

PLACE TITLE HERE: PLACE SUBTITLE AFTER COLON

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## ABSTRACT

*This paper is an example of and a template for typesetting ASME Conference Papers in L<sup>A</sup>T<sub>E</sub>X using the asmeconf class. This class follows ASME guidelines for margins, fonts, headings, captions, and reference formats as of 2020. The class is intended to be used with the asmeconf.bst BibT<sub>E</sub>X style, which is part of this distribution. The class incorporates the hyperref package, so that pdfs will contain hyperlinks, bookmarks, and metadata, and references can include the DOI and URL fields. Links may be colored, for online use, or black, for publication. The class enables inline author names, following ASME's current style, but can also produce the traditional grid style. Options include line numbering, final column balancing, various math options, government copyright, and archivability (PDF/A). In addition, section headers may contain mathematics, references, citations, and footnotes. The class is compatible with pdfL<sup>A</sup>T<sub>E</sub>X or LuaL<sup>A</sup>T<sub>E</sub>X.*

**Keywords:** ASME, Paper, Template, L<sup>A</sup>T<sub>E</sub>X, Research

## NOMENCLATURE

*Roman letters*

$k$  Thermal conductivity [ $\text{W m}^{-1} \text{K}^{-1}$ ]

$\vec{q}$  Heat flux vector [ $\text{W m}^{-2}$ ]

*Greek letters*

$\alpha$  Thermal diffusivity [ $\text{m}^2 \text{s}^{-1}$ ]

$\nu$  Kinematic viscosity [ $\text{m}^2 \text{s}^{-1}$ ]

*Dimensionless groups*

Pr Prandtl number,  $\nu/\alpha$

Sc Schmidt number,  $\nu/\mathcal{D}_{1,2}$

*Superscripts and subscripts*

$b$  bulk value

$\infty$  free stream value

## 1. INTRODUCTION

The asmeconf class typesets papers with margins, fonts, headings, captions, and reference formats that follow the specifications for conference papers of the American Society of Mechanical Engineers (ASME). In contrast to older ASME L<sup>A</sup>T<sub>E</sub>X templates, asmeconf will set internal and external hyperlinks, and the pdf file will contain bookmarks and metadata. Many other useful features have been incorporated. This class is not a publication of ASME, but the author has published in ASME conferences since 1983.

The .tex file may be written using standard L<sup>A</sup>T<sub>E</sub>X commands, although some specific initial commands are needed to format the blocks containing the author[s], title, and abstract. This class loads a number of other packages, all of which are contained in up-to-date versions of T<sub>E</sub>X Live, MacT<sub>E</sub>X, and similar platforms. If you find that you are missing one of these packages, you may obtain it at no cost from CTAN ([ctan.org](http://ctan.org)).

### 1.1 Essential Initial Commands

To begin, fill in the fields to be completed at top of the asmeconf-template.tex file. These fields include the headers for your conference and your paper number. Specified metadata will be placed into the pdf file itself. The title should be placed into \title{...}.

Put author names into the \SetAuthors{name, name,...} command in the desired order; follow the syntax illustrated asmeconf-template.tex file. Put each distinct address sequentially into a separate \SetAffiliation{n}{address}, where  $n = 1, 2, \dots$ . Tag each author with an affiliation by putting \affil{n} after that author's name inside the \SetAuthors{...} command.

Keep author addresses short. List the author institution, and the City, State (US authors), City, Province, Canada (Canadian authors), or City, Country (other international authors).

One author (or more) may be designated as the corresponding author by placing \CorrespondingAuthor{email} after

<sup>†</sup>Joint first authors

\*Corresponding author: [lienhard@mit.edu](mailto:lienhard@mit.edu)

Documentation for asmeconf.cls. Version 1.21; December 10, 2020.

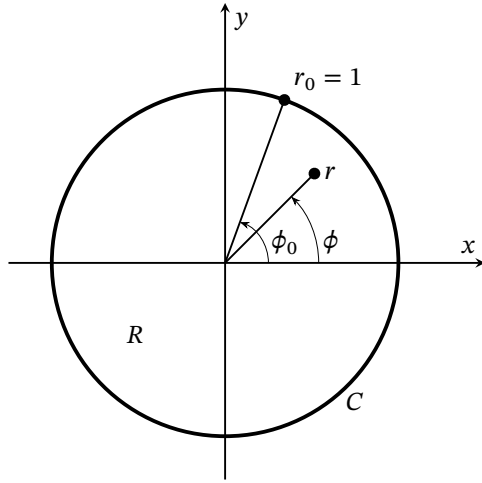


FIGURE 1: FIGURE CAPTION WITH MATH, EQN. (1):  $z = (r, \phi)$  [7]

`\affil{n}`. Two or more authors may be joint first authors by putting `\JointFirstAuthor` after `\affil{n}`.

