

Changelog history of the IEEEtran LaTeX class.

2015/08/26

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2015/08/26 V1.8b (MDS) changes:

- 1) Added new comsoc mode for the IEEE Communications Society.
This mode (at present) only invokes the use of the newtxmath math fonts.
- 2) Revised IEEEeqnarray column specifications to work with active " (or other punctuation catcode changes) as with babel under the german or ngerman language modes.
Thanks to Stefan M. Moser for reporting this problem.
- 3) Added \indexspace and other index related macros as newer versions of article.cls now do. These macros are needed to avoid an error when using the glossaries package.
Thanks to Sebastian Nyberg for suggesting this change.
- 4) Fixed odd/even page header font bug under comsoc mode and other page style code improvements.
Thanks to Marco Paolieri for reporting this problem.
- 5) Added hooks to allow for easy control of spacing above title.
- 6) Added the \IEEEEnoauxwrite command.
Thanks to Sudarshan Mukherjee for suggesting this feature.

2014/09/17 V1.8a (MDS) changes:

- 1) Extensive rework of the comsoc mode to comply with the latest standards
of the IEEE Computer Society.
- 2) Internal code improvements for page setup and command argument processing.
- 3) Fixed abstract, index terms and diamond line for comsoc technotes.
Thanks to Dimitris Schinianakis for reporting this problem.
- 4) New cspaper option to support the special trim paper size (7.875in x 10.75in) used in actual Computer Society journals. For comsoc journal mode, typesetting will not be altered by the use of this option.
- 5) New \IEEEraisesectionheading{} command to provide for the special raised first section heading of Computer Society journal papers.
- 6) Increased \clubpenalty, \widowpenalty, \displaywidowpenalty to discourage paragraph breaks at the first and last lines.

Thanks to Dirk Beyer for suggesting this change.

7) Added lines per column console message.

2012/12/27 V1.8 (MDS) changes::

- 1) New transmag class option to support the IEEE Transactions on Magnetism format. Thanks to Wei Yingkang, Sangmin Suh and Benjamin Gaussens for suggestions and beta testing.
- 2) The `\IEEEcompsocitleabstractindextext` and `\IEEEdisplaynotcompsocitleabstractindextext` commands have been deprecated in favor of their `\IEEEtitleabstractindextext` and `\IEEEdisplaynontitleabstractindextext` (observe that the "not" has changed to "non") equivalents. This change generalizes and decouples them from compsoc mode because the new transmag mode also uses them now.
- 3) Added new *-forms of `\IEEEyesnumber*`, `\IEEEnonumber*`, `\IEEEyessubnumber*`, and `\IEEEnosubnumber*` (the non-star form of the latter is also new) which persist across `IEEEeqnarray` lines until countermanded. To provide for continued subequations across instances of `IEEEeqnarrays` as well as for subequations that follow a main equation (e.g., 14, 14a, 14b ...) `\IEEEyessubnumber` no longer automatically increments the equation number on it's first invocation of a subequation group. Invoke both `\IEEEyesnumber\IEEEyessubnumber` together to start a new equation/subequation group.
- 4) Hyperref links now work with `IEEEeqnarray` equations. Thanks to Stefan M. Moser for reporting this problem.
- 5) Fixed `\markboth` so that it does not cause an error with `babel.sty`. Thanks to Frank Meier for suggesting this change.
- 6) Change all instances of `~` to `\nobreakspace` to avoid

! Argument of `\language@active@arg~` has an extra }

figure caption error with `babel.sty` under spanish. Thanks to Manuel Olivares and Javier Bezos for suggesting this change.
- 7) Allow line breaks within long theorem names. Thanks to Miquel Payaro for suggesting this change.
- 8) Revised `\IEEEeqnarraymulticol{}` to allow inner alignments without requiring extra containing braces to prevent an incomplete `\ifx` error. Thanks to Stefan M. Moser and Auke van der Valk for reporting this problem.

