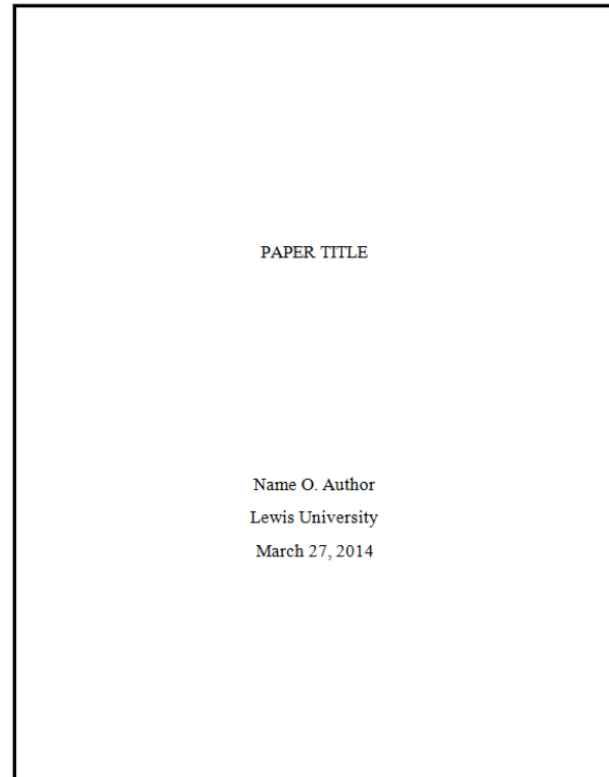




IEEE Formatting

IEEE format, used for math and computer-science papers, journal papers, and patents, consists mostly of rules for citations and references. General formatting should follow *The Chicago Manual of Style* guidelines:

- ⇒ 11 or 12 point serif typeface (Times New Roman, Georgia, Garamond, etc.)
- ⇒ 1 to 1.5 inch margins
- ⇒ Page numbers in the top, right corner, except on cover page
- ⇒ Double-space entire paper except block quotes (over 5 lines long)
- ⇒ A title page (as shown) with ALL-CAPITAL title in the upper third of the page, author name, class/institution, and date on three lines in the bottom third of the page.



In-text Citations

As you write your paper, any referenced material must be cited with a square-bracketed number. The citations should be sequential from the beginning of the paper through its end. Examples:

- The reference number follows a name:
 - ⇒ **Smith [3]** found that pterodactyls were allergic to maize.
- The reference number follows paraphrased material:
 - ⇒ Triceratopses were not allergic to anything **[8]**.
- The reference number follows a specific work:
 - ⇒ **The study [78]** showed that herbivorous dinosaurs were less choosy.
- The reference numbers are used as nouns in the sentence:
 - ⇒ **According to [6] and [16]**, the sky is red.



- Reuse a number for work previously cited (do not use a new number for an old source):
⇒ Regrettably, **Smith [3]** also found that pterodactyls loved cornbread.

Headings

Heading Level	Numbering Style	Header Format
1	I. II. III.	Capitalize First Letters, Center Text, Use Roman Numerals
2	A. B. C	<i>Capitalize First Letters, Italicize, Align to Left Margin</i>
3	1) 2) 3)	<i>Capitalize First Letters, Italicize, Indent One Em (about 3 spaces). Keep header on same line as beginning of paragraph.</i>
4	1) 2) 3)	<i>Do not capitalize. Italicize, indent two ems (about 6 spaces). Keep header on same line as first line of paragraph.</i>

En and Em Dashes

An **en dash** (a short dash) is used to represent a range, such as “Pages 5-10” or “1996-2004”. If you use “from”, you must use “to”; do not write “from 1996-2004”. An **em dash** (a long dash) is used to represent a parenthetical comment or interjectory phrase—like this one—in the middle of a sentence.

Reference List

Hanging indents should be used to align numerals along their right edges and the other text with its left, one em to the right of the numerals, as shown below. Omit information which does not apply to the particular source you are referencing.

Books

- [1] F. M. Lastname, “Title of chapter in the book,” in *Title of Book*, #th ed., vol. #, City of Publisher, Country if not USA: Publisher, year, ch. #, sec. #, pp. ###-###.
- [8] A. B. Author, “Ostriches,” in *Birds With Funny Names*, 4th ed., vol. 3, Buenos Aires, Argentina: Bob’s Big Books, 1772, ch. 213, sec. 4, pp. 401-411.
- [13] L. F. Winner, “Aging,” in *Mudhouse Sabbath*, Orleans, MA: Paraclete Press, 2007, pp. 89-97.
⇒ In this citation, chapter and section number are omitted because they are not applicable to this particular book.



