

L^AT_EX

FOSSEE

Department of Aerospace Engineering
IIT Bombay

Outline

- 1 Introduction
- 2 Adding Structure
- 3 Typesetting Text
- 4 Figures, Tables & Floats
- 5 Typesetting Math
- 6 Bibliography
- 7 Presentations - Beamer
- 8 Miscellaneous

L^AT_EX - 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 L^AT_EX?

- 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

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

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

L^AT_EX as a Mark-up

- L^AT_EX 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 → 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 \backslash
- Environments have a $\backslash\text{begin}$ and $\backslash\text{end}$
- Any content after the $\backslash\text{end}\{\text{document}\}$ 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)

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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.

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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

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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 L ^A T _E X’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

Also see `longtable`, especially relevant for `hltlatex`

List of Tables, Figures

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

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Math in L^AT_EX

- 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

<code>matrix</code>		none
<code>pmatrix</code>		(
<code>Bmatrix</code>		{
<code>vmatrix</code>		
<code>Vmatrix</code>		

See rev19 of hg

Superscripts & Subscripts

- \wedge 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 $\backslash [$ and $\backslash]$ to get displayed math.
- $\backslash \text{begin}\{\text{equation*}\}$ is equivalent to this.
- Use $\backslash \text{begin}\{\text{equation}\}$ 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

Shortcuts/aliases/newcommands

We often need shortcuts

- `\def`
- `\newcommand`
- `\renewcommand` : to be used judiciously!
Overwrites: those sharing your tex file won't be warned :-)
- `\newcommand{\yourownshortcut}[1]{\frac{d^{#1}}{dt^{#1}}}`
`\yourownshortcut{5}` gives $\frac{d^5}{dt^5}$
- Exercise: use `\def` and `\newcommand` and look up optional arguments

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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
<code>\,</code>	<code>\thinspace</code>	AB
<code>\:</code>	<code>\medspace</code>	AB
<code>\;</code>	<code>\thickspace</code>	$A B$
	<code>\quad</code>	$A \quad B$
	<code>\qquad</code>	$A \qquad B$
<code>\!</code>	<code>\negthinspace</code>	$A!B$
	<code>\negmedspace</code>	AB
	<code>\negthickspace</code>	AB

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Bibliography

- **thebibliography** environment provides a clean and simple way to add a bibliography to \LaTeX documents.
- `\begin{thebibliography}{10}` (Argument '10' (for example) is the maximum width of the label that references will have (for certain bibliography styles).
- 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

Bibtex

- Rather than reproducing bibitems at the end of each report/paper, shift to bibtex
- bib file allows systematic storing of references
- bst file to help with reference formatting
- bibtex creates bbl file to include as bibitems (for manual tweaking)
- $\text{pdflatex} \rightarrow \text{bibtex} \rightarrow \text{pdflatex} \times 2$

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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`
- Can change `mode` from `presentation` to `printout` to disable themes/section-headings and pauses (ideal for printing out).

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Relevant shell variables

- Bash shell variables that help keep your personal cls files, figures in your common directory: do not maintain multiple copies of same file!
- TEXINPUTS (with double // for ‘across all subdirectories’)
- BIBINPUTS (for bib file, to avoid duplication)
- Alternatively, use shell variable ‘ln’ (for link, instead of cp: copy)

More control over floats

- Spirit behind latex: let latex decide locations and no manual tweaking
- Sometimes need to tweak: floats are quite 'disobedient'
- Explore minipage environment, subfigure and caption packages
- Use longtable for a table that extends across pages

These slides were made using beamer.
FOSSEE project employees contributed to the content.

Thank You!