Writing scientific reports / theses

Suddhasheel Ghosh

Department of Civil Engineering,
Jawaharlal Nehru Engineering College
Aurangabad, Maharashtra
431003

LaTeX for Technical and Scientific Documents
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Day III

Outline

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In this workshop:

- Day 1: Introduction to LATEX
- Day 2: Typesetting Mathematics
- **Day 3: Writing your thesis / technical report**
- Day 4: Make your presentations
- Day 5: Basics of science communication

Outline

Typesetting numbered figures

Figure 1: The plastic duck found in muggle houses

```
\begin{figure}
\centering
\includegraphics[scale=0.3]{duck.jpg}
\caption{The plastic duck found in muggle houses}
\end{figure}
```

Typesetting numbered tables

	Judge 1	Judge 2	Judge 3
Karishma	8	9	10
Kareena	9	10	8
Katrina	10	8	9

Table 1: Score of participants

```
\begin{table}
\centering
\begin{tabular}{lccc}
\hline
{} &Judge 1 &Judge 2
&Judge 3 \\
\hline
Karishma &8 &9 &10 \\
Kareena &9 &10 &8 \\
Katrina &10 &8 &9 \\
\hline
\end{tabular}
\caption{Score of
participants}
\end{table}
```

Typesetting numbered equations

Mathematically, the integral form of the continuity equation is:

$$\frac{dq}{dt} + \oiint_S \mathbf{j} \cdot d\mathbf{S} = \Sigma \qquad (1)$$

which in vector notation can also be written as

$$\frac{dq}{dt} + \oiint_S \vec{j} \cdot d\vec{S} = \Sigma \qquad (2)$$

```
Mathematically, the integral form of the continuity
equation is:
\begin{equation}
\frac{d q}{d t} + \oiint_S\mathbf{j} \cdot
d\mathbf{S} = \Sigma
\end{equation}
which in vector notation can also be written as
\begin{equation}
\frac{d q}{d t} + \oiint_S\vec{j} \cdot d\vec{S} = \Sigma
\end{equation}
```

Outline

1. What did we learn earlier?

2. **Thesis fundamentals**

3. Page Layout

4. References to objects

Start working on the report
Preamble settings

For a thesis or a technical report, one can use the basic `report`
class. The basic options for the `report` class are `a4paper`, and `12pt`

```
\documentclass[a4paper,12pt]{report}
\usepackage{amsmath,amssymb}
\title{My first thesis report}
\author{Suddhasheel Ghosh}
\date{Thesis report}
\begin{document}
\maketitle
\end{document}
```

Tables of contents
... and figures and tables

The table of contents, figures and tables are generated by the following commands, automatically with the page numbers!

```
%for giving the table of contents
\tableofcontents

%for giving the table of figures
\listoffigures

%for giving the table of tables
\listoftables
```

The fonts in the report
Fonts by default

- The default set is a serif font
- The sans serif set is also available
- Along with the true-type variant

```
\begin{itemize}
\item The default set is a serif font
\item {\sf The sans serif set is also available}
\item {\tt Along with the true-type variant}
\end{itemize}
```

The fonts in the report
What if I don't wish to use the default font?

- Many font sets available
- Recommended fonts for thesis / reports
  - Times fonts. Setting commands in the preamble:

```
\usepackage{txfonts}
\usepackage[T1]{fontenc}
```

  - Palatino fonts. Setting commands in the preamble:

```
\usepackage{pxfonts}
\usepackage[T1]{fontenc}
```

  - Fourier version of the fonts. Setting commands in the preamble:

```
\usepackage{fourier}
\usepackage[T1]{fontenc}
```

This presentation is using the Fourier font set.

Outline

Page sizes and Margin control

Most thesis and reports have recommendations on the margin requirements and paper size.