- 9) Revised spacing at top of top figures and tables to better align with the top main text lines as IEEE does in its journals. Thanks to Dirk Beyer for reporting this issue and beta testing.
- 10) Removed support for legacy IED list commands, legacy QED and proof commands and the legacy biography and biographynophoto environments. IEEEtran no longer defines or references \labelindent so as to avoid namespace problems with list packages that define it. Thanks to Sven Köhler for reporting the problem with enumitem.sty.

2007/03/05 V1.7a (MDS) changes:

- 1) Corrected problem of unwanted two column peer review title page format.
Thanks to Virgilio Rodriguez for reporting this bug.
- 2) "deprecated" -> "deprecated". Thanks to Virgilio Rodriguez for suggesting this change.

2007/01/11 V1.7 (MDS) changes:

- 1) New class option compsoc to support the IEEE Computer Society format.
- 2) New class option captionsoff disables the display of figure/table captions. endfloat.sty is now mentioned in the docs. Thanks to Geoff Walker for suggesting these changes.
- 3) Fixed compatibility issues with subfig.sty and caption.sty. Thanks to Steven Douglas Cochran and Axel Sommerfeldt for suggesting this change.
- 4) New \CLASSINPUT, \CLASSOPTION and \CLASSINFO interface allows for more user control and conditional compilation.
- 5) \ifcenterfigcaptions (\centerfigcaptionstrue, \centerfigcaptionsfalse), \CMPARstart and \overrideIEEEEmargins have been removed and no are longer supported. The effect of \overrideIEEEEmargins can be mimicked via the more general \CLASSINPUT interface:
% US letter paper:
\newcommand{\CLASSINPUTinnersidemargin}{0.775in}
\newcommand{\CLASSINPUToutersidemargin}{0.585in}
% A4 paper:
\newcommand{\CLASSINPUTinnersidemargin}{17mm}
\newcommand{\CLASSINPUToutersidemargin}{11.647mm}
- 6) Several commands and environments have been deprecated in favor of replacements with IEEE prefixes to better avoid potential future name clashes with other packages. Legacy code retained to allow the use of the obsolete forms (for now), but with a warning message to the console during compilation:

```
\IEEEauthorblockA, \IEEEauthorblockN, \IEEEauthorrefmark,  
\IEEEbiography, \IEEEbiographynophoto, \IEEEkeywords, \IEEEPARstart,  
\IEEEproof, \IEEEpubid, \IEEEpubidadjcol, \IEEEQED, \IEEEQEDclosed,  
\IEEEQEDopen, \IEEEspecialpapernotice. IEEEtran.cls now redefines  
\proof in way to avoid problems with the amsthm.sty package.  
For IED lists:  
\IEEEiedlabeljustifc, \IEEEiedlabeljustifl, \IEEEiedlabeljustifyr,  
\IEEEnocalcleftmargin, \IEEElabelindent, \IEEEsetlabelwidth,  
\IEEEusemathlabelsep
```

- 7) These commands/lengths now require the IEEE prefix and do not have legacy support: `\IEEEnormaljot`.
For IED lists: `\ifIEEEnocalcleftmargin`, `\ifIEEElabelindentfactor`, `\IEEEiedlistdecl`, `\IEEElabelindentfactor`
- 8) `\normalsizebaselineskip skip` replaced by `\CLASSINFOnormalsizebaselineskip` (nonrubber dimen) length.
Also, new `\CLASSINFOnormalsizeunitybaselineskip` (nonrubber dimen) provided.
- 9) Now defaults to using Alpha numbering rather than Roman for appendices numbering. This is because Alpha numbering is more common and avoids problems with theorem numbering. `\ifuseRomanappendices` (`\useRomanappendicestrue`, `\useRomanappendicesfalse`) is no longer supported. Instead, use the new class option `romanappendices` if Roman appendices numbering is desired. Thanks to Leonid Mirkin for reporting the problem with theorems in appendices and suggesting changes.
- 10) Improved paper size setting code for `pdflatex`.
- 11) Better handling of theorem numbering when using the section counter within the `appendix(cies)`. Thanks to Leonid Mirkin for suggesting this change.
- 12) Fixed bug that caused equations at the end of theorems to be too close to the line below them.
- 13) Provided hook to conference mode console notice and changed notice to better support conferences that use A4 paper. Thanks to Volker Kuhlmann for suggesting this change.
- 14) `\IEEEauthorrefmark` made robust to allow it to be used in `\thanks` without a leading `\protect`
- 15) Improved `\textunderscore` to provide a much better fake `_` when used with OT1 encoding. Under OT1, detect use of `pcr` or `cmtt` `\ttfamily` and use available true `_` glyph for those two typewriter fonts.
- 16) Revised internal `\@sect` command to be more robust for users who employ modified section heading formats. Thanks to Zarko F. Cucej for suggesting this change.

