

# Preprint Template for ASME Journal Papers: asmejour.cls

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*This paper is an example and template for the asmejour class. Papers typeset in this class will follow ASME journal style for margins, fonts, headings, captions, and reference formats. Standard L<sup>A</sup>T<sub>E</sub>X commands are used. The class will lay out the author, title, and abstract in ASME style. The class will produce a pdf file that includes hyperlinks, bookmarks, and pdf metadata. The class is intended to be used with the asmejour.bst BIB<sub>T</sub>E<sub>X</sub> style for typesetting references, which is part of this distribution. This style supports hyperlinks and modern reference formats, following current ASME practice. 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 Live and in CTAN ([ctan.org](http://ctan.org)). The class is compatible with pdf<sub>L</sub>T<sub>E</sub>X or Lua<sub>L</sub>T<sub>E</sub>X.*

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

## Introduction

The asmejour class file will typeset papers with margins, fonts, headings, captions, and reference formats that follow those used in journals published by 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 intended use of this package is to allow authors to format their papers in ASME style prior to submission to an ASME journal for peer review.

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 block containing the author[s], title, and abstract.

**Essential Initial Commands.** To begin, fill in the fields to be completed at top of the asmejour-template.tex file. The pdf metadata will be placed into the pdf file itself.

For each author, put author names and affiliation (with line breaks) into a separate \SetAuthorBlock{name}{affiliation} command; follow the syntax illustrated asmejour-template.tex file. One author (or more) may be designated as the \CorrespondingAuthor by placing the command at the end of the name.

The title should be placed into \SetTitle{...}, and line breaks may be included if desired. Keywords may optionally be included 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.

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

**Optional to the Color Title Bar.** The vertical bar in the title block is black in all ASME journals. Since the asmejour class is only for preprints, we include the [fun] option to have the bar in color. Any color name recognized by the xcolor package may be invoked by including the option barcolor=name in the \documentclass[...]{asmejour} command. The color name is Red4 by default. (To have a black bar, either omit the option entirely or use the name black.)

## References to Figures, Equations, and Citations

For ASME papers, the labels Figure and Equation should be abbreviated when they do not start a sentence, as in Fig. 1 and

Eq. (1). Figure 1 is spelled out when it starts a sentence. Equation (1) is spelled out when it starts a sentence.

Citations will be numbered automatically [1]. They should be inserted at the appropriate point using a \cite{ref} command [2, 3]. The citations will be automatically sorted and compressed, as well, if they are given in a set [1, 4–9]. Just refer to the number when naming a reference, as in [8]. Reference [8] is appropriate at the beginning of a sentence. See the asmeconf-sample.bib file for examples of how to enter your references.

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.

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

## Section Headings and Captions

ASME requires that section headings and captions be set in bold face. In addition, the captions must be in sans serif type. The asmejour class will do this automatically. You can place \cite{...}, \ref{...}, \label{...}, and into headings and captions directly, as you would in the main text. You can place \footnote{...} into headings, but not into captions.<sup>2</sup>

Sections may either be numbered or left unnumbered. ASME publishes papers in either style.

Math can be used in either captions or section headings, and an appropriate math font will be automatically selected. For a section heading that includes 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 asmejour-template.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 a heading or caption, put \mathversion{normal} in the heading or caption. (The newtxmath package [10] includes a complete set of bold math fonts, however, so the need to override should be rare.)

Single-sentence captions should not end with a period. Multi-sentence captions do include periods.

**Subsection Headings.** Section, subsection, and subsubsection headings should be in title case (first letter of primary words capitalized). ASME does not use \paragraph, so the class file treats this commands like \subsubsection.

<sup>1</sup>Corresponding author

<sup>2</sup>See tex-stackexchange for various approaches to footnotes in captions, if they seem necessary. For footnotes in tables, use the tablefootnote package.