Periodicals

[17] F. M. Lastname, "Title of article," *Title of Journal/Publication*, vol. #, pp. ###-###, Mo. Year.

[20] P. C. Author, "Ostriches," *Journal of Funny-Looking Flying Things*, vol. 42, pp. 121–131, Oct. 2040.

Website:

[24] F. L. Author. (year, month day published). Article Title. Website or Magazine [Online]. pp ###-###. Available: Full URL.

[25] P. C. Author. (2009). Ostriches. Birds Online [Online]. Available: <http://www.birdsonline.com/articles/pcauthor/ostriches.html>.

IEEE provides guidelines for almost all other types of publications, including patents, theses, and emails. The general guidelines for books and journals above should be followed when applicable.

Additional Guidelines

- Figures and tables are labeled "Fig. #". When referring to a figure or table in a sentence, refer to it as "Fig. #", not "Figure #".
- Lists follow the numbering/lettering format shown at right (numbers, letters, lower-case Roman numerals for first, second, and third-level list items, respectively).
- Initialisms and acronyms do NOT get an apostrophe unless they are possessive. The airplane had two separate IPUs; the IPU's functions were disabled. Indefinite articles (a/an) preceding an initialism or acronym follow normal English rules, thus: an FCC regulation, a BTU issue.
- Unlike in standard English, multiple adjectives do not need to be separated by commas.
- Plurals require just adding an "s":
 - ⇒ Years/ages: in the 1990s and in his early 50s (no apostrophe!)
 - ⇒ Quantities: 3 gallons is abbreviated as 3 gal.
 - ⇒ Only use an apostrophe when necessary to avoid confusion: the student got straight A's (to avoid confusing for the word "As").
- Variables are set italic; vectors are usually boldface italic.
- Remove commas around variables in text.

List Levels
1) First-level
a) Second-level
i) Third-level
b) Second-level
i) Third-level
ii) Third-level
2) First-level



- Always add the zero before decimal values (i.e. 0.25). Exclude repeating zeroes after decimal values (i.e. 0.25000).
- Check whether parentheses or brackets are used (i.e. $[0,1)$).
- Spell out units used in text when there are no associated quantities or values (e.g., “where the noise is given in decibels”). For units appearing with quantities, use standard abbreviations (e.g., “10 lbs.
- Always use thin spaces instead of commas between numbers in tens or hundreds of thousands (e.g. 62 000, 100 000).
- When working with micron units, do not use μ (“micron”). Instead, you should use μm (“micrometers”).
- When working with cycles per second, you should use hertz (Hz). Never use cps, c/s, csec.
- Fractions should not appear stacked in line (i.e. $\frac{1}{2}$). Fractions should be written using the solidus operator (“/”) (i.e. $1/2$). Keep in mind that parentheses may need to be included in the fraction in order to distinguish between expressions.
- When working with exponential expressions (e.g., $e^{-(j\omega t)}$), the superscript can get long and complicated. These can be brought down onto the same line with the substitution of “exp” for “e” and the addition of square brackets (e.g., $\text{exp}[-(j\omega t)]$).
- Always use numerals for numbers written with units. Otherwise, spell out numbers below 11, and use numerals for others unless they begin a sentence or are combined in a phrase.
- Use zeroth, first, nth, $(k + 1)$ th. Do not use 1st, 2nd, $(k+1)$ st, etc.
- Use the word “Equation” at the start of a sentence, but in text, just use the equation number.
- Use the \$ symbol when working with sums of money instead of the word “dollars.”
- The slash (/) is acceptable in place of the word “per” if and when it lends clarity to the sentence.



Formatting

Ellipses

You may use ellipses (...) to show continuation in a mathematical expression (e.g., $x_1, x_2, x_3, \dots, x_n$). If commas or operational signs are present, the ellipses are placed after each term and after the three ellipses points. If operational signs are used, the ellipses are centered on the operator. When commas are used, the ellipses are on the baseline.

⇒ **Example:** commas: $x_1, x_2, x_3, \dots, x_n$

⇒ **Example:** operators: $x_1 + x_2 + x_3 + \dots + x_n$

Conditions

In displayed equation, a comma or parentheses and a two-em space is inserted between the main expression and the condition following it.

⇒ **Example:** $X = y_{n-2} \quad n = 3$

⇒ **Example:** $x = y_{n-2}, \text{ if } n = 3 - y - 4.$

Note: There is no comma before a for all “” symbol.

