

Introduction to LaTeX

- ▶ A Computerized Typesetting Program

What is LaTeX?

- ▶ LaTeX (pronounced laytekh) is a typesetting program, not a word processor.
- ▶ It is written on an ordinary text editor and translated by means of a program into a finalized version, usually in pdf format.
- ▶ Formatting codes are embedded in the text.
- ▶ Equations, symbols, tables, etc. are created by means of formatting codes.

History

- ▶ 1977: Donald Knuth devised “TeX”, a markup language for the purpose of attractively typesetting technical documents.
- ▶ LaTeX was then developed by Leslie Lamport as an overlay to the TeX language, enabling easier use, especially for including math formulas.

Downloads

- ▶ Dedicated LaTeX editor (including tex, pdftex, latex, pdflatex, dvi2ps, dvipdf or dvipdfm, and possibly others)
- ▶ Downloads are available for PC, Mac, Unix, Linux from <http://www.tug.org/texlive/>
- ▶ There is no cost.

Recommended programs

	MAC	PC
LaTeX	TeXShop	TextMaker
BibTeX	BibDesk	JabRef2.6

- ▶ These are all free of charge and available online.

LaTeX Wikibook

- ▶ An excellent Wikibook for LaTeX is available, free of charge, at <http://en.wikibooks.org/wiki/LaTeX>
- ▶ Download the pdf version for convenient reference.

General Structure of a File

- ▶ Every LaTeX file begins with `\documentclass{...}`
- ▶ `article`, `book`, `report` etc. are example of different document class.
- ▶ This begins a section called the “preamble”, which contains global instructions for the file.
`\usepackage{...}` commands and others are placed here.
- ▶ After the preamble, the body of the text begins with `\begin{document}`.
- ▶ At the end of the file is `\end{document}`.

[...] vs. {...}

- ▶ [...] contains an optional argument.
- ▶ {...} contains a required argument.

Eg:

```
\documentclass[a4paper,12pt,oneside]{article}
```

```
\usepackage[margin=1in]{geometry}
```

Caution !!

- ▶ LaTeX is very unforgiving of errors. Everything must be exactly right in order for it to work.
- ▶ If you type (instead of {, or if you use a reserved character such as _, it will crash or do something unintended.
- ▶ This is one reason why a well tested template is very helpful.

Preamble

- ▶ After %, LaTeX ignores the rest of the line (comments).
- ▶ `\documentclass{article}` causes LaTeX to format the text as an article with set formatting rules.
- ▶ `\usepackage{...}` specifies an exception or addition to the set formatting rules. Multiple packages can be used.

Body: Top Matter

▶ `\begin{document}`

`\title{...}`

`\author{...}`

`\date{...}` (Put % in front of it to suppress.)

`\maketitle` (Title and name appear here.)

`\end{document}`

Abstract

▶ `\documentclass{article}`

`\begin{document}`

`\begin{abstract}`

...

`\end{abstract}`

`\end{document}`

Sectioning

- ▶ `\section{...}`
- ▶ `\subsection{...}`
- ▶ `\subsubsection{...}`
- ▶ (These will be numbered: 1., 1.1., 1.1.1.)

Bibliography

- ▶ Manual bibliography
- ▶ Automated bibliography (BibTeX)

Manual Bibliography

► `\begin{thebibliography}{99}`

`\bibitem{proakis_book}`

J. G. Proakis, `\emph{Digital Communications.}`
McGraw-Hill, 4th ed., 2001.

`\end{thebibliography}`

- ▶ `\begin{thebibliography}{99}`
- ▶ Place this command at the place where you want the bibliography to begin.
- ▶ Use “99” if you have more than 9 references but fewer than 100.
- ▶ Use “9” if you have fewer than 10 references.

- ▶ `\bibitem{proakis_book}`
- ▶ This command introduces a reference. In the braces, put an identifier that LaTeX can use to refer to your item. (A common choice is the first three letters of the author's name and the last two digits of the year. But any abbreviation will work.)
- ▶ After this, put the information for the reference. Separate the parts by commas. Use whatever style you wish (APA, IEEE, etc.).
- ▶ You may type the parts on one line or separate lines. LaTeX will automatically format them.
- ▶ Note: `\emph{...}` puts the text within the braces into italics.

- ▶ Type all your references, beginning each one with the `\bibitem` code.
- ▶ When you are finished, put the `\end{thebibliography}` code on a separate line.
- ▶ In the text, use `\cite{...}` to refer to the source. For example, if the book by Proakis is the third book in your list, `\cite{proakis_book}` will insert [3] in your text.
- ▶ If you insert other references in the the middle of the bibliography, LaTeX will automatically adjust all the numbers in the bibliography and in the text.

Footnotes

- ▶ Insert a footnote in the text with
- ▶ `\footnote{...}`
- ▶ Numbering is automatic.

Bulleted Lists

- ▶ Insert a bulleted list with:
- ▶ `\begin{itemize}`
 - ▶ `\item ...`
 - ▶ `\item ...`
 - ▶ `\item...`
- ▶ `\end{itemize}`

Numbered Lists

- ▶ Insert a numbered list with:
- ▶ `\begin{enumerate}`
 - ▶ `\item ...`
 - ▶ `\item ...`
 - ▶ `\item...`
- ▶ `\end{enumerate}`

Ellipsis

- ▶ An ellipsis (...) is inserted with the code:
- ▶ `\ldots`
- ▶ This will space the dots properly.

