

# Preparation of Papers for IEEE TRANSACTIONS and JOURNALS (February 2017)

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**Abstract**—These instructions give you guidelines for preparing papers for IEEE Transactions and Journals. Use this document as a template if you are using L<sup>A</sup>T<sub>E</sub>X. Otherwise, use this document as an instruction set. The electronic file of your paper will be formatted further at IEEE. Paper titles should be written in uppercase and lowercase letters, not all uppercase. Avoid writing long formulas with subscripts in the title; short formulas that identify the elements are fine (e.g., “Nd–Fe–B”). Do not write “(Invited)” in the title. Full names of authors are preferred in the author field, but are not required. Put a space between authors’ initials. The abstract must be a concise yet comprehensive reflection of what is in your article. In particular, the abstract must be self-contained, without abbreviations, footnotes, or references. It should be a microcosm of the full article. The abstract must be between 150–250 words. Be sure that you adhere to these limits; otherwise, you will need to edit your abstract accordingly. The abstract must be written as one paragraph, and should not contain displayed mathematical equations or tabular material. The abstract should include three or four different keywords or phrases, as this will help readers to find it. It is important to avoid over-repetition of such phrases as this can result in a page being rejected by search engines. Ensure that your abstract reads well and is grammatically correct.

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## I. INTRODUCTION

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## A. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have already been defined in the abstract. Abbreviations such as IEEE, SI, ac, and dc do not have to be defined. Abbreviations that incorporate periods should not have spaces: write “C.N.R.S.,” not “C. N. R. S.” Do not use abbreviations in the title unless they are unavoidable (for example, “IEEE” in the title of this article).

## B. Other Recommendations

Use one space after periods and colons. Hyphenate complex modifiers: “zero-field-cooled magnetization.” Avoid dangling participles, such as, “Using (6), the potential was calculated.” [It is not clear who or what used (6).] Write instead, “The potential was calculated by using (6),” or “Using (6), we calculated the potential.”

Use a zero before decimal points: “0.25,” not “.25.” Use “cm<sup>3</sup>,” not “cc.” Indicate sample dimensions as “0.1 cm × 0.2 cm,” not “0.1 × 0.2 cm<sup>2</sup>.” The abbreviation for “seconds” is “s,” not “sec.” Use “Wb/m<sup>2</sup>” or “webers per square meter,” not “webers/m<sup>2</sup>.” When expressing a range of values, write “7 to 9” or “7–9,” not “7~9.”

A parenthetical statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.) In American English, periods and commas are within quotation marks, like “this period.” Other punctuation is “outside”! Avoid contractions; for example, write “do not” instead of “don’t.” The serial comma is preferred: “A, B, and C” instead of “A, B and C.”

If you wish, you may write in the first person singular or plural and use the active voice (“I observed that . . .” or “We observed that . . .” instead of “It was observed that . . .”). Remember to check spelling. If your native language is not English, please get a native English-speaking colleague to carefully proofread your paper.

Try not to use too many typefaces in the same article. You’re writing scholarly papers, not ransom notes. Also please remember that MathJax can’t handle really weird typefaces.

### C. Equations

Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (6). To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Use parentheses to avoid ambiguities in denominators. Punctuate equations when they are part of a sentence, as in

$$E = mc^2. \quad (1)$$

$$\dot{x} = Ax. \quad (2)$$

Be sure that the symbols in your equation have been defined before the equation appears or immediately following. Italicize symbols ( $T$  might refer to temperature, but  $T$  is the unit tesla). Refer to “(6),” not “Eq. (6)” or “equation (6),” except at the beginning of a sentence: “Equation (6) is . . .”

### D. $\LaTeX$ -Specific Advice

Please use “soft” (e.g., `\eqref{Eq}`) cross references instead of “hard” references (e.g., (1)). That will make it possible to combine sections, add equations, or change the order of figures or citations without having to go through the file line by line.

Please don’t use the `{eqnarray}` equation environment. Use `{align}` or `{IEEEeqnarray}` instead. The `{eqnarray}` environment leaves unsightly spaces around relation symbols.

Please note that the `{subequations}` environment in  $\LaTeX$  will increment the main equation counter even when there are no equation numbers displayed. If you forget that, you might write an article in which the equation numbers skip from (17) to (20), causing the copy editors to wonder if you’ve discovered a new method of counting.