Compound Units

Compound units should be separated by a center dot (e.g. $4 \text{ V} \cdot \text{s}$), but a slash may be used since this has a different meaning (for instance, 6 V/s means volts per second). It is also possible to use a negative power to put a unit in the denominator: $\text{cm/s}^2 = \text{cm} \cdot \text{s}^{-2}$. Parentheses may be used to clarify a unit: $\text{g}/(\text{cm} \cdot \text{s})$ or $\text{g} \cdot \text{cm}^{-1} \cdot \text{s}^{-1}$.

Equations and the Use of Periods and Commas

Equations which conclude a sentence should end with a period. The only time punctuation is used to lead into an equation is when the lead-in text is a complete sentence. Commas that appear at the ends of equations are deleted unless they are critical to the punctuation of the sentence containing the equation.

Example: “...where we had the following: $x = Y + Z.$ ” Or “...where, i.e., $x = Y + Z.$ ”

Equation Numbers

Equation numbering should be consecutive, should appear flush right on-line with the last line of an equation, should not have repeats or missing numbers, and should use a correct numbering style.



Displayed Equations

Material in displayed equations is automatically italic unless you indicate otherwise. Some simple general rules apply. All variables are italic. Function names and abbreviations are Roman, as are units, unit abbreviations, complete words, and abbreviations of words. Superscripts and subscripts follow this same formula: when they are variables, they are italic; when they are abbreviations of words (such as “in” and “out” for input and output), they are Roman. Single-letter superscripts and subscripts may be italic even if they are abbreviations unless this leads to inconsistency between italic and Roman characters for similar types of subscripts.

Break / Alignment Rules

- **Rule 1:** Break equations at comparison operators such as, equals signs (=), greater than (>), lesser than (<), greater than or equal to(\geq), and lesser than or equal to (\leq). Align the equation on the same line when possible.
- **Rule 2:** In an equation with one comparison operator, break the equation at the operator and align the equation to the right of the operator.
- **Rule 3:** If you have multiple equations, use an em quad to separate each equation only if they all fit on one line. If you can't fit all the equations on one line, stack and align each equation based on the comparison operator, if possible.
- **Rule 4:** An equation that will fit conveniently on two lines without further breaks should be broken at the comparison operator and aligned flush left/flush right over the column width.
- **Rule 5:** When breaking an equation within brackets [], break the equation at an operator and align the equation at the left-hand bracket.

Exceptions and Oddities

- **Right to left Equations:** In equations where the comparison operator appears in the right half of the statement, the equation should be broken before an operator and aligned to the left of the comparison operator.

⇒ **Example:**

$$5\alpha + x + 10y$$

$$+ \beta^2 + z = x$$

- **Solidus as Operator:** Break after a solidus (/) and align the next line to the right of the verb.

⇒ **Example:**

$$A = [(2z - 5a + x)(xy + 6a)] /$$

$$[(xy + 6a)]$$



- **Implied Product:** When a set of parentheses is followed by another set of parentheses, the equation may be broken between them, provided that a multiplication sign (\times) is inserted between the two. Align the equation to the right of the comparison operator as for other operators.

⇒ **Example:**
$$x = (-b + 4ac)(a - 2bc)$$

$$\times (-c + 3ab)$$

- **Integrals and Differentials:** If an equation containing an integral must be broken before the differential expression, break it at an operator and align to the right of the integral. It is preferential not to break this type of equation until a differential occurs, then break after the differential expression.

⇒ **Example:**

Preferred:
$$x = \int_1^0 \frac{1}{2} + \left(\frac{n-1}{n}\right) - dyA_0$$

$$+(2x - 3zy)$$

If necessary:
$$x = \int_1^0 \frac{1}{2} + \left(\frac{n-1}{n}\right)$$

$$-dyA_0 + (2x - 3zy)$$

Headings for Theorems, Proofs, and Postulates

Some articles do not conform to an outline style for theorems and proofs that is easily transformed into the normal heading sequence. The preferred style is to set the head giving the theorem number as a tertiary heading (no Arabic numeral preceding) and the proof head as a quaternary head. This rule also applies to Lemmas, Hypotheses, Propositions, Definitions, Conditions, etc.

Numbered Display Equations:

Consecutive Numbering: Equations within an article are numbered consecutively from the beginning of the article to the end. There are some Transactions in which an author's own numbering system such as numbering by section, e.g., (1.1), (1.2.1), (A1), is permitted.

Appendix Equations: Continued consecutive numbering of equations is best in the Appendix, but if an author starts equation numbering over with (A1), (A2), etc., for Appendix equations, it is permissible to leave the copy as is.

Hyphens and Periods: Hyphens and periods are usually removed from equation numbers, i.e., (1a) rather than (1-a) and (2a) rather than (2.a). This should be done consistently throughout the article.

Further Assistance: For more detailed help or if you have questions, visit the Writing Center located in the Lewis University Library or call 815-836-5427.