AMS Author Handbook Journal Classes

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CHAPTER 1

Introduction

This handbook is directed mainly to authors preparing material for publication by the American Mathematical Society (AMS), using AMS-IFTEX document classes. As such, it deals with the AMS publishing style. Since these document classes are also used by authors who are not submitting items to the AMS, the handbook also covers topics of more general relevance. However, it assumes familiarity with standard IFTEX techniques and conventions, and contains only material specific to AMS packages.

The tagging of elements in a manuscript—title, author(s), section headings, theorems, etc.—is consistent through all AMS author packages, and the structure of elements in the body is based on that of the original LATEX document classes. Thus a manuscript prepared using an appropriate generic document class can be modified trivially to use a more specific AMS document class, simply by updating the \documentclass statement and making a few adjustments to the tagging of data in the top matter. For example, specify the journal *Proceedings of the Americam Mathematical Society* as follows: \documentclass{proc-1}

Table 1. The AMS Journal series.

Code	Full Journal Name
bull	Bulletin (New Series) of the American Mathematical Society
ecgd	Conformal Geometry and Dynamics
jag	Journal of Algebraic Geometry
jams	Journal of the American Mathematical Society
mcom	Mathematics of Computation
qam	Quarterly of Applied Mathematics
proc	Proceedings of the American Mathematical Society
ert	Representation Theory
spmj	St. Petersburg Mathematical Journal
suga	Sugaku Expositions
tpms	Theory of Probability and Mathematical Statistics
tran	Transactions of the American Mathematical Society
mosc	Transactions of the Moscow Mathematical Society

The AMS-IATEX packages are available from:

www.ams.org/authors/journalpackages

For more information, see Chapter 5.

CHAPTER 2

Using the journal classes

1. The basic checklist

Some basic principles are important for effective handling of electronic submissions. Keep these principles in mind when preparing and submitting your files.

- Use the **template** supplied in the author package for your particular publication and the appropriate document class.
- Do not modify page sizes or other **dimensions**. Page sizes must conform to the specifications of the publication for which you are preparing your manuscript.
- Use only "public" packages available from CTAN (the Comprehensive TEX Archive Network).
- All of the AMS document classes incorporate the code for the AMS theorem (amsthm) package and automatically load the amsmath package. It is not necessary to request either one explicitly. Except for a brief overview of how to activate theorems (see page 9), the details will not be repeated here; see the user guides for these packages [ATH, AMG]. The amsfonts package is loaded as well, unless the [noamsfonts] option is specified; see the AMSFonts User's Guide [AFG] for the features provided.
- Do not redefine any existing LATEX or \mathcal{AMS} -LATEX commands.
- Put definitions for frequently occurring mathematical expressions together in the preamble, before the start of the text of the manuscript. Macros should be defined with \newcommand, not with \def. Once a macro is created for an expression, use it for every occurrence of that expression.
- Do not use **author-defined macros** in author names, titles, section and theorem headings, or references; use only standard commands. Do not hard-code font changes. Use TEX coding for special fonts (e.g., boldface or italic) only within the text of the manuscript.
- Avoid the use of math in the title and in other headings. **Titles** are provided to on-line bibliographic services for indexing. Use of TEX math coding (especially dollar signs) will result in inaccurate bibliographic listings, and problematic PDF bookmarks.
- Determine the **2010 Mathematics Subject Classification** numbers representing the primary and secondary subjects of the work. A list of these numbers can be found on the web at www.ams.org/msc.
- Make sure that **graphics** do not extend into the margins; the width of the text may vary depending on the journal. Check that all graphics conform to the AMS graphics guidelines—see Chapter 3, page 21.
- Do not use TEX coding to control **line and page breaks**. Lines and pages may break differently in the published article from the way they break in the file you submit. If you insert TEX coding for line and page breaks, it will have

to be removed for production. This work could offset any time saved by your keyboarding the manuscript, and any change to your TEX file creates a small chance of additional errors being introduced.

- Avoid explicit horizontal and vertical spacing commands for the same reason.
- For displayed equations, the AMS style requires equation numbers to be on the left, flush with the left margin. See section 5.7, page 14.
- File names should not exceed 20 characters in length, and consist only of numeric or unaccented alphabetic characters. Avoid overly generic file names such as article.tex, mybib.tex or fig1.eps.
- Use \cite to indicate citations in the manuscript. The \cite command may not appear in an abstract.
- Include all available information for **references**; use the abbreviations for journals and book series from [ABMR], either in print or on the web. All references will be replaced in production by corresponding entries in amsrefs form drawn from MathSciNet (see section 7.1, page 16).
- Include the research **address** or institutional affiliation and current address (if different) of each author. Email addresses and URLs may be included optionally. Email addresses will appear in articles posted online; URLs will not; both will appear in print.
- Proofread your article thoroughly and carefully.
- **Verify** that author-submitted source files exactly match the accepted reference copy of the article.

2. A checklist for using AMS journal classes

- Most AMS journals are published both in print and on line. In order to expedite processing, the following restrictions are placed on journal articles:
 - Only "public" macro packages (packages available from CTAN, the Comprehensive T_EX Archive Network) may be used.
 - Other macro definitions must be embedded in the preamble of the article file. Files must be able to be processed independently with all macros (not entire macro files) included.
 - Macros should be defined with \newcommand, not with \def.
- The hyperref package will be added by AMS staff at the appropriate stage of the production process primarily for the purpose of adding PDF bookmarks. This will also affect internal cross-references and external URLs.
- The first page of an article must contain a **descriptive title**. This title should be short, but informative; avoid useless or vague phrases such as "some remarks about" or "concerning".
- For article titles, only the first word, the first word after a ':' and proper nouns should be capitalized. Supply a shortened form of the title if the full title is too long for the running head, which cannot exceed 24 picas (10 cm.).
- The running heads on the left-hand (even-numbered) pages should have the name(s) of the author(s) in uppercase letters. Names in running heads should match the names as given on the first page. Shortened forms must be provided if necessary to fit on one line, leaving room for the page number. Uppercasing will be applied automatically if you are using AMS style files.

