

Basic + Advanced L^AT_EX Tutorial

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(based on the material by Jan Chrin and Todd Satogata)

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Introduction

An interactive tutorial to typesetting with L^AT_EX is presented. The tutorial is aimed at JACoW editors with no previous experience with L^AT_EX. As we learn the basic L^AT_EX commands, users will be invited to get T_EXing as we go along. A laptop with a browser is all that is required. We will use an online L^AT_EX tool (overleaf.com) for writing our first L^AT_EX document.

L^AT_EX 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^AT_EX 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 L^AT_EX,
<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 L^AT_EX command
- The braces $\{ \}$ take a single argument which L^AT_EX 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 L^AT_EX 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 L^AT_EX 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_EX 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{J. Trudeau}
\date{\today}

\begin{document}

  \maketitle % uses info above to typeset title page
  \begin{abstract}
    How to get started with the \LaTeX~text processing
    package.
  \end{abstract}

\end{document}
```

- Note that JACoW template has a more complex structure of the preamble

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^AT_EX 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 First bullet
\item Second bullet
\item Third bullet
\end{itemize}
```

```
\begin{enumerate} % numbered points
\item Item 1
\item Second item
\item Penultimate item
\item Last item
\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 (<http://mirrors.ctan.org/macros/latex/required/tools/tabularx.pdf>)
- 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}
```

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 T_EX 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 `\usepackage{cite}` and `\usepackage{url}`

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

```
\begin{thebibliography}{9} % or {99} if > than 9 refs.
  \bibitem{icalpecs11: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}
```


Let's try it: head over to Overleaf!

**Let's talk about
some advanced topics:
JACoW templates
and paper samples**

JACoW template

- The current JACoW template is available in the Overleaf gallery <https://www.overleaf.com/latex/templates/jacow-latex-template/sndznvggsycb>
- Click “Open as Template”
- The body of the document does not begin until line 59
- Let us walk through the template and point out highlights

JACoW paper preparation instructions

- JACoW paper preparation instructions are available at <http://jacow.org/Authors/LaTeX>
- There is both a L^AT_EX file and a PDF document, so that you can look at the result and dissect the source

PREPARATION OF PAPERS FOR JACoW CONFERENCES*

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Abstract

Many conference series have adopted the same standards for electronic publication and have joined the Joint Accelerator Conferences Website (JACoW) collaboration for the publication of their proceedings. This document describes the common requirements for the submission of papers to these conferences. Please consult individual conference information for page limits, method of electronic submission, etc. It is not intended that this should be a tutorial in word processing; the aim is to explain the particular requirements for electronic publication at www.JACoW.org. The abstract itself is to act as a stand-alone entity and, as such, should not include citations. Any acronyms should be expanded on their first occurrence, both in the abstract and in the rest of the paper. The abstract itself is to act as a stand-alone entity and, as such, should not include citations. Any acronyms should be expanded on their first occurrence, both in the

Table 1: Margin Specifications

Margin	A4 Paper	US Letter Paper
Top	37 mm (1.46 in)	0.75 in (19 mm)
Bottom	19 mm (0.75 in)	0.75 in (19 mm)
Left	20 mm (0.79 in)	0.79 in (20 mm)
Right	20 mm (0.79 in)	1.02 in (26 mm)

use only Symbol and, depending on your platform, Times or Times New Roman fonts in standard, bold or italic form.

The layout of the text on the page is illustrated in Fig. 1. Note that the paper's title and the author list should be the width of the full page. Tables and figures may span the whole 170 mm page width, if desired (see Fig. 2), but if they span both columns, they should be placed at either the top or bottom of a page to ensure proper flow of the text (which

Common mistakes

- Title formatting
- Author list overruns hbox
- Old template
- Wrong type of quotes used: "double quotes" instead of "two single left and two single right quotes"
- μ vs μ in units
- Units in general! (more on the next slide)
- Equation overrun, using equations in text, equation punctuation
- Missing `\url{}` in citations

More on units

- It is very common for authors to write out their own units instead of using `\siunitx` e.g. writing 10,mm or $10\sim\text{mm}$ or $50\sim\Omega$
- This is (almost) okay (as long as consistent) except units should use an upright mu, not a default italic mu
- Better solution: `\SI{1.23}{m/s^2}` (result: 1.23 m/s²). Way more detail in <http://mirrors.ctan.org/macros/latex/contrib/siunitx/siunitx.pdf>
- Units and descriptive labels (super/subscripts) should be upright, quantities should be italic
- The situation is more subtle, find details at <https://physics.nist.gov/cuu/pdf/checklist.pdf>
- LaTeX math symbols all have various codes: <http://tug.ctan.org/info/symbols/comprehensive/symbols-a4.pdf>

`\usepackage{siunitx}`

```
\SI[mode=text]{1.23}{J.mol^{-1}.K^{-1}}
```

```
\SI{.23e7}{\candela}
```

```
\SI[per-mode=symbol]{1.99}[\$]{\per\kilogram}
```

```
\SI[per-mode=fraction]{1,345}{\coulomb\per\mole}
```

1.23 J mol⁻¹ K⁻¹

0.23 × 10⁷ cd

\$1.99/kg

1.345 $\frac{\text{C}}{\text{mol}}$

Let's practice some more

- Download the zip file <http://www.toddsatogata.net/JACoW/MOYGB1.zip>
- Start a new Overleaf project and import the zip file into Overleaf
- Edit the paper until it looks correct!

Thank You!