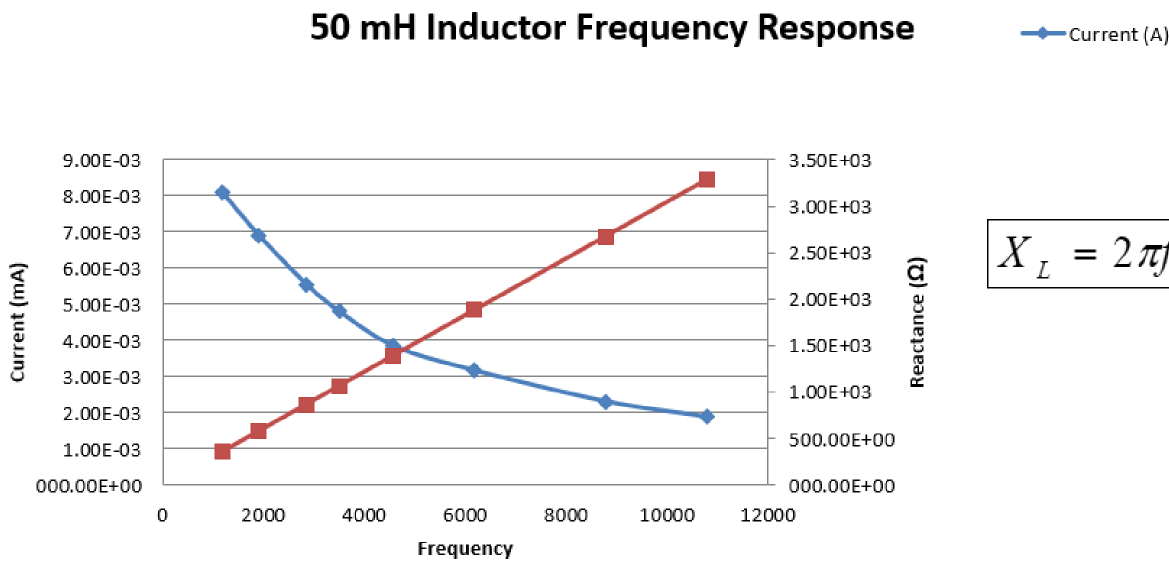
Quantity	Description
1	50mH inductor
1	0.47µF non-polar capacitor
1	Digital multimeter (DMM)
1	Global Specialty Trainer
1	Digital Oscilloscope

Procedure – Inductor Frequency Response

1. Built Circuit 1 with the DMM configured for AC current measurement.
2. Used the oscilloscope to set the GS Trainer function generator to sine waveform, kHz x 10, and 3.75 V_{RMS}.
3. Starting with the function generator frequency slider set at the highest frequency recorded frequency, current and V_{RMS} readings for up to 8 different frequencies between 10kHz and 1kHz.

Inductance	48.50E-03	718.00E-03			
Frequency (Hz)	**Current (A)**	**Voltage (Vrms)**	**Expected Reactance (Ω)**	**Measured Reactance (Ω)**	**Percent Error**
10780	1.88E-03	700.00E-03	3.29E+03	372.14E+00	-88.7%
8772	2.31E-03	689.00E-03	2.67E+03	298.40E+00	-88.8%
6173	3.17E-03	667.00E-03	1.88E+03	210.54E+00	-88.8%
4579	3.84E-03	633.00E-03	1.40E+03	164.84E+00	-88.2%
3506	4.80E-03	627.00E-03	1.07E+03	130.63E+00	-87.8%

2851	5.55E-03	550.00E-03	868.80E+00	99.10E+00	-88.6%
1911	6.91E-03	478.00E-03	582.35E+00	69.18E+00	-88.1%
1185	8.10E-03	355.00E-03	361.11E+00	43.83E+00	-87.9%

