

Thin Section: Intro to LaTeX

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1 Introduction

This is a brief introduction to some aspects of \LaTeX (pronounced Lay-Tek), which is a document preparation system that is particularly useful for formatting equations. I use Overleaf – it will flag up errors, (attempt to) autocomplete commands, allow you to compile the document in the same window, and more.

LaTeX is fairly intuitive, e.g.: if you want a new page, use `\newpage`; for a footnote, write `\footnote{}`. However, the internet is very useful for when you do run into issues – you can usually look up the problem (/ thing you want to do) and find a solution, e.g., on Stack Exchange, an Overleaf guide, or in a package manual.

Link to a (very) basic LaTeX template, with (most of the) packages mentioned in this document: https://github.com/jesscrwhite/latex_template/blob/main/main.tex.

2 Preamble

2.1 Packages

- Preamble that should already be on the document in Overleaf:
 - `\documentclass[12pt]{extarticle}` (setting font size and document type)¹
 - `\usepackage[utf8]{inputenc}` (saying which characters are being used)
 - `\usepackage[margin=2.5cm]{geometry}` (setting margin width)
- Packages that should let you use frequently needed commands / symbols:
 - `\usepackage{siunitx}`
 - `\usepackage{amsmath}`
 - `\usepackage{amsfonts}`
 - `\usepackage{amssymb}`
 - `\usepackage{textcomp, gensymb}`
 - `\usepackage{mathtools}`
- Tables:
 - `\usepackage{booktabs}`
 - Making tables that span more than one page: `\usepackage{longtable}`
- Figures:
 - `\usepackage{graphicx}`
 - For subfigures:
 - * `\usepackage{caption}`
 - * `\usepackage{subcaption}`
 - For placing a figure / table exactly where you want it:
 - * `\usepackage{float}` (use [H], e.g., `\begin{table}[H]`)
- Formatting:
 - For hyperlinks: `\usepackage{hyperref}`

¹Other document classes include `beamer` (for making presentations) and `report`.

- * E.g., `\url{https://www.overleaf.com/learn/latex/Matrices}` appears as: <https://www.overleaf.com/learn/latex/Matrices>.
 - * Fig. `\ref{fig:sedg_club_logo}` appears as Fig. 1 and, when clicked, will send you to the figure.²
 - * Table `\ref{tab:pre_ch1_table}` for: Table 1.
 - * `\ref{eq:evolution_of_dislocation_density_breithaupt_2023}` for: E.2.
- To automatically break up long urls: `\usepackage{xurl}`
 - Bold text in math mode: `\usepackage{bm}`
 - * E.g., `\bm{H}\times\bm{m}` for: $H \times m$.
 - For coloured text: `\usepackage[dvipsnames]{xcolor}`
 - * E.g., `\textcolor{Magenta}{text}` for: **text**.
 - Chemical formulae: `\usepackage[version=4]{mhchem}`
 - * E.g., `\ce{3Fe^{2+}Al^{3+}2O4}` for: $3\text{Fe}^{2+}\text{Al}_2^{3+}\text{O}_4$.
 - Upright Greek letters in text: `\usepackage{textgreek}`
 - * E.g., `\textdelta` for δ and `\textDelta` for Δ , as opposed to `\delta` for δ and `\Delta` for Δ .
 - * Micrometres – `\textmu m` for μm .
 - Indent the first paragraph in a section too (optional): `\usepackage{indentfirst}`
 - Making multiple columns (/ rows) possible (optional):
 - `\usepackage{multicol}`
 - `\usepackage{multirow}`
 - Customising a document using the ‘fancy’ page style (optional):
 - `\usepackage{lastpage}`
 - `\usepackage{fancyhdr}`
 - `\fancyhead{}` (clearing the headers)
 - `\renewcommand{\headrulewidth}{0pt}` (setting the width of the line at the top of the page)

²You have to label the figure, using `\label{}`, for this option to be available. But using this function means that the referenced numbers of equations, figures, etc. **automatically** update.

`\fancyhead[R]{\slshape\leftmark}` (marking the right of the page with the section name)

`\setlength{\headheight}{14.49998pt}` (this value seems to work well)

`\fancyfoot[C]{\thepage/\pageref*{LastPage}}` (the asterisk prevents there from being a hyperlink on every page leading to the last page) (optional)

`\fancypagestyle{plain}{`

`\fancyfoot[C]{\thepage/\pageref*{LastPage}}` (i.e., making the page number at the bottom of the page display as x /final page no.)