- All AMS journal articles (except book reviews) must contain an **abstract**. The abstract should contain no \cites or text references to the bibliography unless the bibliographic reference is fully supplied. For example, [3] is meaningless to the reader once the abstract is separated from the article.
- Give information on **grants** or contracts under which the research was performed, including grant number, using the **\thanks** command.
- Unmarked, unnumbered **footnotes on the first page** of an article should include primary classification numbers according to the 2010 Mathematics Subject Classification scheme (www.ams.org/msc) (required); grant information (optional); and key words and phrases describing the subject matter of the article (optional). Formatting is automatic when using the AMS style files.
- All bibliographic data must be incorporated into the article file. If you are using amsrefs, include this data in the appropriate place. If you are using BibTEX, insert the contents of the .bbl file into your .tex file; do not send the .bib file. Be aware that BibTEX data will be updated, in amsrefs form, by data drawn from MathSciNet. These are called "enhanced references"; see section 7.1, page 16.
- Academic or other **affiliations** should appear at the end of your article, after the bibliography or references. A **current address**, if different from the affiliation, should follow the affiliation on a separate line. An **email address** should be included if available. Addresses are part of the top matter in AMS author packages; formatting is taken care of automatically by the AMS style files.
- A Consent to Publish and Copyright Agreement is sent to the author(s) when the accepted work is received at the AMS. Production of your work begins once the signed form is received by the AMS so attend to this as quickly as possible. Authors retain the right to use all or part of their own work in future publications of their own. They are, however, asked, but not required, to sign other rights over to the AMS. If the author(s) transfers copyright to the AMS, the author(s) may dedicate their work to the public domain after 28 years from the date of publication; works in the public domain are not protected by copyright and can be used freely by everyone.
- Some AMS subscription research journals provide open access alternatives. For details, see www.ams.org/journals/open-access.

3. The preamble

The area between the \documentclass statement and the line \begin{document} is referred to as the "preamble". This is the place to load external packages and define document-specific commands.

- **3.1. Document class options.** There are several \documentclass options authors might find useful. Some restrictions that may apply to particular journals or book series are not presented here in detail, but can be found in the author package instructions for those publications.
 - Paper size defaults to [letterpaper], and this is the size expected when files are submitted for publication. However, authors outside the U.S. may find [a4paper] useful for preparing drafts.

- Two-sided or one-sided printing defaults to [twoside]. [oneside] might also be useful for drafts, but should be removed when files are submitted for publication.
- Version can be specified as [draft] or [final]. The [draft] option causes overfull lines to be marked with a black slug in the right margin, calling attention to problems that should be corrected before submission. The default option is [final].
- Font sizes can, for some publications, be selected as [10pt] (the usual default), [11pt] or [12pt]. Restrictions or alternate default sizes are given in the documentation for specific author packages.
- Equation numbering defaults to the left, equivalent to [leqno]. Numbering on the right, with [reqno], is also supported, but is strongly discouraged because it is incompatible with the marking of theorem endings with a \qed box at the right margin.

For multiline equations, the equation number is by default centered vertically on the total height of the display (option [centertags]). To make the equation number print on the first line (for left-hand numbers) or the last line (for right-hand numbers), there is the option [tbtags] (top/bottom).

- Flush left displays can be specified by [fleqn]. With this option, displayed equations are aligned on the left instead of centered, with an indentation of \mathindent from the left margin.
- 3.2. Packages. The AMS document classes incorporate the code for the AMS theorem (amsthm) package and automatically load the amsmath package. It is not necessary to request either one explicitly. The user guides for these packages [ATH, AMG] contain the details, which will not be repeated here, but see section 3.4 for suggestions on setting up theorems. The amsfonts package is loaded as well, unless the [noamsfonts] option is specified; see the AMSFonts User's Guide [AFG] for the features provided.

Not all publicly available packages are compatible with the AMS document classes. For this reason, we mention some that are:

- amssymb provides names for additional symbols from the AMS symbol fonts; see [AFG] for details.
- graphicx is part of the LATEX suite, preferred for inclusion of graphics.
- longtable facilitates tables longer than one page.
- mathtools provides some display math enhancements that weren't anticipated when amsmath was developed.
- natbib supports author-year referencing, appropriate for historical and expository works, when used with BibTEX. amsrefs has a comparable facility.
- upref forces cross-references with \ref to roman (upright); see "Roman type", page 14.
- tikz is recommended for creating charts and other graphics, including commutative diagrams.
- xypic is also recommended for creating commutative diagrams.

Some of these recommendations are noted in the templates that are included in every author package.

There are several packages that cause particular problems for AMS production. Their use should be avoided:

- geometry changes page dimensions even if no explicit changes are specified by the author.
- epsfig has been superseded by graphicx.
- diagrams, by Paul Taylor, contains a "time bomb" that renders it inappropriate for a production environment.
- parskip redefines the processing of tables of contents, as well as making other format changes that do not follow AMS guidelines.

Don't load any packages that aren't actually needed.

3.3. New commands. Place all definitions for new commands in the preamble. This includes instructions to access fonts that are not already defined in the AMS document classes or amsmath, such as a new math alphabet (see [AMG]).

Always use \newcommand; this will let you know if the name you have chosen has already been used. Do not redefine any command from LATEX, amsmath, or any AMS document class, as this could cause problems in AMS production. New definitions may be used to provide shorthand forms for mathematical expressions that are used frequently, but do not use new definitions for text; for articles posted online, this will prevent indexing software from identifying relevant references.

Use commands and environments provided by the AMS document classes and standard packages whenever applicable—for example, you should use the AMS proof environment rather than defining your own alternative.

When the file is complete, remove any commands that haven't been used.

3.4. Theorem declarations. Comprehensive theorem facilities are provided by the inclusion of the amsthm code in the AMS document classes, but to use them, the particular theorem types must be activated in the preamble. A theorem "type" consists of two parts: a \theoremstyle and a \newtheorem statement. Three predefined theorem styles are provided: plain (default) adds extra space above and below, and sets the text in italic; definition adds space above and below, but sets the text in upright type; remark has no extra space above or below, and sets the text in upright type. Suggested associations for theorem types and theorem styles are given in the amsthm documentation [ATH].