Page breaks

- ▶ `\newpage` breaks the page at that point without stretching the content.
- ▶ `\pagebreak` is like `\newpage` but stretches the content to fit the page.
- ▶ `\clearpage` is like `\newpage` but in addition typesets all the remaining figures and tables. If figures and tables interrupt a sequence such as the bibliography, put `\clearpage` immediately before the sequence.

Graphics

- ▶ Import a graphics file with:
- ▶ `\includegraphics[width=...cm]{filename}`
- ▶ A graphics package must be called in the preamble.
- ▶ e.g. `\usepackage{graphicx}`
- ▶ Generally *.eps* format is used to yield best resolution.

```
\begin{figure}[t/h/b/p]
```

```
\centering
```

```
\includegraphics[width=2in]{file}
```

```
\caption{Figure of xyz}
```

```
\label{fig:xyz}
```

```
\end{figure}
```

Tables

`\begin{table}`

`\centering`

`\begin{tabular}{|c|c|c|}`

`\hline`

`□ & □ & □ \\`

`□ & □ & □ \\`

`□ & □ & □ \\`

`\hline`

`\end{tabular}`

`\caption{Table of xyz}`

`\label{table:xyz}`

`\end{table}`

Math

- ▶ For any serious use of math formulas:
- ▶ Use “`\usepackage{amssymb}`” in the preamble.
- ▶ This is a package created by the American Mathematical Society. It provides a large set of extra math symbols to LaTeX.
- ▶ Note: If equation numbers appear on the left and you want them to appear on the right, add the argument `[reqno]` to the document class options (put ‘reqno’ in [] brackets).

Math example

- ▶ To set Gauss' Law $\oint \vec{E} d\vec{A} = \frac{q}{\epsilon_0} = 4\pi kq$, the following coding:
- ▶ `$ \oint \vec{E} \vec{dA} = \frac{q}{\varepsilon_0} = 4\pi k q $`

- ▶ ▶ `\int` gives an integral sign.
- ▶ `\oint` gives an closed line integral sign (an integral sign with a circle on it).
- ▶ `\vec` gives a vector notation. If the vector contains two or more characters, enclose them in `{...}`.
- ▶ `\varepsilon` gives the correct version of the Greek letter epsilon.
- ▶ `_` gives a subscript. (`^` gives a superscript.)
- ▶ `\pi` gives the small Greek letter π .

Typesetting Equations

- ▶ Different equation environments are available:
 - ▶ `equation`
 - ▶ `eqnarray`
 - ▶ `align`
 - ▶ `multiline`
- ▶ These environments put the equations in a separate line and centered.
- ▶ `eqnarray`, `align` and `multiline` are used for multiple line equations.

► Example:
$$P_e = \frac{1}{\pi} \int_0^{\pi/2} M_\gamma \left(\frac{\psi}{\sin^2 \theta} \right) d\theta \quad (1)$$

- To write this equation, LaTeX code is given as:

```
\begin{equation}
```

```
P_e=\frac{1}{\pi}\int_{0}^{\pi/2} M_{\gamma}
```

```
\left(\frac{\psi}{\sin^2\theta}\right) d\theta
```

```
\label{eq:BER}
```

```
\end{equation}
```

- Equation numbering is done automatically
- ‘\label{ }’ is used for referring the equations as:
“As shown in Eq. \ref{eq:BER}” i.e.
“As shown in Eq. 1”

- ▶ To split equations in multiple lines, newline command ‘\\’ is used.
- ▶ To align multiple lines in equation, ‘&’ is used

Eg:

```
\begin{align}
```

```
x(t)&= y(t) \nonumber \\
```

```
&=z^2(t)
```

```
\end{align}
```

$$\begin{aligned}x(t) &= y(t) \\ &= z^2(t)\end{aligned}\tag{2}$$

Bibliography using *.bib* file

- ▶ Bibliography can be added using *.bib* file.

```
@BOOK{proakis_book,
```

```
author="J. G. Proakis",
```

```
title="Digital Communications",
```

```
publisher="McGraw-Hill",
```

```
edition="4th",
```

```
year="2001"}
```

```
@ARTICLE{brennan,
```

```
author="D. G. Brennan",
```

```
title="Linear diversity combining techniques",
```

```
journal="Proc. IRE",
```

```
volume="47",
```

```
pages="1075--1102",
```

```
month="June",
```

```
year="1959"}
```

- ▶ To add references, keywords are used, i.e. to refer the book ‘Proakis’ we have to write “\cite{proakis_book}”.
- ▶ The references are ordered in the pdf file according to their order of occurrence in .tex file instead of their order in .bib file.
- ▶ Non-cited references are not displayed in .pdf.

- ▶ .bib file is called as follows:

```
\bibliographystyle{ieeetr}
```

```
\renewcommand{\bibname}{References}
```

```
\bibliography{references}
```

- ▶ First line shows the bibliography display style.
- ▶ Second line is used to rename the heading to ‘References’ (by default it is ‘Bibliography’)
- ▶ Third line includes the .bib file, which is saved as “references.bib”

► The output turns out to be:

[1] J. G. Proakis, *Digital Communications*. McGraw-Hill, 4th ed., 2001.

[2] D. G. Brennan, “Linear diversity combining techniques,” *Proc. IRE*, vol. 47, pp. 1075-1102, June 1959.

THANK YOU