How to use LaTeX

Daoming Dong & Youchao Wang

CMMPE, Engineering, University of Cambridge

April 12, 2019

Why LaTeX ?

An extremely good philosophical question.

- ▶ Microsoft Office Word and PowerPoint are boring.
- ▶ LaTeX is elegant, charming, or whatever...
- ▶ Excellent for mathematical typesetting.
- ▶ Powerful, lots and lots of power for you to extend it, be it theses, papers, slides (using Beamer), spreadsheets...
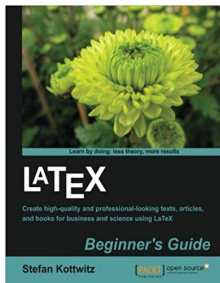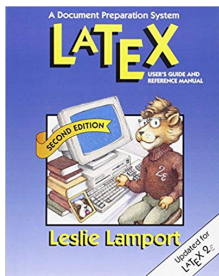
Books list

Figure 1: LaTeX Beginner's Guide

Figure 2: LaTeX: A Document Preparation System: User's Guide and Reference Manual

Useful Resources

Learn LaTeX in one video :
https://www.youtube.com/watch?v=VhmkLrOjLsw

Mr Daoming Dong is also a good resource. He is nice and helpful.

A Brief History

In the mid 1970s, Donald Knuth, a Stanford CS geek developed T_EX in SAIL to typeset his "The Art of Computer Programming" (TAOCP). First public release in 1978. He reimplemented it in Pascal in the mid 80s (WEB, literate programming). Leslie Lamport, the genius, wrote $\LaTeX$ in early 80s by porting the orginal T_EX.

What is the relationship between T_EX and $\LaTeX$? $\LaTeX$ uses the T_EX typesetting programme to compile and generate its output. $\LaTeX$ focuses on the content while T_EX is the main programme for setting up the layout.

The first LATEX version available is 2.09 (strange number and strange version control). Later in 1994, LATEX 2_ε replaced the old version, and remained ever since. LATEX 3 is a long-term research project, which started from the 1990s.

How to pronounce LATEX ?

First and foremost, the pronunciation of LATEX. According to the father of TEX:

> 'English words like 'technology' stem from a Greek root beginning with the letters $\tau\epsilon\chi$...; and this same Greek word means art as well as technology. Hence the name TeX, which is an uppercase form of $\tau\epsilon\chi$.
>
> Insiders pronounce the χ of TeX as a Greek chi, not as an 'x', so that TeX rhymes with the word blecchhh. It's the 'ch' sound in Scottish words like loch or German words like ach; it's a Spanish 'j' and a Russian 'kh'. When you say it correctly to your computer, the terminal may become slightly moist.'

<div align="right">Donald Knuth</div>

How to pronounce LATEX ?

Another quote from the father of LATEX:

> '*One of the hardest things about LaTeX is deciding how to pronounce it. This is also one of the few things I'm not going to tell you about LaTeX, since pronunciation is best determined by usage, not fiat. TeX is usually pronounced teck, making lah-teck, and lay-teck the logical choices; but language is not always logical, so lay-tecks is also possible.*' Leslie Lamport

What LaTeX can do and what it cannot

- ▶ Write scientific papers
- ▶ Write theses
- ▶ Typesetting books and publications
- ▶ Write typeset letters
- ▶ Play around with mathematical formula
- ▶ Make presentation slides
- ▶ and many more

UNIVERSITY OF CAMBRIDGE

Installation

We would highly recommend the following LaTeX distributions.

- For Windows users
  - TeX Live
  - MiKTeX
- For MacOS users
  - TeX Live
  - MacTeX

Editors

There are in fact numerous ways for you to write up a LaTeX document.

- TeXStudio **(behold, the beamer template we used for this tutorial cannot be built using this editor)**
- TeXShop
- Notepad
- Sublime
- Visual Studio Code
- Vim
- and many others...
- Overleaf (the online editor)

How to use

We have to remind you that learning LATEX (might be) very hard

THE ULTIMATE TEX LEARNING CURVE
CREDIT: YOUCHAO
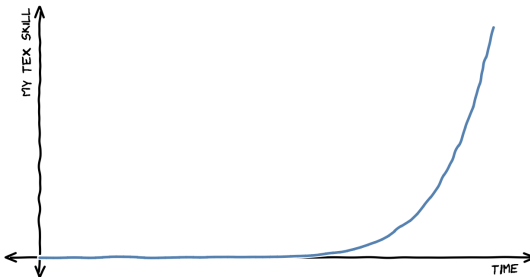
How to use

We have to remind you that learning LATEX (might be) very hard [1]

Newbie

USUALLY
WANT THIS

Give up

Master

UNIVERSITY OF
CAMBRIDGE

Some common knowledge

Since LaTeX is a package implemented in the TeX typesetting **language**, we should consider the TeX input syntax when use it.

Some common knowledge

- The effect of typing multiple space is the same as one space.
- The effect of typing multiple line feeds is the same as one line break.
- If you don't know how and when to use \ (backslash), then you are doomed.
- Be aware of the use of \xpace and whatever that follows the backslash after the ~mark, e.g., ~\ref.