After setting up the headers, authors, and title, issue the `\maketitle` command.

The abstract text must be placed into `\begin{abstract} ... \end{abstract}`. The abstract will automatically be italicized. Keywords may be included using the `\keywords{...}` command. The keyword command *must* be issued before the abstract environment.

## 2. REFERRING TO CITATIONS, FIGURES, AND EQUATIONS

Citations are automatically numbered [1]. They should be inserted at the appropriate point using a `\cite{ref}` command [2, 3]. The citations will be automatically sorted and compressed if they are given in a set [1–6]. A specific reference may be named with an abbreviation, as in Ref. [6]. See the `asmeconf-sample.bib` file and Sect. 5 for examples of how to enter your references.

For ASME conference papers, the labels Equation and Figure should be abbreviated when they do not start a sentence, as in Eq. (3) and Fig. 1. Figure 1 is spelled out when it starts a sentence. Equation (3) is spelled out when it starts a sentence.

Equations are typeset in the usual way and will be automatically numbered. The class file loads the `amsmath` and `mathtools` packages. Further, the `newtxmath` package used for the math fonts includes many additional features (see Sect. 6).

$$\vec{q} = -k \nabla T \quad (1)$$

ASME prefers SI units. (U.S. style units may follow in parentheses.) Be sure to put all symbols into the nomenclature list, including their units.

## 3. SECTION HEADINGS AND CAPTIONS

ASME requires that section headings and captions be set in an uppercase, sans serif font. The class will do this automatically. You can place `\cite{...}`, `\ref{...}`, `\label{...}`, and mathematics into headings and captions directly, as you would in the main text. Do not enclose them braces, e.g. `\cite{...}`, which

TABLE 1: A SIMPLE TABLE

Experiment	$u$ [m/s]	$T$ [°C]
Run 11	12.5	103.4
Run 12	24	68.3

TABLE 2: TABLE WITH MORE COMPLICATED COLUMNS

Experiment	$u$ [m/s]	$T$ [°C]
The first test we ran this morning	124.3	68.3
The second test we ran this morning	82.50	103.46
Our competitor's test	72.321	141.384

will cause errors. You can place `\footnote{...}` into headings, but not into captions.<sup>1,2</sup>

Text in section headings and captions will not be capitalized if enclosed in a `\NoCaseChange{...}` command.

Sections may either be numbered or left unnumbered.

Simple mathematical expressions can be used in either captions or section headings. For a section heading that includes more complicated math (and macros), you may use the optional argument of `\section[...]{...}` to create a pdf bookmark without losing characters or producing warnings or errors. See the `asmeconf-template.tex` source file for examples of this procedure. These bookmarks should usually be text expressions, although some math is supported.

If you wish to override the default math format in captions, put `\mathversion{normal}` in the caption.

### 3.1 Subsection and Sub-subsection Headings

Subsections and sub-subsection headings should be entered in title case, with the first letter of primary words capitalized. Sub-subsections (i.e., paragraphs) are never numbered.

## 4. TABLES AND FIGURES

Table 1 is an example of a simple table. Table captions should be placed above tables. The class loads the `booktabs` package (used for horizontal rules in both Table 1 and 2), and the `array` and `dcolumn` packages which provide extended capabilities for columns in the `tabular` environment (used in Table 2). Table 3 is an example of a table that spans two columns. Two column tables (and figures) will always float to the top of a later page.

Figure captions go below figures. Figure 2 is an example of a figure that spans two columns and includes subfigures. The text in figures (and tables) should be no smaller than 6 point type. Images in figures are handled by the standard `graphicx` package.

Landscape figures and tables may be produced at full-page size by putting `\usepackage[figuresright]{rotating}` in your `.tex` file's preamble and using the `sidewaysstable*` and `sidewaysfigure*` environments [8].

<sup>1</sup>See [tex-stackexchange](https://tex.stackexchange.com) for various approaches to footnotes in captions, if they seem necessary. For footnotes in tables, use the `tablefootnote` package.

<sup>2</sup>Sequential footnotes are automatically separated by a comma.

