



Equations, Figures, & Tables

How to integrate visuals into a document



Follow IEEE conventions for equations, figures, tables

- To learn proper formatting refer to IEEE style guides & the Chicago Manual of Style



IEEE



A. The Language of Math

*[In] technical publications it is important to remember that the mathematics often carries as much if not more meaning than the body of text itself. **Therefore, it is critical that the grammar of an equation be taken into account when editing** (Taken from the IEEE Style Manual).*





Most equations should read like a sentence.

They should contain a noun and a verb and often contain adjectives, prepositional phrases, conjunctions, and conditions.



Equations also contain punctuation.
*When math occurs along with text, [the math] shares the grammatical characteristics of the text. A **displayed** expression may be a main or subordinate clause, an expression in apposition, a direct object, an item in a list, or the object of a preposition.*



Two types of equations occur in journal articles (and lab reports):

■ **Displayed equations:** Equations that are set off from the text.

e.g.

In 1974 Jiang found out Euler formula [4] of the cyclotomic real numbers in the cyclotomic fields

$$\exp\left(\sum_{i=1}^{2n-1} t_i J^i\right) = \sum_{i=1}^{2n} S_i J^{i-1}, \quad (1)$$

where J denotes a $2n$ th root of negative unity, $J^{2n} = -1$, n is an odd number, i t are the real numbers.



A second form of equation in journal articles and lab reports is the ***in-line equation***.

- An **in-line equation** is an equation within text or part of a paragraph. It is not displayed.

Rule 4: Use Roman function exp instead of e followed by a lengthy superscript. $e^{(zx^2+y)(\alpha-2yx)+zx}$ should be written as $\exp[(zx^2+y)(\alpha-2yx)+zx]$.

Rule 5 (optional): Avoid square roots (radical signs) having long bars. $\sqrt{(x+\alpha)}$ should be rewritten as $(x+\alpha)^{1/2}$.



Equations: How to integrate and reference



1. Introduce the equation (and equation #) in the text preceding the calculation
2. Leave blank line between the text and the equation
3. Center the equation between left and right margins
4. Right justify the number of the equation

Example:

... and using the simple expression as shown in (1), the cooling load can be

$$q = 1.08CMF (T_2 - T_1), \quad (1)$$

where q is cooling load (Btu/hr), CMF is airflow in ft^3/min , and T_1 is inlet air temperature.



Referencing an equation that's already been introduced later in the text



- You do not need to repeat an equation in your text, ever
- Refer to the same equation by number:
 - Ex: Recall from (1) that airflow has a large effect on heat transfer



Refer to equations



- At the beginning of sentences spell out the word equation:
**Equation (1) shows the transfer function for blah, blah
blah**
- In the body of the sentence, simply use the number: **The
transfer function is shown in (1):**



Incorporating multi-line equations



- Multi-line equations should read like complete sentences, including use of appropriate punctuation.

Equations (15) and (17) can be put in the general form

$$Z(s) = \frac{H(s + a)}{(s + b)} \quad b > a, \quad (18)$$

with

$$\begin{aligned} H &= R_1, \\ a &= 1/(CR_1), \end{aligned} \quad (19)$$

$$b = 1/(CR_2) \quad \text{for circuit 1,} \quad \text{F}$$

$$\begin{aligned} H &= (R_1 + R_2)R_t/R_0, \\ a &= 1/(CR_t), \end{aligned} \quad (20)$$

$$b = 1/(CR_0) \quad \text{for circuit 2.}$$



When do I include graphics?



- Illustrations are good for presenting numerical data in a compressed, visually understandable form. They allow a reader to *quickly* compare numbers and draw general conclusions. They also enhance your report's visual appeal and break up the text. You can create your own illustration, or use one from another source. Just be sure to cite the source.

+ Tables vs. figures



- A table is a table
- Everything else is a figure
 - Schematics
 - Circuit diagrams
 - Flow charts
 - Graphs
 - Charts
 - Photographs



Figure titles appear in sentence case:



