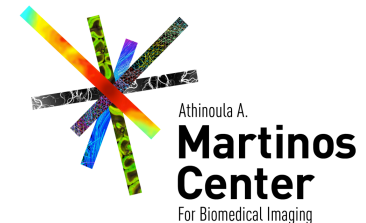# Technical Writing with LaTeX

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Outline

- Basics of LaTeX

- Mathematics

- Figures and Tables

- Cross-references

- Bibliography using BibTeX

- Presentation using Beamer

Introduction

- LaTeX is a document typesetting system

- Pronounced either "Lay-tech" or "Lah-tech"

- Used to produce high-quality technical/scientific documents such as articles, books, theses, technical reports etc.

- Stable, Platform independent - Windows, Linux, Mac OS

- We can concentrate purely on typing the contents of the document; formatting will be taken care by the LaTeX

- Free of cost!

Basics of LaTeX

- The input for LaTeX is a plain text file (.tex)

- Input file contains text of the document and LaTeX commands

- The final output is typically a .pdf file

- Special characters # $ % ^ & _ \ { } ~

  - Special characters can be used in the document by adding a prefix backslash \

  - Example: \ $ \ %

Basics of LaTeX

- Whitespace characters (e.g. blank, tab) are treated uniformly as "space" by LaTeX

- An empty line between two lines of text defines the end of a paragraph

- Example*:

```
It does not matter whether you
enter one or several       spaces
after a word.

An empty line starts a new
paragraph.
```

It does not matter whether you enter one or several spaces after a word.

An empty line starts a new paragraph.

* Example from Not so short introduction to LaTeX

A Basic LaTeX Document

```latex
\documentclass{article}
\title{A Basic LaTeX Document}
\author{B S Mahanand, PhD}

\begin{document}
\maketitle

Document preparation using LaTeX is well suited when it comes to thesis writing or paper writing for conferences or journals. It offers many features like ease of formatting, index generation, references to citations, generating tables, including figures, and writing mathematical equations
\end{document}
```

A Basic LaTeX Document

B S Mahanand, PhD

Document preparation using LaTeX is well suited when it comes to thesis writing or paper writing for conferences or journals. It offers many features like ease of formatting, index generation, references to citations, generating tables, including figures, and writing mathematical equations

Document Class

■ \documentclass command specifies the type of document the user wants to create

\documentclass[*options*]{class}

options = a4paper, 11pt, 12pt, 10pt, twocolumn, ...

class = article, report, book, letter, IEEEtran, elsarticle, ...

■ Examples

- \documentclass{article}

- \documentclass[12pt,a4paper]{report}

Packages

- \usepackage command is used to enhance the capabilities of LaTeX

    \usepackage{package name}

    package name = amsmath, graphicx, multirow, color, ...

- Examples

  - \usepackage{amsmath} – mathematics operators

  - \usepackage{graphicx} – to include graphics files such as figures, graphs etc.

Main Text

- Start with command \begin{document}

  …

  …

- End with command \end{document}

- Text in the document can be commented using % character

Sections

- **Sectioning commands**

  - \section{title}

    - \subsection{ title}

      - \subsubsection{title}

- **Example**

```
\documentclass{article}
\begin{document}
\section{Introduction}
Section numbering is done automatically by LaTeX
\subsection{Methods}
No need to specify begin and end commands for sections
\subsubsection{Materials}
Sectioning commands are very useful
\end{document}
```

1   Introduction

Section numbering is done automatically by LaTeX

1.1   Methods

No need to specify begin and end commands for sections

1.1.1   Materials

Sectioning commands are very useful

Lists

- itemize

```
\begin{itemize}
\item Each list item is marked with a label. The labels are bullets.
\item Lists can be nested within one another, four levels of nesting possible.
\item Blank lines before an item have no effect.
\end{itemize}
```

- Each list item is marked with a label. The labels are bullets.

- Lists can be nested within one another, four levels of nesting possible.

- Blank lines before an item have no effect.

Lists

- enumerate

```
\begin{enumerate}
\item The item labels in an enumerated list are numerals or letters.
\item A list should have atleast two items.
\end{enumerate}
```

1. The item labels in an enumerated list are numerals or letters.

2. A list should have atleast two items.

Lists

- description

```
\begin{description}
\item [Species 1] Man
\item [Species 2] Animals
\item [species 3] Birds
\begin{description}
\item [a] Flying
\item [b] Non-flying
\end{description}
\item [Species 4] Reptiles
\end{description}
```