To declare the theorem types to be used, list the declarations below the appropriate \theoremstyle line, as follows:

- \newtheorem{thm}{Theorem} will set up an environment thm that will be numbered consecutively throughout the entire document. To number theorems within sections, specify this as \newtheorem{thm}{Theorem}[section].
- To number a different theorem type consecutively with ordinary theorems, declare it as \newtheorem{lem}[thm]{Lemma}. This works with any other element with a defined counter; substitute the desired counter for [thm]. For example, authors wishing to number theorem-class objects consecutively with equations can specify \newtheorem{thm}[equation]{Theorem} and thereafter use [thm] as the reference counter.
- The two "reference" counters can be thought of this way:
 - $\newtheorem{\langle environment \rangle}{\langle Heading \rangle}[\langle number-within \rangle]$
 - $\mbox{ } [\langle reference\text{-}counter \rangle] \{\langle Heading \rangle\}$

4. Top matter

The top matter associated with an article includes information that would appear in a bibliographic reference to the article, plus additional information about the author(s), subject classifications, key words, acknowledgments of support, and the abstract.

4.1. Summary of tags and elements. Table 2 lists the top matter commands provided by $\mathcal{A}_{\mathcal{M}}\mathcal{S}$ -IATEX version 2.0 and later. Not every tag is necessary for each article. The table shows which tags are required and which are optional. The template file included in every author package contains all the necessary tags and instructions for using them.

Table 2. Top matter tags for journals, used in this order only

\title[]{}	$required^1$
\author[]{}	$required^1$
\contrib[]{}	$optional^2$
	required
	optional
	optional
	optional
	optional
	3
	optional
	3
\subjclass[2010]{}	required
	optional
\begin{abstract}\end{abstract}	required
\maketitle	required

 $^{^{1}}$ If no short form is needed, omit the bracketed option.

4.2. Title. For AMS journal articles, capitalize only the first word, the first word after a colon (:), and proper nouns in the title. The title should be input in a style appropriate for use in a bibliography; the style of the title that will appear in print for the particular publication will be generated automatically when the article is processed at the AMS.

A multiline title may be left for LATEX to break, or a desired break may be indicated \linebreak[1] for a journal article that will appear in print and/or electronic form.

Unless the title is very short, provide a form of the title suitable for use in running heads. This should be entered in brackets between the tag title and the full title: $\mathsf{title}(\mathsf{short}\ \mathsf{title})$ { $\mathsf{full}\ \mathsf{title}$ }. Do not use author-defined macros in the title.

4.3. Author information. Enter the name(s) of the author(s) with the tag \author, using standard capitalization for proper names. Use a separate \author

² For contributors, see details on page 11.

³ If this is necessary, it will be filled in by the AMS staff.

command for each author. Names will be combined by LATEX according to the dictates of the document class. See also "contributors", below.

If the author name(s) cannot fit in the space available for the running head, enter a shortened form for each name in [brackets] between the tag \author and the full name. Acceptable shortened forms use initials for all but the surname(s). For example,

```
\author[J. Smith]{Joseph Smith}
```

If the list of shortened author names is still too long for the running head (including a reasonable space for the page number), it can be shortened for an article as in the following example:

```
\author[J. Smith et al.]{Joseph Smith} ... \author[]{\langle second\ name \rangle} ... \author[]{\langle final\ name \rangle}
```

For each author you should provide one or more addresses. Tag them as follows, grouping them in this order by author:

- \address{...} address where the research was carried out (required)
- \curraddr{...} current address, if different from the research address (optional)
- \email{...} address for electronic mail (optional)
- \urladdr{...} URL address (optional)

Do not include any addresses within the scope of an **\author{}** command (this is different from basic LATEX document classes). Do not use abbreviations in addresses.

Addresses are considered part of the top matter, but in AMS articles they are ordinarily printed at the end of the article following the bibliography (this is different from basic LATEX). Suitable labels will indicate the current, email, and URL addresses, typically *Current address*:, *E-mail address*:, *URL*:, respectively.

If a tilde ($\tilde{}$) is needed in a URL address, enter it directly as $\tilde{}$ if you are using $\mathcal{A}_{\mathcal{M}}\mathcal{S}$ -LaTeX version 2.20 or later; otherwise, see the Author FAQ [FAQ] for instructions.

4.4. Contributors (new with version 2.20). Contributors are much like authors, but are responsible for only a portion of a document, e.g., an appendix or auxiliary tables. The bracketed portion is not optional; it gives the exact text that will be printed to indicate the nature of the contribution:

```
\contrib[with an appendix by]{William Rogers}
```

Multiple contributors and contributions are input like this:

```
\contrib[with Appendix A by]{William Rogers}
\contrib[]{Henry Taylor}
\contrib[and Appendix B by]{John Henderson}
```

Note the empty brackets on the second line. Multiple contributors indicated in this way will be combined with "and" added where appropriate. Contributors will not be included in running heads. Addresses provided for contributors will be treated the same as for regular authors.

- **4.5. Dedication.** Use the tag \dedicatory for such things as "Dedicated to Professor X on the occasion of his eightieth birthday." If the dedication is longer than one line, you may indicate a break with \\.
- 4.6. Acknowledgments of support and other first-page footnotes. Use the command \thanks to acknowledge grants and other kinds of support or for other general information not covered by one of the more specific commands such as \keywords or \subjclass. Enter \thanks immediately following the address(es) for the relevant author, not within the scope of the \author{} author{} command (this is different from basic IATEX). Like \address, \thanks can appear more than once in the top matter. Each occurrence will be printed as an unnumbered footnote at the bottom of the first page of the article.
- **4.7. Subject information.** Subject classifications and key words, like titles and author names, are part of the top matter and appear as unnumbered footnotes at the bottom of the first page.

Subject classifications may be primary (the major topic(s) of the paper) or secondary (subject areas covered by ancillary results, motivation or origin of problems discussed, intended or potential field of application, or other significant aspects worthy of notice). At least one primary subject classification is **required**. Additional primaries and secondaries are optional.

These classifications are entered as

```
\subjclass[2010]{Primary \langle primary \ class \rangle;
Secondary \langle secondary \ classes \rangle}
```

separated by commas within. Omitting [2010] will cause the 1991 Subject Classification to be cited; if an error for 2010 is reported, your version of the AMS document classes is from before 2009 and should be upgraded.

