LaTeX

FOSSEE

Department of Aerospace Engineering
IIT Bombay

Outline

LaTeX - Introduction

- Typesetting program
  - What is typesetting?
- Excellently Typeset Documents - specially Math
- Anything from one page articles to huge books
- Pronounced *Lah-tech* or *Lay-tech*

Why LaTeX?

- Excellent visual quality!
- Handles the typesetting; Lets you focus on content
- Makes writing math extremely simple
- It is a standard – widely used in Scientific community

$$\tilde{N}_{\mathbf{x}} \times \mathbf{r}(\mathbf{x}) f_{1k}(\mathbf{x}, t) - \frac{1}{2} \tilde{N}\tilde{N} : \mathbf{B}\mathbf{B}^T P(\mathbf{x}, t) = -m_k f_{1k}(\mathbf{x}, t) + 2 \sum_{j=1}^{K} f_{1j}(\mathbf{x}, t) m_j P_{k|j}$$

Course Outline

- Look at the sample document - **`sample.pdf`**
  - Title, Author, Date
  - Abstract
  - Sections & Subsections
  - Appendix
  - References/Bibliography
  - Tables
  - Figures
  - Math
- The document will be produced by the end of the course.
- First Hour - Basic Structure
- Second Hour - Text, Tables, Figures, References
- Third Hour - Math, Bibliography, Presentations

LaTeX as a Mark-up

- LaTeX is a document based mark-up
- Mark-up — a system of annotating text, adding extra information to specify structure and presentation of text
- Document based markup $\longrightarrow$ you don't have to worry about each element individually
- Allows you to focus on content, rather than appearance.

Typesetting a minimal document

- Write the sample code into the file **draft.tex**

  See **hg** rev0 of draft

- To compile, (in terminal)

```
$ pdflatex draft.tex
```

- This produces the output file **draft.pdf**
- Note: **latex** vs. **pdflatex**

Commands & Environments

- LaTeX is case sensitive
- Commands begin with a `\`
- Environments have a **`\begin`** and **`\end`**
- Any content after the **`\end{document}`** is ignored

Comments & Special Characters

- Anything that follows a % symbol till end of the line is a comment
- Special characters (`~ # $ ^ & _ { }`) are escaped by a `\`
- `\` symbol is inserted using `\textbackslash` command

Spacing

- \\ inserts a new line in the output
- An empty line marks the beginning of a new paragraph
- Multiple spaces (or empty lines) are equivalent to a single space (or empty line)

Outline

documentclass

- Used to select the *class* of our document
- Some available classes - **article**, **proc**, **report**, **book**, **slides**, **letter**.
- For example:

  \documentclass[12pt,a4paper,draft]{report}
  The parameters within **[ ]** are optional.
  - **12pt** – sets the font size of main font and others are relatively, adjusted. **10pt** is the default.
  - **a4paper** – specify paper size
  - **draft** – marks hyphenation and justification problems in typesetting with a square in the margin

Top Matter

Let's add the title, author's name and the date.

- Add title, author and date.
- Compile.
- Nothing changes.

See **hg** rev1 of draft.

Top Matter . . .

- **`\maketitle`** command inserts the top-matter.
- Add the command to the document & compile again.
- If no date is specified, today's date is automatically inserted.

See **`hg`** rev2 of draft.

Abstract

- **`abstract`** environment inserts abstract.
- Place it at the location where you want your abstract.

See rev3 of **`hg`**

Sectioning

- `\section`, `\subsection` `\subsubsection`
- Auto numbered sections!
- `*` to prevent numbering of a section

See rev4 of `hg`

Sectioning . . .

- Longer documents, use **report** or **book** class
- Chapter can be added using **\chapter**

```
\documentclass{report}

\chapter{One}
```

- subsections do not get numbering
- Change **secnumdepth**

```
\setcounter{secnumdepth}{3}
```

See rev5 of **hg**

Appendices

- **`\appendix`** command indicates the beginning of Appendices.
- Any content after **`\appendix`**, will be added to the appendix
- Use sectioning commands to add sections

See rev7 of **`hg`**

Table of Contents [TOC]

- Our document is short, but let's learn to add a TOC
- Add `\tableofcontents` where you want TOC to appear
- Compile
- Only headings appear. No page numbers
- A `.toc` file is generated
- Re-compile
- Any numbered section/block automatically appears

See rev8 of `hg`

TOC . . .

- Un-numbered sections are added to TOC using **`\addcontentsline`**
- For instance, **`\addcontentsline{toc}{section}{Intro}`**

See rev9 of **`hg`**

Bibliography

We shall look at Bibliographies, later in the course.

Outline

Quotation Marks

- Use ` (accent) for left quote
- Use ´ (apostrophe) for right quote
- For double quotes, use them twice

See rev11 of **hg**

Fonts - Emphasis, Fixed width, . . .

- **`\emph`** gives emphasized or italic text
- **`flushleft`** to have text left aligned
- **`flushright`**, **`center`**

See rev12 of **`hg`**

Fonts - Emphasis, Fixed width, . . .

- `\texttt` gives fixed width font
- `\textbf` bold face font
- `--` en dash (–); `---` em dash (—).

