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# An Introduction to $\text{\LaTeX}$

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## Abstract

$\text{\LaTeX}$  is a Document Preparation System which is useful for the preparation of all kinds of reports. It is particularly suited, but not limited to, scientific and mathematical papers and reports. In association with various of support packages it is possible to produce high quality output which can be electronically submitted to a number of Journals. In addition, the separation of form and content allows the same text to be formatted to different specifications with only a few simple changes.

The aim of this talk is to introduce the  $\text{\LaTeX}$  Document Preparation System, to explain its capabilities, its limitations, how it works within the UNIX environment of the Faculty of Engineering, and to introduce some of the support programs which are used in conjunction with  $\text{\LaTeX}$ .



## Overview

- $\text{\LaTeX}$ 
  - What is  $\text{\LaTeX}$ ?
  - Capabilities, Limitations and Comparisons
- $\text{\LaTeX}$  Documents and  $\text{\LaTeX}$  commands
- Support Programs
  - $\text{\BibTeX}$ ,  $\text{dvips}$ , Graphics, Converters and other programmes
- Some  $\text{\LaTeX}$  Classes and Packages
- Getting Started
- Further Information



## L<sup>A</sup>T<sub>E</sub>X

- L<sup>A</sup>T<sub>E</sub>X is a document processing system in which you specify the content and layout(style) separately
- Many powerful features: Mathematics, Labels, Refs, Equation Numbers, Section Numbers, Table of Contents, List of Figures, List of Tables, Glossaries, Indexes, etc.
- Style Features: Multi-column, Paper Size, Headers, Footers, Page Numbering, Reference Style, etc.
- Available on many systems
- Limitations: Tables, not WYSIWYG, learning threshold, typesetting conventions



## Why “Document Processing”?

- Documents communicate ideas (journal articles, class material, books, reports, memos), in multiple formats
- Need **cross-platform** means for converting formats as well as presentation
- L<sup>A</sup>T<sub>E</sub>X is a high quality, inexpensive, typesetting system.
- Can easily handle PostScript files
- Can easily handle bibliography databases.
- Conversion to HTML, PDF, DVI, and Postscript formats is simple
- L<sup>A</sup>T<sub>E</sub>X is *Structured*



## Documents for communication

- articles (expository, research, informative)
- letters
- books
- bibliographies

## Forms for dissemination

- Hardcopy
- Electronic Forms (PostScript, dvi, pdf, html)



## Why L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>

and not Word Processors?

1. good cross-platform compatibility.
2. Inexpensive or free.
3. Better quality typesetting.
4. WYSIWYG wastes time better spent on content (forget about how it looks until it contains what you want to discuss!)

## Why not L<sup>A</sup>T<sub>E</sub>X 209

1. 209 isn't supported.
2. 2e is better packaged with a more natural programming flow.





## A Comparison of $\text{\LaTeX}$ and Word

	$\text{\LaTeX}$	Word
WYSIWYG	No	Yes
Figures	Yes	Yes
Mathematics	Yes	(Yes)
Style Changes	Yes	(Yes)
Cross References	Yes	No
Citations & References	Yes	No
Multi-platform	Yes	No
Free	Yes	No



## What are all these T<sub>E</sub>X things?

**T<sub>E</sub>X** the basic system (a low level programming language for documents).

**L<sup>A</sup>T<sub>E</sub>X** a set of macros defining document styles (higher level language).

**L<sup>A</sup>T<sub>E</sub>X209** the *old* version of L<sup>A</sup>T<sub>E</sub>X.

**L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>** the *current* version of L<sup>A</sup>T<sub>E</sub>X.

**A<sub>M</sub>S-T<sub>E</sub>X** or **A<sub>M</sub>S-L<sup>A</sup>T<sub>E</sub>X** set of macros, which can be used instead of L<sup>A</sup>T<sub>E</sub>X.

While all of these are somewhat interesting in their own right, we will focus on L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>.



