Preprint Template for ASME Journal Papers: asmejour.cls

John H. Lienhard[1]
Honorary Member ASME
Rohsenow Kendall Heat Transfer Laboratory,
Department of Mechanical Engineering,
Massachusetts Institute of Technology,
Cambridge, MA 02139 USA
email: lienhard@mit.edu

Author Name[s]
Department of Mechanical Engineering,
Institution or Company Name,
Street address,
City, State, Country
email: xxx@yyy.zzz

This paper is an example and a LaTeX *template for the* `asmejour` *class. Papers typeset in this class will follow ASME journal style for margins, fonts, headings, captions, and reference formats. The class will also lay out the author, title, and abstract in ASME style. The pdf file produced will include internal and external hyperlinks, bookmarks, and pdf metadata. The class is intended to be used with the* `asmejour.bst` BibTeX *style, which is part of this distribution. This style produces modern reference formats, including hyperlinked DOI and URL fields, and following current ASME practice. Options to the class include line numbering, final column balancing, various math options, government copyright notices, and archivability (PDF/A). In addition, section headers may contain mathematics, references, citations, and footnotes. The class is compatible with* pdfTeX *or* LuaLaTeX.

Keywords: ASME, Paper, Template, LaTeX, BibTeX, pdfTeX, LuaLaTeX

1 Introduction

The `asmejour` class typesets 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. Many other useful features are supported.

This class is not a publication of ASME, but the author has published in ASME journals since 1984. The intended use of this package is to enable 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 LaTeX commands, although some specific initial commands are needed to format the block containing the author[s], title, and abstract. The class calls a number of packages, all of which are contained in up-to-date versions of TeX Live, MacTeX, and similar platforms. If you find that you are missing a package, you may obtain it at no cost from CTAN (ctan.org).

Both pdfTeX and LuaLaTeX will load fonts that should be in your LaTeX installation (all are in TeX Live). If fonts are missing from your installation, you can get them in CTAN (ctan.org). For best results, use an up-to-date LaTeX installation.

1.1 Essential Initial Commands.

To begin, fill in the fields to be completed at top of the `asmejour-template.tex` file. The first are pdf metadata in the preamble that will tag the pdf file itself. Next is the `\JourName{..}` command, which should be changed as appropriate (omit "Journal of").

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 corresponding author by placing the command `\CorrespondingAuthor` at the end of that name.

The title should be placed into `\title{..}`, and line breaks may be specified if desired. Keywords may optionally be including using the `\keywords{..}` command; this command *must* be issued before the abstract. To omit keywords, just omit this command. Next, the abstract text must be placed into `\begin{abstract}...\end{abstract}`. The abstract will automatically be italicized.

The date is automatically given as an unnumbered footnote, which defaults to `\today`. Different text may be given using `\date{..}`. Putting `\date{}` will suppress the date footnote.

After setting up the authors, title, and abstract, issue the `\maketitle` command. The introduction section comes next.

1.2 Option to Color the 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 [1] may be invoked by including the option `[barcolor=name]` in the `\documentclass[..]{asmejour}` command. The color for this example is `Goldenrod3`. To have a black bar, either omit `barcolor` entirely or use the name `black`.

2 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 [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 [2,5–10]. If naming a reference explicitly, put "Ref." in front of the number, as in Ref. [9]. Reference [9] 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, which provide many macros to support sophisticated mathematics.

$$\mathbf{q} = -k\nabla T \tag{1}$$

3 Section Headings and Captions

ASME sets section headings and captions in bold face. In addition, the captions are in sans-serif type. The `asmejour` class chose appropriate fonts 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.[2]

[1] Corresponding Author.
Version 1.28, November 5, 2026

[2] See `tex-stackexchange` for various approaches to footnotes in captions, if they seem necessary. For footnotes in tables, use the `tablefootnote` package.