To determine the classifications, use the 2010 Mathematics Subject Classification scheme, which can be accessed on the Web at www.ams.org/msc. Please use the full number; the two-digit code from the Contents of *Mathematical Reviews* is not sufficient.

Key words are not required but may be provided by an author if desired. They should be entered as \keywords{...}, separated by commas, with only the first word and proper nouns capitalized.

4.8. Abstract. With an AMS article document class, place the abstract before \maketitle, contrary to the practice with the basic IATEX document classes. This is necessary to ensure that the abstract can always be printed in the proper location and style. If the abstract is given after \maketitle, it will be printed in place and generate a warning message.

Input the abstract text between \begin{abstract}...\end{abstract}. It may comprise multiple paragraphs and include unnumbered display material if appropriate. The length of the abstract depends primarily on the length of the paper itself and on the difficulty of summarizing the material. An upper limit of about 150 words for short papers and 300 words for long papers is suggested. Do not use author-defined macros, \cite, or \ref in the abstract.

5. Document body

- **5.1.** Linking for the Web. All AMS primary journals are posted online. Electronic manuscripts prepared in LATEX for any AMS journal should be tagged for maximum linking on the Web. For use of \label, \ref, and \cite, see [MG]; for \eqref, see [AMG]. The hyperref package will be added by AMS staff at the appropriate stage of the production process and will be applied to internal cross-references and external URLs.
- **5.2.** Headings. Five levels of headings are provided to permit logical sectioning of a manuscript.

```
\part[...]{...}
\specialsection{...}
\section[...]{...}
\subsection{...}
\subsubsection{...}
```

\part is the highest level, and is ordinarily used only when distinct portions of the manuscript have significantly different types of content.

 \specials ection differs from \special in the formatting of the heading.

Any heading may be given a label to allow references to be made to it, by including a \label{...} command with a unique identifier directly *after* the heading. References are made using the command \ref{...} and the same identifier. For example,

```
\section{Historical note}
\label{s:hnote}
```

will establish a label for this section that can be referred to with \ref{s:hnote}. Cross references of this sort will require LATEX to be run at least twice for proper resolution. A warning at the end of the LATEX run, "Cross references may have changed...", should be heeded in this regard.

- **5.3. Mathematical text.** For instructions on preparing mathematical text, refer to $[\mathbf{AMG}]$ and $[\mathbf{Gr}]$. See also "Roman type", below.
- **5.4.** Lists. Follow usual LATEX conventions for producing list environments.
- 5.5. Theorems, lemmas, and other proclamations. See the manual *Using the amsthm package* [ATH] for details. Theorem environments following AMS style with respect to punctuation, spacing, and paragraphing are defined in the AMS document classes. This is incompatible with the LATEX theorem package, which cannot be used with the AMS document classes.

Three different theorem styles are provided by AMS document classes: plain, definition, and remark. By referring to these styles and using the \newtheorem command, you can build a complement of theorem environments appropriate for any paper or monograph. All \newtheorem specifications should be included in the preamble; a starter set is included in the template for every AMS author package.

Theorem support is also available separately in the amsthm package for users of document classes other than those from the AMS.

- **5.6.** Equations. Check displayed equations carefully, making sure they are broken and aligned following the guidelines in [Sw, pp. 38–41], and that they do not exceed the width of the page for the publication in which they are to appear. For multi-line displays, use the structures defined in the amsmath user's guide [AMG].
- 5.7. Equation numbering. AMS style (and the default behavior) for display numbers is always to place them at the left margin, so that they are always in a predictable location, and thus easily found. Left placement ensures that they don't interfere with the qed box on proofs, or other similar flags. Please note that the use of any other numbering style will be changed to accord with standard AMS practice, which may run the risk of introducing inadvertent errors. If you have any questions about this, please contact AMS technical support; see page 29.
- **5.8. Roman type.** Numbers, punctuation, (parentheses), [brackets], {braces}, and symbols used as labels should ideally be set in roman (upright) type. This is true even within the statement of a theorem, which is ordinarily set in italic type.

Be careful to distinguish between roman elements that are mathematical in nature (e.g., "a group of class 2"), and those that are part of the text (e.g., a label or a year). Mathematical expressions, no matter how short or insignificant, should be coded as math, by enclosing them within dollar signs \$...\$ or \(\lambda(\ldots\rangle)\). Roman text elements should be coded as \textup{\ldots\ldots} in potentially nonroman environments such as theorems.

Abbreviated forms of mathematical terms are also usually set in roman type to distinguish them from mathematical variables or constants. Use the control sequences for common mathematical functions and operators like log and lim; use \DeclareMathOperator to add additional operator names (see [AMG, §5]).

The style of reference citations, though publication-dependent, is usually roman. To ensure consistency and support linking for the Web, always use the standard IATEX \cite command when citing a reference (alternate forms of the \cite command are provided by natbib if that package is used for bibliographies in author-year style). Internal references with the \ref command are not automatically roman in non-roman environments, but can be forced by using the upref package (part of the AMS-IATEX collection). The command \eqref, to be used for references to numbered equations, includes parentheses along with the equation number, all in roman type, e.g., \eqref{eqn2.4} will produce "(2.4)" (assuming that is the correct label for that equation).

5.9. Exercises. The xca environment is encouraged for producing exercises that appear individually within a section. This environment is defined in the document preamble with \theoremstyle{definition} and the \newtheorem command; it is used in a manner similar to that of any other theorem-class environment.

6. Floating objects: Figures and tables

Figures and tables are usually handled as floating inserts. Such items are often so large that fitting them into the document at the point of reference may cause problems with pagination. Placing such items into a floating insert allows them to be repositioned automatically by IATFX as required for good pagination.

A floating insert generally contains one of these possibilities:

- IATEX code that produces an object such as a table or commutative diagram;
- a command to incorporate an item produced by another application (most often an Encapsulated PostScript (EPS) file produced by a graphics utility; see *Graphics*, page 21).

If a figure is described by LATEX code (e.g., using xypic, tikz, or the picture environment), it should be included directly in the file.

6.1. Placement. Floats should

- (1) be numbered consistently throughout the paper (figures and tables are numbered separately),
- (2) be placed at the top or bottom of the page,
- (3) have an in-text reference, and
- (4) definitely appear within the same section as their first text reference.