$\text{BIB}\TeX$  does not work by magic. It doesn’t get the bibliographic data from thin air but from .bib files. If you use  $\text{BIB}\TeX$  to produce a bibliography you must send the .bib files.

$\LaTeX$  can’t read your mind. If you assign the same label to a subsection and a table, you might find that Table I has been cross referenced as Table IV-B3.

$\LaTeX$  does not have precognitive abilities. If you put a `\label` command before the command that updates the counter it’s supposed to be using, the label will pick up the last counter to be cross referenced instead. In particular, a `\label` command should not go before the caption of a figure or a table.

Do not use `\nonumber` inside the `{array}` environment. It will not stop equation numbers inside `{array}` (there

won’t be any anyway) and it might stop a wanted equation number in the surrounding equation.

If you are submitting your paper to a colorized journal, you can use the following two lines at the start of the article to ensure its appearance resembles the final copy:

```
\documentclass[journal,twoside,web]{ieeecolor}
\usepackage{JournalName}
```

## II. PROBLEM FORMULATION AND PRELIMINARIES

Consider the switched neutral system described by the following equations:

$$\begin{aligned} \dot{x}(t) = & A_0x(t) + B_1w(t) + B_2u(t) \\ & + \sum_{i=1}^K [A_ix(t - \tau_i) + B_{1i}w(t - \tau_i) \\ & + B_{2i}u(t - \tau_i) + E_i\dot{x}(t - \tau_i)]. \end{aligned} \quad (3)$$

If we do not consider the interfere  $w(t)$

$$\begin{aligned} \dot{x}(t) = & A_0x(t) + B_2u(t) + \sum_{i=1}^K [A_ix(t - \tau_i) \\ & + B_{2i}u(t - \tau_i) + E_i\dot{x}(t - \tau_i)]. \end{aligned} \quad (4)$$

If we also don’t consider the output  $y(t)$ , we can convert Equation (2) to standard NDS(neutral delay system) form

$$\begin{aligned} \begin{bmatrix} \dot{x}(t) \\ z(t) \\ y(t) \end{bmatrix} = & \begin{bmatrix} A_0 & 0 & B_2 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x(t) \\ w(t) \\ u(t) \end{bmatrix} \\ & + \sum_{i=1}^K \begin{bmatrix} A_i & 0 & B_{2i} & E_i \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x(t - \tau_i) \\ w(t - \tau_i) \\ u(t - \tau_i) \\ \dot{x}(t - \tau_i) \end{bmatrix}. \end{aligned} \quad (5)$$

Convert standard NDS form to DDF(Differential Difference Equations)

$$\begin{aligned} D_{rvi} = & \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ I & 0 & 0 \end{bmatrix} \\ [C_{ri}B_{r1i}B_{r2i}] = & \begin{bmatrix} I_n & 0 & 0 \\ 0 & I_m & 0 \\ 0 & 0 & I_p \\ A_0 & 0 & B_2 \end{bmatrix} \\ \begin{bmatrix} B_v \\ D_{1v} \\ D_{2v} \end{bmatrix} = & I_{n+q+r} \\ C_{vi} = & \begin{bmatrix} A_i & 0 & B_{2i} & E_i \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \\ C_{vdi}(s) = & 0 \end{aligned}$$

Representation of Networks and Systems with Delay:DDEs, DDFs, ODE-PDEs and PIEs

standard DDF form

$$\begin{bmatrix} \dot{x}(t) \\ z(t) \\ y(t) \end{bmatrix} = \begin{bmatrix} A_0 & 0 & B_2 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x(t) \\ w(t) \\ u(t) \end{bmatrix} + \sum_{i=1}^K \begin{bmatrix} A_i & 0 & B_{2i} & E_i \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x(t-\tau_i) \\ w(t-\tau_i) \\ u(t-\tau_i) \\ \dot{x}(t-\tau_i) \end{bmatrix}. \quad (6)$$

Convert standard DDF form to PIE( Partial Integral Equation) form

$$\hat{C}_{vi} = C_{vi}$$

$$D_I = \begin{bmatrix} (I - \sum_{i=1}^K C_{vi} D_{rvi})^{-1} & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & I \end{bmatrix}$$

$$C_{Ii} = -D_I C_{vi}$$

$$= \begin{bmatrix} -(I - \sum_{i=1}^K E_i)^{-1} A_i & 0 & -(I - \sum_{i=1}^K E_i)^{-1} B_{2i} & -(I - \sum_{i=1}^K E_i)^{-1} E_i \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