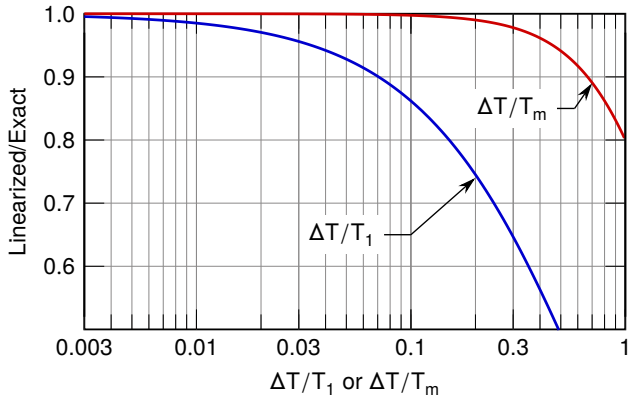


Fig. 1 Caption with math, eqn. (1): $\Delta T/T_m$ vs. $\Delta T/T_1$ [11]

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

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

Math can be used in captions or section headings, and an appropriate math font will be selected automatically.[3] 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 technique. 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.

3.1 More About 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 equates this command to `\subsubsection`.

4 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 coded to have exactly the width of a text column.

The `booktabs` package [12] is loaded (and customized) to provide versions of `\toprule`, `\midrule`, and `\bottomrule` appropriate to ASME-style tables.

Table 4 spans both text columns using the `table*` environment. Figure 2 spans both columns using the `figure*` environment. Two column tables and figures will always float to the top of a later page. Subcaptions in figures, such as Fig. 2(*a*), may be labeled and referenced individually.

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. 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 `sidewaystable*` and `sidewaysfigure*` environments [13].

[3] In LuaLaTeX, the caption's math font digits differ slightly from the text font. If you want a perfect match, do your math digits this way: `\textbf{\textsf{0123…}}`.

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 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

5 Reference Formatting with `asmejour.bst`

The `asmejour.bst` BibTeX style follows the reference styles observed in ASME journals in 2025.[4] The vast majority of published references are to journal papers and books. Examples for these and many other entry types are given in the `asmejour-sample.bib` file, which is part of this distribution. Citations and references are managed by the `natbib` package. Nevertheless, a few comments are necessary.

5.1 Capitalization of Titles.

ASME's bibliography style requires that titles be in title case. The first letters of principal words are capitalized. This must be done when writing the `.bib` file. ASME capitalizes "With", but not other prepositions.

5.2 Hyperlinked Titles or Paper Numbers.

When the entries `@article{..`, `@book{..`, `@inbook{..`, `@incollection{..`, `@proceedings{..`, or `@techreport{..` include `doi={..}`, the document title, paper number, or report number will be hyperlinked to that doi number, and the doi number will not be printed. If no doi is included, but a url or eprint is included, then the title will be hyperlinked to that url or eprint. To display the doi (or the url or eprint when no doi is given), put it into the `note={..}` field (using `\doi{..}` or `\url{..}`) like this:

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

Include doi numbers in references whenever possible.

5.3 eprint Support.

Elementary support for `eprint` numbers is included, either hyperlinking or generating a url at the end of the citation. The `archive` type may be specified using the macros `arxiv`, `googlebooks`, `hndl`, `jstore`, `oclc`, 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/}`.

5.4 Online Sources.

A bibliography field `@online{..` is included for citation of online sources, such as web pages. A `url`, `doi`, or `eprint` with `archive` should be included. See the examples of use in the `asmejour-sample.bib` file.

5.5 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.

[4] `asmejour.bst` is intended as a replacement for the older style `asmems4.bst`, which does not follow ASME's current reference formats or support DOI and URL.