TABLE 3: A TABLE SPANNING TWO COLUMNS

$x$	$\operatorname{erf}(x)$	$\operatorname{erfc}(x)$	$x$	$\operatorname{erf}(x)$	$\operatorname{erfc}(x)$
0.00	0.00000	1.00000	1.10	0.88021	0.11980
0.05	0.05637	0.94363	1.20	0.91031	0.08969
0.10	0.11246	0.88754	1.30	0.93401	0.06599
0.15	0.16800	0.83200	1.40	0.95229	0.04771
0.20	0.22270	0.77730	1.50	0.96611	0.03389
0.30	0.32863	0.67137	1.60	0.97635	0.02365
0.40	0.42839	0.57161	1.70	0.98379	0.01621
0.50	0.52050	0.47950	1.80	0.98909	0.01091
0.60	0.60386	0.39614	1.8214	0.99000	0.01000
0.70	0.67780	0.32220	1.90	0.99279	0.00721
0.80	0.74210	0.25790	2.00	0.99532	0.00468
0.90	0.79691	0.20309	2.50	0.99959	0.00041
1.00	0.84270	0.15730	3.00	0.99998	0.00002

## 5. REFERENCE FORMATTING WITH `asmeconf.bst`<sup>3</sup>

The `asmeconf.bst` BibTeX style follows the reference styles shown on ASME’s conference web site in 2020.<sup>4</sup> Examples for these and many other cases are given in the `asmeconf-sample.bib` file, which is part of this distribution. Citations and references are managed by the standard `natbib` package. Nevertheless, a few comments are necessary.

**DOI, URL, and eprint.** Include DOI numbers when they are available. URL’s may alternatively be given. ASME requests that URLs point to a document’s abstract.

Elementary support for eprint numbers is also included, generating a url at the end of the citation. The archive type may be specified using the macros `arxiv`, `googlebooks`, `hdl`, `jstore`, `oclc`, or `pubmed` (e.g., `archive=hdl`, *without* braces). Both eprint and archive fields *must* be given. Other root urls may be invoked using `archive = {http://another.url.org/}`.

**Online Sources.** A bibliography entry `@online{..}` is included for citation of online sources, such as web pages. A url or eprint with archive must be included. See the examples of use in the `asmeconf-sample.bib` file.

**Date Accessed.** The `urldate={..}` field may be used to provide the date on which a given url was accessed. By default, the text printed will be Accessed ‘date’. The word “Accessed” may be changed using the `urltype={..}` field.

**Conference Location and Date.** For the entry types `@inproceedings{..}` and `@proceedings{..}`, you may include `venue={..}` and `eventdate={..}` to specify the city and the date of a conference.

**Capitalization of Titles.** ASME’s bibliography style requires that document titles be in title case. The first letters of principal words are capitalized. Do this in the `.bib` file.

<sup>3</sup>If you have text in a section heading or caption that you do not want to be capitalized, such as an SI unit, enclose it in a `\NoCaseChange` command.

<sup>4</sup>`asmeconf.bst` is intended as a replacement for the old `asmems4.bst`, which does not follow ASME’s current reference formats or support DOI and URL.

## 6. MORE ON MATH: $\vec{u} \cdot \vec{\omega} = 0$

In most cases, the need for a wide equation can be eliminated by using one of the multiline equation environments defined by `amsmath`, such as `align`, `split`, or `multline` [9]. The following equation is set with the `multline` environment:

$$\begin{aligned} \frac{\partial}{\partial t} [\rho(e + |\vec{u}|^2/2)] + \nabla \cdot [\rho(h + |\vec{u}|^2/2)\vec{u}] \\ = -\nabla \cdot \vec{q} + \rho \vec{u} \cdot \vec{g} + \frac{\partial}{\partial x_j} (d_{ji} u_i) + \dot{Q}_v \end{aligned} \quad (2)$$

An example using `align` appears in Appendix A.

An alternative solution may be to set large equations into two-column-wide tables or figures. While a package exists for setting equations that span two columns (`widetext.sty`), that code is erratic in relation to floats and page breaks.

Math italics are used for roman and greek letters by default. If you want an upright letter in math, you can use the relevant math alphabet, e.g., `\mathrm`, `\mathbf`, `\mathsf`:

$$\vec{F} = m\vec{a} \quad \text{or} \quad \vec{F} = m\vec{a} \quad \text{or} \quad \mathbf{F} = m\mathbf{a} \quad \text{or} \quad \vec{F} = m\vec{a} \quad (3)$$

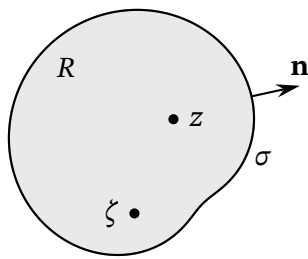
To get additional symbols in bold math, you can use the `\bm{..}` macro from the `bm` package, which is loaded by the class.