9

$$[T_0 \quad T_1 \quad T_2] =$$

$$\begin{bmatrix} C_{r1} + D_{rv1} C_{vx} & C_{r1} + D_{rv1} D_{vw} & C_{r1} + D_{rv1} D_{vu} \\ C_{r2} + D_{rv2} C_{vx} & C_{r2} + D_{rv2} D_{vw} & C_{r2} + D_{rv2} D_{vu} \\ \vdots & \vdots & \vdots \\ C_{rK} + D_{rvK} C_{vx} & C_{rK} + D_{rvK} D_{vw} & C_{rK} + D_{rvK} D_{vu} \end{bmatrix}$$

9

$$[C_{vx} \quad D_{vw} \quad D_{vu}] =$$

$$\begin{bmatrix} (I - \sum_{i=1}^K E_i)^{-1} (\sum_{i=1}^K (A_i + E_i A_0)) & (I - \sum_{i=1}^K E_i)^{-1} (E_i B_1) & (I - \sum_{i=1}^K E_i)^{-1} (E_i B_2) \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

9

$$D_{rv1} C_{I1} =$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ -(I - \sum_{i=1}^K E_i)^{-1} A_1 & 0 & -(I - \sum_{i=1}^K E_i)^{-1} B_{21} & -(I - \sum_{i=1}^K E_i)^{-1} E_1 \end{bmatrix}$$

$$T_b(s, \theta) = -I_{\sum_i p_i} + T_a(s, \theta)$$

$$\mathcal{B}_{T_2} = \mathcal{P} \begin{bmatrix} 0 & \emptyset \\ T_2 & \{\emptyset\} \end{bmatrix}$$

$$I_\tau =$$

$$\begin{bmatrix} \frac{1}{\tau_1} I_{p1} & 0 & 0 & 0 \\ 0 & \frac{1}{\tau_2} I_{p2} & 0 & 0 \\ 0 & 0 & \ddots & 0 \\ 0 & 0 & 0 & \frac{1}{\tau_K} I_{pK} \end{bmatrix}$$

$$\mathcal{B}_1 = \mathcal{P} \begin{bmatrix} \mathbf{B}_1 & \emptyset \\ 0 & \{\emptyset\} \end{bmatrix}$$

$$\mathcal{B}_2 = \mathcal{P} \begin{bmatrix} \mathbf{B}_2 & \emptyset \\ 0 & \{\emptyset\} \end{bmatrix}$$

$$\mathcal{C}_1 = \mathcal{P} \begin{bmatrix} \mathbf{C}_{10} & \mathbf{C}_{11} \\ \emptyset & \{\emptyset\} \end{bmatrix}$$

$$\mathcal{C}_2 = \mathcal{P} \begin{bmatrix} \mathbf{C}_{20} & \mathbf{C}_{21} \\ \emptyset & \{\emptyset\} \end{bmatrix}$$

$$\begin{bmatrix} A \\ C_{11} \\ C_{21} \end{bmatrix} = \begin{bmatrix} B_v \\ D_{1v} \\ D_{2v} \end{bmatrix} [C_{I1} \dots C_{IK}]$$

$$\begin{bmatrix} \mathbf{A}_0 & \mathbf{B}_1 & \mathbf{B}_2 \\ \mathbf{C}_{10} & \mathbf{D}_{11} & \mathbf{D}_{12} \\ \mathbf{C}_{20} & \mathbf{D}_{21} & \mathbf{D}_{22} \end{bmatrix} = \begin{bmatrix} A_0 & B_1 & B_2 \\ C_{10} & D_{11} & D_{12} \\ C_{20} & D_{21} & D_{22} \end{bmatrix} [C_{vx} \quad D_{vw} \quad D_{vu}]$$

$$\mathcal{D}_{ij} = \mathcal{P} \begin{bmatrix} D_{ij} & \mathbf{C}_{11} \\ \emptyset & \{\emptyset\} \end{bmatrix} = \begin{bmatrix} 0 & \mathbf{C}_{11} \\ \emptyset & \{\emptyset\} \end{bmatrix}$$