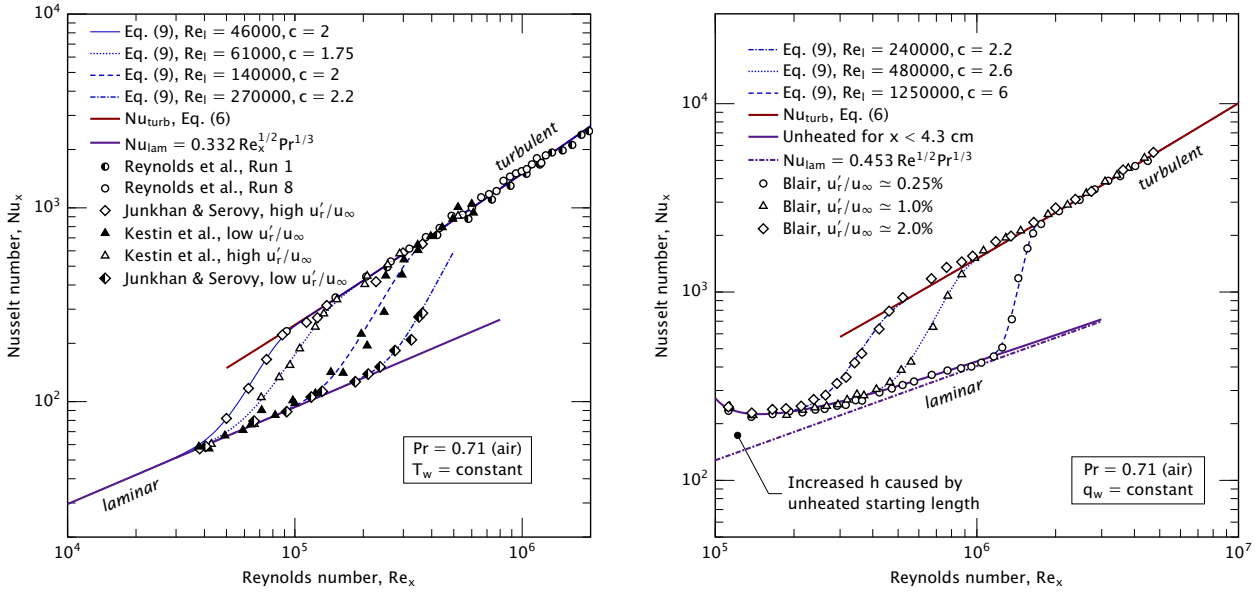


Fig. 2 A figure with two subfigures: (*a*) uniform wall temperature; and (*b*) uniform wall heat flux, unheated starting length [14]

5.6 Conference Location and Date. For the entry types `@inproceeedings{..` and `@proceeedings{..`, you may include `venue={..}` and `eventdate={..}` to specify the city and the date of a conference. Omit `address={..}` if `venue={..}` is used.

5.7 Version Number[5]**.** The `version={..}` field may be used with `@book`, `@online`, and `@manual`. By default, the text will read `Version 'number'` as in Refs. [15,16], but different wording may be selected using the `versiontype={..}` field, e.g., to say "Revision" or something similar, as in Ref. [17]. ASME often puts the version in the title, as in Refs. [18,19], so I've left the final decision for discussion between the authors and the copy editor.

5.8 Articles in Collections. In addition to the standard entry, `@incollection{..`, an entry `@inserialcollection{..` is defined for serials in which each volume has a different title. See the `asmejour-sample.bib` file for discussion and compare Ref. [20] to Ref. [21].

6 More on Math

In most cases, long equations can be kept below the column width by using one of the multiline equation environments defined by `amsmath`, such as `align`, `split`, or `multline` [22]. The following equation is set with the `multline` environment:

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

An example using `align` appears in Appendix A.

For equations that seem impossible to break over several lines, two options are available. First, an experimental package for setting equations that span two columns, `asmewide.sty`, can be loaded, although that code may require hand-fitting around floats and page breaks (see the examples in [23]). Second, a new page can be started in one-column mode, then returning to two-column mode:

```
\twocolumn[A passage of single column text.
\[ F = \textrm{wide and unbreakable expression} \]
]
```

That approach also involves finding a break point, to avoid leaving a lot of white space on the previous pages.

