

Thesis Preparation Tips

Based on my reading of many ECE theses, the following pointers are offered in an attempt to help future thesis writers.

Before you begin

1. **Word processor choices:** At a *minimum*, a word processor should be able to print subscripts and superscripts. If your word processor cannot do at least that, move on to another one.
2. **Greek and math symbols:** If your word processor cannot produce Greek letters and math symbols, they should be carefully hand-lettered into the manuscript. Do *not* resort to such measures as spelling out the symbols (e.g., using “omega” instead of ω) or substituting a letter for a symbol, e.g., using the letter “w” for an ω . Students writing theses with significant use of Greek symbols should find a word processor capable of printing them.
3. **Thesis tone:** A thesis is a formal scientific document. As such, it is inappropriate to use slang, superlatives, hyperbole, contractions, references to oneself, i.e., “I”, and other forms of informal language.
4. **Tense:** The thesis is generally written in the past and present tense.

The goals were to design and build the circuit, to measure the circuit’s frequency response, The tested circuit is shown in Fig. 5. It was unsuccessful, so the revised circuit of Fig. 6 was built. It met the desired goals.

5. **Sentences:** Only one thought per sentence, please. Only skilled writers should exceed this amount.
6. **Footnotes** are not usually used in engineering technical literature. They should be included only when necessary for presenting *important* explanatory material whose inclusion in the text would be distracting.¹
7. **Figures from other sources:** It is permissible to use photocopies from other sources *as long as the source is acknowledged with a reference citation in the caption*. If the figure is copied directly, then the citation should indicate “From Ref. 5.”; if the figure is a close replica, but is slightly modified, then the citation should indicate “After Ref. 5.”
8. **Explanation of figures:** All but the most simple of figures should be discussed in the text of thesis. In particular, figures showing results must be discussed. It is *not* sufficient to present results in figures without discussing them.
9. **Graphs with multiple data sets:** Some graphs plot more than one data set on a single graph, e.g., with crosses, circles, or other markers, or might plot the data along with a theoretical prediction curve. It is important to identify each of the data sets or curves. This identity can be done in a legend that is incorporated into the figure or in the caption. (If the identification is so complicated that a caption is unwieldy, then the identification can be done

¹Although the footnote is usually even *more* distracting.

in the text. The caption should then indicate that the identification of the data is discussed in the text.)

10. **Graphs with lines and data points:** Graphs that contain both lines and data points need an explanation on how the lines were obtained. Generally, there are three possibilities:
 - (a) the lines merely connect the data points,
 - (b) the lines are fit to the data points (be sure to describe the fitting method), or
 - (c) the lines are plots of the theoretical equations.
11. **Abbreviations and acronyms:** If your thesis contains lots of abbreviations and/or acronyms, a table that lists them should be included. This table or listing can appear either at the front of the thesis (after the table of contents and list of figures) or in an appendix.
12. **Punctuation of equations:** It is appropriate to punctuate equations with periods or commas after the equation, as necessary.
13. **Right justification:** If you right-justify your text, be sure to use hyphenation; otherwise the inserted spaces used to justify will distort the text. If you do not hyphenate, do not right-justify your text; stay with a ragged-right margin.

While you are writing

1. **Abstract:** The abstract of the thesis is a summary of the work performed (*not an introduction*). It must be substantive in nature, presenting concisely the objectives of the work, the methodology used, the results obtained, and the significance of those results. Avoid using exclusively the passive voice in the abstract.
2. **Equations:** *Every* display equation, i.e., equations not in a line of text, must be numbered sequentially. The sequential numbering can either be within a chapter, e.g., 1-1, 1-2, . . . 2-1, 2-2, . . . , or sequentially throughout the entire thesis, e.g., 1, 2, 3, . . .
3. **References** should be numbered consecutively in the order of their first appearance. Citations such as *ibid.*, *op. cit.*, etc., are not used in the technical literature; the reference number is reused. References are collected at the end of the text in a list following the format examples shown below. References must be complete. In particular, journal articles must include the starting and finishing page numbers.
4. **Reference format:** The purpose of the reference citations is to allow the interested reader (or a reference librarian acting on the reader's behalf) to find the original source material. To aid in the electronic search of databases, citations must be complete and accurate. The format used for citations varies with disciplines. The format examples shown below are used frequently in the Electrical Engineering and Physics fields. They are taken from the formats presented in the January issue of the *Proceedings of the IEEE* and the *Style Manual of the American Institute of Physics*. If you have any questions about reference formats, consult your advisor (or second reader) or the Department Chairman.

The authors' names should be in the same format as appears in the source document. If the author uses his/her full name, the citation must use his/her full name. If the author uses initials instead, the citation must use initials.

The following are examples of suitable formats:

- A book

R. U. Cerius and I. M. Kidding, *Serendipity in Science, Vol. 2*, pp. 25–34, McGraw-Hill, New York, 1985.

Note: Depending on the capabilities of your printer, the book title should either be in *italics* or be underlined. The publisher, city (and state or country, for small cities), and publication year should be included.