If we introduce the controller

$$u(t) = K\mathbf{x}(t) \quad (7)$$

$$\mathcal{A} = \mathcal{P} \begin{bmatrix} A_0 & A \\ 0 & \{I_\tau, 0, 0\} \end{bmatrix}$$

$$\mathcal{T} = \mathcal{P} \begin{bmatrix} I & 0 \\ T_0 & \{0, T_a, T_b\} \end{bmatrix}$$

$$\mathbf{x}(t) := \begin{bmatrix} x(t) \\ \Phi(t, \cdot) \end{bmatrix}$$

than we got the standard PIE form

$$\mathcal{B}_{T_1} = \mathcal{P} \begin{bmatrix} 0 & \emptyset \\ T_1 & \{\emptyset\} \end{bmatrix}$$

$$\mathcal{T}\dot{\mathbf{x}} + \mathcal{B}_{T_2} K \dot{\mathbf{x}} = \mathcal{A}\mathbf{x} + \mathcal{B}_2 K \mathbf{x} \quad (8)$$

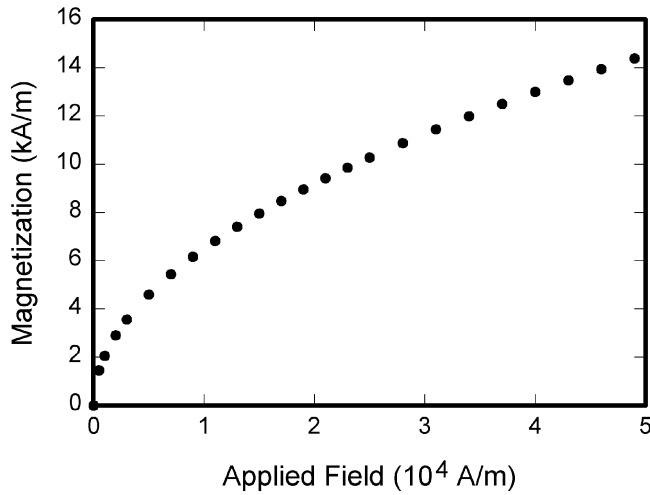


Fig. 1. Magnetization as a function of applied field. It is good practice to explain the significance of the figure in the caption.

$$\mathcal{T}'\dot{\mathbf{x}} = \mathcal{A}'\mathbf{x} \quad (9)$$

$$\mathcal{T}'^*\mathcal{H}\mathcal{A}' + \mathcal{A}'^*\mathcal{H}\mathcal{T}' < 0 \quad (10)$$

$$\begin{aligned} \dot{V}(\mathbf{x}) &= \langle \mathcal{T}'\mathbf{x}, \mathcal{H}\mathcal{T}'\mathbf{x} \rangle_Z + \langle \mathcal{A}'\mathbf{x}, \mathcal{H}\mathcal{T}'\mathbf{x} \rangle_Z \\ &= \langle \mathbf{x}, (\mathcal{T}'^*\mathcal{H}\mathcal{A}' + \mathcal{A}'^*\mathcal{H}\mathcal{T}')\mathbf{x} \rangle_Z \end{aligned} \quad (11)$$

$$\mathcal{T}' = \mathcal{T} + \mathcal{B}_{T_2}K \quad (12)$$

$$\mathcal{A}' = \mathcal{A} + \mathcal{B}_2K \quad (13)$$

### III. SOME COMMON MISTAKES

The word “data” is plural, not singular. The subscript for the permeability of vacuum  $\mu_0$  is zero, not a lowercase letter “o.” The term for residual magnetization is “remanence”; the adjective is “remanent”; do not write “remnance” or “remnant.” Use the word “micrometer” instead of “micron.” A graph within a graph is an “inset,” not an “insert.” The word “alternatively” is preferred to the word “alternately” (unless you really mean something that alternates). Use the word “whereas” instead of “while” (unless you are referring to simultaneous events). Do not use the word “essentially” to mean “approximately” or “effectively.” Do not use the word “issue” as a euphemism for “problem.” When compositions are not specified, separate chemical symbols by en-dashes; for example, “NiMn” indicates the intermetallic compound  $\text{Ni}_{0.5}\text{Mn}_{0.5}$  whereas “Ni–Mn” indicates an alloy of some composition  $\text{Ni}_x\text{Mn}_{1-x}$ .

Be aware of the different meanings of the homophones “affect” (usually a verb) and “effect” (usually a noun), “complement” and “compliment,” “discreet” and “discrete,” “principal” (e.g., “principal investigator”) and “principle” (e.g., “principle of measurement”). Do not confuse “imply” and “infer.”