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`:

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

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 $\boldsymbol{J}_1$ is a matrix:

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

Note that selecting bold-face italic depends on the engine: with pdfTEX, do `\bm{..}`; with LuaLATEX, do `\symbfit{..}`. But for both engines, you can get upright letters, as used in the text font, using `\mathbf{..}` or with `\textbf{..}`

$$\mathbf{u}_r=u_r\,\hat{\mathbf{i}}+v_r\,\hat{\mathbf{j}}+w_r\,\hat{\mathbf{k}} \quad (5)$$

or, *very* rarely (perhaps never?), `\mathversion{bold}` for an entire equation[6]:

$$\boldsymbol{S}=\boldsymbol{k}\ln\boldsymbol{w}=\boldsymbol{k}\ln\left(\frac{\boldsymbol{N}!}{\prod_i \boldsymbol{N}_i!}\right) \quad (6)$$

Note that the math version must be changed *before* starting math mode. To end bold, do `\mathversion{normal}`.

Slanted lower-case greek letters are available in the usual way, e.g., `\alpha`. The class file also provides *upright* sans-serif Greek letters with `\sfalpha` and similar expressions: $\mathsf{\alpha}$, $\mathsf{\beta}$, $\mathsf{\gamma}$, $\mathsf{\delta}$, etc. Bold upright sans-serif greek can be obtained in pdfTEX as `\bm{\sfalpha}` or in LuaLATEX as `\sfbfalpha`.

Also note that `newtxmath` (pdfTEX) provides upright, serif Greek letters as, e.g., `\upomega` (vs. `\omega`).

[5] Footnotes can appear in `\section` commands.

[6] For sans-serif math expressions, `asmejour.cls` provides `\mathversion{sans}` and `\mathversion{sansbold}`. These fonts can act as engineering gothic for figures.

6.1 The newtxmath and unicode-math Packages [15,24]. The newtxmath package, loaded by default with pdfTEX, includes many options for mathematics, most of which can be called as options to \documentclass. For example, the upint option selects upright integral signs (rather than slanted integral signs):

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

The option subscriptcorrection improves the spacing of math subscripts. Math options are discussed further in the asmeconf-template.tex file.

If using LuaLATEX, the math features of unicode-math are available. These include commands to select a boldface, upright symbol, \symbfup{..} or \mathbfup{..}, to select boldface fraktur symbol, \symbffrak{..} or \mathbffrak{..}, and so on. See the documentation of unicode-math for details [24].

The [upint] option also works under LuaLATEX.

6.2 Controlling Calligraphic, Script, Fraktur, or BB Fonts. With pdfTEX, the [mathalpha] package may be loaded in the preamble [16].[7] This package supports variety of font for calligraphic, fraktur, script, and blackboard bold fonts. For example,

```
\usepackage[cal=euler,frak=boondox]{mathalpha}
```

selects the Euler font for \mathcal and the Boondox font for \mathfrak. See the mathalpha documentation for details [16].

Under LuaLATEX, the unicode-math range function can be used to select such fonts [24]. For example, the following command in the preamble would select the Euler Math font for calligraphic, script, fraktur, and blackboard bold fonts:

```
\setmathfont{Euler-Math}[
 range={cal,scr,frak,bb},
 Extension=.otf,Scale=MatchUppercase]
```

6.3 Math in a Section Heading: $\dot{\omega}\cdot\mathbf{U}=\mathbf{0}$. To include complicated math in a section heading without producing bookmark-related errors, use the optional argument of \section to create the pdf bookmark. The heading above was set with the following command:

```
\subsection[Math in a Section Heading:
  \omega\cdot U{=}0]{Math in a Section Heading:
  $\dot{\omega}\cdot\mathbf{U}=0$}
```

Note that bookmarks can include simple math.

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

7 Additional Options for asmejour.cls

7.1 Lists of Figures and Tables. A list of figures and a list of tables are generated automatically as the last page. To omit these lists, use the option [nolists].

