



Jan Chrin

November 13, 2022

L<sup>A</sup>T<sub>E</sub>X **JACOW.org**

- 1 Introduction
- 2 Minimal example
- 3 Error handling
- 4 Typesetting document
  - Text
  - Special characters
  - Preamble
  - Structure
  - Packages
  - Environments
  - Lists
  - Figures
  - Tables
  - SI Units
  - Equations
  - References
  - Bibtex and Biber Processors
- 5 Try it yourself now!

# Introduction

An interactive tutorial to typesetting with  $\text{\LaTeX}$  is presented. The tutorial is aimed at JACoW editors with no previous experience with  $\text{\LaTeX}$ . As we learn the basic  $\text{\LaTeX}$  commands, users will be invited to get  $\text{\TeX}$ ing as we go along. A laptop with a browser is all that is required. We will use an online  $\text{\LaTeX}$  tool ([overleaf.com](https://overleaf.com)) for writing our first  $\text{\LaTeX}$ document.

# L<sup>A</sup>T<sub>E</sub>X is cool!

- Created by mathematicians and scientists, for mathematicians and scientists
- Documents are written in plain text, with `commands` that determine its structure
- Text and commands are processed by `latex` to produce neatly formatted documents
- Extendable, numerous libraries with packages of extra commands and environments

Takeaway: the philosophy is *“you think about the content, L<sup>A</sup>T<sub>E</sub>X takes care of the formatting.”*

- This is a very different approach from WYSIWYG (e.g. MS Word).
- Once you embrace it, you are golden!

# Where to get help

Plenty of sources on the web:

- Tutorials (e.g. <https://www.overleaf.com/learn/latex/Tutorials>)
- Reference manuals:
  - The Not So Short Introduction to  $\LaTeX$ ,  
<https://tobi.oetiker.ch/lshort/lshort.pdf>
  - An Unofficial Reference Manual, <http://texdoc.net/texmf-dist/doc/latex/latex2e-help-texinfo/latex2e.pdf>
  - **Individual packages** (e.g. "graphicx",  
<https://ctan.org/pkg/graphicx?lang=en>)
- Forums – you can literally find answers to any questions you might have (e.g. <https://tex.stackexchange.com/> – **priceless!!!**)

# Hello JACoW! example

```
\documentclass[10pt,a4paper]{article}
\begin{document}
  Hello JACoW! %This is a comment
\end{document}
```

- A backslash  $\backslash$  signifies the start of a command
- `\documentclass` is the first  $\text{\LaTeX}$  command
- The braces  $\{ \}$  take a single argument which  $\text{\LaTeX}$  uses for formatting. Standard formats are, e.g., `article`, `book`; customized formats are, e.g., `jacow`
- The square brackets  $[ ]$  embrace user supplied options. The above instructs  $\text{\LaTeX}$  to typeset the document as an article, with 10pt base font size for printing on A4
- Text is entered between `\begin{document}` and `\end{document}`
- The percentage sign  $\%$  starts a comment (which  $\text{\LaTeX}$  ignores)

# Error handling

- If during compilation the compiler spits out an error then:
  - **DON'T PANIC!**
  - Read the *first* error message, which will also point you to the source of the error (line number)
  - Correct the error and recompile
- If the error message looks cryptic or does not show the line number
  - Head straight to Google or T<sub>E</sub>X Stack Exchange (see link above) and enter the error description
  - There is a *really* good chance your questions was asked and answered a while ago
- Still lost and confused?
  - There is always more than one way to achieve your goal, consider trying something else
  - You are still not on your own: the key to success is the right Google query (it's only hard for the first 15 year, then you've mastered it!)

# Typesetting text

```
\documentclass{article}
```

The space between `\documentclass` and `\begin{document}` is referred to as the "preamble"

```
\begin{document}
```

Spaces between words do not matter as they are collapsed in the output.

Paragraphs are separated by one or more blank lines or by the command `\par`

Text can be typed in simply like this, using almost any character such as `* ( ? < > |`  
However, a few common characters have a special meaning in LaTeX.

```
\end{document}
```



# Special characters

{ } % # & \$ \_

To make any of these characters appear in your text you will need to escape the character by preceding it with a backslash:

\{ \} \% \# \& \\$ \\_

to get: { } % # & \$ \_

To make a backslash appear in the text, type `\textbackslash`

# Formatting preamble

```
\documentclass{article}

% in "preamble" space
\title{My First \LaTeX~Paper}
\author{R. Sunak}
\date{\today}

\begin{document}

  \maketitle % uses info above to typeset title page
  \begin{abstract}
    How to get started with the \LaTeX~text processing
    package. I am the newly elected prime minister of
    the United Kingdom. It is my wish to remain in
    office until the end of this JACoW Team Meeting.
  \end{abstract}

\end{document}
```