- A chapter in a book

R. U. Cerius and I. M. Kidding, "Serendipity in science and engineering," in *Studies of Serendipity*, Thomas J. Smart, Jr., and C.M. Pigs, eds., pp. 86–100, Sunshine Press, Lake Wobegone, Minnesota, 1987.

Notes: Only the first word and proper nouns are capitalized in the chapter title. The comma at the end of the title goes *inside* the closing quotation marks.

- A paper in a journal

R. U. Cerius and I. M. Kidding, "Serendipity in communications theory," *IEEE Trans. on Communications*, Vol. C-25, No. 5, pp. 1045–1054, 1988.

Notes: Only the first word and proper nouns are capitalized in the article title. The comma at the end of the title goes *inside* the close quotation marks. Journals have standard abbreviations that have been established by reference librarians, e.g., Trans. = Transactions, J. = Journal. If you are not sure of the standard abbreviation write out the journal title in full. It is better to provide excess information than not enough. Include the journal volume, serial number, and the start and stop pages of the article.

- A paper in a published conference proceedings

R. U. Cerius and I. M. Kidding, "Serendipity in computer design," *Proc. of 28th Asilomar Conf. on Circuits, Systems and Computers*, Joseph Doe, ed., pp. 45–65, IEEE Press, New York, Pub. No. CG-456-88, 1988.

- An unpublished paper presented at a conference

R. U. Cerius and I. M. Kidding, "Serendipity in controls theory," presented at the 12th International Symposium on Control Theory, New York, October 1988.

Note: The exact dates of the conference are not necessary; the month and year will suffice.

- A technical report

R. U. Cerius and I. M. Kidding, "Serendipity in the construction of the AN/123," Technical Report No. TR1234-89, Cerius Engineering, Inc., Kansas City, October 1988.

- A previous thesis

R. U. Cerius, "Serendipity in military systems," Master's thesis, Naval Postgraduate School, Monterey, California, 1981.

- Class notes

I. M. Kidding, Notes for EC2999 (Introduction to Serendipity), Naval Postgraduate School, 1987 (unpublished).

Notes: The indication that the notes are unpublished warns that the notes are not generally available and that it will be difficult for the reader to obtain a copy. Avoid the use of such a reference unless the referenced information is absolutely unavailable anywhere else.

- Phone conversation

R. U. Cerius in private telephone conversation, 20 June 1988.

Notes: Avoid the use of such a reference unless the referenced information is absolutely unavailable anywhere else.

- Conversation

R. U. Cerius, private conversation at Cerius Research, Inc., 20 July 1987.

Notes: Avoid the use of such a reference unless the referenced information is absolutely unavailable anywhere else.

5. **Abbreviations** for *Figure* and *Reference* can be used except when beginning a sentence.

... as seen in Fig. 5.

... as found in Ref. 3.

Figure 5 shows that ...

Reference 5 has shown that ...

6. **Symbols at start of sentence:** Do *not* begin a sentence with a symbol.

Incorrect— θ should be between 5° and 10° .

Correct— The angle θ should be between 5° and 10° .

7. **Leading zero:** A decimal value looks best when a zero precedes the decimal point, e.g., "... value is 0.567." reads easier than "... value is .567."

8. **Abbreviations:** Do *not* put a period after common abbreviations such as ac, Hz, MHz, mA, μF , etc.

9. **Input and output** are *nouns*. Do *not* use them as verbs.

10. **Hyphens, ems, ens, and minus signs:** Those who use a desktop publishing system (such as GTHESIS or L^AT_EX) have to worry about the length of the lines that appear as hyphens, etc. There are usually four choices:

(a) a short hyphen (-) used to join short phrases such as "*i*-th".

(b) a longer one (–) used to form compound modifiers such as "...second–order effect.". (Called an *en* because it usually the width of an *n* character).

(c) a longer one (—) used to separate phrases or for other purposes such as "... at (408) 555—1212." (Called an *em* because it is the width of an *m* character).

(d) a mathematical minus sign (−) used in math text and display equations, such as "... is −5 m·s".

Be sure to use the right one!! (In particular, do NOT use a short hyphen to represent a minus sign in mathematical text. It should be "... answer is −5"; not "... answer is -5".)

11. Do NOT capitalize “where” in introducing a list of variables after an equation.

Example: The equation for a is given by

$$a = b + c \quad (1)$$

where

a is the first variable,
 b is the second variable, and
 c is the third variable.

Grammar

1. **It, its, and it’s:** *Its* is the possessive of *it*; *it’s* is a contraction of *it is*. (Contractions are not allowed in a thesis, so “it’s” should *never* appear in a thesis.)

Be careful using the word *it*; be sure that the word being referred to is clear.

2. **Contractions:** Do *not* use any contractions (*it’s*, *don’t*, *can’t*, *won’t*, etc.) in a thesis. Spell out the words completely (e.g., *it is*, *do not*, *cannot*, *will not*, etc.).
3. **Compound-word modifiers:** Compounds that modify a noun should be hyphenated. A frequently-applied test is to split the compound into two and apply each individually.

