Preprint Template for ASME Journal Papers: asmejour.cls

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This paper is an example and 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, which is part of this distribution. This style produces modern reference formats, following current ASME styles and including hyperlinked DOI and URL fields. 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* pdfLATEX *or* LuaLATEX.

Keywords: ASME, Paper, Template, LATEX, BIBTEX

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, although 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).

For LuaLATEX, you must have the following fonts installed as system fonts on your computer: TeX Gyre Termes, TeX Gyre Heros, and Insolatazi4. These fonts can be downloaded at no charge here: http://www.gust.org.pl/projects/e-foundry/tex-gyre and https://ctan.org/tex-archive/fonts/inconsolata/opentype. No additional fonts should need to be loaded with pdfLATEX.

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. Further, the `newtxmath` package used for the math fonts includes many additional features.

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

3 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,

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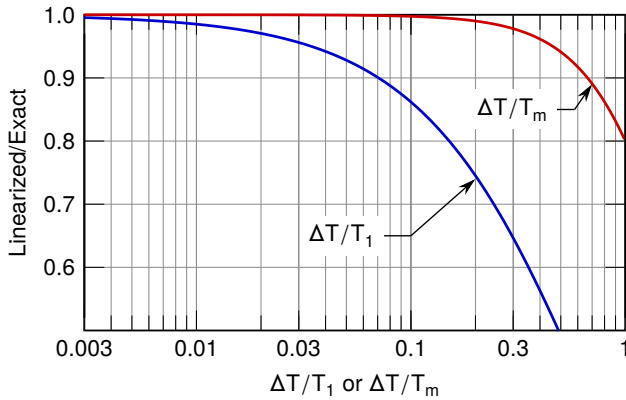
Fig. 1 Caption with math, eqn. (1): $\Delta T/T_m$ vs. $\Delta T/T_1$ [12]

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

as you would in the main text. You can place \footnote{..} into headings, but not into captions.[2]

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

Math can be used in 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 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. (The newtxmath package [11] 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.

3.1 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 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 [13] is loaded (and customized) to provide versions of \toprule, \midrule, and \bottomrule appropriate to ASME-style tables.

Table 4 shows a table that spans both text columns. Figure 2 shows a figure spanning both columns. Two column tables and figures will always float to the top of a later page. Subframes in figures, such as Fig. 2(a), may be 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 [14].

5 Reference Formatting with `asmejour.bst`

The asmejour.bst BibTeX style follows the reference styles observed in ASME journals in 2021.[3] 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 standard 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.

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{..):

    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.

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.

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

[3]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.
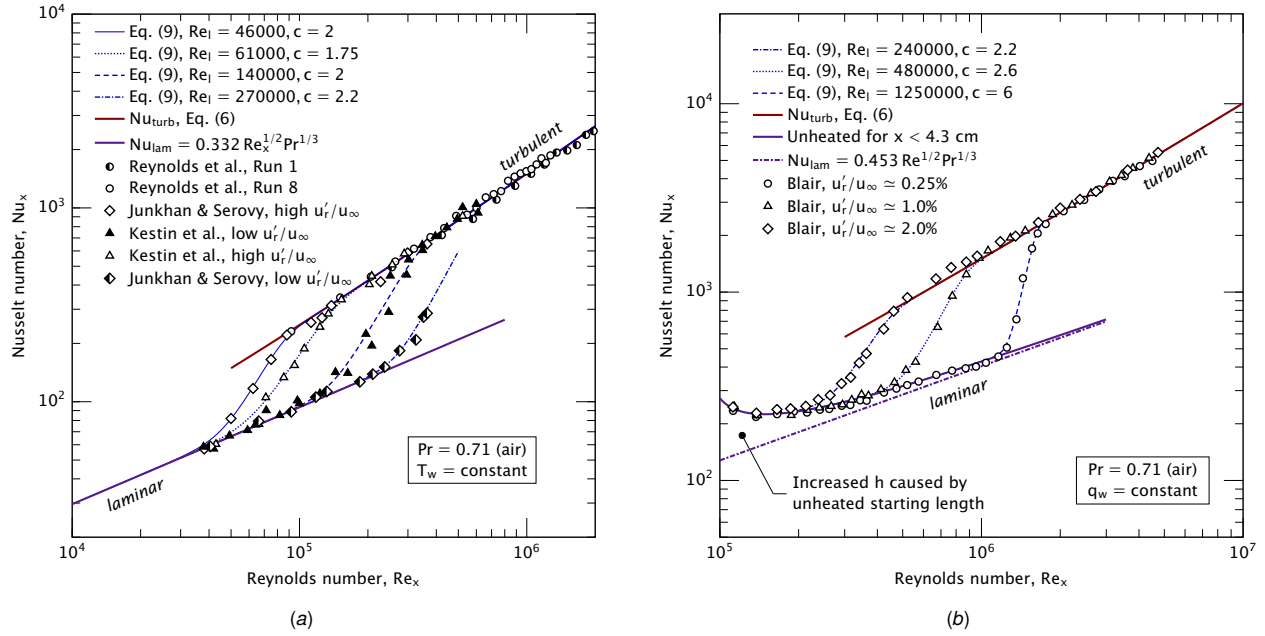
Fig. 2 A figure with two subfigures: (a) uniform wall temperature; and (b) uniform wall heat flux, unheated starting length [15]