`\fancyhead{`

`}` (making the correct page number style show up, and making sure there is no header on the first page)

`\pagestyle{fancy}`

- For right before the document begins (these should also already be loaded into the template on Overleaf):
 - `\title{Thin Section: Intro to LaTeX}` (with your own title)
 - `\author{Jess White, jw2189}` (and own name)
 - `\date{Easter 2023}` (and date)
 - `\begin{document}`
 - `\maketitle`
- Optional – table of contents:
 - `\tableofcontents` (input at some point after `\begin{document}`)
 - `\usepackage[nottoc,notlot,notlof]{tocbibind}` (place with the other packages in order to display the bibliography in the table of contents) (optional)

2.2 New commands

(This is just to demonstrate how you can define your own commands.)

- For equations to be labelled as (E. 1) rather than just (1):
 - `\renewcommand{\theequation}{E.\arabic{equation}}`
- For superscript in text mode: `\newcommand{\ts}{\textsuperscript}`
 - E.g., `1\ts{st}` for: 1st.

3 Style guide

3.1 LaTeX-specific

- For quote marks, you have to use ‘ for the left quote mark and ’ for the right.
 - Compare: ’ ’quote’ ’ (“quote”) and ‘ ‘quote’ ’ (“quote”).
- Some characters are used for specific functions within LaTeX,³ so must be typed with a backslash before them to be output.
 - E.g., `\&` for & (also # and %).
- Sometimes a manual space is required before / after certain characters, achieved by using a backslash (followed by a space).
 - E.g., **before** `\textrm{d}x` in an equation (technically optional).
 - E.g., **after** pretty much any character that is not %, &, or # – e.g., `\textgamma` (γ) and `\textperthousand` (‰).⁴
 - Some depend on context, e.g., `0\degree C` (0°C) but `5\degree\ angle` (5° angle).

3.1.1 Math mode

(Math mode is entered within `$$` and the `{equation}` environment.)

- Some things should be written in upright text, e.g.:
 - `$$\sin x$` for $\sin x$.
 - `$$\ln x$` for $\ln x$.
- Adjusting bracket size: use `\left(` and `\right)` with the bracket of interest, e.g., (x) , $\{x\}$, $[x]$, $|x|$, $\langle x \rangle$. E.g.:

$$f(x) = \sum_{n=-\infty}^{\infty} \frac{1}{a} \exp\left(\frac{2\pi i n x}{a}\right). \quad (\text{E.1})$$

Input:

```
\begin{equation}
  f(x)=\sum_{n=-\infty}^{\infty}\frac{1}{a}\exp\left(\frac{2
  \textrm{\textpi i}nx}{a}\right).
\end{equation}
```

³E.g., & is used for alignment and % is used for commenting in the source file.

⁴Unless, of course, the character is to be followed by some punctuation.

- Potentially useful commands:

- `\underbrace{}_{}`, e.g.⁵:

$$\dot{\rho} = \underbrace{\frac{1}{b} \left(m\sqrt{\rho} + \frac{n}{d} \right)}_{\text{storage}} \dot{\epsilon} - \underbrace{\left(\mathcal{R}_{\text{gb}}(T) \frac{\rho^2}{d} + \mathcal{R}_{\text{pipe}}(T) \rho^3 \right)}_{\text{static recovery}}, \quad (\text{E.2})$$

Input:

```
\dot{\rho}=\underbrace{\frac{1}{b}\left(m\sqrt{\rho}+\frac{n}{d}\right)\dot{\epsilon}}_{\text{storage}}-\underbrace{\left(\mathcal{R}_{\text{gb}}(T)\frac{\rho^2}{d}+\mathcal{R}_{\text{pipe}}(T)\rho^3\right)}_{\text{static recovery}},
\label{eq:evolution_of_dislocation_density_breithaupt_2023}
```

- Set theory, e.g., $n \in \mathbb{Z}$.
- Much greater than: \gg , rather than \ggg (\ggg).⁶
- Overbar: $\bar{1}$, \bar{I} , or $\overline{1}$, \overline{I} .
- Text over arrow: $f(x) \xrightarrow{K} g(x) = f(x) \xrightarrow{K} g(x)$.

3.2 General

- Upright vs. italicised.⁷
 - Physical constants – italicised (because they are measured).
 - * E.g., R , c , \hbar (\hbar), Z , and e (elementary charge).
 - Mathematical constants – upright.
 - * E.g., i ($\sqrt{-1}$), π , and e (Euler’s number).
 - Alpha particle – upright (α).

⁵From Breithaupt *et al.*, 2023.

⁶A selection of other symbols: \sim for \sim ; \approx for \approx ; \geq for \geq ; \cdot for \cdot ; ∂ for ∂ ; \implies for \implies ; \propto for \propto ; and \circledast for \circledast .

⁷As per, e.g., <https://iupac.org/wp-content/uploads/2016/01/ICTNS-On-the-use-of-italic-and-roman-fonts-for-symbols-in-scientific-text.pdf>.