A figure or table should not precede its first text reference unless they both appear on the same page spread. When a figure or table is an integral part of text, it may appear unnumbered in place in the middle of text.

Figures and tables should be allowed to float according to the LATEX defaults preset by the document class. If you are submitting a file that will be processed at the AMS (this applies to all journal articles), you could introduce major problems with pagination if you hard-set your figures and tables by using the [h!] option. Production problems will be avoided when you use the appropriate author package class file and avoid using figure or table options. For electronic manuscripts, the final placement of inserts will be determined by the AMS production staff, on the basis of the most appropriate page layout.

6.2. Captions. Captions for floating inserts are usually positioned above a table and below a figure. The following is the general structure used to specify a figure insert, with a caption at the bottom:

This is the general structure for a table insert, with a caption at the top:

```
\begin{table} \\ \caption{ \langle caption\ text \rangle \} } \\ \label{ \langle reference\ label \rangle } \\ \code\ for\ the\ insertion\ body \rangle \\ \end{table}
```

Caption headings (e.g., "TABLE 3.1." or "FIGURE 7.") will be supplied automatically. The $\langle caption\ text \rangle$ is any appropriate descriptive text, and may be omitted if no descriptive text is desired. (The style of the caption differs from the basic IATEX caption style.) A reference label should usually be associated with the caption, and must be given after the caption. A reference in text to the figure or table has the form $\mathbf{ref}\{\langle reference\ label \rangle\}$.

LATEX packages for captions may appear to work with the AMS document classes, but the caption style usually doesn't match the AMS style.

6.3. Centering tables and figures. All AMS classes center the content of table and figure environments. Using \centering or \begin{center} and \end{center}, therefore, is unnecessary. For example,

\begin{table}
\caption{This is a table}
\begin{tabular}{cccc}
1&2&3&4\\
5&6&7&8\\
9&10&11&12
\end{tabular}
\end{table}
causes this to be typeset

Table 3. This is a table

7. Bibliographic references

Bibliographies may be prepared using either amsrefs or BibT_EX.

- **7.1. Enhanced references.** References in journal articles will be replaced by enhanced information from MathSciNet, in amsrefs format. If an entry is not present in MathSciNet, the style of the entry may be updated (if necessary) for consistency. When enhanced references are enabled, the author's bibliography is combined with data from MathSciNet to provide the following additional features:
 - Direct links to journal articles published by the AMS (requires journal subscription).
 - Article DOIs.
 - Links to MathSciNet author pages (requires subscription to MathSciNet).
 - More complete and standardized bibliographic information.

Enhanced references are offered to provide the researcher with greater opportunities to access information in the mathematical sciences literature. You will find that not every reference has a corresponding record in MathSciNet, so the enhancement process may result in style inconsistencies in some individual reference lists.

In addition, it is possible that in some cases, especially in older papers, a reference was published with an incorrect MR number, which would result in an incorrect reference appearing in the enhanced references. We will be grateful to have any such errors brought to our attention by sending email to <code>eprod-support@ams.org</code>.

7.2. Using BibTeX to prepare a bibliography. An author may find it convenient to maintain a file of references in BibTeX form, as described in *The LaTeX Companion* [MG, Section 13.2]. Two BibTeX styles are provided:

amsplain.bst will produce numeric labels; preferred for articles; amsalpha.bst will produce labels constructed from the author name(s) and year of publication.

Both will translate references in a BibTeX input (.bib) file to LaTeX input in a .bb1 file in the form appropriate for AMS publications, including all necessary formatting instructions. This method of preparing bibliographies is therefore recommended.

To access a BibTeX bibliography in a paper, include these instructions in the appropriate place in the input file:

```
\bibliographystyle{\langle style \rangle} (amsplain or amsalpha) \bibliography{\langle name\ of\ bibliography\ .bib\ file \rangle}
```

Running BibTEX on the .bib file will produce a .bbl file. The .bib file may have any name the author finds convenient; however, the .bbl file must have the same name as the source file from which it is input, so it may be necessary for the author to rename it. For an article or paper, after the bibliography has been completed (including processing by BibTEX), the contents of the .bbl file should be inserted into the main article input file, replacing the \bibliographystyle and \bibliography statements.

Items in the bibliography are usually ordered alphabetically by author. BibTeX processing may alter this order, especially if the amsalpha style is used.

All categories of bibliographic entries listed in [MG, Table 13.1] are supported in the two AMS BibTEX styles. In addition to the fields listed in Table 13.1, a language field is provided in the AMS styles for use in identifying the original language of an item whose title has been translated.

The natbib package (available from CTAN or present in distributions based on TEX Live) provides an author-year style that is compatible with the AMS document classes. This should ordinarily be used only for papers on historical topics.

Standard abbreviations for periodicals should be obtained from [ABMR].

- 7.3. Using amsrefs to prepare a bibliography. amsrefs is a LATEX package for preparing bibliography or reference lists. It attempts to provide many of the convenient features that LATEX and BibTEX users have come to expect without imposing all of the overhead that BibTEX entails. In particular, it has been carefully designed to encourage the preservation of structured markup of the bibliography throughout the entire lifetime of a document from rough draft to final archival version. It does this by replacing LATEX's unstructured .bb1 file format by a new, fully structured format. The package is compatible with the showkeys, hyperref, and backrefs packages and implements the functionality of the popular cite package. Interoperability with BibTEX is supported via a special bibliography style file, but amsrefs can be used without BibTEX. Full documentation of the amsrefs package can be found in [AMSR].
- 7.3.1. Using the amsrefs package. There are three ways of using the amsrefs package:
- (1) Enter bibliography items directly in your LATEX document using the biblist environment and the \bib command.
- (2) Import items from an external .1tb file.
- (3) Import items from a .bib file using BibTEX and the special bibliography styles distributed with the amsrefs package.

¹Note that unlike most packages, which must be loaded *before* hyperref, the amsrefs package must be loaded *after* hyperref in order to work properly.

