

Learning L^AT_EX

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Chapter 1

Table of contents

Command to tell \LaTeX to show table of contents

```
1 \tableofcontents
```

Listing 1.1: Add table of contents

Add certain title to the TOC.

```
1 \section*{Abstract}  
2 \addcontentsline{toc}{chapter}{Abstract}
```

Listing 1.2: Add table of contents

Chapter 2

Packages

2.1 useful packages

```
1 % !Mode:: "TeX:UTF-8" % read in as utf8 file.
2
3 \usepackage{microtype}
4
5 \usepackage{amsmath}
6 \usepackage{amsfonts}
7 \usepackage{amssymb}
8 \usepackage{amsthm} % thm = theorem
9
10 \usepackage{hyperref} % url command
11
12 \usepackage{todonotes}
13
14 \usepackage{biblatex}
15
16 \RequirePackage[l2tabu, orthodox]{nag}
17
18 \usepackage{tikz}
19
20 \usepackage[width=21.00cm, height=29.70cm, left=2.54cm, ↵
    right=2.54cm, top=2.54cm, bottom=2.54cm]{geometry}
21
22 \usepackage[utf8]{inputenc}
23
24 \usepackage{booktabs} % three-line tables: toprule, midrule↵
    , bottomrule
25 \usepackage{array}
26
27 \usepackage{siunitx}
28 \DeclareSIUnit\rotation{r}
29
30 \usepackage{mathtools}
31
32 \usepackage{graphicx}
33 \graphicspath{{figures/}}
```

```

34 \usepackage{color}
35 \usepackage{colortbl}
36 \definecolor{bkg}{rgb}{0.95,0.95,0.92}
37
38
39 \usepackage{listings} % can print various codes including ↵
    listings itself and LaTeX. can also use lstinline ↵
    command.
40 % ===== set styles for listings. =====
41 \definecolor{codegreen}{rgb}{0,0.6,0}
42 \definecolor{codegray}{rgb}{0.5,0.5,0.5}
43 \definecolor{codepurple}{rgb}{0.58,0,0.82}
44
45 \lstdefinestyle{zstyle}{
46   backgroundcolor=\color[rgb]{0.95,0.95,0.92},
47   commentstyle=\color{codegreen},
48   basicstyle=\ttfamily\small,
49   keywordstyle=\color{codepurple},
50   numberstyle=\tiny\color{codegray},
51   numbersep=5pt,
52   stringstyle=\color{red},
53   showspaces=false,
54   showstringspaces=false,
55   showtabs=false,
56   numbers=left,
57   prebreak=\raisebox{0ex}[0ex][0ex]{\ensuremath{\{\leftarrow
        hookleftarrow}}},
58   captionpos=b,
59   frame=single,
60   breakatwhitespace=false,
61   breaklines=true,
62   keepspaces=true,
63   tabsize=4,
64   %escapeinside,
65 }
66
67 \lstset{style=zstyle}
68 % ===== set styles for listings. =====
69
70 \usepackage{tabularx} % tabularx environment. equivalent ↵
    lenth?
71
72 \usepackage{CJKutf8} % Chinese, Japanese, Korean input with ↵
    utf-8 encoding. it loads \usepackage[utf8]{inputenc} ↵
    internally
73
74
75
76 \usepackage{longtable}
77
78 \usepackage{subcaption} % subfigure environment.
79
80 \usepackage{caption} % captionof command. when inserting ↵
    graphics without figure environment, captionof can ↵

```



```

    produce the caption.
81
82 \usepackage{multirow}
83
84 %\usepackage{fancyvrb} % not familiar with
85
86 \usepackage{cleveref}
87 % \crefname{ <type> }{ <singular> }{ <plural> }
88 % \Cref{ key} capitalize the first letter.
89 \crefname{table}{table}{tables}
90 \crefname{figure}{fig.}{figs.}
91 \crefname{equation}{eq.}{eqs.}
92
93 \usepackage{newverbs} % if listings package doesn't work, ←
    use this one to highlight.
94 \newverbcommand{\cverb}{\color{red}}{} % colored vertb with ←
    red
95 \newverbcommand{\bverb} % verbatim with gray background
96 {\begin{lrbox}{\verbbox}}
97 {\end{lrbox}\colorbox{gray}{\box\verbbox}}
98
99 %===== separator
100
101 \usepackage{txfonts} % piup
102 \usepackage{xfrac} % more beautiful and standard fractions. ←
    \sfrac{1}{2}
103
104 %\usepackage{enumerate}
105
106 \numberwithin{equation}{section} % number equation with ←
    section number.
107
108 %\usepackage[numbers,sort]{natbib} % [1,3,2] => [1,2,3]
109 \usepackage[numbers,sort&compress]{natbib} % [1,3,2] => ←
    [1-3]

```

2.2 microtype

microtype plays with ever-so-slightly shrinking and stretching of the fonts and with the extent to which text protrudes into the margins in a way that yields results that look better, that have fewer instances of hyphenation, and fewer overfull hboxes. It doesn't work with **latex**, you have to use **pdflatex** instead. It also works with **lualatex** and (protrusion only) with **xelatex**.

```

1 \usepackage[stretch=10]{microtype} % this allows font ←
    expansion up to 1% (default is 2%)

```

2.3 AMS math packages

The family of **AMS math packages**. At least **amsmath** and **amssymb**. Also **amsthm** if I need theorems and the class I'm using doesn't already define them.