[7] As of v1.25, the [mathalfa=ccc=ddd] class option has been dropped.

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_{gray}	q_{int,T_1}	q_{int,T_m}	q_{exact}
400.2	462.1	371.0	371.8

7.2 Final Column Balancing. The option [balance] invokes the the flushend package [25]. 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 the lineno package [26], which produces line numbers in the margins. You must run LATEX *twice* for proper placement of the numbers. The lineno package is not compatible with the flushend package that makes final short columns the same height. Balancing is disabled when this option is called. See the documentation of the lineno package for further commands to control line numbering. The abstract, tables, captions, and footnotes will not be numbered.

7.4 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 left and right preprint strings can be changed separately using an optional argument: \PreprintString{..}[L] and \PreprintString{..}[R]. The final paper number may be added to the page number using \PaperNumber{..}.

The footers are generated with the fancyhdr package [27].

7.5 Vertical Space on Title Page. The space between the author/title/abstract block and the main text defaults to 12.5 mm. Infrequently, a different value may be desirable. The space can be changed using \AbstractSep{..}, where the argument is a LATEX dimension with units (e.g., 5mm).

7.6 Federal Copyright Notices. Several types of copyright statement can be placed in an unnumbered footnote on the first page. Use the option [govt] when all authors are federal employees, [govtsome] when some authors are federal employees, and [contractor] when the authors are federal contractors.

7.7 Accessibility and Archivability. PDF/A standards for accessibility and archivability are supported through the command \DocumentMetadata{..} at the beginning of the document. The settings for accessibility (e.g., UA-2 or "well-tagged PDF") are described in Appendix D.

As of asmejour v1.25, the legacy PDF/A options [pdf-a], [pdfapart=], and [pdfaconformance=] have been dropped.

7.8 Typewriter Font Options. This font is the sans-serif, monospaced font inconsolata. By default, the word spacing is variable, but option [mono] ends this behavior. A slashed zero is the default; option [var0] removes the slash. Option [hyphenate] enables hyphenation of the typewriter font when running pdfTEX.

7.9 Single column layout. The class option [singlecolumn] switches from two-column to one-column layout.

8 Conclusions

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 references are shown in the asmejour-sample.bib file. The asemjour.bst file produces references following ASME's current formats. The code is compatible with both pdfTEX and LuaLATEX. This package is not a publication of ASME and is offered at no cost under the terms of the MIT license.

(1) First conclusion
(2) Second conclusion
(3) Third conclusion

Table 4 A table spanning two columns

x	erf(x)	erfc(x)	x	erf(x)	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

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Nomenclature

$\overline{h}$ = average heat transfer coefficient (W m^{-2} K^{-1})
k = thermal conductivity (W m^{-1} K^{-1})
$\mathbf{q}$ = heat flux vector (W m^{-2})

Greek Letters

α = thermal diffusivity (m^2 s^{-1})
ν = kinematic viscosity (m^2 s^{-1})

Dimensionless Groups

Pr = Prandtl number, ν/α
Sc = Schmidt number, $\nu/\mathscr{D}_{1,2}$

Superscripts and Subscripts

b = bulk value
∞ = free stream value

Appendix A: Incomplete Zeta Function [11]

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

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

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

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

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

where the Gamma function $\Gamma(4) = 3!$ and the Riemann zeta function, $\zeta(4)$, has the indicated integral representation [28, §13.12]. A classical result due to Euler [29] gives $\zeta(4) = \pi^4/90$ (see also [30, §167]), from which we recover the usual definition of the Stefan-Boltzmann constant, σ.

Appendix B: Language Support

ASME publishes in English, but the `babel` package is loaded for users who may wish to include other languages. For example, an author might wish to include an appendix that provides the abstract in another language. As an example, a passage in German is shown in Anhang C.