7.3.2. Using the amsrefs package with $BibT_{E\!X}$. Finally, you can use amsrefs in conjunction with $BibT_{E\!X}$:

```
\documentclass{...}
\usepackage{amsrefs}
\begin{document}
Alan Sokal~\cite{Sokal96} recommends Bourbaki's
text~\cite{Bourbaki70} for a gentle introduction to set theory.
\bibliography{nonsense}
\end{document}
```

Note two things:

- Unlike when you use \bibselect to import entries from a .1tb, in this case the .bbl will contain the bibdiv and biblist environments.
- There is no need for a \bibliographystyle command. In fact, any \bibliographystyle command you put in your document will be ignored. amsrefs will automatically invoke the correct style.

The main advantages of using BibTeX are:

- you can take advantage of BibTFX's ability to sort your items for you, and
- you can take advantage of the large number of BibTEX database files already in existence.

As when using an .1tb file, you may wish to replace the \bibliography command by the contents of the .bbl file when you have finished compiling your bibliography.

7.4. Preparing a bibliography without BibTEX. The references section of a paper is contained between the commands

This environment resolves to an unnumbered section in a paper, following AMS publication specifications. The indentation for the labels is set to an appropriate width using the model given with the \begin command. Thus the widest label in the bibliography should be used as the model; for example, 99 will provide space for a 2-digit numeric label.

For the proper order of reference elements and use of fonts and punctuation, look at an issue of the journal for which your document is intended and follow the examples you see there. More examples are given in [Sw].

Reference input. Begin each item with the command $\bitim{\{\langle bibitem\ label\}\}}$. The LATEX default is to number references automatically; however, other labels may be used by inserting an optional key argument in square brackets between the command and the internal label:

```
\bibitem[ABC]{Arno1994}
```

The item label and the key need not be identical. Whatever appears within the [] is what prints; whatever is within the curly braces is used for linking and must not include any math or special characters.

Give at least one full name; initials and last name is an acceptable form. If a subsequent reference is by the same author(s), use $\begin{substance} \begin{substance} \begi$

8. Permissions

Authors must obtain permission for the use of any material, including graphics, photographs, and text, appearing in their Work which comes from *any* other source. Authors should use the Society's Permission Form to request permission from an author or publisher for material previously published or owned by another. Permissions must be obtained for both print and electronic rights for all editions (present and future) and must be free of any restrictions which may limit the AMS's ability for itself or through licensees to produce, publish, promote, and distribute the Work in any territory, any language, and any medium now known or hereafter discovered. If you are applying for permission using a publisher's on-line form, please match the AMS's requirements as closely as possible. Any permissions that include restrictions will likely result in the material being omitted from the Work.

Additional help is available from the AMS Acquisitions Department:

Acquisitions Department American Mathematical Society 201 Charles Street Providence, RI 02904-2294 USA Email: acquisitions@ams.org

Written permission for use of material in both print and electronic media should be sent to the AMS along with the final manuscript.

Information about copyright and permissions is available on the Copyright and Permission Information page at www.ams.org/jourhtml-copyright-info.

CHAPTER 3

Graphics

1. Getting started

Please take a moment to review the material in this chapter. Problems with graphics in production can lead to significant delays in processing and publishing your work. Graphics are critically important in conveying large amounts of complex information and by observing a few relatively simple guidelines, you can assist in the efficiency of the publishing process.

- Use a standard T_EX graphics inclusion macro package. The recommended graphics inclusion package for I^AT_EX 2_€ is graphicx. Be sure that commands used to include graphics in T_EX are compatible with Radical Eye Software's dvips.
- Do not place graphics for use in TEX files in subdirectories.
- Number figures consistently throughout the paper.
- Use an in-text reference.
- Set figure captions in TeX.
- Set figure captions below the figure.
- Make sure figures are sized correctly and do not extend into the margins of the paper.

2. File format

The preferred file format for graphics is EPS (Encapsulated PostScript). Other formats will be converted to EPS at the AMS.

3. Resolution requirements for bitmap graphics

Line art: 600 pixels per inch (PPI) at 100%.

Halftone: 300 PPI at 100%.

Combination halftone: 600 PPI at 100%.

4. Size of graphics

Create graphics at 100% of the size at which they will be printed.

• If the figure is too large, resize the figure in a graphic program, not in T_FX.

5. Naming files

File names should be no longer than 20 alphanumeric characters. Do not use accented alphabetic characters. Avoid overly generic file names such as fig01.eps.

6. Placing graphics in your paper

Use a standard TeX graphics inclusion macro package. We recommend graphicx.

7. Lines and rules

Do not use a line/rule weight less than half a point (.5 point) at 100%.

- If you must scale your figure, be sure that you compensate by making line weights thicker. A .5 point line scaled at 50% becomes a .25 point line. Lines with weights less than half a point may disappear during the printing process.
- Increase graded lines in half-point increments (i.e., .5 point, 1 point, 1.5 points). Otherwise, the lines will not appear as distinctly different lines.
- Give lines that are a shade of gray (screened) or colored a line weight of at least 1 point at 100%. Gray and colored lines with weights less than 1 point look broken and jagged because of the small dot pattern used to simulate a shade of gray or color tone.

8. Shades of gray (screens)

Screens (a pattern of small black and white dots used to simulate shades of gray) should not be lower than 10% or higher than 85%.

- \bullet Screens outside the range 10% to 85% are either too light or too dark to print correctly.
- Screen density should increase in increments of no less than 10%. Screen variations of less than 10% are not distinguishable.
- Do not put (black or colored) type on a screen darker than 35%. Type on a screen that is above 35% is not legible.
- White type can be used only on 100% black. White type on a gray background looks broken and jagged because a small dot pattern is used to simulate shades of gray.

9. Font usage

Fonts should be fully embedded in your graphics.

- Whenever possible, fonts used in graphics should match those used in text.
- Fonts should be fully embedded in your graphics. If the fonts are not embedded in a graphic, it is possible that the font will be replaced with a default font such as Courier and the characters will not print properly. If you are unable to embed the fonts in your graphic, convert the fonts to paths (or outlines) prior to exporting the file to EPS. The fonts can be converted in the program you used to create the graphics. (For assistance, consult your graphics program's documentation.)
- Use Type 1 outline fonts instead of bitmap fonts. Type 1 outline fonts are vector based. These fonts do not lose quality when they are output to high-resolution printers.
- Do not subset fonts included in your graphics. It is imperative that the full font set be included in every graphic. If only a subset of a font is included, a font error can occur, which may cause characters to disappear in both the graphic and the DVI file.
- Avoid using fonts with city names such as Chicago, Monaco, Geneva, etc.