- 17) Improved `\thesubsubsection` definition to prevent breaks at the hyphen.
Thanks to Moritz Borgmann for suggesting this change. Thanks to Dan Luecking and Heiko Oberdiek for explaining some of the various alternatives and techniques to fix it.
- 18) No longer provide `\NAT@parse` hack to get `cite.sty` to play (somewhat) with `hyperref.sty` as this is already included in `cite.sty` version 4.0 (2003-05-27) and later.
- 19) At the beginning of document, set the default style of `url.sty` to be the same as the current text font - as is done in IEEE journals.
- 20) Corrected excessive line spacing in journal table captions. Thanks to Moritz Borgmann for suggesting this change.
- 21) Corrected `\thesubsubsection` to use the "I-A1" format IEEE uses rather than "I-A.1" as was done before. Ditto for `\theparagraph`. Thanks to Moritz Borgmann for suggesting this change.
- 22) Enclose `papersize` specials within `\AtBeginDvi` in case someone wants to make a format with `IEEEtran`. Thanks to Moritz Borgmann for suggesting this change.
- 23) Eliminated the small space after abstract and keywords dash as IEEE now does. Thanks to Moritz Borgmann for suggesting this change.
- 24) `IEEEkeywords` is no longer locked out in conference mode
- 25) Increase defaults of `\binoppenalty` and `\relpenalty` to discourage breaks within equations. Thanks to Moritz Borgmann for suggesting this change.
- 26) Support optional argument for `IEEEproof`. Thanks to Ingo Steinwart for suggesting this change. Also, start a new `\par` with `\IEEEproof`.
- 27) Add support for an optional argument to `\bstctlcite`.
- 28) Changed `\topfraction` and `\dbltopfraction` from 1.0 to 0.9. Thanks to Donald Arseneau for suggesting this change.

2005/09/13 V1.6c (MDS) changes:

- 1) Changed `endfigure/endfloat` definitions so as not to cause problems with `preview-LaTeX` and other packages. Thanks to Stephan Heuel and David Kastrup for reporting this problem.

2002/11/18 V1.6b (MDS) changes:

- 1) Fixed problem with figure captions when using `hyperref`. Thanks to Leandro Barajas and Michael Bassetti for reporting this bug.

2) Provide a fake nabib command `\NAT@parse` so that `hyperref` will not interfere with the operation of `cite.sty`. However, as a result citation

numbers will not be hyperlinked. Also, `natbib` will not be able to work

with `IEEEtran`. However, this is perhaps the best solution until `cite.sty` and `hyperref.sty` are able to co-exist with each other.

It easy enough to override the fake command via:

```
\makeatletter
\let\NAT@parse\undefined
\makeatother
```

3) Revised font selection method so as not to have problems when used with `setspace.sty`. Thanks to Zhang Yan for reporting this bug.

4) Added `\special` to feed `papersize` to `dvips`. Thanks to Moritz Borgmann for suggesting this feature.

5) In addition to the IEEE IED lists, the original IED style list environments (as is done in `article.cls`) are now provided as `LaTeXitemize`, `LaTeXenumerate`, and `LaTeXdescription`. Also, users can now redefine `\makelabel` within IEEE IED list controls. There may be some use for this in specialized applications. Thanks to Eli Barzilay for suggesting this feature.