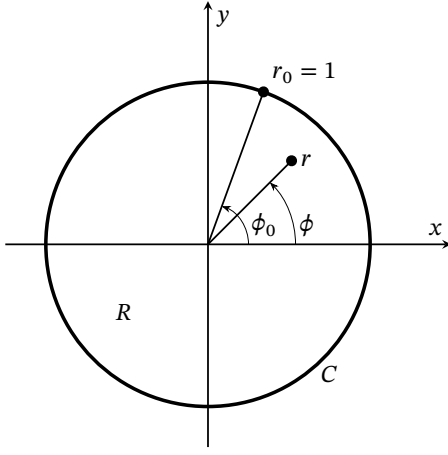


Fig. 1 A figure caption with math,  $z = (r, \phi)$  [11]

### More on Math

To get bold math outside of the captions, you can use the `\bm{...}` macro from the `bm` package, which is loaded by the class.

$$S = k \ln w \quad (2)$$

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

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

ASME typesets vectors in upright bold, like the third instance in Eq. (3), and sets matrices in bold italic. In the next equation  $\mathbf{w}$  is a vector and  $\mathbf{J}_1$  is a matrix:

$$d\mathbf{w} = \begin{pmatrix} du \\ dv \end{pmatrix} = \underbrace{\begin{pmatrix} \partial u / \partial x & \partial u / \partial y \\ \partial v / \partial x & \partial v / \partial y \end{pmatrix}}_{=\mathbf{J}_1} \begin{pmatrix} dx \\ dy \end{pmatrix} \quad (4)$$

The `newtxmath` package 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]{asmejour}.
```

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]{asmejour}
```

which selects the Euler font for `\mathcal` (this is our default). To find all the font options, refer to the `mathalfa` package documentation [12].

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.

**Units and Nomenclature.** ASME requires SI units. U.S. style units may be followed in parentheses. Be sure to put your symbols into the nomenclature list, including the SI units.

Table 1 A simple table

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

### Tables and Figures

Table 1 is an example of a simple table. Table captions should be placed above tables. The class loads the `array` and `dcolumn` packages which provide extended capabilities for columns in the tabular environment (used in Tables 2 and 3). Table 3 is designed to have exactly the width of a text column. Table 4 shows a table that spans both text columns.

Text in the figures should be checked for legibility at either single-column width (about 83 mm) or full-column width (about 170 mm). Figure captions should be placed below figures.

### Reference Formatting with `asmejour.bst`

The `asmejour.bst` BibTeX style follows the reference styles observed in ASME journals in 2019. The vast majority of published references are to journal papers and books. Examples for these and many other cases are given in the `asmejour-sample.bib` file, which is part of this distribution. Nevertheless, a few comments are necessary.

**Hyperlinked Titles.** If an `@article{...}` or `@book{...}` includes `doi={...}`, the journal title will be hyperlinked to that doi number, and the doi number will not be printed. If no doi is included, but a url is included, then the title will be hyperlinked to that url. To display the doi (or the url when no doi is given), put it into the `note={...}` field:

```
note = {\doi{10.1115/1.4042912}}
```

Include doi numbers in references whenever possible.

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`, `jstore`, or `pubmed` (e.g., `archive=hndL`, *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.

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

**Version Number<sup>3</sup>.** The `version={...}` field may be used with `@book`, `@online`, and `@manual`. By default, the text will read Version ‘number’ as in [10, 12], but different wording may be selected using the `versiontype={...}` field, to have “Revision” or something similar, as in [13]. ASME often puts the version in the title, as in [14, 15], so I’ve left the final decision for discussion between the authors and the copy editor.

<sup>3</sup>Another longer footnote to show the leading and line breaking, and how it will sit at the bottom of a column. Another longer footnote to show the leading and line breaking, and how it will sit at the bottom of a column.

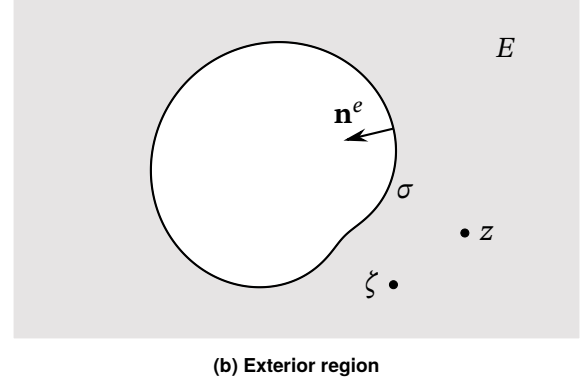
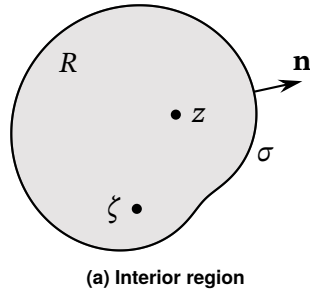


Fig. 2 A figure with two subfigures [11]

Table 2 Table with more complicated columns

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

#### Additional Options for asmejour.cls

The class accepts a number of options in addition to those already described.