10. Multiple-part figures

Multiple-part figures should be configured as one figure in a graphics program, not in T_{EX} .

• Aligning multiple-part figures is very difficult in TEX. It is easier and more cost-effective to do so in a graphics program.

11. Cropping and bounding boxes

Do not crop by pasting areas of white over portions of the graphic.

- When using a smaller area of a larger graphic, clip or crop within the graphics application to delete all but the desired portion.
- Do not crop by pasting areas of white over portions of the graphic. Doing this will make the bounding box larger than it should be and will cause problems when the graphic is included in TeX.
- If possible, verify that bounding box information is correct. If the bounding box is not correct, graphics might be clipped off in unexpected ways.

12. Color graphics

The AMS normally does not include color graphics in the print version of its journals, except in special circumstances, when the Managing Editor and Publisher mutually agree that color graphics are warranted. The AMS offers color to authors who are willing to pay for four-color graphics that aren't deemed essential to the mathematics by the Editor and Publisher. Note, however, that color graphics that appear in black and white in the print version will appear in color in the electronic version as submitted.

12.1. Color spaces and gamuts. There are two main color spaces in use: RGB (Red-Green-Blue) and CMYK (Cyan-Magenta-Yellow-Black). The former is used for light-emitting displays (computer monitors, for instance) while the latter is used for printing.

One of the characteristics of a color space, such as RGB or CMYK, is its gamut, the range of colors that it can reproduce. The RGB color space has a much larger color gamut than the CMYK color space, as shown in Figure 1 (page 24, left). Colors in the RGB color space that lie outside the gamut of the CMYK color space must be approximated by the CMYK color space, with varying degrees of success: Figure 1 (page 24, right) compares the color output from various color technologies. CMYK colors can generally appear more muted when compared to their RGB counterparts. All RGB color graphics have to be converted to CMYK for printing. All color graphics, both RGB and CMYK, are subjected to analysis here at the AMS and optimized for printed publication.

Above all, bear in mind that color graphics viewed on a monitor or printed on a personal printer will not necessarily be an accurate rendering of how colors will look when printed on a press. Our Graphic Arts group has years of experience in bringing out the best from a wide variety of graphics, particularly color graphics.





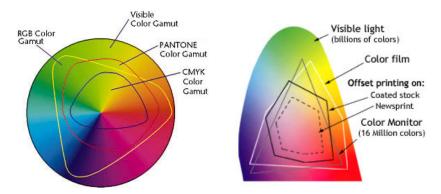


FIGURE 1. Left: A comparison of the colors available in various color spaces. Right: A comparison of the colors available with various display technologies.

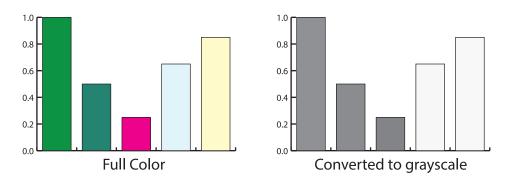


FIGURE 2. Colors don't always have the intended effect when converted to grayscale.

- 12.2. Requirements for graphics to be published in color. Graphics intended to be printed in color should be submitted in CMYK format. If you submit RGB files they will be converted to CMYK. The AMS cannot guarantee that color reproduction in the print product will match the RGB file.
- 12.3. Color graphics to be printed in black and white or grayscale should be converted to black and white or grayscale before being submitted to the AMS. When color graphics are printed in black and white or grayscale, sometimes lighter colors, such as yellow, disappear, or darker colors, such as red and blue, appear to be the same tone. It is preferable that you convert your color graphics to grayscale and check to be sure that all the elements in your graphics print as desired—see Figure 2, above. Check your color figures on a black and white printer to ensure that the black and white printout of your figure is legible.
- 12.4. Shades of colors. Inherently light colors should be handled carefully when using shades of them. Whereas 50% red turns out to be a usable pink, a 50% yellow or cyan may be almost invisible.

12.5. Colored lines should be no less than .5 point in width. Colored lines in inherently light colors (e.g. yellow and cyan) should always be at or near 100% in tint.

13. Using type in graphics

Type within graphics requires special attention to reproduce legibly.

- Basic type size should be no less than 10 point at 100%. For graphics intended for viewing online, although 10-point type is acceptable for print, screen resolution is 72 PPI and 10-point type will be difficult to read online.
- Do not put type on a dark background. Dark type on dark colors is not legible.
- Check your color figures on a black and white printer to ensure that the black and white printout of your figure is legible.

14. Tables

Tables can be thought of as a special kind of graphic. They often require a great deal of attention to make them effective.

- Make sure that the width of the table does not exceed the width of the text block.
- Very wide tables can be rotated using the rotating package together with the sidewaystable environment. Remember that tables (and figures) should be rotated such that the left-hand side of the table (or figure), after rotation, is at the bottom of the page.
- Set table captions above the table.
- For more help on the formatting of tables, see [MG, chapter 5] and [tbl-voss].

15. Photographs

Photographs must be at a minimum resolution of 300 dpi at the actual size that the photograph will be printed in the published product.

- Photographs should be at least 300 dpi in resolution at the actual size that the photograph will be printed in the published product. Do not scale photographs in T_FX.
- File format can be EPS, TIFF, or JPEG.
- Color photographs must be saved in CMYK format. (See Color Graphics, section 12.)

16. T_FX graphics

There are several ways of providing graphics by the use of TEX coding, the principal choices being

tikz: Based on the PGF (portable graphics format), this is a very flexible environment for creating graphics within a TEX document. Note that it functions equally well in dvips-based LATEX and pdfLATEX as well as the newer varieties of TEX such as XELATEX and LualATEX. The native documentation [tkz] is excellent, though massive. There are two very good primers by Mertz and Slough: [ttkz] and [ptkz]. A large set of examples, often generously documented, can be found at [tkz-ex].