Species 1 Man

Species 2 Animals

species **3** Birds

   a Flying

   b Non-flying

Species 4 Reptiles

Mathematics

- **Writing formulas**

  - \alpha = \frac{n}{2} \times \xi

    $$\alpha = \frac{n}{2} \times \xi$$

  - \sum_{i=1}^n i = \frac{n(n+1)}{2}

    $$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

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

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

Mathematics

- Mathematical formulas in the running text are entered between $ and $

- for numbered equations we can use

    \begin{equation}

    …

    \end{equation}

Mathematics

- Example*

```
This is text style:
$\lim_{n \to \infty}
 \sum_{k=1}^n \frac{1}{k^2}
 = \frac{\pi^2}{6}$.
And this is display style:
 \begin{equation}
  \lim_{n \to \infty}
  \sum_{k=1}^n \frac{1}{k^2}
  = \frac{\pi^2}{6}
 \end{equation}
```

This is text style: $\lim_{n \to \infty} \sum_{k=1}^n \frac{1}{k^2} = \frac{\pi^2}{6}$.
And this is display style:

$$\lim_{n \to \infty} \sum_{k=1}^n \frac{1}{k^2} = \frac{\pi^2}{6} \qquad (3.3)$$

* Example from Not so short introduction to LaTeX

Figures

- **to create figure**

  \begin{figure}[*options*]

  ... figure contents ...

  \end{figure}

- **normally used** *options*
  - h = place figure here
  - t = place at top of page
  - b = place at bottom of page

Figures

- use graphicx package \usepackage{graphicx}

\begin{figure}
\includegraphics {singleplot.jpg}
\caption{Single plot on a graph}
\end{figure}

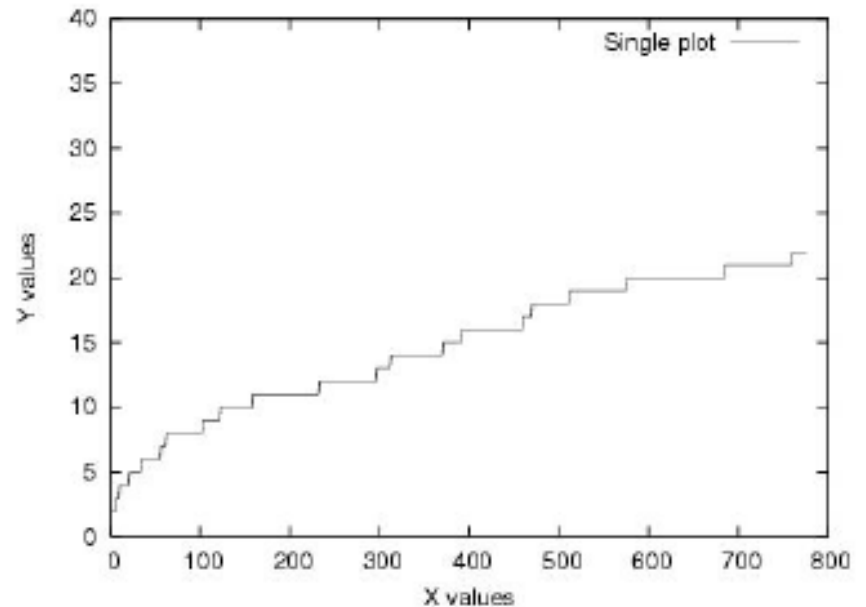Figure 3.2: Single plot on a graph

Tables

- **to create table**

    \begin{table} [*options*]

    \begin{tabular} {…}

    ... table contents ...

    \end{tabular}

    \end{table}

- **normally used** *options*

    - h = place table here

    - t = place at top of page

    - b = place at bottom of page

Tables

- columns

Columns

$\begin{tabular}{|…|…|}$
…
$\end{tabular}$

l = left justify
r = right justify
c = centre text

- rows

  - & - Split text into columns

  - \\ - End a row

  - \hline - horizontal line for row

Tables

- Example

```latex
\begin{table}[ht]
\caption{A sample table}
\centering
\begin{tabular}{|l|c|r|}\hline
Sl. No  & Item  & Price \\ \hline
1        & Pen    & 10 \\
2        & Pencil & 5 \\
3        & Book   & 20 \\  \hline
\end{tabular}
\label{itemtable}
\end{table}
```

Table 1: A sample table

Sl. No	Item	Price
1	Pen	10
2	Pencil	5
3	Book	20

Cross-references

- LaTeX provides cross-referencing commands to easily reference figures, tables, equations, sections etc. in the document

- cross-referencing commands
  - \label{*marker*}
  - \ref{*marker*}
  - \pageref{*marker*}

- *marker* is an identifier chosen by the user

Cross-references

- Example – cross-referencing table

```
\begin{table}[ht]
\caption{A sample table}
\centering
\begin{tabular}{|l|c|r|}\hline
Sl. No  & Item  & Price \\ \hline
1       & Pen    & 10 \\
2       & Pencil& 5 \\
3       & Book  & 20 \\  \hline
\end{tabular}
\label{itemtable}
\end{table}
```

Table 1: A sample table

Sl. No	Item	Price
1	Pen	10
2	Pencil	5
3	Book	20

- The list of items and their prices is shown in Table \ref{itemtable} on page \pageref{itemtable}.