6) `\table*` now defaults to `\footnotesize` text like `\table`.

7) The draft modes now no longer force a pagebreak after the title. Thanks to Christian Peel for suggesting this change.

8) New `draftclsnofoot` mode is like `draftcls`, but does not display the date and the word "DRAFT" at the foot of the page. Thanks to Christian Peel for suggesting this feature.

9) New `peerreview` and `peerreviewca` modes with `\IEEEpeerreviewmaketitle` command allows for a "cover" titlepage for anonymous peer review. Except for the cover titlepage, `peerreview` is much like journal mode. `peerreviewca` is like `peerreview`, but allows the author names to be entered and formatted as under conference mode so that author affiliations and contact information can be easily seen on the cover page. Thanks to Eric Benedict for suggesting this feature.

2002/08/13 V1.6 (MDS) changes:

1) Added conference mode via `conference` option. Defaults to the traditional journal mode. e.g., `\documentclass[conference]{IEEEtran}`

2) Added support for A4 paper via new `a4paper` option. `Pdflatex`'s paper size lengths are now automatically set to the proper paper size being used.

3) Revised margins again. Page text is now horizontally centered. Conference mode increases the top and bottom margins with the bottom margin being slightly larger. For A4 paper, the top margin and text

typesetting will not change from those of US letter paper, but the side margins will be smaller and the bottom margin will be larger than that of US letter. All per IEEE specs.

- 4) Fixed footnote line spacing anomaly in draft mode. Thanks to Alberto Rodriguez for reporting this bug.

Also, slightly revised footnote and `\thanks` note spacing. Set `\interfootnotelinepenalty=10000` to prevent LaTeX from breaking footnotes across multiple pages or columns.

- 5) Fixed bug that caused overwritten photo areas and sometimes anomalous spacing when a new paragraph was started within a biography. Also, the presence of `\par's`, new lines or spaces at the beginning of abstract, keywords, biography, or biographyphoto will no longer affect the first word spacing. Thanks to Eric Durant for reporting this bug.

The biography environment now does a better job in preventing a biography photo area from being broken across pages or columns.

- 6) Fixed whitespace between `\cite` entries bug. i.e., both `\cite{einstein24, knuth84}` and `\cite{einstein24, knuth84}` are now valid. `\cite` is now a robust command as it should be. IEEEtran now no longer defines the old non-standard `\shortcite` or `\citenam`.

The base IEEEtran.cls does not sort citation numbers or produce ranges for three or more consecutive numbers. However, V1.6 of IEEEtran.cls now pre-defines the following format control macros to facilitate easy use with Donald Arseneau's `cite.sty` package (tested with `cite.sty` V3.9):

```
\def\citepunct{[, []}
\def\citedash{--[]}
```

`cite.sty` is standard on most LaTeX systems and can be obtained from www.ctan.org. Thanks to Donald Arseneau for creating `cite.sty`, providing the required format arguments to produce the IEEE style and designing a cite interface capable of handling the IEEE citation style.

Note: Historically, IEEE has wanted authors to "hardcode" symbolics. (i.e., replace all `\cite{}` with fixed [x]). However, it now seems that most electronic manuscript submissions to IEEE are in .pdf format, and as such, do not require the LaTeX document reference numbers to be hard coded. If an author is required to submit actual LaTeX files, I do recommend that the bibliography file (.bbl) be copied into the .tex document and the `\bibliographystyle{}` and `\bibliography{}` commands be commented out so that the .tex file does not depend on (potentially lengthy and/or confidential) external bibliography database files

7) Adjusted some spacing parameters. The spacing above and below equations

has been revised (to a typical IEEE value). `\jot` now has a decent value.

The title text is now exactly 24pt. (On a related note, `\fontsubfuzz` has

been increased to 0.9pt to prevent annoying font substitution warnings

when using the Computer Modern fonts that use the 24.88pt size.)

In V1.6, `\small` is now 8.5pt in 9pt docs because `\footnotesize` is 8pt.

For 9pt docs, you should probably go ahead and use `\footnotesize` when you need text a little smaller than `\normalsize`.

