

Getting Started with L^AT_EX for a Technical Document or Thesis

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Outline

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What is \LaTeX ?

- \LaTeX is a mark-up language for typesetting documents (Leslie Lamport, 1985).
- ... based on \TeX , a typesetting system created by Donald Knuth (1977)
- \LaTeX is simpler and more structured than \TeX (it's a macro language).
- \LaTeX attempts to separate the “content” from the “look” of the document.
- \LaTeX is not a WYSIWYG word processor.

What is \LaTeX ? 2

- \LaTeX and \TeX have strong mathematical typesetting capabilities.
- The source document is **plain text** so is easily portable.
- \LaTeX is available as free software on all computing platforms.
- To produce a typeset document, the plain text source file is processed by a suite of programs.
- There are commercial versions of \LaTeX that provide a slicker user interface, *e.g.*, TeXtures, Scientific Workplace

Basic Mark-up 1

- All L^AT_EX mark-up **commands** begin with a “ \”.
- Commands use braces “ { } ” to indicate the **argument** (scope):
e.g., `\emph{This text emphasized}`
- Some commands can act as on-off switches (no argument):
e.g., `\large` turns on larger font size (scope not explicit)
- Commands may have **options**:
e.g., `\documentclass[12pt,twocolumn]{article}`

Basic Mark-up 2

- There are 10 **special characters** used in L^AT_EX commands:
`\ # $ % & ~ _ ^ { }`
- Backslash, tilde and caret are produced with:
`\textbackslash \textasciitilde`
`\textasciicircum`
- Other special characters are entered as text by preceding them with a backslash.
- Extra spacing between words and commands is ignored.
Anything following “%” is ignored.
- A blank line indicates a new paragraph.

Basic Mark-up 3

- **Environments** define more complex structures, scoped with `\begin` and `\end` commands:
e.g., `\begin{itemize} ... \end{itemize}`
- Environments define their own commands
e.g., `\item` defines an item within a list.
- Some environments are automatically numbered
e.g., `section` and `equation`
- The “starred” form turns off auto-numbering
e.g., `\begin{equation*}`

Text Mode and Math Mode

- L^AT_EX typesets text and math differently.
- Text (paragraph) mode is the default.
- Math mode must be turned on explicitly by using special delimiters $. . .$ or by using a math environment.
- Font changing commands are different in text and math modes:
e.g., `\textbf` vs. `\mathbf` for bolding.

Source File — Preamble

- The source file(s) contain the document text and L^AT_EX mark-up.
- There is one **master** source file, beginning with the `\documentclass` command.
- The **preamble** section defines:
 - the document type via `\documentclass`
 - add-on **packages** needed *e.g.*,
`\usepackage{amsmath,amssymb}`
 - any special dimensions, *e.g.*, margins, spacing
 - any user-defined commands or environments

Source File — Logical Document

- The **document section** lies between `\begin{document}` and `\end{document}` commands.
- The logical document contains the content material and mark-up.
- Other source files *e.g.*, chapters, may be read into the master file with `\input{filename.tex}` commands.
- Additional source files should not contain a preamble section or `\begin{document}` and `\end{document}` commands.

Text Mark-up 1

There are a few simple commands to remember:

- 1 L^AT_EX recognizes three types of dashes

Punctuation – – – , or `\textmdash`
e.g., He jumped — too late.

Range – – , or `\textndash`
e.g., chapters 1–12

Interword – e.g., thought-provoking

- 2 Use pairs of opening and closing **single** quotes rather than double quotes, to get “this” rather than "this".

Text Mark-up 2

- 3 Force a space with a backslash followed by a space.
e.g., L^AT_EXbeats Word! (`\LaTeX beats Word!`)
e.g., L^AT_EX beats Word! (`\LaTeX\ beats Word!`)
- 4 If necessary, force a line break with `\\`
- 5 Prevent inappropriate line break with tilde
e.g., Ms .~Wong
or `\mbox{No breaks in here}`.
- 6 Ellipsis ... is produced with `\ldots`.
- 7 Change font sizes: `\tiny`, `\small`, `\large`, `\Large`,
`\LARGE`, `\huge`, `\Huge`

Text Mark-up 3 — Environments

- List-type environments:

Bulleted lists Use the `itemize` environment.

Numbered lists Use `enumerate`.