The class file also provides upright sans-serif greek letters with `\sfalpha` and similar expressions (e.g.,  $\alpha, \beta, \gamma, \delta \dots \alpha, \beta, \gamma, \delta \dots$ ), in case they are needed (but note that the `newtxmath` options `frenchmath` and `slantedGreek` also affect how greek letters are presented).

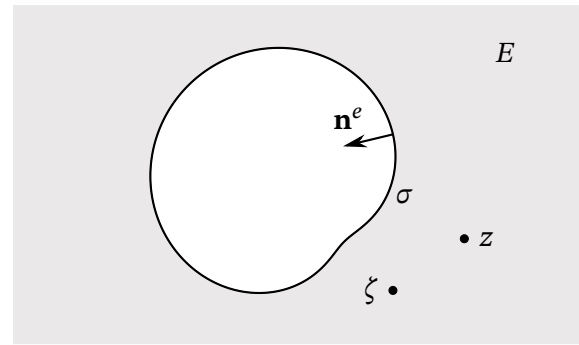
### 6.1 The `newtxmath` and `mathalpha` Packages [10, 11]

The `newtxmath` package [10], loaded by default, includes a large number of options for mathematics, most of which can be called as options to `\documentclass`. For example, the `upint` option of `newtxmath` selects upright integral signs (rather than slanted integral signs):

```
\documentclass[upint]{asmeconf}.
```



(a) Interior region



(b) Exterior region

FIGURE 2: A FIGURE WITH TWO SUBFIGURES [7]

These math options are discussed further in the `asmejour-template.tex` file.

In addition, many options for calligraphic, fraktur, and script fonts are available as options to the `mathalfa` package, which is also loaded. These may be invoked, for example, as

```
\documentclass[mathalfa=cal=euler]{asmeconf}
```

which selects the Euler font for `\mathcal` (this is our default). To find all the font options, refer to the `mathalfa` package documentation [11].

The typewriter font loaded is `inconsolata` (which is sans serif), as suggested by the `newtx` package documentation.

The `asmeconf` class is not set up for use with the `fontspec` or `unicode-math` packages.

## 7. ADDITIONAL OPTIONS FOR `asmeconf.cls`

The class accepts a number of options in addition to those already described. These options are discussed next.

### 7.1 Colored Hyperlinks

ASME requires that all text be **in black** when the paper is submitted for publication. For other uses, authors may obtain colored hyperlinks with the `[colorlinks]` option.

### 7.2 Final Column Balancing

The option `[balance]` invokes the `flushend` package [12]. This package will attempt to give equal height to the two columns on the last page. The performance of this package is sometimes inconsistent (with odd page layout or, very rarely, errors), so use this option with caution.

### 7.3 Line Numbers

The option `[lineno]` invokes the `lineno` package [13]. This option will produce line numbers in the margins. You must run  $\LaTeX$  *twice* for proper placement of the numbers. Tables, captions, and footnotes will not be numbered. Line numbers can be helpful for review and editing, but should not be used in your final manuscript. See the documentation of the `lineno` package for further commands to control line numbering.

The `lineno` package is not compatible with the `flushend` package that makes final short columns the same height. Balancing is automatically disabled when this option is called.

### 7.4 Grid-Style Author Block

The option `[authorgrid]` invokes ASME's grid-style arrangement of author names. The authors and affiliations must be entered differently in this case. See Appendix B for usage.

### 7.5 Changing the Copyright Footer

The option `[nofoot]` will omit the ASME copyright from the page footer. The option `[govt]` will produce a copyright notice for authors who are employees of the U. S. Government. The option `[contractor]` will produce a copyright notice for authors who are employed by a U. S. Government contractor.

The footers are generated with the `fancyhdr` package [14], so you can change them in any way you like using the commands of that package. Only the default arrangement of footers matches ASME's style, however.

### 7.6 Archivability: PDF/A

Compliance with PDF/A standards can be enabled using the option `[pdf-a]` when running with  $\pdf\LaTeX$ . The default setting is for PDF/A-3u with `sRGB OutputIntent (sRGB.icc)`. If levels 1b, 2b, 2u, or 3b are preferred, use the options `[pdfapart=1 or 2 or 3]` and `[pdfaconformance=b or u]`. Note that accessible conformance (a) is not currently possible with  $\LaTeX$ .

### 7.7 Superiors Font

The `newtxtext` package includes a superiors font (both numbers and letters) for use in footnote markers and superscripts. To enable this font, use the option `[nodelaftsups]`.