See rev13 of `hg`

Lists

- **`enumerate`** environment is used for numbered lists
- **`itemize`** environment gives un-numbered lists
- Each item in the list is specified using **`\item`**
- Nested lists are also easily handled, as expected

See rev14 of **`hg`**

Footnotes

- `\footnote` command adds a footnote

See rev15 of `hg`

Labels and References

- **`\label{labelname}`** is used to label an element
- **`\ref{labelname}`** is used to refer to that element
- Compile twice

See rev15 of **`hg`**

Including code

- Instead of using **\texttt** we could use **\verbatim**
- **listings** is a powerful package
- **\usepackage{listings}** needs to be added
- Tell LaTeX the language to be used, using **\lstset**

See rev16 of **hg**

Including code

- Use **`\lstlisting`** for a block of code
- **`\lstinline`** for inline code

See rev16 of **`hg`**

Outline

Figures

- The **graphicx** package allows us to insert graphics
- **\usepackage{graphicx}**
- To add a graphic, use **\includegraphics** command
- Use relative path to the image

See rev17 of **hg**

includgraphics

It takes following optional arguments

- **scale** — specifies the factor by which to scale the image
- **height**, **width** — If only one of them is specified, aspect ratio is maintained
- **keepaspectratio** — boolean value to keep aspect ratio or not
- **angle** — specify by what angle the image should be rotated

Floats

- Graphics (& Tables) are special because they cannot be broken across pages
- They are “floated” to the next page, if they don’t fit in the current page
- Enclose graphic within **`figure`** environment to make it float
- Figure environment takes additional parameter for location of float

Table : Permission Specifiers

Specifier	Permission
t	Top of page
b	Bottom of page
p	Separate page for floats
h	here (the same place where command appears in source)
!	override LaTeX’s internal parameters for good position

Captions and References

- Figure environment allows us add a caption
- To place the image in the center we enclose it in the **`center`** environment
- We can label images too
- label should be added after the caption command
- Figures are auto numbered

See rev17 of **`hg`**

Tables

- **`tabular`** is used to typeset a table
- It is enclosed in a **`table`** environment to make it a float
- **`table`** environment also gives captions, auto numbering

tabular

- tabular takes formatting of each column as argument

Table : tabular environment

`l`	left justified column content
`r`	right justified column content
`c`	centered column content
`|`	produces a vertical line

- also takes an optional parameter for specifying position of table
- `t` for top, `b` for bottom, `c` for center
- each column of table is separated by &
- each row is separated by newline `\\`
- `\hline` give a horizontal line between two rows

See rev18 of `hg`

List of Tables, Figures

- **`\listoftables`** – to add a list of tables
- **`\listoffigures`** – to add a list of figures

Outline

Math in LaTeX

- Math is enclosed in a pair of `$` signs or `\( \)`
- Used for typesetting inline Math.
- `\usepackage{amsmath}`
- Let's now move on to matrices.

Matrices

- **\bmatrix** is used to typeset the matrix A
- It works similar to the tabular environment
- **&** for demarcating columns
- **** for demarcating rows
- Other matrix environments

matrix	none
pmatrix	**(**
Bmatrix	**{**
vmatrix	**|**
Vmatrix	**||**

See rev19 of **hg**

Superscripts & Subscripts

- ^ for superscripts
- _ for subscripts
- Enclose multiple characters in { }

Summation & integration

- **\sum** command gives the summation symbol
- The upper and lower limits are specified using the ^ and _ symbols.
- Similarly the integral symbol is obtained using **\int** command.

`displayed` math

- Display equations are the other type of displaying math
- LaTeX or **`amsmath`** has a number of environments for “displaying” equations, with minor differences.
- In general, enclose math in `\[` and `\]` to get displayed math.
- **`\begin{equation*}`** is equivalent to this.
- Use **`\begin{equation}`** to get numbered equations.

See rev20 of **`hg`**

Groups of equations

- The **`equation`** environment allows typesetting of just 1 equation.
- **`eqnarray`** allows typesetting of multiple equations
- It is similar to the **`table`** environment
- The parts of the equation that need to be aligned are indicated using & symbol.
- Each equation is separated by a **`\newline`** command

See rev21, 22 of **`hg`**

Fractions & Surds

- Fractions are typeset using **`\frac`** command
- **`\frac{numerator}{denominator}`** is typeset as $\frac{numerator}{denominator}$
- Surds are typeset using **`\sqrt[n]`** command

Greek characters & Spacing

- Typesetting Greek characters is simple
- **\alpha**, **\beta**, **\gamma**, . . . **\Alpha**, **\Beta**, **\Gamma** . . .
- To get additional spacing in Math environments —

Abbrev.	Spelled out	Example
\,	\thinspace	$A\,B$
\:	\medspace	$A\:B$
\;	\thickspace	$A\;B$
	\quad	$A\quad B$
	\qquad	$A\qquad B$
\!	\negthinspace	$A\!B$
	\negmedspace	$A\!\!B$
	\negthickspace	$A\!\!\!B$

Outline

Bibliography

- **thebibliography** environment provides a clean and simple way to add a bibliography to LaTeXdocuments.
- **\begin{thebibliography}** takes as argument the maximum width of the label that references will have.
- Each item of the Bibliography is similar to an item in a list.
- **\bibitem[label]{name}** followed by the actual reference info.
- label replaces auto enumeration numbers
- **\cite{name}** is used to **cite** the **bibitem**
- You will need to compile twice.

See rev23 of **hg**

Outline

Beamer

- Use beamer since your report's LaTeX would be re-usable.
- It is recommended to start with one of the beamer templates.
- Let's look at speaker introduction template.
- **`\documentclass{beamer}`** tells LaTeX to start a beamer presentation.
- A beamer document is very similar to any other LaTeX document except that content is divided into slides.

Beamer . . .

- **\usetheme** command is used to specify the theme of the presentation.
- **\usecolortheme** command is used to specify the color theme.
- The content of a slide is enclosed within **\begin{frame}{Title}{Subtitle}** and **\end{frame}**
- If the slide contains **verbatim lstlisting** environments, the **\begin{frame}** should be passed an additional argument **[fragile]**
- Overlays can be achieved using the **\pause** command.
- To achieve more with beamer, it is highly recommended that you look at the `beameruserguide`

Thank You!