**Line Numbers.** The option [lineno] invokes the the lineno package. This will produce line numbers in the margins. You must run L<sup>A</sup>T<sub>E</sub>X twice for proper placement. The lineno package is not compatible with the balance package that makes final short columns the same height. Balancing will be disabled when this option is called. See the documentation of the lineno package for further commands to control line numbering.

**Changing the Footer Text.** The option [nofoot] will omit everything other than a page number from the page footer. The option nocopyright will omit the ASME copyright from the first page footer. The command \PreprintString{...} replaces the words PREPRINT FOR REVIEW. The final paper number may be added to the page number using \PaperNumber{...}.

**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 [nodefualtsups]. The corresponding author mark in the author block will not change.

#### Math in a Section Heading: $\hat{\omega} \cdot \hat{U} = 0$

To include complicated math in a section heading without producing bookmark-related errors, use the optional argument of \section to create the pdfbookmark. The heading above was set with the following command:

Table 3 Table at full column width with columns in math mode

$X_z$	$X_c$	$X_{c,m}$	$X_{c,2}$
3.92069	5.70943	6.32429	7.08757
$\varepsilon(T_1)$	$\varepsilon^i(T_1)$	$\varepsilon^i(T_m)$	$\alpha(T_1, T_2)$
0.7258	0.6237	0.6807	0.7964
$q_{\text{gray}}$	$q_{\text{int}, T_1}$	$q_{\text{int}, T_m}$	$q_{\text{exact}}$
400.2	462.1	371.0	371.8

```
\section*{Math in a Section Heading:
\omega\cdot U=0}{Math in a Section Heading:
$\hat{\upomega}\cdot\hat{\mathrm{U}}=0$}
```

Note that bookmark can include simple math. Also note that newtxmath provides the option to obtain upright Greek letters as \upomega (vs. \omega), etc.

#### Summary

The class asmejour and associated files are for typesetting preprints in the style of ASME journals. Documentation is provided in this file and by comments in the .tex source code. Examples of entering references are shown in the asmejour-sample.bib file. The asmejour.bst file produces references following ASME's current formats. This package is not a publication of ASME and is offered without charge under the terms of the [MIT license](#).

- (1) First conclusion
- (2) Second conclusion
- (3) Third conclusion
- (4) Fourth conclusion

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#### Nomenclature

$\bar{h}$  = average heat transfer coefficient (W m<sup>-2</sup> K<sup>-1</sup>)  
 $k$  = thermal conductivity (W m<sup>-1</sup> K<sup>-1</sup>)  
 $\mathbf{q}$  = heat flux vector (W m<sup>-2</sup>)

#### Greek Letters

$\alpha$  = thermal diffusivity (m<sup>2</sup> s<sup>-1</sup>)  
 $\nu$  = kinematic viscosity (m<sup>2</sup> s<sup>-1</sup>)

#### Dimensionless Groups

Pr = Prandtl number,  $\nu/\alpha$

#### Superscripts and Subscripts

b = bulk value  
 $\infty$  = free stream value

Table 4 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

## Appendix A: Incomplete Zeta Function [16]

This text is just an illustration of an appendix. The radiation fractional function may be written in terms of the incomplete zeta function for convenience:

$$f(\lambda T) = \frac{1}{\sigma T^4} \int_0^\lambda \frac{2\pi h c_o^2}{\lambda^5 [\exp(h c_o / k_B T \lambda) - 1]} d\lambda \quad (\text{A1})$$

$$= \frac{1}{\sigma T^4} \frac{2\pi k_B^4 T^4}{h^3 c_o^2} \int_{c_2/\lambda T}^\infty \frac{t^3}{e^t - 1} dt \quad (\text{A2})$$

