

PLACE TITLE HERE: PLACE SUBTITLE AFTER COLON

Luis Hernández<sup>1,†</sup>, Maria Silva<sup>2,†</sup>, Henry Tudor<sup>3</sup>, Catherine Parr<sup>3</sup>, John H. Lienhard V<sup>4,\*</sup>

<sup>1</sup>Institution or Company Name, City, State

<sup>2</sup>Institution or Company Name, City, Province, Canada

<sup>3</sup>Hampton Court Palace, Richmond, England

<sup>4</sup>Massachusetts Institute of Technology, Cambridge, MA

## ABSTRACT

*This paper is an example and 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 July 2019. The class is compatible with the hyperref package for producing pdf files with links. The optional argument of \section has been modified for manually setting pdf bookmarks when macros or complicated mathematics are included in section headings. The class is intended to be used with the asmeconf.bst BIB<sub>T</sub>E<sub>X</sub> style, which is part of this distribution. The class may be invoked with several options, most of which address math fonts. The class calls a number of packages, all of which are in T<sub>E</sub>X<sub>L</sub>I<sub>V</sub>E and on CTAN ([ctan.org](http://ctan.org)).*

**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 file will typeset papers with margins, fonts, headings, captions, and reference formats that follow those

specified for conference papers of the American Society of Mechanical Engineers (ASME). Internal and external hyperlinks will be set automatically, and the pdf file will contain bookmarks and metadata. This class is not a publication of ASME.

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.

### 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 \PaperTitle{..}.

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 the right affiliation by putting \affil{n} after that author's name. Author addresses are to be kept 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 \CorrespondingAuthor{email} by placing the command at the end of the name. Two or more authors may be joint first authors with \JointFirstAuthor. Either of these commands should come after \affil{#}.

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

Keywords may optionally be including using the \keywords{..} command; this command *must* be issued before the abstract. The abstract text must be placed into \SetAbstract{..}. The abstract will automatically be italicized.

<sup>†</sup>Joint first authors

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

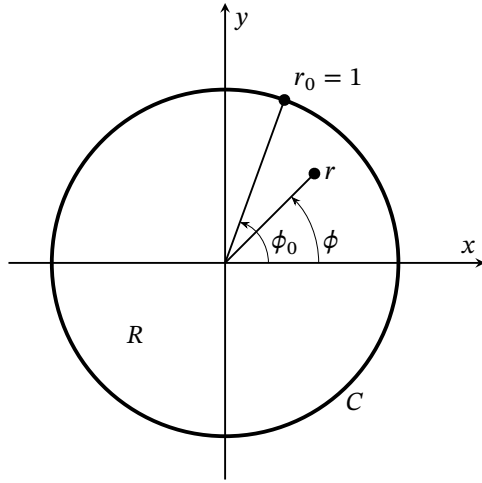


FIGURE 1: A FIGURE CAPTION WITH MATH,  $z = (r, \phi)$  [1]

## 2. EQUATIONS AND NOMENCLATURE

Equations are typeset in the usual way. 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 your symbols into the nomenclature list, including the units.

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.

## 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 into headings and captions directly, as you would in the main text. Do not enclose them braces, e.g. `{\cite{.}}`, which 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 math 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.tex` source file for examples of this. 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.

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

<sup>2</sup>Sequential footnote.

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

### 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.

### 3.2 Colored hyperlinks

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

## 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.

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.

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

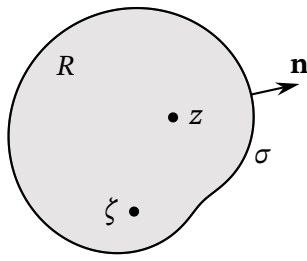
Citations are automatically numbered [2]. They should be inserted at the appropriate point using a `\cite{ref}` command [3, 4]. The citations will be automatically sorted and compressed as well if they are given in a set [2–8]. See the `asmeconf-sample.bib` file for examples of how to enter your references.

The `asmeconf.bst` BibTeX style follows the reference styles posted on ASME's conference web site in mid-2019. Examples for these and many other cases are given in the `asmeconf-sample.bib` file, which is part of this distribution. Nevertheless, a few comments are necessary.