The interword spacing has been adjusted to be extremely close to that which IEEE uses. You can use a new class option, `nofonttune`, if you need

to disable the adjusting of the interword spacing. This adjustment and

an increase to `\hyphenpenalty` have greatly reduced the amount of hyphenation in a typical paper.

The `baselineskip` for the `normalsize` fonts has been tweaked to reduce

`underfull vbox`s on journal paper columns with only paragraphs.

Conference mode does the same thing but by also tweaking the `\textheight`

slightly off 9.25in (IEEE spec) to ensure an integer number of lines per

page. Draft (also `draftcls`) mode has also been revised to reduce `underfull vbox` warnings. However, draft mode can still produce

`underfull`

`vboxes` (a direct result of the increase in line spacing and margins)

if:

A non-`normalsize` font occupies an entire column (abstract and index terms take up a whole column by themselves); or the beginning of a section occurs near the end of a column and cannot be squeezed into

the

bottom, etc. This is normal as draft mode's liberal spacings cannot guarantee perfect formatting.

8) New `biographynophoto` environment for biographies without photos.

Usage:

```
\begin{biographynophoto}{author name}
biography text here
\end{biographynophoto}
```

9) Fixed bug that produced multiple table of contents entries for papers with more than one biography. Also, biography now works better with `hyperref`.

10) New `\sublargetsize` font size command provides for 11pt text in a 10pt document. (Needed for things like author names.) For documents not using 10pt normal size text, `\sublargetsize` is currently identical to `\large`.

11) New `\IEEEmembership` command to provide correct font to indicate IEEE membership for journal papers.

12) Fixed author name line overflow problem when in journal mode. This problem had been introduced in V1.5 in my rush to get `\and` to work for conferences. `\and` is unneeded (and invalid) in journal mode. For conference mode, `\and` will work as expected and features an optional spacing argument. i.e., `\and[\hspace{5ex}]` `\and` will default (recommended) to using `\hfill` which will result in equal spacing between author blocks.

13) New `\authorblockN`, `\authorblockA` and `\authorrefmark` commands to facilitate easy formatting of author names, affiliations and cross reference symbols, respectively, when in conference mode. These three commands are to be used only for conference papers. In conference mode, `\author` text is placed within a modified tabular environment (somewhat like `article.cls`). So, within `\author` in conference mode, you should not try to enclose multiple `\\` within an environment or command (other than the argument braces of `\authorblockX{}`). For example:

```
\author{\authorblockN{{John Doe \\ Jane Doe}}} % WRONG!
```

will generate an error.

Note that font size/attribute changes will now persists across `\\` within `\author`. (But, not across author blocks nor across `\and`.) However, with the new commands, there should be no need to alter any font attributes within `\author`. All text sizing and spacing within `\author{}` and the author block commands is per IEEE specs for both conference and journal modes. (In conference mode, the author names are only very slightly larger than the affiliations which are in normal

size.) For specialized applications you can alter the justification of author lines by placing `\hfill` at the beginning or at the end of a line.

The interline spacing within `\author` is determined by the font attributes that are in effect at the end of each line within `\author`.

14) Because the titles and author name blocks use different font sizes/styles from the main text, it was possible that two column papers with titles that span both columns (standard journal and conference papers, but not technotes) with certain numbers of lines for the title and authors' name/affiliations can cause underfull vbox problems (paragraphs with large spacings between them) in the second column of the main text on the title page - if there were no new sections, equations or figures in this column (they would provide some needed rubber spacing). The use of things like special paper notices and publisher ID marks also affected this issue. The problem could not happen in the first column because the first column has a rubber length around the heading of the first section. Furthermore, problems seldom occurred on pages after the first as the margins had been chosen not to cause it with the popular font sizes. Rubber lengths after the author names would not fix this problem.