Prefixes such as “non,” “sub,” “micro,” “multi,” and “ultra” are not independent words; they should be joined to the words they modify, usually without a hyphen. There is no period after the “et” in the Latin abbreviation “*et al.*” (it is also italicized). The abbreviation “i.e.,” means “that is,” and the abbreviation “e.g.,” means “for example” (these abbreviations are not italicized).

A general IEEE styleguide is available at <http://www.ieee.org/authortools>.

TABLE I  
UNITS FOR MAGNETIC PROPERTIES

Symbol	Quantity	Conversion from Gaussian and CGS EMU to SI <sup>a</sup>
$\Phi$	magnetic flux	1 Mx $\rightarrow 10^{-8}$ Wb = $10^{-8}$ V·s
$B$	magnetic flux density, magnetic induction	1 G $\rightarrow 10^{-4}$ T = $10^{-4}$ Wb/m <sup>2</sup>
$H$	magnetic field strength	1 Oe $\rightarrow 10^3/(4\pi)$ A/m
$m$	magnetic moment	1 erg/G = 1 emu $\rightarrow 10^{-3}$ A·m <sup>2</sup> = $10^{-3}$ J/T
$M$	magnetization	1 erg/(G·cm <sup>3</sup> ) = 1 emu/cm <sup>3</sup> $\rightarrow 10^3$ A/m
$4\pi M$	magnetization	1 G $\rightarrow 10^3/(4\pi)$ A/m
$\sigma$	specific magnetization	1 erg/(G·g) = 1 emu/g $\rightarrow 1$ A·m <sup>2</sup> /kg
$j$	magnetic dipole moment	1 erg/G = 1 emu $\rightarrow 4\pi \times 10^{-10}$ Wb·m
$J$	magnetic polarization	1 erg/(G·cm <sup>3</sup> ) = 1 emu/cm <sup>3</sup> $\rightarrow 4\pi \times 10^{-4}$ T
$\chi, \kappa$	susceptibility	1 $\rightarrow 4\pi$
$\chi_\rho$	mass susceptibility	1 cm <sup>3</sup> /g $\rightarrow 4\pi \times 10^{-3}$ m <sup>3</sup> /kg
$\mu$	permeability	1 $\rightarrow 4\pi \times 10^{-7}$ H/m = $4\pi \times 10^{-7}$ Wb/(A·m)
$\mu_r$	relative permeability	$\mu \rightarrow \mu_r$
$w, W$	energy density	1 erg/cm <sup>3</sup> $\rightarrow 10^{-1}$ J/m <sup>3</sup>
$N, D$	demagnetizing factor	1 $\rightarrow 1/(4\pi)$

Vertical lines are optional in tables. Statements that serve as captions for the entire table do not need footnote letters.

<sup>a</sup>Gaussian units are the same as cg emu for magnetostatics; Mx = maxwell, G = gauss, Oe = oersted; Wb = weber, V = volt, s = second, T = tesla, m = meter, A = ampere, J = joule, kg = kilogram, H = henry.

## IV. GUIDELINES FOR GRAPHICS PREPARATION AND SUBMISSION

### A. Types of Graphics

The following list outlines the different types of graphics published in IEEE journals. They are categorized based on their construction, and use of color/shades of gray:

1) **Color/Grayscale figures:** Figures that are meant to appear in color, or shades of black/gray. Such figures may include photographs, illustrations, multicolor graphs, and flowcharts.

2) **Line Art figures:** Figures that are composed of only black lines and shapes. These figures should have no shades or half-tones of gray, only black and white.

3) **Author photos:** Head and shoulders shots of authors that appear at the end of our papers.

4) **Tables:** Data charts which are typically black and white, but sometimes include color.

### B. Multipart figures

Figures compiled of more than one sub-figure presented side-by-side, or stacked. If a multipart figure is made up of multiple figure types (one part is lineart, and another is grayscale or color) the figure should meet the stricter guidelines.

### C. File Formats For Graphics

Format and save your graphics using a suitable graphics processing program that will allow you to create the images as PostScript (PS), Encapsulated PostScript (.EPS), Tagged Image File Format (.TIFF), Portable Document Format (.PDF), Portable Network Graphics (.PNG), or Metapost (.MPS), sizes them, and adjusts the resolution settings. When submitting your final paper, your graphics should all be submitted individually in one of these formats along with the manuscript.