When  $\lambda T \rightarrow \infty$ ,  $f = 1$  and the last equation yields the well-known result

$$\sigma T^4 = \frac{2\pi k_B^4 T^4}{h^3 c_o^2} \underbrace{\int_0^\infty \frac{t^3}{e^t - 1} dt}_{\equiv \zeta(4)\Gamma(4)} \quad (\text{A3})$$

where the Gamma function  $\Gamma(4) = 3!$  and the Riemann zeta function,  $\zeta(4)$ , has the indicated integral representation [17, §13.12]. A classical result due to Euler [18] gives  $\zeta(4) = \pi^4/90$  (see also [19, §167]), from which we recover the usual definition of the Stefan-Boltzmann constant,  $\sigma$ .

## References

- [1] Edwards, D. K., 1969, "Radiative Transfer Characteristics of Materials," *ASME J. Heat Transfer*, **91**(1), pp. 1–15.
- [2] Toohey, K. S., Sottos, N. R., Lewis, J. A., Moore, J. S., and White, S. R., 2007, "Self-healing Materials with Microvascular Networks," *Nature Materials*, **6**(6662), pp. 581–585.
- [3] Gibson, T. A. and Tucker, M. A., 2008, *The Big Book of Cellular Studies*, John Wiley and Sons, New York, NY.
- [4] Stevens, T. T., 1999, "Stochastic Fields and Their Digital Simulation," *Stochastic Methods*, T. A. Sulle and M. Siiu, eds., Martinus Publishers, Dordrecht, Germany, pp. 22–36.
- [5] Wions, T. and Mills, C. D., 2005, "Structural Dynamics in Parallel Manipulation," *Proceedings of the ASME IDETC/CIE*, New Orleans, LA, September 10–13, ASME Paper No. DETC2005-99532, pp. 777–798.
- [6] Olgaria, T. T., Fredy, C. W., Popullo, A. Z., and Tucker, M. A., 2011, "Characterization of PKM Dynamics," SAE Technical Paper No. 2011-02-8345, 07ATC-96, Society of Automotive Engineers, Warrendale, PA.
- [7] Mollen, T. P., 2014, "Use of General Nonlinear Material in Articulated Systems," Ph.D. thesis, University of Boston, Boston, MA.
- [8] Smith, J., 2014, *A Dog's Life in Berlin*, Oxford University Press, New York, doi: 10.1055/acprof.oso/97890.0394.000.
- [9] "Apple Privacy Policy," Apple Inc., Cupertino, CA, updated April 4, 2019, accessed April 27, 2019, <https://www.apple.com/legal/privacy/en-ww/>
- [10] Sharpe, M., 2018, "New TX font package," Version 1.554, Comprehensive T<sub>E</sub>X Archive Network, accessed April 27, 2019, <https://ctan.org/pkg/newtx>
- [11] Lienhard, J. H., V, 2019, "Exterior Shape Factors from Interior Shape Factors," *ASME J. Heat Transfer*, **141**(6), 061301.