When more than one language option is included in `\documentclass[..]{asmejour}`, English will be assumed to be the main language of the document. (To choose a different main language, set the class option `[main=..]`).

The standard caption and section names will follow `babel`'s dictionary for primary languages other than English. Users may additionally change "Keywords", "Nomenclature", and "Corresponding author" by renewing the commands `\keywordname`, `\nomname`, and `\CAwords`. Changes to the page footer were described in Sec. 7.4.

The font encoding is set to T1 (pdfTEX) or TU (LuaLATEX), and utf-8 input is supported: àáâäæãåā èéęëêēė îíīįì ôöòóœøõō ûüùúū çćč ł ñń ßśš ÿ žźż.

No effort has been made to support customization of language-specific fonts.[8] Such fonts can be implemented using `babel` commands with `fontspec` under LuaLATEX. The bibliography style, `asmejour.bst`, is designed in English and aimed at `BibTeX`.

Anhang C: Der Wärmeaustausch zwischen festen Körpern und Flüssigkeiten mit kleiner reibung und kleiner Wärmeleitung (von E. Pohlhausen)

In einer strömenden Flussigkeit sind Wärmeleitung und Wärmekonvektion Vorgänge, die mit der inneren Reibung (oder Impulsleitung) und mit der Impulskonvektion große Aehnlichkeit besitzen. Mathematisch findet dies seinen Ausdruck in dem gleichartigen Bau der Differentialgleichungen, die einerseits für die Temperatur und anderseits für den Geschwindigkeitsvektor in der Flüssigkeit bestehen. Man kann daraus auf eine Beziehung zwischen dem Wärmeaustanch und dem Reibungswiderstand schließen, die eine strömende Flüssigkeit an einem festen Körper hervorrufen. Dies ist zuerst von Prandtl ausgesprochen und durchgeführt worden, und zwar für turbulente Vorgänge, unter der vereinfachenden Annahme von Wärmequellen und -senken im Innern der Flüssigkeit [31].

[8] For English, you *must* have these OpenType fonts (`.otf`) installed (all are in TeX Live and will be present if your installation is complete and up-to-date): TeX Gyre Termes, TeX Gyre Termes Math, TeX Gyre Heros, Inconsolatazi4, XITSMath-Bold, LeteSansMath, LeteSansMath-Bold, and STIX Two Math.

Appendix D: Accessibility and Well-tagged PDF

As of the November 2025 release of LaTeX, the `asmejour` class can produce accessible PDF files that meet the machine-testable requirements of the PDF/UA-2 and WTPDF 1.0 accessibility standards and the PDF/A-4f archivability standard. For this, run LuaLaTeX and choose the following settings:

```
\DocumentMetadata{
   pdfversion = 2.0,% default setting
   pdfstandard = { ua-2 , a-4f },
   tagging = on ,
   tagging-setup={math/setup=mathml-SE},
}
```

Figure files must be compatible with the standard (e.g., provided as PDF/A-3u or jpg). N.B.: not all language options are compatible with tagging.

Tagged PDF files can render accurately as HTML files (see ngpdf.com). Version 1.27 of `asmejour` added a CSS style sheet to control web appearance, `asmejour-style.css`.

References

[1] Kern, U., 2024, "Extending LaTeX's color facilities: the xcolor package," Version 3.02, Comprehensive TeX Archive Network, accessed Apr. 4, 2025, https://ctan.org/pkg/xcolor

[2] Edwards, D. K., 1969, "Radiative Transfer Characteristics of Materials," ASME J. Heat Transfer-Trans. ASME, **91**(1), pp. 1–15.

[3] 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**(8), pp. 581–585.

[4] Gibson, T. A. and Tucker, M. A., 2008, *The Big Book of Cellular Studies*, John Wiley and Sons, New York, NY.

[5] Stevens, T. T., 1999, "Stochastic Fields and Their Digital Simulation," *Stochastic Methods*, T. A. Sulle and M. Siiu, eds., Martinius Publishers, Dordrecht, Germany, pp. 22–36.