5.7 Version Number[4]. The version={..} field may be used with @book, @online, and @manual. By default, the text will read Version 'number' as in Refs. [11,16], but different wording may be selected using the versiontype={..} field, to have "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.

An alternative solution may be to set large equations into two-column-wide tables or figures. An experimental package for setting equations that span two columns, asmewide.sty, can be loaded as well, but that code may require hand-fitting around floats and page breaks. See the examples in [23].

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:

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

The class file also provides upright sans-serif Greek letters with \sfalpha and similar expressions (e.g., α, β, γ, δ . . . **α, β, γ, δ . . .**).

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:

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

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

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

or, *very* rarely, \mathversion{bold} for an entire equation[5]:

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

6.1 newtxmath and mathalpha. The newtxmath package [11], 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]{asmejour}.

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

In addition, many options for calligraphic, script, and fraktur fonts are available through 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, as in $A \in \mathcal{P}(A)$. To see all the font options, refer to the mathalfa documentation [16].

The class is designed for use with newtxmath and does not support the unicode-math package.

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[4]Footnotes can appear in \section commands.

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

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}	$q_{\text{int},\,T_1}$	$q_{\text{int},\,T_m}$	q_{exact}
400.2	462.1	371.0	371.8

6.2 Math in a Section Heading: $\tilde{\omega} \cdot \hat{U} = 0$. To include complicated math in a section heading without producing bookmark-related errors, use the optional argument of \section to create the 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:
    $\tilde{\upomega}\cdot\hat{\mathrm{U}}=0$}
```

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

6.3 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].

7.2 Final Column Balancing. The option [balance] invokes the the flushend package [24]. 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 [25]. This will produce 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 all generated with the fancyhdr package [26], and you can change them using the commands of that package.

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 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 Archivability: PDF/A. In June 2022, the LaTeX3 team added support for PDF/A to the LaTeX kernel, using the command \DocumentMetadata{..}. This approach works with *both* pdfLaTeX and LuaLaTeX. Note that accessible conformance (a) is still under development by the LaTeX3 team.

For out-of-date LaTeX formats, compliance with PDF/A standards can be enabled using the legacy option [pdf-a] when running with pdfLaTeX. The default setting is PDF/A-3u with sRGB OutputIntent (sRGB.icc). If levels 1b, 2b, 2u, or 3b are desired, use the options [pdfapart=1 or 2 or 3] and [pdfaconformance=b or u]. Accessible conformance (a) is not possible with this method.

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 option [singlecolumn] switches from two-column to single-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 pdfLaTeX 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

Acknowledgment

Funding Data

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

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

Superscripts and Subscripts

b = bulk value
∞ = free stream value

Appendix A: Incomplete Zeta Function [12]

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

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

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

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

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

where the Gamma function $\Gamma(4) = 3!$ and the Riemann zeta function, $\zeta(4)$, has the indicated integral representation [27, §13.12]. A classical result due to Euler [28] gives $\zeta(4) = \pi^4/90$ (see also [29, §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.

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 [main=..]). If no language options are given, the package defaults to English. As an example, a passage in German is shown in Anhang C.

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 pdf bookmark for "Appendices" by be changed by renewing \appendicesname.

The font encoding is set to T1 and utf-8 input is supported: àáâäæãåā èéęěēê îïíįì ôöòóœøōõ ûüùúū çćč ł ñń ßśš ÿ žźż

No effort has been made to support customization of language-specific fonts (some fonts can be implemented using the substitutefont package [30]). The bibliography style, asmejour.bst, is designed in English and aimed at BibTeX. Multilingual bibliographies can be supported using BibLaTeX.

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].

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