## D. Sizing of Graphics

Most charts, graphs, and tables are one column wide (3.5 inches/88 millimeters/21 picas) or page wide (7.16 inches/181 millimeters/43 picas). The maximum depth a graphic can be is 8.5 inches (216 millimeters/54 picas). When choosing the depth of a graphic, please allow space for a caption. Figures can be sized between column and page widths if the author chooses, however it is recommended that figures are not sized less than column width unless when necessary.

There is currently one publication with column measurements that do not coincide with those listed above. Proceedings of the IEEE has a column measurement of 3.25 inches (82.5 millimeters/19.5 picas).

The final printed size of author photographs is exactly 1 inch wide by 1.25 inches tall (25.4 millimeters  $\times$  31.75 millimeters/6 picas  $\times$  7.5 picas). Author photos printed in editorials measure 1.59 inches wide by 2 inches tall (40 millimeters  $\times$  50 millimeters/9.5 picas  $\times$  12 picas).

## E. Resolution

The proper resolution of your figures will depend on the type of figure it is as defined in the “Types of Figures” section. Author photographs, color, and grayscale figures should be at least 300dpi. Line art, including tables should be a minimum of 600dpi.

## F. Vector Art

In order to preserve the figures’ integrity across multiple computer platforms, we accept files in the following formats: .EPS/.PDF/.PS. All fonts must be embedded or text converted to outlines in order to achieve the best-quality results.

## G. Color Space

The term color space refers to the entire sum of colors that can be represented within the said medium. For our purposes, the three main color spaces are Grayscale, RGB (red/green/blue) and CMYK (cyan/magenta/yellow/black). RGB is generally used with on-screen graphics, whereas CMYK is used for printing purposes.

All color figures should be generated in RGB or CMYK color space. Grayscale images should be submitted in Grayscale color space. Line art may be provided in grayscale OR bitmap colorspace. Note that “bitmap colorspace” and “bitmap file format” are not the same thing. When bitmap color space is selected, .TIF/.TIFF/.PNG are the recommended file formats.

## H. Accepted Fonts Within Figures

When preparing your graphics IEEE suggests that you use of one of the following Open Type fonts: Times New Roman, Helvetica, Arial, Cambria, and Symbol. If you are supplying EPS, PS, or PDF files all fonts must be embedded. Some fonts may only be native to your operating system; without the fonts embedded, parts of the graphic may be distorted or missing.

A safe option when finalizing your figures is to strip out the fonts before you save the files, creating “outline” type. This converts fonts to artwork what will appear uniformly on any screen.

## I. Using Labels Within Figures

1) *Figure Axis labels* : Figure axis labels are often a source of confusion. Use words rather than symbols. As an example, write the quantity “Magnetization,” or “Magnetization  $M_z$ ,” not just “ $M_z$ .” Put units in parentheses. Do not label axes only with units. As in Fig. 1, for example, write “Magnetization (A/m)” or “Magnetization ( $A \cdot m^{-1}$ ),” not just “A/m.” Do not label axes with a ratio of quantities and units. For example, write “Temperature (K),” not “Temperature/K.”

Multipliers can be especially confusing. Write “Magnetization (kA/m)” or “Magnetization ( $10^3$  A/m).” Do not write “Magnetization (A/m)  $\times$  1000” because the reader would not know whether the top axis label in Fig. 1 meant 16000 A/m or 0.016 A/m. Figure labels should be legible, approximately 8 to 10 point type.

2) *Subfigure Labels in Multipart Figures and Tables*: Multipart figures should be combined and labeled before final submission. Labels should appear centered below each subfigure in 8 point Times New Roman font in the format of (a) (b) (c).

## J. File Naming

Figures (line artwork or photographs) should be named starting with the first 5 letters of the author’s last name. The next characters in the filename should be the number that represents the sequential location of this image in your article. For example, in author “Anderson’s” paper, the first three figures would be named ander1.tif, ander2.tif, and ander3.ps.

Tables should contain only the body of the table (not the caption) and should be named similarly to figures, except that ‘.t’ is inserted in-between the author’s name and the table number. For example, author Anderson’s first three tables would be named ander.t1.tif, ander.t2.ps, ander.t3.eps.

Author photographs should be named using the first five characters of the pictured author’s last name. For example, four author photographs for a paper may be named: oppen.ps, moshc.tif, chen.eps, and duran.pdf.