[6] Wions, T. and Mills, C. D., 2006, "Structural Dynamics in Parallel Manipulation," *Proceedings of the IDETC/CIE*, New Orleans, LA, September 10–13, ASME Paper No. DETC2005-99532, pp. 777–798.

[7] Oligaria, 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.

[8] Mollen, T. P., 2014, "Use of General Nonlinear Material in Articulated Systems," Ph.D. dissertation, University of Boston, Boston, MA.

[9] Smith, J., 2014, *A Dog's Life in Berlin*, Oxford University Press, New York, doi: 10.1115/1.888209.

[10] "Apple Privacy Policy," Apple Inc., Cupertino, CA, last modified Dec. 31, 2019, accessed Apr. 5, 2020, https://www.apple.com/legal/privacy/en-ww/

[11] Lienhard, J. H., 2019, "Linearization of Nongray Radiation Exchange: The Internal Fractional Function Reconsidered," ASME J. Heat Transfer—Trans. ASME, **141**(5), p. 052701.

[12] Fear, S., 2020, "Publication Quality Tables in LaTeX," Version 1.6180339, Comprehensive TeX Archive Network, accessed Apr. 3, 2025, https://www.ctan.org/pkg/booktabs

[13] Fairbairns, R., Rahtz, S., and Barroca, L., 2016, "A Package for Rotated Objects in LaTeX," Version 2.16d, Comprehensive TeX Archive Network, accessed Oct. 2, 2019, https://www.ctan.org/pkg/rotating

[14] Lienhard, J. H., 2020, "Heat Transfer in Flat-Plate Boundary Layers: A Correlation for Laminar, Transitional, and Turbulent Flow," ASME J. Heat Transfer—Trans. ASME, **142**(6), p. 061805.

[15] Sharpe, M., 2025, "New TX Font Package," Version 1.756, Comprehensive TeX Archive Network, accessed Apr. 3, 2025, https://ctan.org/pkg/newtx

[16] Sharpe, M., 2025, "The mathalpha, AKA mathalfa Package," Version 1.145, Comprehensive TeX Archive Network, accessed March 9, 2025, https://ctan.org/pkg/mathalpha

[17] Galassi, M., Davies, J., Theiler, J., Gough, B., Jungman, G., Alken, P., Booth, M., Rossi, F., and Ulerich, R., 2021, *GNU Scientific Library*, Release 2.7, Free Software Foundation, Boston, MA, https://www.gnu.org/software/gsl/

[18] 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, https://dlmf.nist.gov/

[19] Koch, R., 2025, "TeXShop, Version 5.49," University of Oregon, Eugene, OR, accessed Apr. 3, 2025, https://pages.uoregon.edu/koch/texshop/obtaining.html

[20] Clauser, F. H., 1956, "The Turbulent Boundary Layer," *Advances in Applied Mechanics*, H. L. Dryden and T. von Kármán, eds., Vol. 4, Elsevier, Amsterdam, The Netherlands, pp. 1–51.

[21] 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.

[22] American Mathematical Society and LATEX3 Project, 2024, "User's Guide for the amsmath Package," Version 2.17t, Comprehensive TeX Archive Network, accessed March 14, 2025, https://ctan.org/tex-archive/macros/latex/required/amsmath/amsldoc.pdf

[23] Lienhard, J. H., 2025, "Wide Equations in `asmejour.cls`," Version 1.04, Comprehensive TeX Archive Network, accessed Apr. 5, 2025, https://www.ctan.org/pkg/asmejour

[24] Robertson, W., 2023, "Experimental Unicode mathematical typesetting: The unicode-math package," Version 0.8r, Comprehensive TeX Archive Network, accessed March 9, 2025, https://ctan.org/pkg/unicode-math

[25] Tolušis, S., 2021, "The flushend Package," Version 4.0, Comprehensive TeX Archive Network, accessed March 14, 2025, https://www.ctan.org/pkg/flushend