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pstricks: Also a very flexible and useful environment for drawing in T_EX. It is most easily used with dvips-based T_EX, though, with some care, it can be used with pdfl^AT_EX. There is an excellent new reference book by Herbert Voss, PSTricks: Graphics and PostScript for T_EX and L^AT_EX [pst-voss]. The use of pstricks is also covered in some detail in [GM, chapters five and six].

xy and xypic: Though generally associated with commutative diagrams, these packages can also serve as a general drawing environment for TeX.

A great deal of general information about other \LaTeX graphics packages can be found in $[\mathbf{G}\mathbf{M}]$.

CHAPTER 4

Submitting files to the AMS

1. Submission guidelines

Upon acceptance of your article, the source file(s) should be sent to the AMS office (this includes the TEX source file(s) and any graphics files). Send only the files that are needed to process your submission or archive it for future reference.

Before sending the source file(s), be sure you have proofread your article carefully. The files that you send must be the EXACT files used to generate the proof copy that was accepted for publication. In order to avoid any possible production problems, before sending the files, be sure to verify all items in the sections *The basic checklist* (page 5) and *A checklist for using AMS journal classes* (page 6).

If your submission consists of **multiple files**, we recommend that you bundle them using the Zip utility; this can be obtained (free) for most platforms from freecode.com. Bundling means that only one (compressed) file needs to be sent, lessening the chance of name conflicts or file corruption.

2. Web server submissions (preferred)

Accepted electronic manuscripts can be submitted via the web server at .www.ams.org/submit-book-journal. For security and confidentiality reasons, submitting through the web server requires an AMS web account. Authors who do not already have an account will be given the opportunity to create one as they go through the submission process.

3. Electronic mail submissions

Files sent by electronic mail should be addressed to pub-submit@ams.org. Include them as attachments, not as part of the message.

The subject line of the message should use the publication code to identify the journal (see the list of *The AMS Journal series*, page 4). By including this information in the subject line, you will help speed up the processing of your submission.

Submissions received through email will be acknowledged upon receipt by an automatic reply while your submission is reviewed. If there are any problems with the file received, you will be notified.

4. Other possibilities

If your attempt to submit both through the web server and by electronic mail fails, arrangements can be made for you to post your files via FTP or on physical media. Requests for help can be addressed as described in the section "Getting help: AMS resources" on page 29.

CHAPTER 5

Resources and getting help

1. Getting help: AMS resources

Many questions raised by authors are answered in the AMS Author FAQ [FAQ]. Please check there before asking for assistance.

If you encounter difficulties in preparing or submitting your manuscript in electronic form after it has been accepted for publication by the appropriate editorial board, you can ask for help from AMS Technical Support:

Publications Technical Group

Phone: 800-321-4267, ext. 4080 or 401-455-4080

Email: tech-support@ams.org

All written correspondence should be sent to the appropriate AMS department at:

American Mathematical Society 201 Charles Street Providence, RI 02904-2294 USA

or by FAX to 401-331-3842.

For journals, see submission instructions on the web starting from www.ams.org/authors/journal-list

Problems in accessing the web server should be reported to:

Email: webmaster@ams.org

2. T_FX resources

IATEX and TEX are available on the web free of charge. There are also several commercial TEX implementations. AMS web pages devoted to TEX information can be accessed at www.ams.org/tex. The first of these pages has links to other pages that identify the various sources for the TEX program.

IATEX is the most popular of the free front ends designed for use with TEX, the basic typesetting program. Whereas plain TEX defines basic macros, IATEX defines stylistic packages, setting up styles for a monograph, journal article, and article in a proceedings collection, which you can then alter to your own specifications.

 $\mathcal{A}_{\mathcal{M}}S$ -LATEX is a collection of LATEX extensions that make various kinds of mathematical constructions easier to produce, and take more care with certain finer details in order to yield publication-quality results. For $\mathcal{A}_{\mathcal{M}}S$ -LATEX there are companion design setup packages (variously referred to as 'document class' or 'class' files) that enable authors writing a monograph or article to get largely the same visual appearance in their preliminary drafts as in a final publication with the AMS.

 $\mathcal{A}_{\mathcal{M}}S$ - $\mathcal{A}_{\mathcal{T}}$ EX files are included in the canonical $\mathcal{A}_{\mathcal{T}}$ EX distribution; updates can be obtained directly from the AMS web server or from CTAN.

The book *More Math into LATEX* [Gr] is written from the point of view of a mathematician using *AMS*-LATEX, and contains many examples. The *Guide to LATEX*, fourth edition [KD], is a good general introduction to LATEX. The original and authoritative manual for LATEX is the *LATEX User's Guide & Reference Manual* [La]. George Grätzer has also written a series of articles for *Notices of the AMS* [Gr1, Gr2, Gr3, Gr4, Gr5, Gr6] that keeps the interested user up-to-date with the latest developments in LATEX.

 $\mathcal{A}_{\mathcal{M}}\mathcal{S}\text{-IAT}_{EX}$ is available from the AMS web server at www.ams.org/tex. Distributions of $\mathcal{A}_{\mathcal{M}}\mathcal{S}\text{-IAT}_{EX}$ and AMSFonts each include a copy of the relevant User's Guide and related documentation. Each guide provides important information including installation procedures and coding examples. An electronic version of each of these guides is available as part of the distribution packages on the AMS web server

Another source of information on T_EX and IAT_EX is the T_EX Users Group (TUG). They can be contacted at:

```
T<sub>E</sub>X Users Group
P.O. Box 2311
Portland, OR 97208-2311
(503) 223-9994, FAX: (206) 203-3960
office@tug.org
```

TUG also distributes the TEX Live collection, which includes ready-to-run implementations of TEX for Windows, Mac, and Unix platforms, as well as IATEX and an extensive selection of packages, all freeware.

3. Online assistance

One of the best places to ask for assistance is the group known by the acronym CTT, groups.google.com/forum/comp.text.tex. Most of the people who use CTT are more than willing to answer questions and give advice.

Another online source of assistance is tex.stackexchange.com. This is organized differently from most discussion groups. After signing up, you pose and answer questions. In the process, you gain points which in turn allow you to do more in the group. Be sure to read tex.stackexchange.com/about to get you started.

The AMS is not equipped to handle questions about specific platforms. Links to sites providing such support, as well as addresses for discussion lists and links for on-line forums, are given on this AMS web page:

www.ams.org/tex/additional-sources.

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