The list of items and their prices is shown in Table 1 on page 1.

Bibliography using BibTex

- References are stored in a *.bib file, in BibTex format

- Referencing style is set using command

   \bibliographystyle{*option*}

   Option = plain, IEEEtran, …

- Creating reference section

   \bibliography{bibfile name}

- Citing references in the text

   \cite {*cite_key*}

Bibliography using BibTex

- Example – Article entry in .bib file

```
@ARTICLE{Moody-Darken:RBF,
        author    = {J E Moody and C Darken},
        title       = {Fast learning in networks of locally tuned processing
                        units},
        journal   = {Neural Computation},
        volume   = {1},
        pages    = {281-294},
        year      = {1989},
}
```

Bibliography using BibTex

- **Example – book entry in .bib file**

```
@BOOK{Haykin:NN,
        author     =  {Simon Haykin},
        title      = {Neural Networks: A Comprehensive Foundation},
        edition    = {2nd},
        publisher  = {Prentice Hall International, Inc.},
        year       = {1999},
}
```

Bibliography using BibTex

- Example – citing

Moody and Darken \cite{Moody-Darken:RBF} in 1989 introduced Radial Basis Function (RBF) networks and showed that they are better alternatives to MLP. \\

Simon Haykin \cite{Haykin:NN} is one of the standard books in the study of Neural Networks. \\

Moody & Darken [4] in 1989 introduced Radial Basis Function (RBF) networks and showed that they are better alternatives to MLP.

Simon Haykin [2] is one of the standard books in the study of Neural Networks.

Bibliography using BibTex

- Example – displaying

Bibliography

[1] C Blake and C Merz. Uci repository of machine learning databases, 1998. http://archive.ics.uci.edu/ml/datasets.html.

[2] Simon Haykin. *Neural Networks: A Comprehensive Fundation.* Prentice Hall International, Inc., 2nd edition, 1999.

[3] Minsky M and Papert S. Perceptrons: An introduction to computational geometry. Technical report, MIT Press, Cambridge, MA, 1969.

[4] J E Moody and C Darken. Fast learning in networks of locally tuned processing units. *Neural Computation*, 1:281–294, 1989.

Presentation using Beamer

- Beamer is a LaTeX class for creating presentations

- Standard LaTeX commands work in Beamer

- Presentations can be created using the same LaTeX source used while writing articles

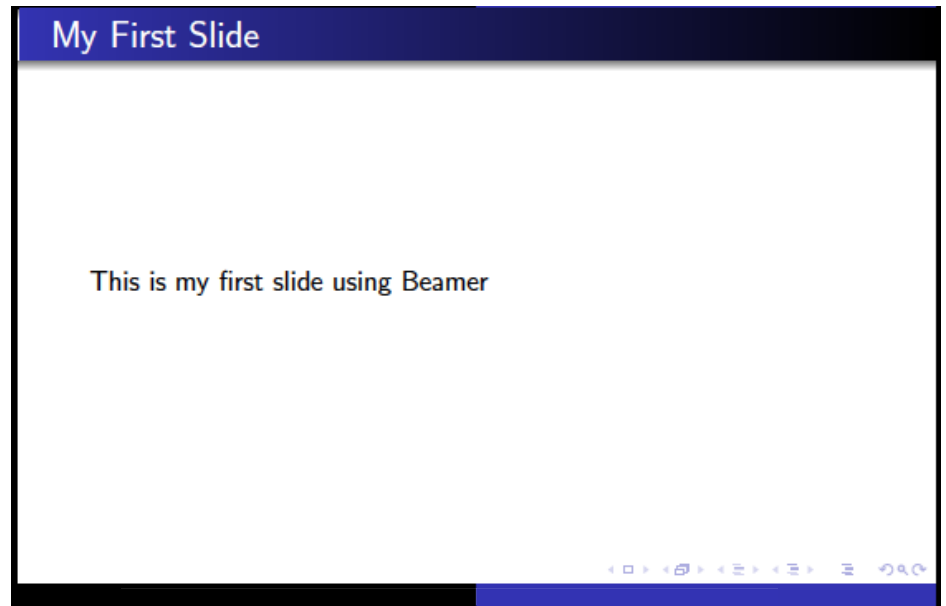- Layout, colors, and fonts can easily be changed globally

Beamer Document Structure

\documentclass{beamer}

\usepackage{...}

\usetheme{…}

\begin{document}

  \begin{frame}

    ...