Auto-calculating a "good" spacing after the title is a tad difficult to do in LaTeX. However, I am pleased to report that V1.6 has this new capability - "dynamically determined title spacing". IEEEtran will now measure the height of all the title and author text in `\maketitle` and then calculate a rigid (non-rubber) spacer to follow that meets IEEE specs and also produces a `\textheight` on the title page that ensures an integer number of normalised lines on the rest of the page. Single column papers, and two column papers with the title entirely in column one (technotes) do not need dynamic rigid spacing and therefore use standard rubber spacers.

Note: This problem can still crop up if you use floats that span both columns (i.e., figure*). It has been a decade+ long limitation with LaTeX that the stretchable portion of `\dbltextfloatsep` is ignored. If you get a problem with underful vbox warnings and paragraphs that "are pulled apart" on page with a float that spans both columns, tweak the space between the figure and the main text a little:

```
\vskip 5pt
\end{figure*}
```

If you can't find a value that fixes both columns, you are going to have to put a rubber spacer somewhere in one or both of the columns.

15) Because of change #14 above, those of you using `\pubid` will, as of V1.6,

intended have to place it *before* `\maketitle` in order for it have the

affect. The dynamic spacer algorithm must see if you are using `\pubid` when `\maketitle` is called. `\pubidadjcol` works as before except that

it now has additional logic to prevent it from doing anything if `\pubid` was never called.

16) In some unusual, non-standard circumstances, an author may desire to alter the spacing after the title area or put some unusual text above the main text. For instance, to stop a bad break when a new section occurs right at the start of the second page. This is difficult to do when the title spans both columns of two column text since LaTeX

treats such title text as a type of float. A new command, `\IEEEaftertitletext{}`, gives access to the end of that produced by `\maketitle`. The types of things that can go into `\IEEEaftertitletext` are the same as those into `\twocolumn[]` - no `\par`, but `\\` are OK.

There is no restriction on the range of spacings that can be used. e.g., `\IEEEaftertitletext{\vspace{-100pt}}` will push the main text well

into the title and `\IEEEaftertitletext{\vspace{100pt}}` will push it far down

the page. You will have complete control. If used, place `\IEEEaftertitletext{}` before `\maketitle` like `\title` and `\author`.

IEEEtran's dynamic title spacing intentionally does not take into consideration the contents of `\IEEEaftertitletext{}` when determining the spacer after the title area (otherwise it would try to second guess you), so the user will have manually adjust the height of the contents in `\IEEEaftertitletext{}` if the problem discussed in #14 above

should develop. A safe bet is to keep the height of contents of `\IEEEaftertitletext{}` to integer multiples of `\baselineskip`, e.g., `\IEEEaftertitletext{\vspace{-1\baselineskip}}`

Because it can result in an IEEE nonstandard format, the use of `\IEEEaftertitletext{}` is discouraged. Possible uses include (1) the use

of IEEEtran for non-IEEE work with different title spacing requirements,

or (2) as an emergency manual override if a problem should develop in IEEEtran's automatic spacing algorithm.

17) completely rewritten `\PARstart` to:

- a. no longer have problems when the user begins an environment within the paragraph that uses `\PARstart`.
- b. auto-detect and use the current font family
- c. revise handling of the space at the end of the first word so that interword glue will now work as normal.
- d. produce correctly aligned edges for the (two) indented lines.

Because the current font family is now auto-detected, there is no longer any need for `\CMPARstart` - it is now the same as `\PARstart`.

18) There is now a new "open box" Q.E.D. symbol (`\QEDopen`) as well as the original default (`\QED`) closed one (`\QEDclosed`). Some journals use the open form. To make `\proof` use the open form, just do:
`\renewcommand{\QED}{\QEDopen}`

19) Additional `\typeout{}` notices added to warn the user when unusual settings/commands are detected or as reminders to avoid common errors when in conference mode.

20) IEEEtran now provides `\abovecaptionskip` and `\belowcaptionskip` skip registers because article class provides them and some packages may error if they are missing. However, IEEEtran only uses `\abovecaptionskip` for actual caption spacing.

21) Fixed bug that prevented users from redefining the section headings to use arabic digits. Thanks to Richardt H. Wilkinson for reporting this bug.