### 7.8 Hyphenation of Typewriter Font

The option `[hyphenate]` will allow hyphenation of the typewriter font. Hyphenation is normally suppressed for typewriter mode because this font is often used for computer code.

### 7.9 Support for Other Languages

The package can be adapted to incorporate (or entirely use) languages other than English. See Appendix C for details.

## 8. CONCLUSION

Provide a brief conclusion (3-4 lines).



## ACKNOWLEDGMENTS

Place any acknowledgments here.

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## APPENDIX A. THE VECTOR PRODUCT $\vec{A} \times \vec{B}$

This brief illustration of an appendix shows the numbering of the appendix and equations. Equations are numbered consecutively, following those in the paper. Consider  $\rho \neq \text{fn}(p)$ :

$$\frac{d\Gamma}{dt} = \frac{d}{dt} \int_{\mathcal{C}} \mathbf{u} \cdot d\mathbf{r} \quad (4)$$

$$= \int_{\mathcal{C}} \frac{D\mathbf{u}}{Dt} \cdot d\mathbf{r} + \underbrace{\int_{\mathcal{C}} \mathbf{u} \cdot d\left(\frac{d\mathbf{r}}{dt}\right)}_{=0} \quad (5)$$

$$= \iint_{\mathcal{S}} \nabla \times \frac{D\mathbf{u}}{Dt} \cdot d\mathbf{A} \quad (6)$$

$$= \iint_{\mathcal{S}} \nabla p \times \nabla \left(\frac{1}{\rho}\right) \cdot d\mathbf{A} \quad (7)$$

## APPENDIX B. OPTION TO USE AN AUTHOR GRID

ASME's most recent templates place author names inline, with affiliations for all authors in rows below. This style is the default for this template.

The traditional style of putting authors with affiliation into a grid of blocks may be invoked with the option [authorgrid]. When using this form, the author names and addresses should be entered as below:

```
\SetAuthorBlock{Name\JointFirstAuthor}{%
    Institution \ City, State}
\SetAuthorBlock{Name\JointFirstAuthor}{%
    Institution \ City, Country}
\SetAuthorBlock{Name, Name}{%
    Institution \ City, Country}
\SetAuthorBlock{\CorrespondingAuthor{John Lienhard%
}{lienhard@mit.edu}}{Institution \ City, State}
```

Directly usable code is contained at the very end of the asmeconf-template.tex file.

Note that ASME interprets the author order in the grid style by reading names from left-to-right in the top row, then left-to-right in each subsequent row.

## APPENDIX C. LANGUAGE SUPPORT

ASME publishes in English, but the babel package is loaded for users who may wish to include other languages. Class op-

tions allow loading a primary language, lang=, as well as secondary and tertiary languages, lang-second and lang-third. The primary language must be specified explicitly if a secondary language is loaded. If no language option is given, the package defaults to English. An example of including a passage in French is shown in Annexe D.

The standard caption and section names will follow babel's dictionary for primary languages other than English. Users may additionally change "Keywords", "Nomenclature", "Corresponding author", and "Joint first authors" by renewing the commands \keywordname, \nomname, \CAwords, and \JAwords. Changes to the page footer were described earlier. The pdf bookmark for "Appendices" may be changed by renewing \appendicesname.

Font encoding is set to T1 with utf-8 input supported: àáâäåæãä òëèèèè ïîïî òöðóœøö ùüüü çč ĺ ŋ ßš ŷ žžž.

The substitutefont package [19] may be loaded in the preamble to enable the selection of language-specific fonts. Examples for Greek and Cyrillic are included in that package's documentation. The bibliography style, asmeconf.bst, is designed in English and aimed at BibTeX. Multilingual bibliographies can be supported using BibLaTeX.

## ANNEXE D. DISCOURS PRÉLIMINAIRE DE FOURIER

Les causes primordiales ne nous sont point connues; mais elles sont assujetties à des lois simples et constantes, que l'on peut découvrir par l'observation, et dont l'étude est l'objet de la philosophie naturelle.

La chaleur pénètre, comme la gravité, toutes les substances de l'univers, ses rayons occupent toutes les parties de l'espace. Le but de notre ouvrage est d'exposer les lois mathématiques que suit cet élément. Cette théorie formera désormais une des branches les plus importantes de la physique générale [20].

TRANSLATION: *Primary causes are unknown to us; but are subject to simple and constant laws, which may be discovered by observation, the study of them being the object of natural philosophy.*

*Heat, like gravity, penetrates every substance of the universe, its rays occupy all parts of space. The object of our work is to set forth the mathematical laws which this element obeys. The theory of heat will hereafter form one of the most important branches of general physics.*