■ **Fig. 1. Theoretical measured values of n .**



Example of a figure in IEEE format

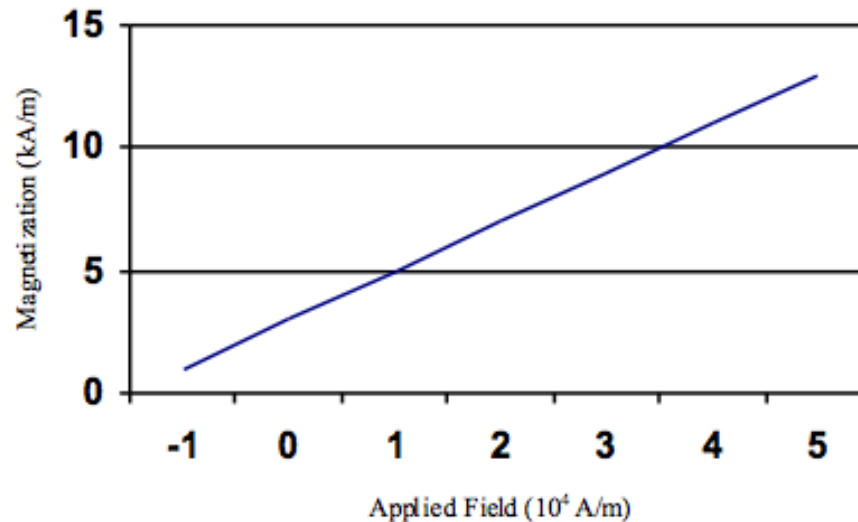
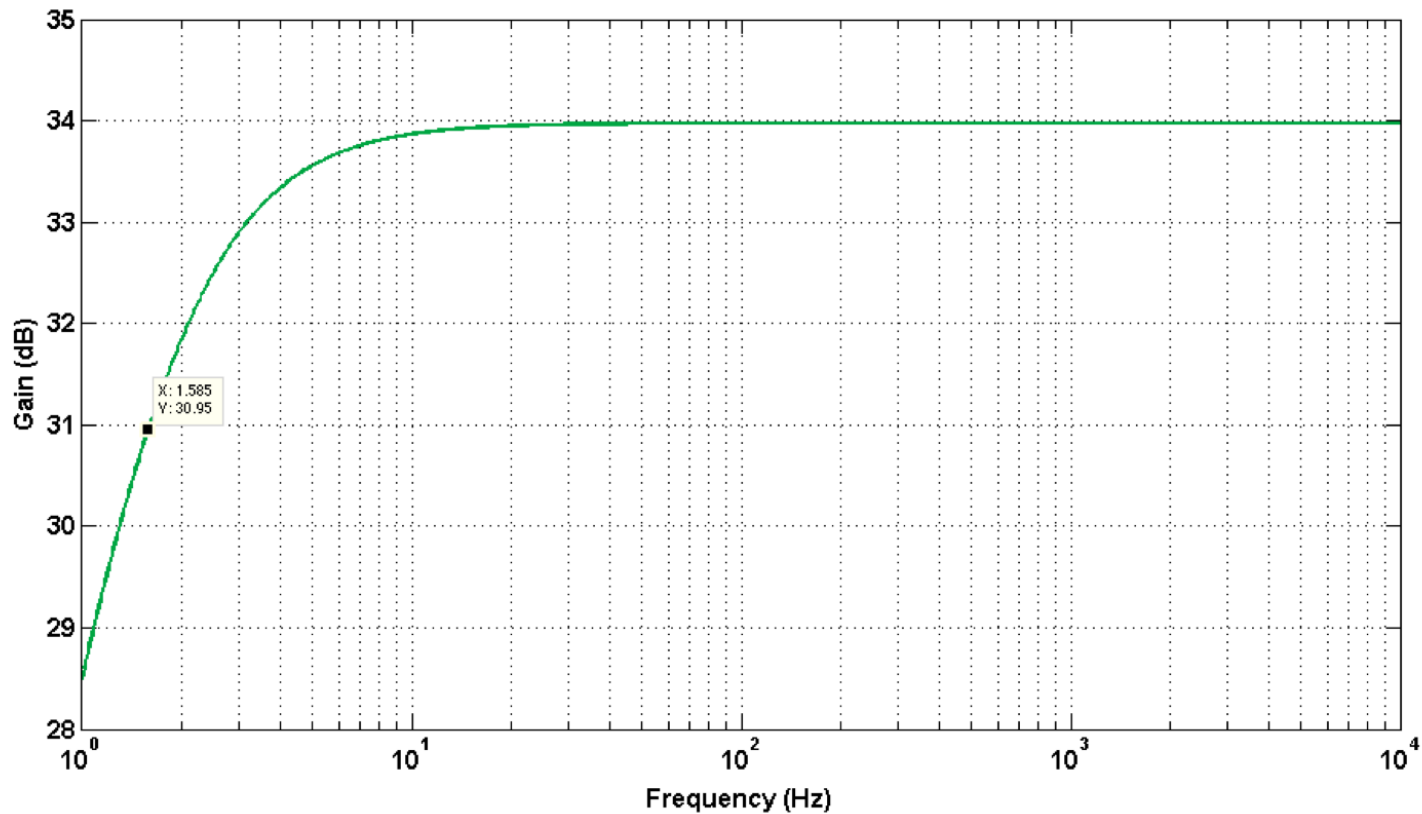


Figure 1. Magnetization as a function of applied field. Note how the caption is centered in the column.