- Variable in a subscript – italicised.
 - * E.g., n_i ($\$n_i\$$).
- Descriptive subscripts – upright.
 - * E.g., E_k ($\$E_{\text{trm}\{k}\}\$$; kinetic energy) and V_m (molar volume).
- Foreign phrases – italicised.
 - * E.g., *et al.* (optional).
- Hyphenation.
 - Use one dash, –, for things like ‘centimetre-scale banding’, ‘temperature-dependent process’, ‘grain-boundary migration’, and ‘high-resolution image’.
 - Use two dashes, --, for things like ‘Rb–Sr’, ‘electron–hole pair’, and ‘Miller–Urey experiment’.

3.3 Miscellaneous commands

- Creating lists, e.g.:
 - `\begin{itemize}` for bullets.
 - `\begin{enumerate}` for numbered lists.
- Manually adding spaces:
 - E.g., `\vspace{0.5cm}` for a vertical space.
- Page numbering, e.g.:
 - `\pagenumbering{roman}` (for numbering from i).
 - `\pagenumbering{arabic}` (for numbering from 1).
- To avoid numbering a section or equation:
 - E.g., `\section*{ }` (i.e., place an asterisk before the bracket).
- Some letters:

<code>\AA</code> = Å.	<code>\c{c}</code> = ç.	<code>\dh</code> = ě.	<code>\~e</code> = ê.	<code>\o</code> = ø.
<code>\ae</code> = æ.	<code>\v{c}</code> = č.	<code>\‘e</code> = è.	<code>\~n</code> = ñ.	<code>\"u</code> = ü.

3.4 Examples

- Figure:



Input:

```
\begin{figure}[H]
\centering
\includegraphics[width=4cm]{sedg.jpeg}
\caption{Sedgwick Club logo.}
\label{fig:sedg_club_logo}
\end{figure}
```

Figure 1: Sedgwick Club logo.

- Table:

Table 1: Pre-chlorite overview.

First column	Second column
Type section:	#185 – phyllite–graphite; 200 ft south of summit Ben Vrackie, Perthshire
Formation:	Clay minerals → Ms

Input:

```
\begin{table}[H]
\centering
\caption{Pre-chlorite overview.}
\begin{tabular}{r p{0.65\linewidth}}
\toprule \textbf{First column} & \textbf{Second column} \\ \midrule
\textbf{Type section:} & \#185 -- phyllite--graphite; 200 ft south
of summit Ben Vrackie, Perthshire \\
\textbf{Formation:} & Clay minerals $\rightarrow$ Ms \\
\bottomrule
\end{tabular}
\label{tab:pre_chl_table}
\end{table}
```

- Differentiation:

$$\Gamma = \frac{dX}{dP} \frac{dP}{dt}. \quad (\text{E.3})$$

$\Gamma = \frac{dX}{dP} \frac{dP}{dt}$.

- Integration:

$$N = \int_0^\pi n(\alpha) d\alpha. \quad (\text{E.4})$$

$N = \int_0^\pi n(\alpha) d\alpha.$

References

- [1] Breithaupt, T., R. F. Katz, L. N. Hansen, and K. M. Kumamoto. “Dislocation theory of steady and transient creep of crystalline solids: Predictions for olivine”. *PNAS* 120, no. 8 (2023). <https://doi.org/10.1073/pnas.2203448120>.
- [2] Warr, L. N. “IMA-CNMNC approved mineral symbols”. *Mineralogical Magazine* 85, no. 3 (2021): 291–320. <https://doi.org/10.1180/mgm.2021.43>.

Manual *input* of the references⁸:

```
\begin{thebibliography}{}

  \bibitem{Breithaupt2023}
  {\small{Breithaupt, T., R. F. Katz, L. N. Hansen, and K. M. Kumamoto.
  ‘‘Dislocation theory of steady and transient creep of crystalline
  solids: Predictions for olivine’’. \textit{PNAS} 120, no. 8 (2023).
  \url{https://doi.org/10.1073/pnas.2203448120}.}}

  \bibitem{Warr2021}
  {\small{Warr, L. N. ‘‘IMA-CNMNC approved mineral symbols’’.
  \textit{Mineralogical Magazine} 85, no. 3 (2021): 291--320.
  \url{https://doi.org/10.1180/mgm.2021.43}.}}

\end{thebibliography}
```

Where `{\small{}}` has been used to make the text smaller (optional).

A “Appendix”

To start the appendix, write `\appendix`, then use `\section{}`, `\subsection{}`, etc. as usual.

⁸Check out BibTeX for “automatic” referencing (e.g., https://www.overleaf.com/learn/latex/Bibliography_management_with_bibtex).