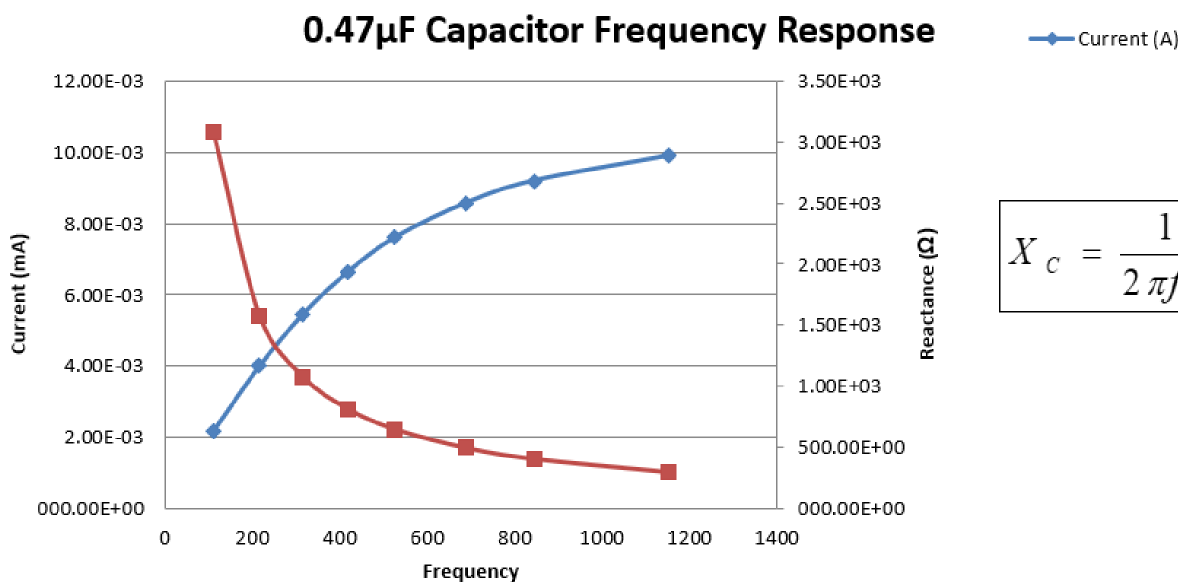


$$\boxed{X_L = 2\pi fL}$$

Procedure – Inductor Frequency Response

1. Built Circuit 1 with the DMM configured for AC current measurement.
2. Used the oscilloscope to set the GS Trainer function generator to sine waveform, kHz x 1, and 718m V_{RMS}. **Note:** trainer could not reach 3.75V_{RMS}.
3. Starting with the function generator frequency slider set at the highest frequency recorded frequency and current and V_{RMS} readings for up to 8 different frequencies between 1kHz and 100Hz.

Capacitance	469.80E-09	310.00E-03			
Frequency (Hz)	**Current (A)**	**Voltage (Vrms)**	**Expected Reactance (Ω)**	**Measured Reactance (Ω)**	**Percent Error**
1152	9.89E-03	310.00E-03	294.07E+00	22.16E+00	-92.5%
844	9.19E-03	378.00E-03	401.39E+00	29.08E+00	-92.8%
687	8.56E-03	434.00E-03	493.12E+00	35.85E+00	-92.7%
526	7.60E-03	512.00E-03	644.05E+00	47.63E+00	-92.6%
417	6.62E-03	544.00E-03	812.40E+00	58.10E+00	-92.8%
316	5.45E-03	614.00E-03	1.07E+03	79.65E+00	-92.6%
216	3.99E-03	625.00E-03	1.57E+03	110.75E+00	-92.9%
110	2.15E-03	695.00E-03	3.08E+03	228.54E+00	-92.6%



$$X_C = \frac{1}{2\pi fC}$$

Critical Thinking

Inductor Frequency Response

1. Describe the effect of the increasing frequency on inductor current flow.

   What the frequency increases through the inductor, the rate of current flow decreases.

2. Describe an application for a frequency dependent resistor that blocks high frequencies.

An application for a frequency dependent resistor that blocks high frequencies would be an audio noise filter, or an audio equalizer.

Capacitor Frequency Response

3. Describe the effect of the increasing frequency on capacitor current flow.

What the frequency increases through a capacitor circuit such as the one built in this lab, the rate of current flow increases.

4. Describe an application for a frequency dependent resistor that blocks low frequencies.

An application for a frequency dependent resistor that blocks low frequencies would be a crossover filter for audio speaker systems that filters high frequencies from a signal so that a speaker is only attempting to replicate sound frequencies within the design range of the speaker.

Conclusion

In this lab, I analyzed the current flow in response to frequency changes of an AC signal through an inductor and then through a capacitor. The error between expected and measured seemed to be significant. I suspect that it has to do with the lower voltage applied through the circuit as a result of limitations in the Global Specialties Trainer. Some trainers in the lab were able to create the requested $3.75V_{RMS}$ signal, some were not. It seems though that the appropriate reactions to current flow were observed during the changes to the frequency of the source signal.

Grading Criteria

		Points Possible	Points Earned
Documentation	Abstract, introduction, experiment, data results, conclusions, attachments, clarity, spelling, grammar	**10**	
Inductor Response Curves	Current and reactance response curves (2) complete and accurate	**10**	
Capacitor Response Curves	Current and reactance response curves (2) complete and accurate	**10**	
Conclusions	Questions answered completely & accurately. State conclusions drawn and lessons learned from the lab	**10**	
On-time submittal	Lab report is submitted in accordance with the assignment due date as posted on Canvas	**5**	
	Total	**45**	

Lab Report Format

Abstract - a summary and high-level overview of the lab and its results
Introduction - State the objectives of the laboratory and list the equipment required
Experiment - Describe the procedure used to carry out the lab
Data Results - list data taken in table or graphical format where appropriate
Conclusion - State the conclusions drawn and lessons learned from the laboratory activities. Answer any questions found within the lab procedure.
Attachments – grading criteria, verification signatures, circuit diagrams, lab procedures & notes