  \end{frame}

   :

   :

   :

\end{document}

- Between \begin{frame} and \end{frame}, pretty much anything we can do in a normal LaTeX document: text, listing, figures, tables, equations etc.

Frames

\documentclass{beamer}

\usetheme{Warsaw}

\begin{document}

   \begin{frame}

   \frametitle{My First Slide}

   This is my first slide using Beamer

   \end{frame}

\end{document}

- **Commonly used themes are:** Berkeley, Berlin, CambridgeUS, Copenhagen, Frankfurt, Madrid, Singapore, Warsaw etc.

Title Page

```latex
\documentclass{beamer}
\usetheme{Warsaw}
\title [Introduction to Beamer] {Introduction to Beamer}
\subtitle{Creating slides for presentations in LaTeX}
\author{Dr. B S Mahanand}
\institute {Associate Professor \\ Department of Information Science and Engineering \\
Sri Jayachamarajendra College of Engineering, Mysuru \\ bsmahanand@sjce.ac.in}
\begin{document}
    \begin{frame}
    \titlepage
    \end{frame}
\end{document}
```

Introduction to Beamer
Creating slides for presentations in LaTeX

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Frames

- Example – listing

```
\begin{frame}
\frametitle{Introduction}
 \begin{itemize}
   \item Beamer is a LaTeX class for creating presentations
   \item Beamer is created by Till Tantau
   \item Standard LaTeX commands work in Beamer
   \item Presentations can be created using the same LaTeX source used while writing articles
   \item Appearance of the presentation is defined by different themes
 \end{itemize}
\end{frame}
```

Frames

Introduction

- Beamer is a LaTeX class for creating presentations

- Beamer is created by Till Tantau

- Standard LaTeX commands work in Beamer

- Presentations can be created using the same LaTeX source used while writing articles

- Appearance of the presentation is defined by different themes

Dr. B S Mahanand   Introduction to Beamer

Blocks

\begin{frame}
 \frametitle{Blocks}
    Blocks can be used to separate a specific section of text from the rest of the frame.
        \begin{block} {What is Beamer?}
           Beamer is a LaTeX class for creating nice presentation.
        \end{block}
    Other block environments are $theorem$, $proof$, $definition$
\end{frame}

Blocks

Blocks can be used to separate a specific section of text from the rest of the frame.

What is Beamer?
Beamer is a LaTeX class for creating nice presentation.

Other block environments are *theorem*, *proof*, *definition*

Formulas and Equations

\begin{frame}

\frametitle{Mathematics}

Mathematical formulas in the running text are entered between \\$ and \\$.

Ex: Formula 1 is \$\alpha=\frac{n}{2} \times\xi\$ and formula 2 is \$\sum_{i=1}^n i = \frac{n(n+1)}{2}\$.

The equation can be written as follows:

\begin{equation}

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

\end{equation}

\end{frame}

Mathematics

Mathematical formulas in the running text are entered between $ and $.

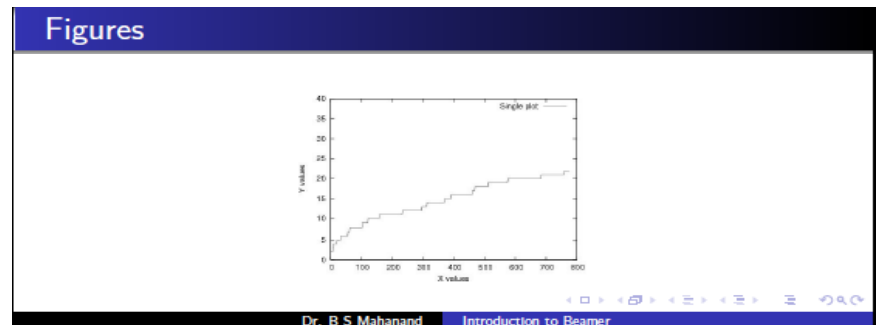Ex: Formula 1 is $\alpha = \frac{n}{2} \times \xi$ and formula 2 is $\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$.

The equation can be written as follows:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{1}$$

Figures and Tables

\begin{frame}
\frametitle{Figures}
  \begin{figure}
  \centering
  \includegraphics {singleplot.jpg}
  \end{figure}
\end{frame}

\begin{frame}
\frametitle{Tables}
\centering
  \begin{table}
  \begin{tabular}{ | l | c | r | } \hline
   No & Item   & Price \\ \hline
   1   & Pen   & 10 \\
   2   & Pencil & 5 \\ \hline
  \end{tabular}
 \end{table}
\end{frame}

References

- **The Not So Short Introduction to LaTeX2e** by Tobias Oetiker

- **LaTeX: A Document Preparation System** by Leslie Lamport

- **Wiki book on LaTeX**

- **User Guide to the Beamer Class** by Till Tantau

Thank You, and Happy TeXing!

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