## Content and Format

- Document contains **Description** of contents rather than detailed **Format** of contents, e.g.,

```
\section{Introduction}
```

rather than “Bold 14pt”

1. Introduction

- L<sup>A</sup>T<sub>E</sub>X uses style sheets or document classes



## Understanding L<sup>A</sup>T<sub>E</sub>X Documents

- `\` is used to start command names while `%` is used to start a comment
- `&` `$` `#` `_` `^` `{` `}` and `~` are special characters
- Words are separated by one or more spaces.
- Paragraphs are separated by one or more blank lines.
- The output is not affected by adding extra spaces or extra blank lines to the input file.
- `'` and `'` create ‘Quotes’ or “Double Quotes”
- `--` and `---` produce en dashes (–) and em dashes (—)
- **Bold** and *emphasised* text are easy.



## General Form of a $\text{\LaTeX}$ 2 $\epsilon$ document

```
% This is a comment
\documentclass[options]{type}           % Must be in document
\usepackage{package name}             % Multiple packages
<Header: options and configuration>
.
.
\begin{document}                       % Must be in document
.
<document content>
.
\end{document}                         % Must be in document
```



## Header Content

The Header consists of items such as:

```
\title{ Document Title }
```

```
\author{ Document Author }
```

```
\date{ Date for paper } %% this is optional
```

and then, in the document content use `\maketitle`.

Also in the header are definitions of new commands, `\usepackage` commands and suchlike.



## Document Content

Documents consist of

- Tables of Contents, Lists of Figures, etc.
- Sectional Units
- Text
- Mathematics
- Lists
- Tables and Figures (graphics)
- Bibliographies



## Tables of Contents etc.

Tables of Contents, Lists of Figures, Lists of Tables are produced by the following commands:

- `\tableofcontents`
- `\listoffigures`
- `\listoftables`



## Sectional Commands

The sectional units in an article are produced by the following commands:

- `\section{title}`
- `\subsection{title}`
- `\subsubsection{title}`
- `\paragraph{title}`

Books and reports also have `\chapter{title}` and can have different parts defined by `\part{title}`.

The `\appendix` command changes the numbering scheme for sections to letters.



## Mathematics

$\text{\TeX}$  was originally designed to presentation mathematics well.  $\text{\LaTeX}$  basically uses the same commands with a few modifications. The equation:

$$\Theta(s) = \int_0^{\infty} \theta(t) e^{-st} dt = \mathcal{L}\{\theta(t)\}$$

is created using the commands

```
\[  
\Theta(s) = \int_0^{\infty} \theta(t) e^{-st} dt  
= \mathcal{L}\{\theta(t)\}  
\]
```

Many symbols and operators are available:  $\Rightarrow$ ,  $\forall$ ,  $\pi$ ,  $\Pi$ ,  $\prod_{i=1}^n$ ,  $\gg$ ,  $\equiv$ ,  $\bar{a}$ ,  $\angle$ ,  $\pounds$ ,  $\clubsuit$ ,  $\updownarrow$ ,  $\oint$ , etc.





## List Environments

- enumerate: Numbered lists
- itemize: Bulleted lists

For example, use the list environment:

```
\begin{enumerate}  
  \item This is a two item list  
  \item This is the second item  
\end{enumerate}
```

to produce:

1. This is a single item list
2. This is the second item



## Tables and Figures

### The Table

	9.00 – 10.00	10.00 – 11.00	11.00 – 12.00
Monday	Applicable Mathematics I	Basic Engineering I	Engineering Design I
Tuesday	Applicable Mathematics I	Basic Engineering I	Engineering Practice I

Table 1: First Year Timetable

is produced by:

```
\begin{table} \begin{tabular}{|l|c|c|c|}  
 \hline & 9.00 -- 10.00 & 10.00 -- 11.00 & 11.00 -- 12.00 \\ \hline  
Monday & Applicable Mathematics I & Basic Engineering I  
 & Engineering Design I \\ \hline  
Tuesday & Applicable Mathematics I & Basic Engineering I  
 & Engineering Practice I \\ \hline  
 \end{tabular}  
 \caption{First Year Timetable}  
 \end{table}
```