22) Code cleaned up to be more efficient with the use of TeX registers; removed some old LaTeX 2.09 code; revised option processing to LaTeX2e standard; eliminated unwanted "phantom" spaces in some environments.

23) Added new `\IEEEeqnarray`, `\IEEEeqnarraybox`, `\IEEEeqnarrayboxm` and `\IEEEeqnarrayboxt` environments to provide superior alternatives to the

standard LaTeX `\eqnarray`, `\array` and `\tabular`. Additional new support commands include `\IEEEeqnarraydecl`, `\IEEEeqnarrayboxdecl`, `\IEEEeqnarraymathstyle`, `\IEEEeqnarraytextstyle`, `\yesnumber`.

`\IEEEnonnumber`, `\IEEEyesnumber`, `\IEEEyessubnumber`,
`\IEEEeqnarraynumspace`,
`\IEEEeqnarraymulticol`, `\IEEEeqnarrayomit`, `\IEEEeqnarraydefcol`,
`\IEEEeqnarraydefcolsep`, `\IEEEeqnarrayseprow`, `\IEEEeqnarrayseprowcut`,
`\IEEEeqnarrayrulerow`, `\IEEEeqnarraydblrowcut`,
`\IEEEeqnarraystrutmode`, `\IEEEeqnarraystrutsize`,
`\IEEEeqnarraystrutsizeadd`, `\IEEEvisiblestrutstrue`,
`\IEEEvisiblestrutfalse` and `\IEEEstrut`.
These are documented in the user's guide.

- 24) V1.6 changed back to using `()` around theorem names (which are also now in italics) as this is what IEEE is using now. Thanks to Christian Peel for reporting this. Also, when section numbers are used as the first part of theorem numbers, display them in arabic, not Roman.
- 25) New `\IEEEtriggeratref{X}` command allows a page break to be triggered just before the given reference number "X". This is most useful when balancing the columns on the last page and a `\newpage` between references is desired. `\IEEEtriggercmd{X}` allows a different command to be executed at trigger.

2001/07/26 V1.5 (MDS) changes:

1) Fixed `\and` within `\author` bug: (! Misplaced `\crrc`. `\endtabular` - `>\crrc`)
Thanks to Rainer Dorsch for discovering and reporting that `\and` did not work.

2) Fixed the biography environment so that if a biography's text is shorter than the area allocated for the photo, a collision with the next biography does not occur. You can now put real graphics (using the `graphicx` package) into the biography photo box with a new optional argument of the biography command! For example:

```
\begin{biography}[\includegraphics[width=1in,height=1.25in,clip,keepaspectratio]{./tux.eps}]{Linux Penguin}
```

will use the specified graphic as the author's photo. The photo area is exactly 1in wide by 1.25in high - as is done in IEEE Transactions.

Try to keep the same 4:5 aspect ratio if scanning/cropping your photos. Note the need for the extra set of enclosing braces around the `\includegraphics`. Without it, The LaTeX parser may get confused when it sees the `\includegraphics`'s brackets within the biography's optional argument. Due to the length of the `\includegraphics` command, you may wish to define your own shorthand form of it. I have not done so with `IEEEtran` to prevent dependence on the `graphicx` package. If you do not

use the optional argument, or leave it empty, a standard frame box with the words "Place Photo Here" will be used. If you want the space to remain completely empty, you can do:

```
\begin{biography}[\mbox{}]{The Invisible Man}
```

The interface to biography's optional argument is into a `1in X 1.25in` minipage in which the argument text is centered both horizontally and vertically:

```
\begin{minipage}[b][1.25in][c]{1in}%
\centering
#1%
\end{minipage}
```

Within the biography environment, `\unitlength` is set to `1in`. With this in mind, you can even design your own custom frameboxes. For instance:

```
\begin{biography}[\framebox(1,1.25){\parbox[][\height
][c]{0.9in}{\centering PLACE\ PHOTO\
HERE}}]{Author Name}
```

will yield the same type of result as the default photo box.

