# Prof. Friedman's Rules for Technical Writing

**General Rules:**

1) Before beginning to write anything, outline your paper in terms of sections and subsections, specifying what topics will be covered within each section/subsection.

2) Always write in the third person, not the first person. Rather than "our results show," say, the results are shown by..."

3) Always write in the present tense except for the special case where you are citing a specific historical event, such as "the transistor *was* invented by Bardeen, Brittain, and Shockly in 1947."

4) Avoid numbered lists and bullets within the paper (unlike a presentation where the use of lists is both common and appropriate).

5) Provide intuitive and/or physical insight into the mathematical and theoretical points you are making, rather than state the idea and support the conclusions with math.

6) The key to good technical writing is clarity and precision.

**Specific Rules:**

1) A section does not show anything. Something can be shown in a section.
    A figure or table cannot show or list anything. Something can be shown or listed in a figure or table.

2) If a section seems to be going on for a long time and covers multiple topics, consider partitioning it into another section or two or breaking the section into subsections.

3) Minimize the use of pronouns such as it, he, and they.

4) Never attach a possessive to an inanimate object.  For example, "the NAND gate's transistors" is not appropriate. Instead use, "the transistors within the NAND gate."

5) Italicize all non-English words (such as *ad hoc*) including "*i.e.,*"  "*e.g.,*" "*et al.*," *and* "*et cetera*."

6) Date your journal submissions but not your conference submissions.

7) Define all acronyms and abbreviations the first time an acronym is introduced. For example, integrated circuit (IC). Depending upon the audience, there are certain exceptions such as VLSI, NMOS, PMOS, CMOS, MOSFET, and I/O.

8) Don't speak in terms of an IC designer. Rather, speak in terms of the effect on the design

process or the circuit itself. For example, use "high speed circuits" rather than "high speed circuit designers."

9) The noun is singular despite the prepositional phrase being plural

"The current in the transistors"

Not "the <u>currents</u> in the transistors" unless there is more than one current in each transistor.

**Format Rules:**

1) Do not leave single lines hanging by themselves at the beginning or end of a column or page. These single lines are colloquially called "widows." Include the line with the following or preceding paragraph.

2) No one paragraph sentences. Every paragraph must contain at least two sentences.

**Stylistic Rules:**

1) Use foreshadowing - that means keeping the reader in tune with where the document is headed.  There are a variety of ways of doing this. Some easy ways are:

a) At the end of the introduction, each of the following sections should be outlined (an example of foreshadowing).

b) Each section with multiple sub-sections should begin the section (before the first subsection) with an outline of the following subsections (another example of foreshadowing).

More generally, communicate with the reader about what one is planning on saying and why. Don't surprise the reader with some strange section or theme.

2) Use layers of details. Start with a high level of introduction, followed by some intermediate details, concluding with fine detail. The intermediate detail is typically the most difficult (and most important) portion to write.

3) Use lots of figures. A number of small independent figures is preferable to a few figures referenced throughout the document.

4) Minimize the use of hypens between an adjective and a noun.

**Title and Address:**

1) For two author institutions, use an asterisk [*] to designate the second institution. For more than two author institutions, identify the author/institution match numerically other than the primary institution.

2) Use author name with middle initial (if desired), department, university/company, city, state, and zip code (and country if not USA or USA if foreign, non-USA publication).

**Acknowledgments:**

1) Use the most recently distributed set of acknowledgments.

2) In a regular conference proceedings paper, place the acknowledgments at the bottom of the first column with a line above the acknowledgments separating the acknowledgments from the body of the text. Occasionally, certain proceedings suggest placing the acknowledgments at the end of the paper before the references.

3) For those (few) papers that deal with research that has been developed directly with and for only one company, only acknowledge that single company.

**Figures and Tables:**

1) All figure captions go below the figure.

2) All table captions go above the table.

3) Items are "shown" or "illustrated" in a figure.

4) Items are "listed" in a table.

5) The caption for a figure containing multiple figures/tables should begin with a general description followed by a specific caption description for each specific figure. Start with some text describing an overview of the set of figures followed by A) some specific text pertinent to Fig. A, and B) some more specific text pertinent to Fig. B. For example, Fig. 9: NAND gate, a) schematic view, b) circuit view.

6) Place the figure or table as close as possible to the paragraph first referencing the figure/table and always after (not before) the initial reference.

**Equations:**

1) Place an equation number after every equation. The expression should look like:
$$F = MA \qquad . \tag{14}$$

2) Reference an equation with the word, "expression," rather than "equation." For example, "as described by the following expression."

3) If the expression is an inequality, then use the term inequality rather than equation or expression.