Example: ...into a two-stage amplifier. (Is it a “two” amplifier? Is it a “stage” amplifier? If either test fails, then a hyphen is called for, as in this example.)

4. **Use of “i.e.” and “e.g.:** The symbols are always followed by a comma and are preceded by either a comma or a left parenthesis.

...its weight, i.e., the mass times the acceleration due to gravity.

...its weight (i.e., the mass times the acceleration due to gravity).

5. **Excessive capitalization:** Do *not* capitalize Really Important Words. Emphasize words by *italics* (preferred), **bold-face** (second choice), or underlining (third choice).

6. **Commas:** Commas are used ...

- ... before the conjunctions *and*, *but*, *for*, *or*, *yet*, and *nor* when they join parts of a compound sentence.

The wave is continuous, but it increases in amplitude.

- ... to separate an introductory clause from the main part of a sentence.

When the paper appeared, it confirmed Fourier’s theory.

- ... to separate items in a list

“... oranges, apples, and pears.”

Note: It is also acceptable to omit the comma before the *and* in a list (although I prefer that it be present), e.g., “... oranges, apples and pears.”. Whichever way you choose, be consistent!!

- ... to set off parenthetical clauses in a sentence.

The curves prove, as careful study will show, that Fourier's theory is correct.

- ... to separate coordinate adjectives modifying a noun. (If you can substitute the word "and" for the comma, then the adjective is a *coordinate adjective*.)

The large, reflective, white target ...

- ... before and after a dependent clause that comes in the middle of a sentence.

The measurement, although it is in rough agreement with the theory, does not agree perfectly.

Note: A comma is followed by a single space and is *never* preceded by a space. Commas are like parentheses; whenever there is one, there is usually another (except when superseded by the start or the end of the sentence).

7. Misused commas:

- Do *not* use a comma to separate independent clauses that are not joined by a conjunction. (This is a "comma splice.")

Incorrect — The measurement follows the theory at low frequencies, however, it deviates from theory at frequencies above 100 MHz.

Correct — The measurement follows the theory at low frequencies; however, it deviates from theory at frequencies above 100 MHz.

- Do *not* use a comma to set off restrictive phrases or clauses, i.e., phrases or clauses necessary to the words that they modify.

Incorrect — The power supply, driving the oscillator, was incorrectly regulated.

Correct — The power supply driving the oscillator was incorrectly regulated.

- Do *not* use a comma to separate a noun clause from its verb.

Incorrect — That the data points agree with theory, is evident.

Correct — That the data points agree with theory is evident.

8. Semicolons: Many people misuse colons and semicolons. Semicolons are used ...

- ... to link two parts of a compound sentence when the conjunction, e.g., "and", "or", is not used.

The value of A is 0.5; the value of B is 0.8.

- ... to separate independent clauses joined by conjunctive adverbs, i.e., *however*, *furthermore*, *nevertheless*, *consequently*, *also*, *besides*, *otherwise*, *accordingly*, *moreover*, *then*, *so*, etc.

The low frequency data is in poor agreement; otherwise, the model seems to agree with the theory.

- ... to separate items in a list when one or more of the items has a comma in it. (This use is tricky; it is best to avoid it.)

... consists of R, L, and C components; transistors and ICs; and wires, connectors, and sockets.

9. **Colons** are used ...

- ... to introduce a list of three or more items in a group. (A comma is used for a list of two items.)

... consists of the following parts: an oscillator, an amplifier, a filter, and an antenna.

... consists of the following parts, an oscillator and an amplifier.

- ... after a main clause when the succeeding clause(s) explains, illustrates, amplifies, or restates the first clause. (This usage is tricky; when in doubt, use a semicolon.)

The circuit works as follows: the oscillator creates the sine wave and the amplifier strengthens it.

10. **Variables set off by commas:** When you use italics to identify math variables, it is not necessary to set off the variable by commas. (If you do set off one variable, then be consistent; all variables must be set off)

The balance *B* is ... (preferred with italicized variables.)

The balance, *B*, is ... (OK, but do same to *all* variables)

The balance, B, is ... (required with unitalicized variables.)

After you finish

1. **Distribution list:** The Chairman of the ECE Department should receive *one* copy of all unclassified theses. The address should read

Chairman, Code EC
Department of Electrical and Computer Engineering
Naval Postgraduate School
Monterey, California 93943-5000

2. Obtaining the Chairman's signature is a two-step process. Be sure to allow time for the full process.

- The "smooth draft", signed by the student, advisor and second reader, is left for review. The Chairman's signature on the smooth draft is approval to go ahead and prepare the final draft. (The thesis advisor and second reader must be informed of any major corrections made by Chairman.)
- The final draft is prepared by the student. The final draft is then reviewed and signed by the advisor, second reader, and Chairman.

References for writing:

W. Strunk, Jr., and E.B White, *The Elements of Style, 3rd Ed.*, Macmillan Publishing Co., 1979.