Particularly for writing equations, the AMS packages define a rich set of environments to group and align formulas in many different and useful ways. I also like that it encourages the use of semantic commands (e.g. the **cases** environment) over syntactic commands (e.g. a `\left{` followed by an array).

In particular,

- **amsthm** provides an easy way to set up different theorem styles
- **amsmath** provides the `text` command
- **amssymb** contains several often-used symbols.

Its documentation can be found running `texdoc amsldoc` on a command line.

2.4 hyperref

hyperref is used for setting PDF metadata and to create links, both within the document and for clickable URLs. Even Elsevier has used **urlbst** to update their bibliography style to support URLs and DOIs; **hyperref** does the actual work of rendering `url=` and `doi=` BibTeX into clickable PDF links.

2.5 todonotes

The **todonotes** package is a must have in all documents.

```
1 \usepackage{todonotes}
```

The package enables you to insert small notes in the text marking things to do in the document. Something like

```
1 \todo{Rewrite this answer \ldots}
```

At any location in the document a list of the inserted notes can be generated with the

```
1 \listoftodos
```

command.

2.6 biblatex

For citations and bibliographies, **biblatex** is the package of my choice. Key points:

- **biblatex** includes a wide variety of built-in citation/bibliography styles (numeric, alphabetic, author-year, author-title, verbose [full in-text-citations], with numerous variants for each one). A number of custom styles have been published.
- Modifications of the built-in or custom styles can be accomplished using L^AT_EX macros instead of having to resort to the BibTeX programming language.

- **biblatex** offers well-nigh every feature of other bibliography-related L^AT_EX packages (e.g. multiple/subdivided bibliographies, sorted/compressed citations, entry sets, ibidem functionality, back references). If a feature is not included, chances are high it is on the package authors' to-do list.
- The **babel** package is supported, and **biblatex** comes with localization files for about a dozen languages (with the list still growing).
- Although the current version of **biblatex** (2.8a) still allows to use BibTeX as a database backend, by default it cooperates with Biber which supports bibliographies using Unicode. Biber (currently at version 1.8) is included in TeX Live and MiKTeX. Many features introduced since **biblatex** 1.1 (e.g., advanced name disambiguation, smart crossref data inheritance, configurable sorting schemes, dynamic datasource modification) are "Biber only".

2.7 nag

One package that's *really* general purpose is **nag**: It doesn't *do* anything, per se, it just warns when you accidentally use deprecated L^AT_EX constructs from l2tabu (English / French / German / Italian / Spanish documentation).

From the documentation:

Old habits die hard. All the same, there are commands, classes and packages which are outdated and superseded. nag provides routines to warn the user about the use of those. As an example, we provide an extension that detects many of the "sins" described in l2tabu.

Therefore, I now always have the following in my header (*before the documentclass*↔, thanks qbi):

```
1 \RequirePackage[l2tabu, orthodox]{nag}
```

It's a bit like having **use strict**; in Perl: a useful best practice.

2.8 tikz

I nearly always use the **tikz** package. Once you learn how to draw with it, you can do almost any vector graphic you need.

2.9 geometry

```
1 \usepackage[width=21.00cm, height=29.70cm, left=2.54cm, ↔
  right=2.54cm, top=2.54cm, bottom=2.54cm]{geometry}
```

2.10 inputenc

```
1 \usepackage[utf8]{inputenc}
```

2.11 booktabs and array

Another essential package combination is

```
1 \usepackage{booktabs}
2 \usepackage{array}
```

The **booktabs** package creates much nicer looking tables than the standard latex tables; the **array** package's ability to create custom columns is invaluable for formatting tabular material on a per-column basis.