# Structuring your document

```
\documentclass{article}
\begin{document}

\section{Introduction}
An introduction to the \LaTeX~text processing packages
is presented.
\section{Methodology}
\subsection{Experimental Setup}
The experiment \ldots
\subsection{Data Analysis}
The data analysis \ldots
\subsubsection{Procedure}
Subsubsections are rarely used.
\section{Results}
\section{Conclusion}
\section{Acknowledgements}

\end{document}
```

# Using packages

L<sup>A</sup>T<sub>E</sub>X features numerous commands and environments. In addition to the built-in set, there are hundreds of others libraries with extra commands/environments made available through packages. Packages are loaded in the preamble through `\usepackage`. Expect to load several more as your expertise grows and you want more refined control! Example: `graphicx` package for the `\includegraphics` command:

```
\includegraphics[width=\textwidth,clip,trim={0 10mm 15mm  
5mm}]{filename.png}
```

# Using specific environments

`\begin`

and

`\end`

commands create a special environment or context. Some examples are:

```
\begin{abstract} \end{abstract}
\begin{itemize} \end{itemize}
\begin{enumerate} \end{enumerate}
\begin{equation} \end{equation}
\begin{figure} \end{figure}
\begin{table} \end{table}
```

# Lists: enumerate and itemize

Canadian national hockey league teams:

```
\begin{itemize} % bullet points
\item Vancouver Canucks
\item Toronto Maple Leafs
\item Montreal Canadians
\end{itemize}
```

```
\begin{enumerate} % numbered points
\item Edmonton Oilers
\item Ottawa Senators
\item Winnipeg Jets
\item Calgary Flames
\end{enumerate}
```

- For finer control of lists, see here (or any other tutorial):  
<https://www.latex-tutorial.com/tutorials/lists/>

# Figures

- Requires package `\usepackage{graphicx}`
- To reference a figure in the text, use the `\ref{}` command that makes reference to the respective figure labeled by `\label{}` as shown below:

```
Figure~\ref{fig:frog} illustrates  
\begin{figure}  
  \centering  
  \includegraphics[width=0.9\textwidth]{frog}  
  \label{fig:frog}  
  \caption{The FROG experimental setup.}  
\end{figure}
```

# Tables I

Table: Margin Specifications

Margin	A4	US Letter
Top	37 mm	0.75 in
Bottom	19 mm	0.75 in
Left	20 mm	0.79 in
Right	20 mm	1.02 in

- Package `booktabs` provides nicer lines: `\toprule`, `\midrule`, and `\bottomrule`
- Package `tabularx` provides finer control over table cells (`()`)
- Package `siunitx` handles a variety of SI units and typesets them correctly
- For further information, please check this awesome website with tutorials, examples, etc: <https://en.wikibooks.org/wiki/LaTeX/Tables>



# Tables II

```
\begin{table}[hbt]
  \centering
  \caption{Margin Specifications}
  \begin{tabular}{lcc}
    \toprule
    \textbf{Margin} & \textbf{A4} & \textbf{US Letter} \\
    \midrule
    Top & \SI{37}{mm} & \SI{0.75}{in} \\
    Bottom & \SI{19}{mm} & \SI{0.75}{in} \\
    Left & \SI{20}{mm} & \SI{0.79}{in} \\
    Right & \SI{20}{mm} & \SI{1.02}{in} \\
    \bottomrule
  \end{tabular}
  \label{table:margin}
\end{table}
```

# SI Units

```
\SI{20}{mm}
```

```
\SI{10}{\um}
```

```
\SI{1}{\pi{\cdot}\mm{\cdot}\radian}
```

```
\SI[per-mode=fraction]{2.00}{\metre\per\sec}
```

```
\SI{2,35}{\metre\per\sec}
```

```
\SI[mode=text]{2,70}{\metre.sec^{-1}}
```

```
\SI{100}[\$]{\per {kW}}
```

20 mm

10  $\mu\text{m}$

1  $\pi \cdot \text{mm} \cdot \text{rad}$

2.00 m/sec

2.35 m/sec

2.70 m sec<sup>-1</sup>

\$100 /kW

# Adding equations: inline math

- Inline math mode: The maths is surrounded by single dollar signs.
- For example,  $x^2 + y^2 = z^2$  is produced by  
 `$x^2 + y^2 = z^2$`
- The single dollar signs surrounding the mathematical expression cause  $\text{T}_{\text{E}}\text{X}$  to enter and exit math mode.