## Including Postscript Files

When using  $\text{\LaTeX} 2_{\epsilon}$  it is better to use `\usepackage[dvips]{graphicx}`, rather than the old  $\text{\LaTeX}$  method of including graphics. Then use:

```
\begin{figure} [htbp]
  \begin{center}
    \includegraphics [height=3in,width=4in,angle=270]
                      {figure.ps}
    \caption{This is the Caption}
    \label{fig:label}
  \end{center}
\end{figure}
```

It is easy to include figures!





## Bibliographies and BibT<sub>E</sub>X

- use `list` or `itemize` environments.
- use `thebibliography` environment
- use **BibT<sub>E</sub>X**: Use the `\cite` command in the text to cite the required references and let **BIBT<sub>E</sub>X** create the bibliography at the end of the document



## Support Programs

**BibT<sub>E</sub>X** References database and citation

**(X)Emacs** Context sensitive editor

**latex2html** Convert L<sub>A</sub>T<sub>E</sub>X source to HTML

**rtf2latex** Convert RTF to L<sub>A</sub>T<sub>E</sub>X

**xdvi** Show output on screen

**dvips** Convert output suitable for printing on a PostScript printer.

**ghostview** Show PostScript on screen

**xfig** Useful for diagrams

**Others** Many programs exist which can be used in conjunction with L<sub>A</sub>T<sub>E</sub>X.





## BibT<sub>E</sub>X

Idea: you probably use the same reference in numerous papers, so why bother typing them in multiple times?

Need to construct a bibliography file (use a .bib suffix). This will be the database for all your references!

However, (X)Emacs will do much of the formatting for you (you simply fill in the blanks for the bibliography file).

```
\cite{GawBal97}
```

```
.
```

```
.
```

```
\bibliography{/home/mech/group/references/common}
```

```
\bibliographystyle{IFAC}
```





## Editing Documents: Emacs

$\text{\LaTeX}$  files can be edited using any text editor. Under Unix, one approach is to use Emacs in combination with Auc-TeX; this allows for the whole development of your document to occur without needing to leave your editor, except perhaps to construct figures using XFig or other programs.



## Printing

To print a standard file:

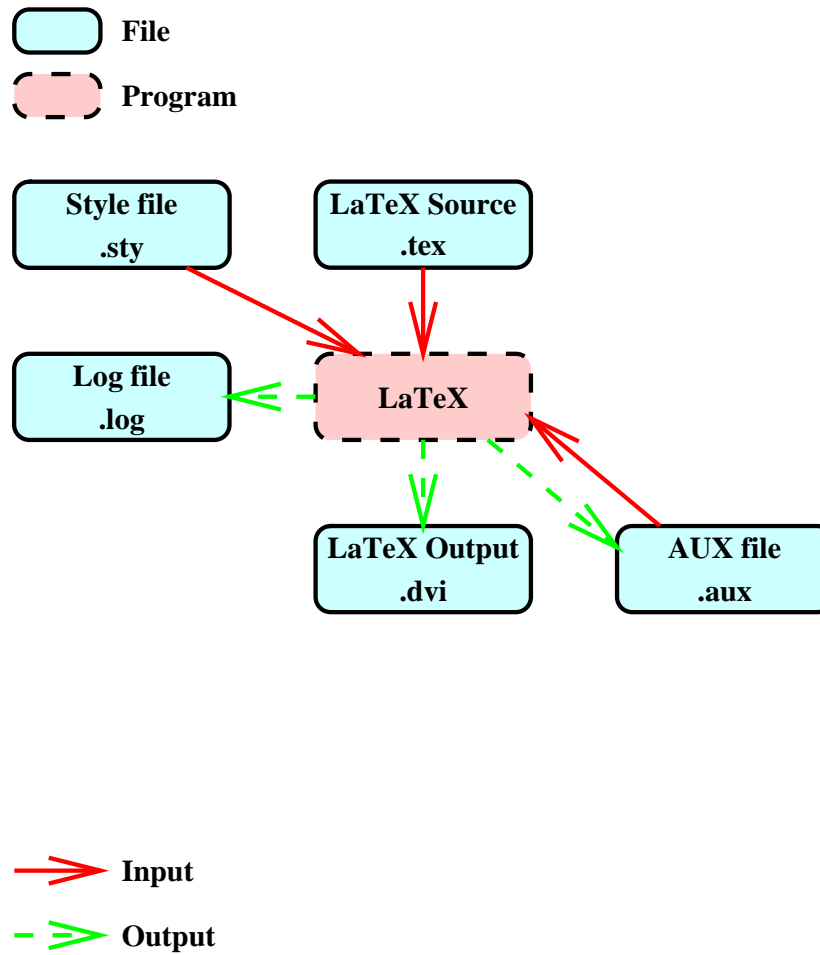
```
dvips filename.dvi -Pprinter
```

where `printer` should be replaced with the name of the printer on which you wish to print. If it different from you `PRINTER` environment variable. If you are doing 2-up, then you need to specify the orientation:

```
dvips filename.dvi -Pprinter -t landscape
```