2.12 siunitx

siunitx, for typesetting units and especially for the "S" column type, which allows numbers in tables to be easily aligned, e.g. on the decimal marker.

```
1 \usepackage{siunitx}
```

useful commands:

```
1 \numrange{1450}{1500}
2 \numrange[range-phrase = $ \sim $]{1450}{1500}
3 \numlist{0.1;0.2;0.3} \\\
4 \numlist[list-separator = {; }]{0.1;0.2;0.3} \\\
5 \numlist[list-final-separator = {, }]{0.1;0.2;0.3} \\\
6 \numlist[list-pair-separator={/}]{300;220} % pay attention ↔
   to the separator;
7
8 \SI[parse-numbers = false]{R}{\metre\per\second}
9 \SI[math-rm = \mathnormal, parse-numbers = false]{R}{\metre↔
   \per\second}
10 \SI[math-rm = \mathnormal, parse-numbers = false, per-mode=↔
   symbol]{n_1}{\rotation\per\minute}
11
12 $ n_1 = \SI[per-mode=symbol]{1450}{\rotation\per\minute} $
```

2.13 mathtools

In addition to many packages already listed here, I always include **mathtools**. It provides implementations of **mathclap** (and similar commands) as well as nice extensible arrow.

$$\sum_{biglongthing}$$

```
1 \usepackage{mathtools}
```

2.14 graphicx

For including figures, rotating or scaling text. I also use the `graphicspath` command to specify a subfolder to help organize my figures and so I can easily change between, for example, a set of figures for internal used (with extra info) and final versions for distribution.

```
1 \usepackage{graphicx}
2 \graphicspath{{figures/}}
```

2.15 listings

I can't live without **listings** — pretty-printing (colours, formatting and all) algorithms and code is indispensable — in pretty much any programming languages and dialects under the sun. Plus, I can import a source file directly from the repository, and the latest version will be automatically rendered.

```
1 \usepackage{listings}
```

2.16 tabularx

I almost always find myself using a **tabularx** environment as opposed to the regular **tabular** environment, as it allows for greater dynamism in column widths.

```
1 \usepackage{tabularx} % tabularx environment. equivalent ↔
   lenth?
```

2.17 CJKutf8

CJKutf8 package is a part of **CJK** bundle, it is designed for documents in UTF-8 encoding only, and it actually loads **CJK** package internally.

The main aim of **CJKutf8** package is, to use utf8 option in inputenc package together with **CJK** package. That is to say, **CJKutf8** patches original **CJK** package to make it work well with inputenc. And it loads **inputenc** package with **utf8** option internally.

Most users do not need to know the technical details. But you can use **CJKutf8** to typeset French, German and Chinese in one document easily. That's it.

```
1 \usepackage{CJKutf8} % Chinese, Japanese, Korean input with ↔
   utf-8 encoding. it loads \usepackage[utf8]{inputenc} ↔
   internally
```

The usage is:

```
1 \begin{document}
2   \begin{CJK*}{UTF8}{song}
3   .
```

```

4      .
5      Contents...
6      .
7      .
8      \end{CJK*}
9  \end{document}

```

2.18 color

Adding colors to your text is supported by the **color** package. Using this package, you can set the **font color**, **text background**, or **page background**. You can choose from **230 predefined colors** or can **define your own colors using RGB, Hex, or CMYK codes**. Mathematical formulas can also be colored.

```

1 \usepackage{color}

```

2.19 longtable

```

1 \usepackage{longtable}

```

2.20 subcaption

The usage of subcaption is:

```

1 \begin{figure}[htbp]
2   \centering
3   \begin{subfigure}[b]{0.45\textwidth}
4     \centering
5     \includegraphics[width=\textwidth]{dataDimensions}
6     \caption{Data dimensions}\label{fig:subfig:datadim}
7   \end{subfigure}
8   \begin{subfigure}[b]{0.45\textwidth}
9     \centering
10    \includegraphics[width=\textwidth]{dataSize}
11    \caption{Data Size}\label{fig:subfig:datasize}
12  \end{subfigure}
13  \caption{Scalability of data}
14  \vspace{\baselineskip}
15 \end{figure}

```

2.21 caption

```

1 \begin{center}
2   \includegraphics[width=0.4\textwidth]{XML}
3   \captionof{figure}{Tree structure}\label{fig:xml_←
   nonfloating}

```

```

4 \vspace{\baselineskip}
5 \end{center}

```

2.22 multirow

[multirow introductions](#)

2.23 cleveref

2.23.1 Setup

As always, the package is called in the preamble by writing `\usepackage{cleveref}`. In your document, all you have to do is write `\cref{...}` instead of figure `\ref{...}`. The **cleveref** package will automatically detect where the reference is about and it will print the corresponding text (e.g. *figure* when you refer to a figure environment).

2.23.2 Capitalized references

To capitalize your references, use `\Cref{...}` instead of `\cref{...}`.

2.23.3 Multiple references

Another thing that is quite nice is that **cleveref** allows multiple references with one command. For example, `\cref{eq1,eq2}` prints ‘*eqs. (1) and (2)*’. But that’s not all! When referencing to multiple environments (e.g. figures, equations and tables as in `\cref{fig1,eq3,tb1}`), the package automatically prints the right names to the right references.