If two authors or more have the same last name, their first initial(s) can be substituted for the fifth, fourth, third. . . letters of their surname until the degree where there is differentiation. For example, two authors Michael and Monica Oppenheimer’s photos would be named oppmi.tif, and oppmo.eps.

## K. Referencing a Figure or Table Within Your Paper

When referencing your figures and tables within your paper, use the abbreviation “Fig.” even at the beginning of a sentence. Do not abbreviate “Table.” Tables should be numbered with Roman Numerals.

## L. Checking Your Figures: The IEEE Graphics Analyzer

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See [6], [7].

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J. K. Author, “Title of chapter in the book,” in *Title of Published Book*, xth ed. City of Publisher, State, Country: Abbrev. of Publisher, year, ch. *x*, sec. *x*, pp. xxx–xxx. [Online]. Available: <http://www.web.com>

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## REFERENCES

- [1] G. O. Young, "Synthetic structure of industrial plastics," in *Plastics*, 2<sup>nd</sup> ed., vol. 3, J. Peters, Ed. New York, NY, USA: McGraw-Hill, 1964, pp. 15–64.
- [2] W.-K. Chen, *Linear Networks and Systems*. Belmont, CA, USA: Wadsworth, 1993, pp. 123–135.
- [3] J. U. Duncombe, "Infrared navigation—Part I: An assessment of feasibility," *IEEE Trans. Electron Devices*, vol. ED-11, no. 1, pp. 34–39, Jan. 1959, 10.1109/TED.2016.2628402.
- [4] E. P. Wigner, "Theory of traveling-wave optical laser," *Phys. Rev.*, vol. 134, pp. A635–A646, Dec. 1965.
- [5] E. H. Miller, "A note on reflector arrays," *IEEE Trans. Antennas Propagat.*, to be published.
- [6] E. E. Reber, R. L. Michell, and C. J. Carter, "Oxygen absorption in the earth's atmosphere," Aerospace Corp., Los Angeles, CA, USA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1988.
- [7] J. H. Davis and J. R. Cogdell, "Calibration program for the 16-foot antenna," Elect. Eng. Res. Lab., Univ. Texas, Austin, TX, USA, Tech. Memo. NGL-006-69-3, Nov. 15, 1987.
- [8] *Transmission Systems for Communications*, 3<sup>rd</sup> ed., Western Electric Co., Winston-Salem, NC, USA, 1985, pp. 44–60.
- [9] *Motorola Semiconductor Data Manual*, Motorola Semiconductor Products Inc., Phoenix, AZ, USA, 1989.
- [10] G. O. Young, "Synthetic structure of industrial plastics," in *Plastics*, vol. 3, Polymers of Hexadromicon, J. Peters, Ed., 2<sup>nd</sup> ed. New York, NY, USA: McGraw-Hill, 1964, pp. 15–64. [Online]. Available: <http://www.bookref.com>.
- [11] *The Founders' Constitution*, Philip B. Kurland and Ralph Lerner, eds., Chicago, IL, USA: Univ. Chicago Press, 1987. [Online]. Available: <http://press-pubs.uchicago.edu/founders/>
- [12] The Terahertz Wave eBook. ZOmega Terahertz Corp., 2014. [Online]. Available: [http://dl.z-thz.com/eBook/zomega\\_ebook.pdf.1206\\_sr.pdf](http://dl.z-thz.com/eBook/zomega_ebook.pdf.1206_sr.pdf). Accessed on: May 19, 2014.
- [13] Philip B. Kurland and Ralph Lerner, eds., *The Founders' Constitution*. Chicago, IL, USA: Univ. of Chicago Press, 1987, Accessed on: Feb. 28, 2010, [Online] Available: <http://press-pubs.uchicago.edu/founders/>
- [14] J. S. Turner, "New directions in communications," *IEEE J. Sel. Areas Commun.*, vol. 13, no. 1, pp. 11–23, Jan. 1995.
- [15] W. P. Risk, G. S. Kino, and H. J. Shaw, "Fiber-optic frequency shifter using a surface acoustic wave incident at an oblique angle," *Opt. Lett.*, vol. 11, no. 2, pp. 115–117, Feb. 1986.
- [16] P. Kopyt *et al.*, "Electric properties of graphene-based conductive layers from DC up to terahertz range," *IEEE THz Sci. Technol.*, to be published. DOI: 10.1109/THZ.2016.2544142.
- [17] PROCESS Corporation, Boston, MA, USA. Intranets: Internet technologies deployed behind the firewall for corporate productivity. Presented at INET96 Annual Meeting. [Online]. Available: <http://home.process.com/Intranets/wp2.htm>