4) Refer to an equation by the number, such as "(14)," not by the phrase, "equation (14)." An exception is if the first word in a sentence is the equation. Then, start the sentence by the phrase, "Equation (14) shows that ......"

5) The equation is part of the sentence. Use a comma or period accordingly.

6) Italicize all equations and any variables within the text that are used in an equation.

**Citations Rules:**

1) Follow the precise formats as listed below. Write out all words as exemplified. Order the data (volume, number, title, etc) as shown below. Italicize the book, journal, and conference titles.

Journal:

> Y. I. Ismail, E. G. Friedman, and J. L. Neves, " Exploiting On-Chip Inductance in High Speed Clock Distribution Networks," *IEEE Transactions on Very Large Scale Integration (VLSI) Systems*, Vol. 9, No. 6, pp. 963-973, December 2001.

Conference proceedings:

> W. Xu and E. G. Friedman, " An Substrate Noise Circuit for Accurately Testing Mixed-Signal ICs," *Proceedings of the IEEE International Symposium on Circuits and Systems*, pp. 1.145-1.148, May 2002.

Book chapter:

> I. S. Kourtev and E. G. Friedman, "System Timing," *The VLSI Handbook*, W. K. Chen (Ed.), IEEE Press/CRC Press LLC, Chapter 47, pp. 47-1 - 47-32, 1999.

Authored book:

> A. V. Mezhiba and E. G. Friedman, *Power Distribution Networks in High Speed Integrated Circuits*, Kluwer Academic Publishers, 2004.

2) Use *et al.*, when the authors number greater than four.

3) A comma or period is always written inside the quotation marks, such as when citing a paper as in "System Timing." See examples for more cases.

4) Include a period after each reference.

**Bad Words/Phrases:**

1) Replace the word, "chip," with the words, "integrated circuit," "die," or "circuit," depending upon the specific intended meaning.

2) Do not use adjectives such as "very" or "extremely." These adjectives do not provide any useful additional information.

3) Try not to use the words, "derive," "create," and "fact."

4) Replace "taken into account" with "considered."

5) Replace "on the other hand" with "alternatively."

6) Replace "enough" with "sufficient."

7) All units should be included, not just the multiplying factor. For example, use "submicrometer" rather than "submicron." Submicron means less than $10^{-6}$, but provides no information about the units.

8) Insert "all of" between the article and the pronoun. For example, use "all of the data" rather than "all data."

9) **_Never_** use the words, "obvious(ly)," "simple," "of course," "clearly," "naturally," "easily," or "trivial."

10) Be careful with your articles. Only use "the" if there is only one item. Use "a" if there is more than one item. Occasionally, the correct decision is not to use an article. This choice is difficult to explain.

11) Use the word, "define," in only the narrowest sense, literally where a concept is actually being defined. Use instead a word such as "determine."

12) Do not use the word, "this" by itself, such as "This has the following implications." Rather, use "This behavior (or property or characteristic *etc*.) ...."

13) Do not use non-committal (or weasel) words such as "try," "attempt," "maybe," "may," *etc*.

14) Instead of using more general words such as "to cause," "to affect," or "to induce," use more precise verbs such as "the decreasing voltage reduces the current."

15) Avoid using the word, "better." Use more specific adjectives such as "lower" or "increased" or words such as "enhanced" or "improved."

16) Use "furthermore" rather than "moreover."

17) Use "per cent" rather than "percent."

18) Place your adverb close to your verb. For example, "the inverter transitions quickly from one to zero" rather than, "the inverter transitions from one to zero quickly."

19) Write out numbers up to twelve (12).

20) Minimize the use of questions within the text. Perhaps once or twice, but no more within a long manuscript. For example, "Why do we scale CMOS technologies?" Rather, say "CMOS technologies are scaled because ..."

21) Do not use contractions. For example, say "cannot" rather than "can't" or "it is" rather than "it's."

22) Use "analytic" rather than "analytical."

**Grammatical Comments:**

1) Include a comma after each item up to the "and" when enumerating a list. For example, "the NAND, NOR, EXOR, and inverter are all logic functions."

2) When to use commas around therefore. If refering to an idea from a different sentence, do not use commas. If refering to a different idea within the same sentence, use commas.

**Final Comments:**

1) Run the spell checker every time.

2) Read the paper in its entirety before returning to me.

3) Return the marked-up edited copy with the revised version.

4) Check the edited copy to ensure that every change was correctly included in the revised manuscript.

5) Do not plagiarize. Understand the meaning of plagiarizing. Do not use any set of three or four sequential words from an existing document or publication. This issue is very serious. The only exceptions are from an existing document previously authored by any of the current authors or when the material is directly quoted, such as

"Four score and seven years ago, our forefathers brought forth a great nation."  Abraham Lincoln 1863.