Some common knowledge

- Special meta characters as part of the TeX language syntax:
  - `# $ % ^ & _ { } ~ \`
- To use them you have to do the following

  `\# \$ \% \^ \& \_ \{ \} \textasciitilde \textbackslash`

Changing fonts and styles

You may either use (1) commands or (2) lexical declarations. *Contents are referenced from the slides for a course held at the Computer Lab, Cambridge.*

`\mdseries`	`\textmd{text}`	Medium series
`\bfseries`	`\textbf{text}`	**Boldface series**
`\rmfamily`	`\textrm{text}`	Roman family
`\sffamily`	`\textsf{text}`	Sans-serif family
`\ttfamily`	`\texttt{text}`	Typewriter family
`\upshape`	`\textup{text}`	Upright shape
`\itshape`	`\textit{text}`	*Italic shape*
`\slshape`	`\textsl{text}`	*Slanted shape*
`\scshape`	`\textsc{text}`	Small caps shape
`\normalfont`	`\textnormal{text}`	Normal style

Starting a report and title page

```latex
1   \documentclass{article}
2   \begin{document}
3   \begin{titlepage}
4     \begin{center}
5       \line(1,0){300}\\
6       [0.25in]
7       \huge{\textbf{ CSSA \LaTeX\ Notes
                }}\\
8       [2mm]
9       \line(1,0){200}\\
10      [1.5cm]
11      \textsc{\LARGE University of
              Cambridge}\\
12      \textsc{\LARGE Using \LaTeX\ to
              Write a Simple Report}\\
13      [8cm]
14    \end{center}
15    \begin{flushright}
16      \textsc{\large CSSA. \\ A Latex
              User\\
17      20th Apr 2019}
18    \end{flushright}
19  \end{titlepage}
20  \end{document}
```


CSSA LATEX Notes

UNIVERSITY OF CAMBRIDGE
USING LATEX TO WRITE A SIMPLE REPORT

CSSA.
A LATEX USER
20TH APR 2019

UNIVERSITY OF
CAMBRIDGE

Sections

```latex
\section{Introduction}
This is the first line of the report.
    This report will show you how to
    use \LaTeX\\\
% Text holder: show one paragraph of
    \lipsum
\lipsum[1]
% Text holder: show one paragraph of
    \lipsum
\section{Second section}
This is the second section of this
    report.
\subsection{Sub section 1}
This is the first sub section in this
    report.
\subsection{Sub section 2}
This is the second sub section in this
    report.
\subsubsection{Sub sub section}
This is a sub sub section. Replace
    text here when you write your
    report.
```

Margins, page number

```
1   \documentclass{article}
2   \usepackage{lipsum}
3   % geometry package, control the margin
        of the article
4   \usepackage[margin = 1 in, left = 1.5
        in, includefoot]{geometry}
5   % Header and Footer Stuff
6   \usepackage{fancyhdr} % fancyhdr
        package
7   \pagestyle{fancy}
8   % Clear previous head and foot style
9   \fancyhead{}
10  \fancyfoot{}
11  % Position the page number RHS of the
        footer
12  \fancyfoot[R]{ \thepage\ }
13  % Clear the header line
14  \renewcommand{\headrulewidth}{0pt}
15  % Keep the footer line
16  \renewcommand{\footrulewidth}{1pt}
```

Lists

```
1   % Normal bullet point: itemized
2   \begin{itemize}
3     \item This is our first line
4     \item This is our second line and I
          am making it longer so that you
          can see how text wraps around
          automatically in \LaTeX
5     \begin{itemize}
6       \item A bullet within a bullet!
7       \begin{itemize}
8         \item More deeper
9       \end{itemize}
10    \end{itemize}
11    \item [Title] blah blah blah
12    \item [This is a longer title] blah
          blah blah
13    \begin{enumerate}
14      % Numberd lists
15      \item \lipsum[1]
16      % Just try to make the PDF looks
            okay for this presentation
17      \item \lipsum[2]
18    \end{enumerate}
19  \end{itemize}
```

Figures and tables

```
1  \usepackage{graphicx}% Import images
2  \usepackage{float} % Control float
```

```
1   \section{Figures and Tables}
2   \subsection{Figures}
3   \begin{figure}[H]
4       \centering
5       \includegraphics[width = \textwidth
            ]{Figures/space.png}
6       \caption{My desktop background}
                \label{fig}
7   \end{figure}
8   \subsection{Tables}
9   \begin{table}[H]
10      \centering \label{tab}
11      \caption{This is a very simple table
                }
12      \begin{tabular}{l | c r}
13        Name & University & Department
                \\\hline
14        CSSA & Cambridge & Engineering \\
15      \end{tabular}
16  \end{table}
17  Figure \ref{fig}. Table \ref{tab}.
```