## Adding equations: display mode

- Display math mode: the math surrounded by escaped brackets (“\[" and “\]”),
- For example:

$$x^2 + y^2 = z^2$$

is produced by:

```
\[  
x^2 + y^2 = z^2  
\]
```

- Keep in mind, those equations are not numbered (see below for numbered equations and basic equation grouping)

# Basic math expressions I

- Elementary maths,  $a \leq 6$ ,  
`$a \le 6$`
- Fraction,  $\frac{3}{4}$ ,  
`$$\frac{3}{4}$$`
- Square root,  $\sqrt{2}$ ,  
`$$\sqrt{2}$$`
- Superscripts and subscripts are indicated by carets and underscores:  
`$2^n$`, `$x_1$`, `$a^{x+y}$`,  
which gives  $2^n$ ,  $x_1$ ,  $a^{x+y}$
- Greek Letters,  $\alpha, \beta, \gamma, \delta, \Delta$ ,  
`$$\alpha, \beta, \gamma, \delta, \Delta$`

## Basic math expressions II

- Sums and Integrals,  $\sum$ ,  $\int$ ,  $\oint$ ,  $\iiint$ ,  
`\sum`, `\int`, `\oint`, `\iiint`  
(typeset differently in line and display mode)
- Functions, e.g. sin, cos, log, exp:

$$\sin(x + y) = \sin x \cos y + \cos x \sin y \log z$$

```
\[  
  \sin(x+y) = \sin x \cos y + \cos x \sin y \log z  
\]
```

## Numbered equations

$$f(\alpha, \beta) = \sqrt{(\alpha^2 + \beta^2)} \quad (1)$$

$$\sum_n^{(n+1)} = (\gamma_1^{(n+1)} + \gamma_2^{(n+1)}) \quad (2)$$

```
\begin{equation}
f(\alpha, \beta) = \sqrt{(\alpha^2 + \beta^2)}
\end{equation}
```

```
\begin{equation}
\sum_n^{(n+1)} =
(\gamma_{1}^{(n+1)} + \gamma_{2}^{(n+1)})
\end{equation}
```

Use `equation*` (or `\[, \]` for short) to remove numbering

## Aligning equations

$$f(\alpha, \beta) = \sqrt{(\alpha^2 + \beta^2)} \quad (3)$$

$$\sum_n^{(n+1)} = (\gamma_1^{(n+1)} + \gamma_2^{(n+1)}) \quad (4)$$

```
\begin{align}
f(\alpha, \beta) &= \sqrt{(\alpha^2 + \beta^2)} \\
\sum_n^{(n+1)} &= \\
&(\gamma_1^{(n+1)} + \gamma_2^{(n+1)})
\end{align}
```

- Use `align*` to remove numbering
- More information about `align` is here:  
[https://latex.wikia.org/wiki/Align\\_\(environment\)](https://latex.wikia.org/wiki/Align_(environment))
- ...or in the `amsmath` package manual: <http://texdoc.net/texmf-dist/doc/latex-dev/amsmath/amslldoc.pdf>
- **Note:** package manuals are typically perfectly readable and full of examples!



# References

- A. Alpha, B. T. Beta, C. Gamma, and D. Delta, “An overview of control systems,” in *Proc. ICALEPCS’15*, Melbourne, Australia, Oct. 2015, pp. 89–91, doi:10.18429/JACoW-ICALEPCS2015-WEB3004

Requires `\usepackagecite` and `\usepackageurl`

See Ref. `\cite{icalpecs11:alpha}`

```
\begin{thebibliography}{9} % or {99} if > than 9 refs.
  \bibitem{icalepcs11:alpha}
  A.~Alpha, B.~T.~Beta, C.~Gamma, and D.~Delta,
  ‘‘An overview of control systems,’’
  in \emph{Proc. ICALEPCS\textquotesingle 15},
  Melbourne, Australia, Oct. 2015, pp. 89--91,
  \url{doi:10.18429/JACoW-ICALEPCS2015-WEB3004}
\end{thebibliography}
```

# biber/bibtex

Latest JACoW template requires the following 'magic commands'.  
They are placed at the top of the source file, i.e., before `\documentclass`  
See “Editing recommendations for JACoW conferences”, Volker RW Schaa  
<https://www.jacow.org/uploads/Editors/editing-recommendations.pdf>  
They are in the latest template.

```
% !BIB TS-program = biber/bibtex
% !BIB program = biber/bibtex
% !TeX spellcheck = en_GB/en_US
% !TeX program = pdflatex/lualatex/xetex
% !TEX TS-program = pdflatex/lualatex/xetex
% !TeX encoding = utf8/IsoLatin/IsoLatin
```

**Let's try it: head over to Overleaf!**

**Thank You!**