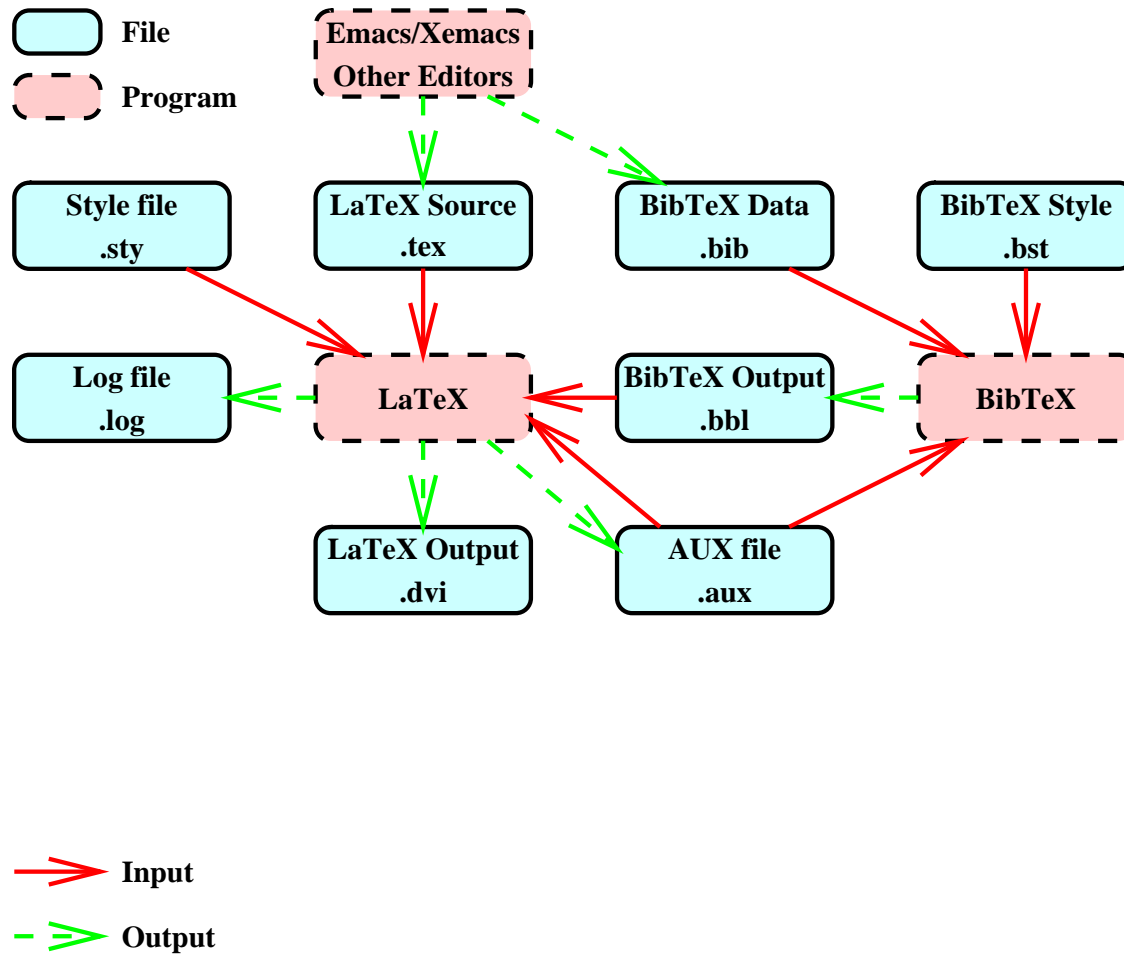


# Graphical Overview



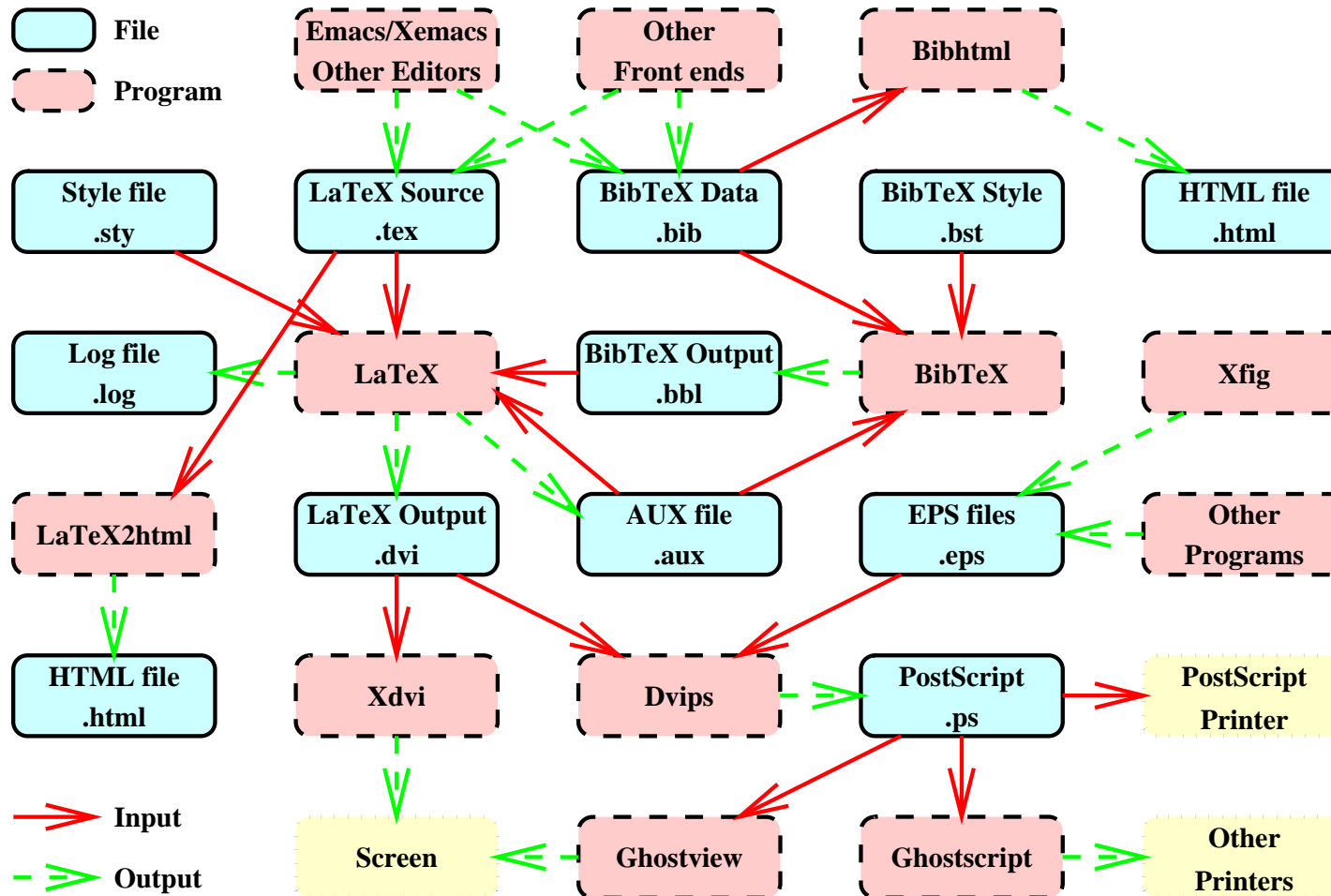


# Graphical Overview





# Graphical Overview





## Standard Classes (1)

The following classes are distributed with  $\text{\LaTeX}$ :

**article** The article class described in  $\text{\LaTeX}$ : A Document Preparation System.

**book** The book class described in  $\text{\LaTeX}$ : A Document Preparation System.

**report** The report class described in  $\text{\LaTeX}$ : A Document Preparation System.

**letter** The letter class described in  $\text{\LaTeX}$ : A Document Preparation System.

**slides** The slides class described in  $\text{\LaTeX}$ : A Document Preparation System, formerly S $\text{\LaTeX}$ .



## Standard Classes (2)

**proc** A document class for proceedings, based on article. Formerly the proc package.

**ltxdoc** The document class for documenting the  $\text{\LaTeX}$  program, based on article.

**ltxguide** The document class for  $\text{\LaTeX} 2_{\epsilon}$  for Authors and  $\text{\LaTeX} 2_{\epsilon}$  for Class and Package Writers, based on article. The document you are reading now uses the ltxguide class. The layout for this class is likely to change in future releases of  $\text{\LaTeX}$ .

**ltnews** The document class for the  $\text{\LaTeX}$  News information sheet, based on article. The layout for this class is likely to change in future releases of  $\text{\LaTeX}$ .



## Standard Packages (1)

The following packages are distributed with  $\text{\LaTeX}$ :