Descriptions Use `description`.

- Example:

```
\begin{enumerate}
```

```
\item First item
```

```
\item Second item
```

```
\end{enumerate}
```

① First item

② Second item

- List environments can be nested.

Text Mark-up 4 — Layout

- Layout environments:

Tables Use `tabular`. Borders optional.

Fancier Layout Use `minipage`.

- Example table:

```
\begin{tabular}{lr}
```

One & Two

One Two

Three & Four

Three Four

```
\end{tabular}
```

- Example minipage:

```
\begin{minipage}{4cm}
```

This is some text
in a minipage.

This is some text in a
minipage.

```
\end{minipage}
```

Text Mark-up 5 — Cross-references

- Any numbered structure (section, equation, *etc.*) can be given a name.
- When that name is referred to, the number is inserted.
- Use *e.g.*, `\label{sec-intro}` right after the `\begin{section}` command.
- Refer to label in text with `\ref{sec-intro}`
e.g., In section~`\ref{sec-intro}`

Math Mark-up 1

- Only certain fonts contain many math symbols:
 - Computer Modern (the default Donald Knuth-designed font)
 - Lucida Bright
 - Times
- AMS packages **amsmath**, **amssymb**, **amstext** provide many useful environments and symbols (hundreds!).
- Math content can be in-line or displayed.
 - In-line** Between $\$$'s or $\backslash($ and $\backslash)$.
 - Displayed** Use `equation` or `equation*` environments.
- Text can be added in math mode:
e.g., `\text{Some text}` (requires **amstext**)

Math Mark-up 2

- Spacing in math mode can be adjusted manually, if necessary.

	Default Spacing	3 4
<code>\,</code>	<code>\thinspace</code>	3 4
<code>\;</code>	<code>\medspace</code>	3 4
<code>\;</code>	<code>\thickspace</code>	3 4
	<code>\quad</code>	3 4
	<code>\qquad</code>	3 4
<code>\!</code>	<code>\negthinspace</code>	3 4
	<code>\negmedspace</code>	3 4
	<code>\negthickspace</code>	3 4

Math Mark-up 3 — Simple Examples

- Example In-line Math:

We define matrix
`$A_{m \times n}$`,
where `$m=4$` and
`$n=5$`.

We define matrix $A_{m \times n}$,
where $m = 4$ and $n = 5$.

- Example Displayed Math:

```
\begin{equation*}
\label{quad_form}
x = \frac{
-b \pm
\sqrt{b^2 - 4ac}
}{
2a
}
\end{equation*}
```

For $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

is the quadratic formula.

Math Mark-up 4 — Multi-line Eqns

- **Example** `eqnarray` environment:

```
\begin{eqnarray}
```

```
a &=& b+c-d
```

```
\nonumber\\
```

```
&\:& +e-f\\
```

```
&=& g+h\\
```

```
&=& i
```

```
\end{eqnarray}
```

$$a = b + c - d + e - f \quad (1)$$

$$= g + h \quad (2)$$

$$= i \quad (3)$$

- Suppress a line number with `\nonumber`.
- An `eqnarray` has exactly 3 columns, tabbed with `&`.

Math Mark-up 5 — Matrices & Arrays

- **Example Matrix:**

```
\begin{equation*}
\begin{bmatrix}
\alpha & \beta^* \\
\gamma^* & \delta
\end{bmatrix}
\end{equation*}
```

$$\begin{bmatrix} \alpha & \beta^* \\ \gamma^* & \delta \end{bmatrix}$$

- **Example Array:**

```
\begin{equation*}
\left|
\begin{array}{lr}
1 & \cos(\theta) \\
\sin(\theta) & 0
\end{array}
\right|
\end{equation*}
```

$$\left| \begin{array}{lr} 1 & \cos(\theta) \\ \sin(\theta) & 0 \end{array} \right|$$

Math Mark-up 6 — Cases

- Example Case:

```
\begin{equation*}
P_{r-j} =
\begin{cases}
0 & \text{if } r-j \text{ odd,} \\
r! \cdot (-1)^{(r-j)/2} & \text{if } r-j \text{ even.}
\end{cases}
\end{equation*}
```

$$P_{r-j} = \begin{cases} 0 & \text{if } r-j \text{ odd,} \\ r! (-1)^{(r-j)/2} & \text{if } r-j \text{ even.} \end{cases}$$

Math Markup 7 — Cross-References

- Use `\label` and `\eqref` e.g.,

```
\begin{equation}
```

```
\label{alg}
```

```
\begin{split}
```

```
a = b+c-d\\
```

```
+e-f
```

```
\end{split}
```

```
\end{equation}
```

```
In equation
```

```
\eqref{alg},
```

```
\ldots
```

$$a = b + c - d \quad (4)$$

$$+e - f$$

In equation (4) ...