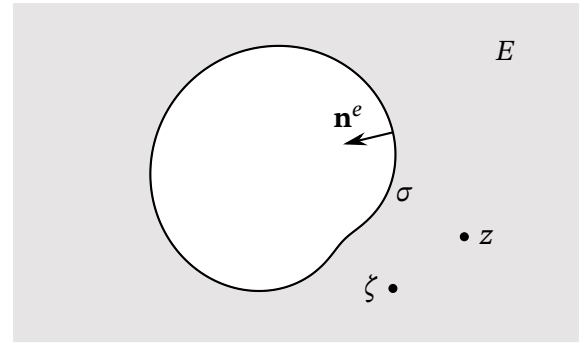
**DOI, URL, and eprint.** Include DOI numbers when they are available. URL's may alternatively be given.

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`, `hndl`,

<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.



(a) Interior region



(b) Exterior region

FIGURE 2: A FIGURE WITH TWO SUBFIGURES [1]

jstore, or pubmed (e.g., archive=hnd1, *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 field @online{.. is included for citation of online sources, such as web pages. See the examples of use in the asmejour-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.

## 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. (You can find code online that sets equations across two columns, but the results may be sketchy.)

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 is presented).

## 6.1 The newtxmath and mathalfa packages [10, 11]

The newtxmath package [10], loaded by default, includes a large number of options for mathematics. Most options 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}.
```

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

In addition, many options for calligraphic, script, and fraktur 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 class is not set up for use with the fontspec or unicode-math packages.

## 7. CONCLUSION

Provide a brief conclusion (3-4 lines).

## ACKNOWLEDGMENT

Place any acknowledgments here.

## REFERENCES

- [1] Lienhard, John H., V. "Exterior Shape Factors from Interior Shape Factors." *J. Heat Transfer* Vol. 141, No. 6 061301. DOI 10.1115/1.4042912.
- [2] Ning, Xiang and Lovell, Mary Rose. "On the Sliding Friction Characteristics of Unidirectional Continuous FRP Deposits." *ASME Journal of Tribology* Vol. 48, No. 5 (2002): pp. 2000–2008. DOI 10.1115/1.4042912. URL <https://doi.org/10.1115/1.4042912>.

TABLE 3: A TABLE SPANNING TWO COLUMNS

$x$	$\text{erf}(x)$	$\text{erfc}(x)$	$x$	$\text{erf}(x)$	$\text{erfc}(x)$
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

- [3] Gibson, Tom A. and Tucker, Matthew A. *The Big Book of Cellular Studies*. John Wiley and Sons, New York (2008).
- [4] Stevens, Thomas T. “Stochastic Fields and Their Digital Simulation.” *Stochastic Methods*. Martinius Publishers, Dordrecht (1999): pp. 22–36.
- [5] Wions, Thomas and Mills, Christopher D. “Structural Dynamics in Parallel Manipulation.” *Proceedings of the ASME IDETC/CIE*. DETC2005-99532: pp. 777–798. New Orleans, LA, 2005. DOI [10.1115/1.4042912](https://doi.org/10.1115/1.4042912). URL <https://doi.org/10.1115/1.4042912>.
- [6] Smith, Robert. “Conformal Lubricated Contact of Cylindrical Surfaces Involved in a Non-Steady Motion.” Ph.D. thesis, Rochester Institute of Technology, Rochester, NY. 2002. DOI [10.1115/1.4042912](https://doi.org/10.1115/1.4042912). URL <https://doi.org/10.1115/1.4042912>.
- [7] Watson, David. “Evaporative Heat Transfer in the Contact Line of a Mixture.” Technical Report No. HTL-26, CFD-4, Iowa State University, Ames, IA. 1982. DOI [10.1115/1.4042912](https://doi.org/10.1115/1.4042912). URL <https://doi.org/10.1115/1.4042912>.
- [8] Smith, Robert. “Conformal Lubricated Contact of Cylindrical Surfaces Involved in a Steady Motion.” Master’s thesis, Rochester Institute of Technology, Rochester, NY. 1998.
- [9] American Mathematical Society and LATEX3 Project, “User’s Guide for the amsmath Package, Version 2.1.” Comprehensive T<sub>E</sub>X Archive Network (2018), accessed 5 July 2019, URL <https://ctan.org/tex-archive/macros/latex/required/amsmath/amslatex/doc.pdf>.