**doc** Allows the documentation of  $\text{\LaTeX}$  programs. Described in doc.dtx and in The  $\text{\LaTeX}$  Companion.

**exscale** Provides scaled versions of the math extension font. Described in ltexscale.dtx.

**fontenc** Specifies which font encoding  $\text{\LaTeX}$  should use. Described in ltoutenc.dtx.

**ifthen** Provides commands of the form ‘if...then do...otherwise do...’. Described in ifthen.dtx and The  $\text{\LaTeX}$  Companion.

**latexsym** Loads the  $\text{\LaTeX}$  symbol font (Not loaded by default). Described in latexsym.dtx and in The  $\text{\LaTeX}$  Companion.





## Standard Packages (2)

**makeidx** Provides commands for producing indexes. Described in  $\text{\LaTeX}$ : A Document Preparation System and in The  $\text{\LaTeX}$  Companion.

**newfont** Emulates the font commands of  $\text{\LaTeX}$  2.09 with the New Font Selection Scheme. Described in The  $\text{\LaTeX}$  Companion.

**oldfont** Emulates the font commands of  $\text{\LaTeX}$  2.09. Described in The  $\text{\LaTeX}$  Companion.

**syntonly** Processes a document without typesetting it. Described in syntonly.dtx and in The  $\text{\LaTeX}$  Companion.

**tracefmt** Allows you to control how much information about  $\text{\LaTeX}$ 's font loading is displayed. Described in The  $\text{\LaTeX}$  Companion.



## Related Software

In addition, the following software should be available.

