Writing Center

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Electronics Lab Report Guidelines and Model

Dr. Fred Craddock has challenged the widely accepted – though seldom voiced – assumption that attention to method, form, and style shall be in inverse ratio to the importance of the subject matter. The accuracy or significance of the information cannot stone for the poor way it is sometimes communicated.

In electronics, the ability to document one's work accurately and to communicate one's ideas clearly is not optional. In the competitive marketplace of the current information explosion, engineers and technicians can no longer (if they ever could) afford to be reclusive geniuses whose inadequacies in language are tolerated for the sake of technical expertise. Such "geniuses" today are replaced by people who can think and communicate.

Lab reports should be expressed in complete, clear, correct sentences and paragraphs so that readers can understand fully every step of the process and the explanations that accompany it. Students should take appropriate writing courses to prepare themselves for writing successful reports. Unless our teacher provides you with a specific format, these general guidelines would satisfy most electronics report requirements.

The major sections or components of these reports are as follows:

1. Title page
2. Purpose
3. Theory and/or analysis
4. Procedure
5. Resulting data*
6. Conclusions
7. Appendix

*Include your hand-written data sheets and other results here.

Title Page

Include on this page:

1. Title of project or experiment
2. Full name of student writing the report
3. Date report is due
4. Date submitted
5. Late penalty points (2 per calendar day)
6. Course number and section number
7. Instructor's name
8. A box for the grade (if requested, with two sections, one for form and one for content)

Purpose

State your purpose in clear, concise, grammatical sentences.

Theory

Clearly state the appropriate theoretical and operational concepts and state their application to this investigation.

Procedure

Include adequate information for the experiment to be repeated precisely. Include and procedural problems encountered and tell how they were solved. Include relevant diagrams and schematics. Be sure to present all steps in logical sequence. (Note that the procedure is not a copy of the lab guide.)

Results

Record resulting data in the most appropriate form (graphs, tables, diagrams, etc.). Develop sample calculations showing the anticipated theoretical results. Compare calculated results with measured results clearly and quantitatively, using percentage differences. Clearly identify any approximations and known error components. Label all data adequately. Make all presentations as concise as possible.

Conclusions

This is the most important section of the report. It includes the explanation of variations between theoretical and measured data. The explanations must be specific and quantitative. It is appropriate here to include your opinion of the value of the experiment in meeting the educational objectives of the course. Be sure to explain why and how you formulated that opinion.

Appendix

You may include in appendices such elements as the lab guide and component specifications.

Final Paper

Carefully revise your rough draft to correct any problems of organization, completeness, accuracy, spelling, punctuation, grammar, and clarity of presentation. Prepare a neatly typed or handwritten final version to turn in. If there's any doubt about the legibility or neatness of your handwriting, type or letter the final draft. Reports prepared on a word processor should use letter-quality or near-letter-quality print. Be sure to use only one side of standard size (8 ½ by 11 inches), white paper with no ragged edges. Proofread your final paper carefully, making neat corrections if you find minor errors. If you find major errors, retype or rewrite the pages. Reports should be stapled n the upper left corner and submitted without any folder or binder.

Series AC Circuits

by
Student Name

ETR 114 91B
W. T. Blythe

Due: January 01, 2000
Submitted: January 01, 2000
Late points:__________

Form: ______ Content:______

I. Purpose

The purpose of this lab is to investigate the characteristics of series AC circuits.

II. Theory:

The behavior of series AC circuits is similar to those of DC series circuits. The basic laws such as Ohm's Law, Kirchhoff's Current and Voltage Laws, Current and Voltage Divider Rules, and the additive properties of resistance and power hold true. The differences lie mainly in the methods of analysis used for AC circuits which are somewhat more complicated than those used for DC analysis.

The circuit consisting of a resistor a capacitor, and an inductor in series was placed in series with a frequency generator. Voltages were measured, recorded, and compared with calculated values. Since resistances in series can be rearranged in any given order, it was possible to measure each value with respect to ground which is sometimes necessary when using an oscilloscope.

Although the term "resistance" was used in the above discussion, the actual term is actually impedance. The impedance of the resistor at most frequencies (below a few hundred kilohertz) is equal to its resistance value. In a purely resistive circuit, resistance is unaffected by a sinusoidal voltage. Therefore the current through and the voltage across the resistor will be in phase. The use of vectors known as phasor algebra most easily expresses this type of relationship. This mathematical "tool" expresses the magnitude of currents, voltages, and impedances along with the value of the phase angle in degrees. Using this tool, an impedance diagram can be made by plotting resistance on the positive horizontal (real) axis, and reactance on the vertical (imaginary) axis.

In an ideal conductor, the voltage is said to lead the source current by 90 degrees. The inductive reactance is therefore plotted on the positive imaginary axis which is denoted as “j”. In an idea capacitor, the voltage lags the source current by 90 degrees. The phase angle therefore is – 90 degrees and the capacitive reactance is plotted on the negative imaginary axis which is denoted as “- j”. These values can be expressed in two formats. In rectangular form, the value is composed of the real value along with the imaginary value. This is known as complex number with the format: $C = A + jB$. The other form is polar form, which expresses the resultant magnitude and the phase angle with the format: $C = C < 0$.

The effects of frequency on reactance is also to be considered. Since inductive reactance is equal to the product of (2n) (f)(L), reactance increases with frequency. Capacitive reactance equals 1/(2N)(f)(c) which means that as frequency increases, reactance decreases. Analysis for a given circuit is therefore limited to a specific frequency.

Because the components are not ideal, phase relationships may vary from the ideal 90 degrees. A voltage diagram of measured voltages should however indicate a strong similarity to the calculated voltages.

III. Procedure:

1. Measure all components on the impedance bride. (also measure the inductor’s resistance)
2. Using the oscilloscope and a small series resistor, calculate the effective resistance and inductance of the inductor.
3. Construct a series circuit with the components and a frequency generator.
4. Measure voltage across each element with respect to ground. (rearranging as necessary)
5. Design an equivalent circuit. (two elements)
6. Draw a phasor diagram with measured and predicted results on the same axes, but with different colors.
7. Repeat steps 1 through 5 at 4K.

IV. Results:

V. Conclusions:

This lab definitely proved to be a challenge both in making the measurements and performing the calculations. Though applications of the basic laws of DC circuits were used, the mathematics necessary for AC analysis were more demanding. It was hard to be accurate beyond two significant figures when making measurements with the oscilloscope. Certainly, this lack of precision was part of the reason for inaccuracies. Another possible cause for error is the inductor. The resistance (6.5 ohms) had to be accounted for when calculating total impedance and when calculating voltage across the inductor itself. But more important may be the effect of power losses due to hysteresis, eddy currents, skin effect, and radiation. Since radiation looses only occur at radio frequencies, these can be ruled out at 2khz, but the bottom line is that any loss of power translates into a gain of effective resistance. If the total power is divided by the square of the total current, the result is the effective resistance. (by rearranging P = I2R) he calculated result for the lab circuit was 395 ohms which matches the resistance of the equivalent circuit. The measured value is 413 ohms which makes a difference of 18 ohms in the effective resistance.