- [10] Sharpe, Michael, “New TX font package, Version 1.554.” Comprehensive T<sub>E</sub>X Archive Network (2018), accessed 27 April 2019, URL <https://ctan.org/pkg/newtx>.
- [11] Sharpe, Michael, “The mathalfa package, Version 1.10.” Comprehensive T<sub>E</sub>X Archive Network (2018), accessed 27 April 2019, URL <https://ctan.org/pkg/mathalfa>.
- [12] Smith, Robert. “Cylindrical Surfaces Involved in a Steady Motion.” BS thesis, Rochester Institute of Technology, Rochester, NY. 1996.
- [13] Watson, David. “Evaporative Heat Transfer in the Contact Line of a Mixture.” NASA Technical Memorandum No. TN-1234, National Aeronautics and Space Administration, Washington, DC. 1981. URL <https://doi.org/10.1115/1.4042912>.
- [14] Bejan, Adrian. *Advanced Engineering Thermodynamics*. John Wiley & Sons, Inc., New York, NY (1988).
- [15] Edwards, Donald K. “Thermal Radiation Measurements.” Eckert, Ernst R. G. and Goldstein, Richard J. (eds.) *Measurement Techniques in Heat Transfer*, Vol. 130 of AGAR-Dograph, Chapter 9. Technivision Services, Slough, England (1970): pp. 353–396. Published by the Advisory Group for Aerospace Research and Development of NATO.
- [16] Lienhard, John H., Mistry, Karan H., Sharqawy, Mostafa H. and Thiel, Gregory P. “Thermodynamics, Exergy, and Energy Efficiency in Desalination Systems.” Arafat, Hassan A. (ed.) *Desalination Sustainability*, Chap. 4. Elsevier Publishing Co., Amsterdam (2017): pp. 127–206. URL <https://www.elsevier.com/books/desalination-sustainability/unknown/978-0-12-809791-5>.
- [17] Govindan, Prakash Narayan, Lam, Steven and St. John, Maximus G. “Systems including a condensing apparatus such as a bubble column condenser.” US Patent #9700811 (2017).
- [18] Swaminathan, Jaichander, Stover, Richard L., Tow, Emily W., Warsinger, David M. and Lienhard, John H. “Effect of practical losses on optimal design of batch RO systems.” *Proceedings of IDA World Congress on Desalination and Water Reuse*. IDA17WC-58334. São Paulo, Brazil, 2017. International Desalination Association, Topsfield, MA. URL <http://hdl.handle.net/1721.1/111971>.
- [19] Fong, Chamberlain. “Analytical Methods for Squaring the Disc.” *ArXiv e-prints* (2015). URL <https://arxiv.org/abs/1509.06344>.
- [20] Galassi, Mark, Davies, Jim, Theiler, James, Gough, Brian, Jungman, Gerard, Alken, Patrick, Booth, Michael, Rossi, Fabrice and Ulerich, Rhys. *GNU Scientific Library Release 2.4*. Free Software Foundation, Boston, MA (2017). URL <https://www.gnu.org/software/gsl/>.

- [21] van der Walt, Stéfan and Smith, Nathaniel, “mpl colormaps.” GitHub, San Francisco, CA (2015), accessed 26 August 2018, URL <http://bids.github.io/colormap/>.
- [22] Johnson, Howard, (ed.) *Title of edited book*. John Wiley and Sons, Inc., New York, NY (1980).
- [23] Johnson, Howard, (ed.). *The title of the proceedings*, Vol. 2. The organization, Name of publisher, Address of publisher (2015). Optional note.

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

This is just a brief illustration of an appendix, showing numbering of the appendix and equations. Equations are numbered consecutively, following those in the paper.

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

$$= \iint_S \nabla \times \frac{D\mathbf{u}}{Dt} \cdot d\mathbf{A} \quad (5)$$

$$= \iint_S \nabla p \times \nabla \left( \frac{1}{\rho} \right) \cdot d\mathbf{A} \quad (6)$$

## 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 historical style of authors with affiliation in a grid of blocks may be invoked with the option [oldauthors]. 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}
```