UNIVERSITY OF
CAMBRIDGE

```latex
\section{Math equation}
Fractions, inline equation: $d = v_it
    + \frac{1}{2} \cdot at^2$\\
Brackets:
$$\left(\frac{1}{2}\right) \cdot 2 =
    1$$
$$\left|-7 \right| = 7$$
$$x^{2^3}$$
\begin{eqnarray*}
    \sqrt{4} & \neq& 5 \\
    \pi &\approx& 3 \\
    \pi &\times& \sqrt{4} < 15
\end{eqnarray*}
\begin{equation}
    U(\alpha, \beta) = \frac{e^{jkz}}{j
        \lambda z}e^{j\frac{k(\alpha^2+
        \beta^2)}{2z}}\iint \left\{U(x,y
        )e^{j\frac{k(x^2+y^2)}{2z}}
        \right\}e^{-j\frac{2\pi}{
        \lambda z}(\alpha x+\beta y)}
        dxdy
    \label{eq:Fresnel}
\end{equation}
```

References: set up

- LHS: Journal paper
- RHS: Conference paper

```
1   @article{GaborHolography,
2     author = {D. Gabor},
3     journal = {Nature},
4     number = {161},
5     pages = {777--778},
6     publisher = {Nature},
7     title = {A new microscopic principle
              },
8     volume = {161},
9     month = {May},
10    year = {1948},
11    url = {https://www.nature.com/
              articles/161777a0},
12    doi = {https://doi.org
              /10.1038/161777a0},
13  }
```

```
1   @inproceedings{HardReview_84,
2     author = {M. Lucente and Galyean, T.
              A.},
3     title = {Rendering Interactive
              Holographic Images},
4     booktitle = {Proceedings of the 22Nd
              Annual Conference on Computer
              Graphics and Interactive
              Techniques},
5     series = {SIGGRAPH '95},
6     year = {1995},
7     isbn = {0-89791-701-4},
8     pages = {387--394},
9     numpages = {8},
10    url = {http://doi.acm.org
              /10.1145/218380.218490},
11    doi = {10.1145/218380.218490},
12    acmid = {218490},
13    publisher = {ACM},
14    address = {New York, NY, USA},
15  }
```

References: use

```
1  % Reference setup
2  \cleardoublepage
3
4  \section{How to use refernces}
5  \lipsum[1]
6  \textbf{I'm citing a journal article}
        \cite{GaborHolography}.\\
7  \lipsum[2]
8  \textbf{I'm now citing a conference
        article} \cite{HardReview_84}.
9
10
11 \bibliographystyle{IEEEtran}
12 \cleardoublepage
13 \bibliography{References/references.
        bib}
14 \addcontentsline{toc}{section}{
        \numberline{}References}
```

```
1  % .bibtex file
2  use google
```

Appendix

```
1    \cleardoublepage
2    \appendix
3    \section{Appendix-1}
4    This is the first appendix.
5    \lipsum[1]
6    \section{Appendix-2}
7    This is the second appendix.
8    \begin{figure}[H]
9      \begin{subfigure}{0.5\linewidth}
10       \includegraphics[width =
             \textwidth]{Figures/Cubic_
             aperture.png}
11       \caption{cubic aperture}
12       \label{cubicAperture}
13     \end{subfigure}
14     \begin{subfigure}{0.5\linewidth}
15       \includegraphics[width =
             \textwidth]{Figures/Circular_
             aperture.png}
16       \caption{circular aperture}
17       \label{circularAperture}
18     \end{subfigure}
19     \caption{Two figures}
20   \end{figure}
```
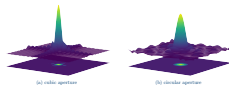
Table of contents, list of figures, list of tables

```
1   \end{titlepage}
2   \cleardoublepage
3   % Table of contents stuff
4   \pagenumbering{roman}
5   \tableofcontents
6   % \cleardoublepage
7   % List of figures, list of tables
8   \listoffigures
9   \listoftables
10
11  \thispagestyle{empty}
12  \addcontentsline{toc}{section}{
        \numberline{}List of Figures}
13  \addcontentsline{toc}{section}{
        \numberline{}List of Tables}
14  \cleardoublepage
15
16  % Main body stuff
17  \pagenumbering{arabic}
18  \setcounter{page}{1}
19
20  \cleardoublepage
21  \section{Introduction}
```

UNIVERSITY OF CAMBRIDGE

There are, in fact, **en dashes**, **em dashes**, **hyphens** and **minus signs**.

<div align="center">

`-` corresponds to - hyphen
`--` corresponds to – en dash
`---` corresponds to — em dash
`$-$` corresponds to − minus sign

</div>

In terms of how to properly use them, try searching the internet for answers. **Metaphysics** it is.

Templates

We will demonstrate some useful LaTeX templates.

However, keep in mind that before you use templates, you should make yourself comfortable with the basic LaTeX commands.

Useful resources revisit

- University of Cambridge CUED thesis template, **Gitlab: Siegfriedchao**, modified from **Github: kks32**
- University of Cambridge Powerpoint template, **Gitlab: Siegfriedchao**, modified from **Github: rjw57**