- [18] R. J. Hijmans and J. van Etten, "Raster: Geographic analysis and modeling with raster data," R Package Version 2.0-12, Jan. 12, 2012. [Online]. Available: <http://CRAN.R-project.org/package=raster>
- [19] Teralyzer. Lytera ÜG, Kirchhain, Germany [Online]. Available: [http://www.lytera.de/Terahertz.THZ\\_Spectroscopy.php?id=home](http://www.lytera.de/Terahertz.THZ_Spectroscopy.php?id=home), Accessed on: Jun. 5, 2014
- [20] U.S. House. 102<sup>nd</sup> Congress, 1<sup>st</sup> Session. (1991, Jan. 11). *H. Con. Res. 1, Sense of the Congress on Approval of Military Action*. [Online]. Available: LEXIS Library: GENFED File: BILLS
- [21] Musical toothbrush with mirror, by L.M.R. Brooks. (1992, May 19). Patent D 326 189 [Online]. Available: NEXIS Library: LEXPAT File: DES
- [22] D. B. Payne and J. R. Stern, "Wavelength-switched passively coupled single-mode optical network," in *Proc. IOOC-ECOC*, Boston, MA, USA, 1985, pp. 585–590.
- [23] D. Ebehard and E. Voges, "Digital single sideband detection for interferometric sensors," presented at the 2<sup>nd</sup> Int. Conf. Optical Fiber Sensors, Stuttgart, Germany, Jan. 2–5, 1984.
- [24] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.
- [25] J. O. Williams, "Narrow-band analyzer," Ph.D. dissertation, Dept. Elect. Eng., Harvard Univ., Cambridge, MA, USA, 1993.
- [26] N. Kawasaki, "Parametric study of thermal and chemical nonequilibrium nozzle flow," M.S. thesis, Dept. Electron. Eng., Osaka Univ., Osaka, Japan, 1993.
- [27] A. Harrison, private communication, May 1995.
- [28] B. Smith, "An approach to graphs of linear forms," unpublished.
- [29] A. Brahms, "Representation error for real numbers in binary computer arithmetic," IEEE Computer Group Repository, Paper R-67-85.
- [30] IEEE Criteria for Class IE Electric Systems, IEEE Standard 308, 1969.
- [31] Letter Symbols for Quantities, ANSI Standard Y10.5-1968.
- [32] R. Fardel, M. Nagel, F. Nuesch, T. Lippert, and A. Wokaun, "Fabrication of organic light emitting diode pixels by laser-assisted forward transfer," *Appl. Phys. Lett.*, vol. 91, no. 6, Aug. 2007, Art. no. 061103.
- [33] J. Zhang and N. Tansu, "Optical gain and laser characteristics of InGaN quantum wells on ternary InGaN substrates," *IEEE Photon. J.*, vol. 5, no. 2, Apr. 2013, Art. no. 2600111
- [34] S. Azodolmolky *et al.*, "Experimental demonstration of an impairment aware network planning and operation tool for transparent/translucent optical networks," *J. Lightw. Technol.*, vol. 29, no. 4, pp. 439–448, Sep. 2011.



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**Second B. Author** was born in Greenwich Village, New York, NY, USA in 1977. He received the B.S. and M.S. degrees in aerospace engineering from the University of Virginia, Charlottesville, in 2001 and the Ph.D. degree in mechanical engineering from Drexel University, Philadelphia, PA, in 2008.

From 2001 to 2004, he was a Research Assistant with the Princeton Plasma Physics Laboratory. Since 2009, he has been an Assistant Professor with the Mechanical Engineering Department, Texas A&M University, College Station. He is the author of three books, more than 150 articles, and more than 70 inventions. His research interests include high-pressure and high-density nonthermal plasma discharge processes and applications, microscale plasma discharges, discharges in liquids, spectroscopic diagnostics, plasma propulsion, and innovation plasma applications. He is an Associate Editor of the journal *Earth, Moon, Planets*, and holds two patents.

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Mr. Author's awards and honors include the Frew Fellowship (Australian Academy of Science), the I. I. Rabi Prize (APS), the European Frequency and Time Forum Award, the Carl Zeiss Research Award, the William F. Meggers Award and the Adolph Lomb Medal (OSA).