**amslatex** Advanced mathematical typesetting from the American Mathematical Society

**babel** Supports typesetting in many languages.

**color** Provides support for colour.

**psnfss** Typesetting with Type 1 (PostScript) fonts.

**tools** Miscellaneous packages written by the L<sup>A</sup>T<sub>E</sub>X<sub>3</sub> project team.

These packages come with documentation and each of them is also described in at least one of the books *The L<sup>A</sup>T<sub>E</sub>X Companion* and *L<sup>A</sup>T<sub>E</sub>X: A Document Preparation System*.





## Tools (1)

This collection of packages includes, at least, the following (some files may have slightly different names on certain systems):

**array** Extended versions of the environments `array`, `tabular` and `tabular*`, with many extra features.

**dcolumn** Alignment on ‘decimal points’ in tabular entries. Requires the `array` package.

**delarray** Adds ‘large delimiters’ around arrays. Requires `array`.

**hhline** Finer control over horizontal rules in tables. Requires `array`.

**longtable** Multi-page tables. (Does not require `array`, but it uses the extended features if both are loaded.)



## Tools (2)

**tabularx** Defines a tabularx environment that is similar to tabular\* but it modifies the column widths, rather than the inter-column space, to achieve the desired table width.

**afterpage** Place text after the current page.

**enumerate** Extended version of the enumerate environment.

**fontsmpl** Package and test file for producing ‘font samples’.

**ftnright** Place all footnotes in the right-hand column in two-column mode.

**indentfirst** Indent The first paragraph of sections, etc.

**multicol** Typeset text in columns, with the length of the columns ‘balanced’.



## Tools (3)

**rawfonts** Preload fonts using the old internal font names of L<sup>A</sup>T<sub>E</sub>X2.09.

**somedefs** Selective handling of package options. (Used by the rawfonts package.)

**showkeys** Prints the ‘keys’ used by `\label`, `\ref`, `\cite` etc.; useful whilst drafting.

**theorem** Flexible declaration of ‘theorem-like’ environments.

**varioref** ‘Smart’ handling of page references.

**verbatim** Flexible extension of the verbatim environment.

**xspace** ‘Smart space’ command that helps you to avoid the common mistake of missing spaces after command names.





## Getting Started (1)

A typical session might look like the following:

```
host:project > use tetex
New Latex
host:project > use gnu
GNU Utilities for Solaris 2
host:project > use x11
X Window System (Openwindows + MIT X11R5)
host:project > textedit <filename>.tex
host:project > latex <filename>           % run latex to create .aux file
This is TeX, Version 3.14159 (C version 6.1)
(slides.tex
LaTeX2e <1996/06/01>
.
host:project > bibtex <filename>         % run bibtex to process references
host:project > latex <filename>         % run latex to include references
host:project > latex <filename>         % run latex to get cross-references
```



## Getting Started (2)

The commands to view and print the output would be:

```
host:project > xdvi <filename>           % view on screen
host:project > dvips -o <filename>.ps <filename> % create PostScript file
host:project > ghostview <filename>       % view on screen
host:project > dvips <filename>           % print to standard printer
host:project > dvips -P<printer> <filename> % print to printer
host:project > dvips -p 4 -n 2 <filename> % print pages 4 and 5
```



## Further Information

- Example Documents
  - `/local/tetex/texmf/tex/latex/base/small2e.tex`
  - `/local/tetex/texmf/tex/latex/base/sample2e.tex`
  - The Not So Short Guide to L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>
  - Essential L<sup>A</sup>T<sub>E</sub>X ++
- On-line Help via
  - <http://www.mech.gla.ac.uk/Control/Facilities.html>
- Books
  - L<sup>A</sup>T<sub>E</sub>X A Document Preparation System
  - The L<sup>A</sup>T<sub>E</sub>X Companion
  - L<sup>A</sup>T<sub>E</sub>X Notes: Practical Tips for Preparing Technical Documents



## Summary

- System is not WYSIWYG, more a programming language
- Powerful
- Relatively easy to use, although not that “friendly”
- Good for mathematics and technical papers
- Multi-platform: DOS, Windows, Mac, UNIX, Vax, ...
- FREE