- [12] Sharpe, M., 2018, "The mathalfa package," Version 1.10, Comprehensive T<sub>E</sub>X Archive Network, accessed April 27, 2019, <https://ctan.org/pkg/mathalfa>
- [13] Galassi, M., Davies, J., Theiler, J., Gough, B., Jungman, G., Alken, P., Booth, M., Rossi, F., and Ulerich, R., 2017, "GNU Scientific Library," Release 2.4, Free Software Foundation, Boston, MA, accessed Dec. 12, 2018, <https://www.gnu.org/software/gsl/>
- [14] Olver, F. W. J., Olde Daalhuis, A. B., Lozier, D. W., Schneider, B. I., Boisvert, R. F., Clark, C. W., Miller, B. R., and Saunders, B. V., eds., 2017, "NIST Digital Library of Mathematical Functions, Release 1.0.17," National Institute of Standards and Technology, Gaithersburg, MD, accessed Dec. 22, 2018, <http://dlmf.nist.gov/>
- [15] Koch, R., 2018, "T<sub>E</sub>XShop, Version 4.01," University of Oregon, Eugene, OR, accessed Apr. 16, 2018, <http://pages.uoregon.edu/koch/texshop/obtaining.html>
- [16] Lienhard, J. H., V, 2019, "Linearization of Nongray Radiation Exchange: The Internal Fractional Function Reconsidered," *ASME J. Heat Transfer*, **141**(5), 052701.
- [17] Whittaker, E. T. and Watson, E. N., 1920, *A Course of Modern Analysis*, 3rd ed., Cambridge University Press, Cambridge, UK.
- [18] Euler, L., 1740, "De summis serierum reciprocarum," *Commentarii academiae scientiarum Petropolitanae* (Vol. 7), pp. 123–134, First communicated to Daniel Bernoulli in 1734 and read before the St. Petersburg Academy in December 1735, <https://arxiv.org/abs/math/0506415>
- [19] Euler, L., 1748, *Introductio in analysin infinitorum*, Vol. 1, Apud Marcum-Michaellem Bousquet & Socios, Lausannae.
- [20] Edwards, D. K., Denny, V. E., and Mills, A. F., 1979, *Transfer Processes*, 2nd ed., Hemisphere Publishing, Washington, DC.
- [21] Montijano, J. I., Pérez, M., Rández, L., and Varona, J. L., 2014, "Numerical methods with LuaT<sub>E</sub>X," *TUGboat*, **35**(1), pp. 51–56.
- [22] Reynolds, W. C., Kays, W. M., and Kline, S. J., 1958, "Heat transfer in the incompressible turbulent boundary layer. I—constant wall temperature," NASA Technical Memorandum No. 12-1-58W, National Aeronautics and Space Administration, Washington, DC, <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19980228020.pdf>
- [23] Edwards, D. K., 1970, "Thermal Radiation Measurements," *Measurement Techniques in Heat Transfer* (AGARDograph, Vol. 130), E. R. G. Eckert and R. J. Goldstein, eds., Advisory Group for Aerospace Research and Development of NATO, Technivision Services, Slough, England, Chap. 9, pp. 353–396.
- [24] Swaminathan, J., Stover, R. L., Tow, E. W., Warsinger, D. M., and Lienhard, J. H., 2017, "Effect of practical losses on optimal design of batch RO systems," *Proceedings of IDA World Congress on Desalination and Water Reuse*, São Paulo, Brazil, October 15–20, Paper No. IDA17WC-58334, International Desalination Association, Topsfield, MA, <http://hdl.handle.net/1721.1/111971>
- [25] Fong, C., 2015, "Analytical Methods for Squaring the Disc," *ArXiv e-prints*, <https://arxiv.org/abs/1509.06344>
- [26] van der Walt, S. and Smith, N., 2015, "mpl colormaps," GitHub, San Francisco, CA, accessed Aug. 26, 2018, <http://bids.github.io/colormap/>
- [27] Lienhard, J. H., IV and Lienhard, J. H., V, 2018, *A Heat Transfer Textbook*, 4th ed., Version 2.12, Phlogiston Press, Cambridge, MA.
- [28] Govindan, P. N., Lam, S., and St. John, M. G., 2017, "Systems including a condensing apparatus such as a bubble column condenser," US Patent #9700811.
- [29] Smith, R., 1998, "Conformal Lubricated Contact of Cylindrical Surfaces Involved in a Steady Motion," Master's thesis, Rochester Institute of Technology, Rochester, NY.
- [30] Smith, R., 1996, "Cylindrical Surfaces Involved in a Steady Motion," BS thesis, Rochester Institute of Technology, Rochester, NY.
- [31] Johnson, H., ed., 1980, *Title of edited book*, John Wiley and Sons, Inc., New York, NY.
- [32] Johnson, H., ed., 2015, *The title of the proceedings*, Vol. 2, City, State, Month, days, The organization, Name of publisher, Address of publisher, Optional note.
- [33] Kirk, J. T., 2288, *Decline and Fall of the Romulan Empire*, 7th ed., No. 23 in Humankind's Greatest Writings, Vulcan Free Press, T'Paal.

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