2.23.4 Editing the reference names

I like my references to be written out in full, but the cleveref package prints ‘eq. ...’ instead of ‘equation ...’. Again, this is easily changed:

```

1 \crefname{equation}{equation}{equations}

```

In the first argument of `\crefname{}{}{}` comes the type of reference (equation, figure, table, section, etc.). The second argument contains the word that is printed if only one reference is made and the third argument contains the plural form for multiple references.

```

1 \cref{table: geometry factor of bevel gear}.

```

[cleveref introductions](#)

2.24 newverbs

```

1 \usepackage{newverbs}
2 \newverbcommand{\cverb}{\color{red}}{} % colored verb with↔
   red
3 \newverbcommand{\bverb} % verbatim with gray background
4 {\begin{lrbox}{\verbbox}}
5 {\end{lrbox}\colorbox{gray}{\box\verbbox}}

```

Usage:

```

1 \cverb|&*/|
2 \bverb|&*/|

```

2.25 natbib

Usage:

```

1 \usepackage[numbers,sort]{natbib} % [1,3,2] => [1,2,3]
2 \usepackage[numbers,sort&compress]{natbib} % [1,3,2] => ↔
   [1-3]

```

2.26 Options that can be added to `\usepackage`

- **round**: (default) for round parentheses;
- **square**: for square brackets;
- **curly**: for curly braces;
- **angle**: for angle brackets;
- **colon**: (default) to separate multiple citations with colons;
- **comma**: to use commas as separators;
- **authoryear**: (default) for author-year citations;
- **numbers**: for numerical citations;
- **super**: for superscripted numerical citations, as in *Nature*;
- **sort**: orders multiple citations into the sequence in which they appear in the list of references;
- **sort&compress**: as **sort**: but in addition multiple numerical citations are compressed if possible (as 3-6, 15)
- **longnamesfirst**: makes the first citation of any reference the equivalent of starred variant (full author list) and subsequent citations normal (abbreviated list);
- **sectionbib**: redefines `\thebibliography` to issue `\section*` instead of `\chapter*`; valid only for classes with a `\chapter` command; to be used with the **chapterbib** package;

- **nonamebreak**: keeps all the authors' names in a citation on one line; causes overfull hboxes but helps with some **hyperref** problems.

2.27 colortbl

Use the **colortbl** package and its macro `\cellcolor{<color>}`

2.28 enumerate

Use the `\enumerate`

```
1 \begin{enumerate}[i]
2 \item One
3 \item Two
4 \item Three
5 \end{enumerate}
```

2.29 platform package

```
1 % packages we need
2 \usepackage{pdftexcmds}
3 \usepackage{catchfile}
4 \usepackage{ifluatex}
5 \usepackage{ifplatform}
```

```
1 \ifwindows
2 % add settings
3 \fi
4 \iflinux
5 % add settings
6 \fi
7 \ifmacosx
8 % add settings
9 \fi
```


Chapter 3

L^AT_EX Symbols

3.1 Accents letters

von Kármán `{von K\'arm\'an}`

3.2 Math letters

ℓ `\elll`

3.3 unsorted

Table 3.1: L^AT_EX special symbols

Symbol	Command	Usage	Package
-	<code>_</code>		
\	<code>\textbackslash</code>		
{ }	<code>\{ \}</code>		
%	<code>\%</code>		
	<code>\textbar</code>		
1°	<code>\ang{1}</code>		siunitx
~	<code>\$ \sim \$</code>		
·	<code>\$ \cdot \$</code>	multiplication symbol	
$\frac{1}{y}$	<code>\$ \dfrac{1}{y} \bigr\rrvert \$</code>		
$\underbrace{\mathbf{F}}_{\vec{t}}$	<code>\$ \underbrace{\mathbf{F}}_{\vec{t}} \$</code>		
±	<code>\$ \pm \$</code>		
9°14'55"	<code>\$ \$ \ang{9;14;55} \$</code>		
<	<code>\textless</code>		
>	<code>\textgreater</code>		
v	<code>\$ \upsilon \$</code>		
u, \dot{u}, \ddot{u}	<code>\$ u, \dot{u}, \ddot{u} \$</code>		

Continued on next page

Table 3.1 – continued from previous page

Symbol	Command	Usage	Packa
\equiv	<code>\$ \equiv \$</code>		
ℓ	<code>\$ \ell \$</code>		
$\max_{1 \leq j \leq n}$	<code>\$ \max \limits_{1 \leq j \leq n} \$</code>		
$\lim_{\Delta x \rightarrow a \atop \Delta y \rightarrow b}$	<code>\$ \lim_{\substack{\Delta x \rightarrow a \\ \Delta y \rightarrow b}} \$</code>		