Thanks to Herbert Voss for discovering the collision bug, suggesting the ability to handle graphics and providing some prototype code.

2001/03/15 V1.4 (MDS) changes:

- 1) New "draftcls" and "final" options have been added. Thanks to Dragan Cvetkovic for suggesting an option like draftcls.
- 2) Documentation changes to reflect the fact that this IEEEtran.cls is no longer beta test.
- 3) Slightly revised caption sizes. Figure and table captions are now in `\footnotesize`, not `\small` as before.
- 4) Allow user to control figure caption justification. IEEEtran.cls normally defaults to left justified as is done in Transactions. However, for conferences, you may wish to issue the command:
`\centerfigcaptionstrue`
in the preamble. Short (less than one line long) figure captions will then be centered. Multi-line figure captions will always be properly left justified. V1.6: This is already done for you when using the conference mode.

2001/01/18 V1.3

Michael Shell (MDS) made extensive changes and additions:

BUGS FIXED (and many others too numerous to mention!):

- 1) Fixed improper alignment with itemized, enumerated and description lists. Added new controls to these three environments so that it is easy to get the alignment IEEE uses. Furthermore, the itemize, enumerate and description lists no longer force a new paragraph to begin at the end the list (`\par`). (Sometimes lists are used within paragraphs.)
- 2) JVH's fixes now allow things like $\mathbf{N}(0, P(0))$ to work properly without needing the extra braces: $\{\mathbf{N}\}(0, P(0))$. There is no longer any dependence on the "rawfonts" and "oldlfont" packages. Thanks Juergen!
- 3) Fixed underfull hbox errors and incorrect reference number alignment when the number of references in the bibliography exceeded 9 entries (which is almost every paper!).
- 4) Removed dependence on the LaTeX `sizexx.clo` files. Now, 9pt documents should work correctly even on systems that lack a `size9.clo` file. This is most often used in conjunction with the option "technote" for "correspondence" papers like those in IEEE Transactions on Information Theory. For virtually all other papers, 10pt is used and so it is the default. Some improper font sizes have been corrected. `\footnotesize` is now 8pt in 9pt docs, so footnotes in technotes should be the correct size now.
- 5) Added `\interlinepenalty` within the bibliography section to discourage LaTeX from breaking within a reference. IEEE almost never breaks within a reference and when they do it is usually in technotes (correspondence papers). You may get an underfull vbox warning in the bibliography indicating that the spacing just before the "REFERENCES" section is larger than normal, but the final result will be more like what IEEE will publish. See the comments in the BIBLIOGRAPHY section around line 2034 below if you want to change this behavior.
- 6) No longer "blows up" when you use `\paragraph` and have a table of contents.
- 7) Theorem environment changed, (but for V1.6, back to the old way, sigh).
- 8) Figure captions adjusted: IEEE left (not center) justifies figure captions (for journals) and does not indent figure caption text.
- 9) Adjusted some spacings in the table of contents(TOC)/list-of-figures/
list-of-tables so that section/table numbers will not so easily collide with the titles. Section VIII was usually the worst offender. Still doesn't right justify the section numbers, but neither does `article.cls` (This must be why LaTeX likes the x.y.z section numbering scheme unlike I, II, III, etc. of IEEE.)
It may be "normal" as it is (left justified). sigh.
- 10) Now uses "index terms" now as a heading instead of "keywords".

Furthermore, the "index terms" and "abstract" headings are in bold italic. This is how IEEE does things.

11) \thebibliography and \biography now put entries into the table of contents for you.

2000/09/06 (JVH) changes: (now designated as V1.2)

made some corrections to get closer to LaTeX2e
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1996 (JWD) LaTeX2e version: (now designated as V1.1)

In the most recent TeXhax digest, there was a request for a copy of IEEEtrans.sty modified to work with LaTeX2e. I have a version I modified to make it IEEEtrans.cls, which I have sent to the person making the request and am now sending to you to consider posting to the archives.

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30-August-1993 original LaTeX 2.09 version (IEEEtran.sty),
(now designated as V1.0):

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