[26] Böttcher, S. I., Lück, U., and Wette, K., 2025, "lineno.sty: A LaTeX Package to Attach Line Numbers to Paragraphs," Version 5.4, Comprehensive TeX Archive Network, accessed March 14, 2025, https://www.ctan.org/pkg/lineno

[27] van Oostrum, P., 2025, "The fancyhdr and extramarks Packages," Version 5.2, Comprehensive TeX Archive Network, accessed March 14, 2025, https://www.ctan.org/pkg/fancyhdr

[28] Whittaker, E. T. and Watson, E. N., 1920, *A Course of Modern Analysis*, 3rd ed., Cambridge University Press, Cambridge, UK, Chap. XIII, pp. 265–280.

[29] Euler, L., 1740, "De Summis Serierum Reciprocarum," Commentarii Academiae Scientiarum Petropolitanae, **7**, pp. 123–134, First communicated to Daniel Bernoulli in 1734 and read before the St. Petersburg Academy in December 1735.

[30] Euler, L., 1748, *Introductio in Analysin Infinitorum*, Vol. 1, Apud Marcum-Michaelem Bousquet & Socios, Lausannae.

[31] Pohlhausen, E., 1921, "Der Wärmeaustausch zwischen festen Körpern und Flüssigkeiten mit kleiner reibung und kleiner Wärmeleitung," Zeitschrift für Angewandte Mathematik und Mechanik, **1**(2), pp. 115–121.

[32] Fourier, J. B. J., 1822, *Théorie Analytique de la Chaleur*, Firmin Didot, Père et Fils, Paris.

[33] Reynolds, W. C., Kays, W. M., and Kline, S. J., 1958, "Heat transfer in the Incompressible Turbulent Boundary Layer. I—Constant Wall Temperature," National Aeronautics and Space Administration, Washington, DC, NASA Technical Memorandum No. 12-1-58W.

[34] Edwards, D. K., Denny, V. E., and Mills, A. F., 1979, *Transfer Processes*, 2nd ed., Hemisphere Publishing, Washington, DC.

[35] Montijano, J. I., Pérez, M., Rández, L., and Varona, J. L., 2014, "Numerical Methods With LuaLaTeX," TUGboat, **35**(1), pp. 51–56.

[36] 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*, International Desalination Association, São Paulo, Brazil, Oct. 15–20, Paper No. IDA17WC-58334.

[37] Fong, C., 2015, "Analytical Methods for Squaring the Disc," *ArXiv e-prints*, https://arxiv.org/abs/1509.06344

[38] van der Walt, S. and Smith, N., 2015, "mpl Colormaps," GitHub, San Francisco, CA, accessed Aug. 26, 2018, https://bids.github.io/colormap/

[39] Lienhard, J. H., V and Lienhard, J. H., IV, 2024, *A Heat Transfer Textbook*, 6th ed., Version 6.00, Phlogiston Press, Cambridge, MA.

[40] 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, https://patents.google.com/patent/US9700811B2

[41] Smith, R., 1998, "Conformal Lubricated Contact of Cylindrical Surfaces Involved in a Steady Motion," Master's thesis, Rochester Institute of Technology, Rochester, NY.

[42] Smith, R., 1996, "Cylindrical Surfaces Involved in a Steady Motion," Bachelor's thesis, Rochester Institute of Technology, Rochester, NY.

[43] Johnson, H., ed., 1980, *Title of Edited Book*, John Wiley and Sons, Inc., New York, NY.

[44] Johnson, H. W., ed., 2015, *The Title of the Proceedings*, Vol. 2, Organization, City, State, April 27–28, Optional note.

[45] 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, To appear.

[46] Churchill, W. S., 1948, *The Gathering Storm*, 1st ed., Vol. 1 of The Second World War, Houghton Mifflin Co., Boston, Chap. 5, pp. 66–89, "The Locust Years".

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