Embedded Graphics 1 — Encapsulated Postscript

- The **latex** formatter only allows embedded EPS figures.
- Encapsulated PostScript is PS that describes a partial page.
- PS is easily produced from your favourite drawing package via “Print to file” though a Postscript print driver.
- **GSView** can convert PS to EPS (calculates the drawing’s “bounding box”).
- Your drawing program may also export to EPS directly.
- Otherwise, programs such as **ImageMagic** can convert among many image formats.

Embedded Graphics 2 — `\includegraphics`

- Graphics are included via the `\includegraphics` command, defined by the `graphicx` package. *e.g.*,

```
\includegraphics[height=5cm]{myfig.eps}
```
- Options to `\includegraphics` allow resizing, *etc.*
- However, it's better to draw your figures to the size you need (to avoid problems with scaling text annotations).
- Common options to `\includegraphics` are:
 - `width=, height=` Set only one to keep original proportions.
 - `clip=true` For cropped images, ensure the figure is clipped to the bounding box.

Embedded Graphics 3 — Portable Document Format

- The **pdflatex** formatter only allows embedded graphics in the following formats:
 - PDF
 - JPEG
 - PNG
 - TIFF
- For PDF documents vector graphics are preferred, to allow zooming without degradation.
- EPS is a scalable “vector graphic” format.
- EPS drawings may be converted to PDF through **GSView** or **Acrobat Pro**.
- Graphics are included via the `\includegraphics` command (as above).

Embedded Graphics 4 — Floating Figures (and Tables)

- The `figure` and `table` environments provide “floating” structures that are numbered and captioned.
- Captions are listed in the lists of figures and tables.

```
\begin{figure}[htbp]
\begin{center}
\includegraphics[clip=true]{beam.pdf}
\end{center}
\caption{Cantilever Beam}
\label{fig.beam}
\end{figure}
```

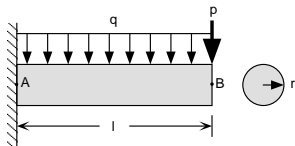


Figure: Cantilever Beam

Embedded Graphics 5 — Floats . . . continued

- Floating structures are placed in the document by L^AT_EX where they cause the least disruption to the look of the typesetting.
- Options `[htbp]` allow you to state your location preferences in order.
 - h Here, if possible
 - t Top of a following page
 - b Bottom of current or following page
 - p Page of floats
- The `float` package provides the **H** option for keeping a figure environment from floating.
- The `floatfig` provides for wrapping text around narrow floating figure environments.

Thesis Template — Example Preamble

```
% Example thesis for formatting with "latex", i.e. EPS figs. and dvips DVI formatter
\documentclass[12pt]{report}
\usepackage{amsmath,amssymb,amstext} % lots of Math symbols and environments
\usepackage[dvips]{graphicx} % includegraphics environment
\usepackage[dvips=true,bookmarks=true]{hyperref} % hyperlinks in PDF
% Create a listing in the log of all files needed to process this document
\listfiles
% Reset page margins according to UW thesis regulations
\setlength{\hoffset}{0pt} % 1 inch left margin
\setlength{\oddsidemargin}{0pt} % 1 inch left margin
\setlength{\voffset}{0pt} % 1 inch top margin
\setlength{\marginparwidth}{0pt} % no margin notes
\setlength{\marginparsep}{0pt} % no margin notes
\raggedbottom

\renewcommand{\baselinestretch}{1.2} % 1.2 line spacing for legibility (optional)
```

Resources

- The UW LaTeX for EThesis and Large Documents page.
- The Comprehensive TeX Archive Network where all things \TeX and \LaTeX are found.
- There are many good books on \LaTeX . The standards are:
 \LaTeX , A Document Preparation System, by Lamport
The \LaTeX Companion, by Goosens, Mittelbach and Samarin