Don't forget to include axis labels & units for graphs!!!!



+ IEEE example from Dutta Roy & Nagarajan:

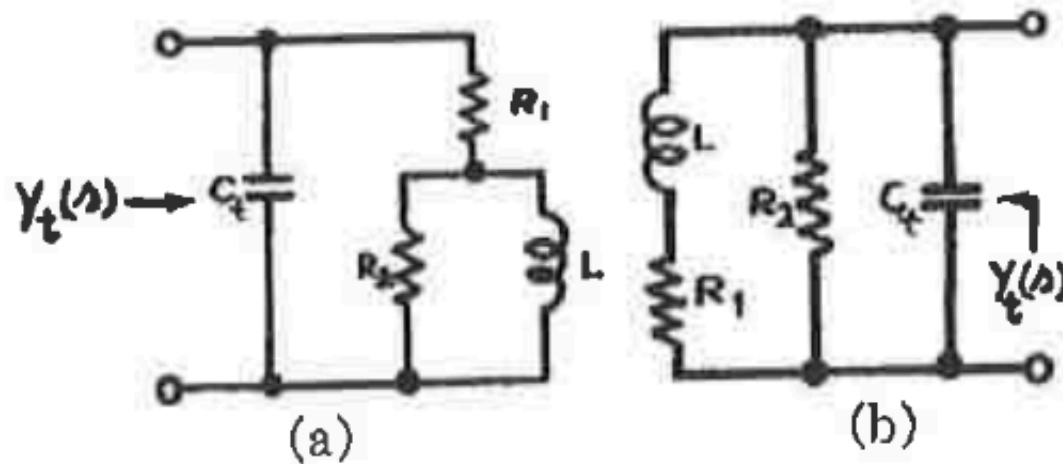


Fig. 4. Tuned circuits using the passive equivalent circuits of the active inductances.



For both figures and tables: employ the sandwich technique



- Introduce visual (top slice)
- Insert visual (filling)
- Analyze visual (bottom slice)

+ Example:

Figure 1 depicts the circuit diagram.

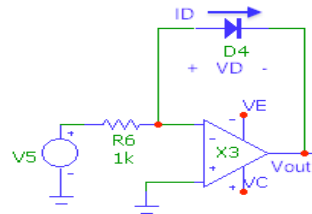


Figure 1. Temperature sensor template.

Because D_4 is in the feedback loop of X_3 , V_5 always has to be positive to keep D_4 forward biased and allow current flow and a temperature varying output signal. If V_5 were negative, D_4 would be reverse biased, and the output would become unstable, saturating the operational amplifier.



Tables have their own conventions:



- Roman numerals rather than Arabic
- Title is centered on the top
- Table caption is centered underneath table number
- Title is capitalized



Tables have their own conventions.

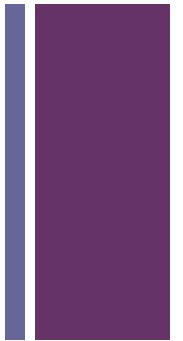


TABLE I.
IEEE GUIDELINES ON TYPE SIZES FOR CAMERA-READY PAPERS,
AS OF SEPT. 2006



Type size (pts.)	Appearance		
	Regular	Bold	Italic
6	Table captions, table superscripts		
8	Section titles, references, tables, table names, first letters in table captions, figure captions, footnotes, text subscripts, and superscripts		
9		Abstract	
10	Authors' affiliations, main text, equations, first letters in section titles		Subheadings
11	Authors' names		
24	Paper title		





Integrating tables into your text



- As with figures, employ the sandwich technique:
 - Introduce table
 - Insert table
 - Interpret table



The title here is incorrect, but it's a good example of the sandwich method.



Table 1 compares the design values with the measured values for the resistors and capacitors. . . .

Table 1: Measured Component Values vs. Design Values

Component	Design Value	Measured Value
R1	1k Ω	996 Ω
R2	1k Ω	988 Ω
R3	50k Ω	51.3k Ω
R4	100k Ω	98.2k Ω
R5	100k Ω	98.6k Ω
R6	10k Ω	9.83k Ω
R7	25.6k Ω	12.44k Ω
C1	100 μ F	87.4 μ F
C2	10 μ F	9.45 μ F
C3	10 μ F	9.44 μ F

Notice how the measured value for R7 is outside the 5% tolerance. . . .



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