For A4 paper-size and margins with the following specifications:

- Left Margin: 2 inches
- Right Margin: 1 inch
- Top Margin: 1.5 inch
- Bottom Margin: 1.5inch

Type in the preamble:

```
\usepackage[a4paper,left=2in,right=1in,top=1.5in,
bottom=1.5in]{geometry}
```

Line spacing

Depending on the requirement of the report seeking agency, e.g. university, college, the line spacing can be set by using any one of the following commands, in the preamble

```
%in the preamble for single spacing
\usepackage[singlespacing]{setspace}

%in the preamble for double spacing
\usepackage[doublespacing]{setspace}

%in the preamble for 1.5 line spacing
\usepackage[onehalfspacing]{setspace}
```

In case, variable line space is desired, one can use `linespread` command instead of the `setspace` package.

```
\linespread{1.5}
```

Headers and footers

In the preamble, announce the use of the package:

```
\usepackage{fancyhdr}
```

The settings of the package, `fancyhdr` is given as follows:

```
%on the header there are three parts, left side,
%center and right
%left side
\lhead[<even output>]{<odd output>}
%center
\chead[<even output>]{<odd output>}
%right side
\rhead[<even output>]{<odd output>}

%on the footer there are three parts, left side,
%center and right
%left side
\lfoot[<even output>]{<odd output>}
%center
\cfoot[<even output>]{<odd output>}
%right side
\rfoot[<even output>]{<odd output>}
```

In the body, whenever one wishes to include the "fancy" page style use

```
\pagestyle{fancy}
```

Page numbering blues

- From the table of contents to the abstract, "YOUR PAGE NUMBERING HAS TO BE ROMAN"

```
\pagenumbering{roman}
```

- From Chapter 1, "YOUR PAGE NUMBERING HAS TO BE INDO-ARABIC"

```
\pagenumbering{arabic}
```

- If the articleclass is book
  - Before contents requiring ROMAN style type

  ```
  \frontmatter
  ```

  - Before contents requiring INDO-ARABIC numbering style type

  ```
  \mainmatter
  ```

- Do not want any page number?

```
\pagenumbering{gobble}
```

Page numbering blues

- From the table of contents to the abstract, "YOUR PAGE NUMBERING HAS TO BE ROMAN"

```
\pagenumbering{roman}
```

- From Chapter 1, "YOUR PAGE NUMBERING HAS TO BE INDO-ARABIC"

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Page numbering blues

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\pagenumbering{roman}
```

- From Chapter 1, "YOUR PAGE NUMBERING HAS TO BE INDO-ARABIC"

```
\pagenumbering{arabic}
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- If the `articleclass` is `book`
  - Before contents requiring ROMAN style type

    ```
    \frontmatter
    ```

  - Before contents requiring INDO-ARABIC numbering style type

    ```
    \mainmatter
    ```

- Do not want any page number?

```
\pagenumbering{gobble}
```

The title page I
A thesis from JNEC

Sample code for designing a thesis / report for the JNEC

```
%this is the title page
\pagenumbering{gobble}
\begin{center}
\textbf{DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY
AURANGABAD}
\vfill
A REPORT \\ ON
\vfill
{\Large \textbf{The Thesis Title}}
\vfill
SUBMITTED BY \\
A Student \\
Roll Number XYZ \\
```

The title page II
A thesis from JNEC

```
M. E. (Discipline)
\vfill
Under the guidance of \\
Dr. Kantaprasad Kantilal \\
Super Professor \\
\vfill
\includegraphics{logo.png} %MGM logo
\vfill
JAWAHARLAL NEHRU ENGINEERING COLLEGE
AURANGABAD
2014 - 15
\end{center}
\cleardoublepage
```

The title page III
A thesis from JNEC

One should save the title page in a file called `titlepage.tex` and
use it in the body of the document as

```
\include{titlepage}
```

The chapters in the report

The macro for starting a chapter is \chapter. For example

```
\chapter{Introduction}
```

Suggestion!

It is suggested that each chapter be stored in a separate file, and in the same directory, where the thesis file is. The chapter can be included for compilation using the \include command. Therefore

```
\include{chapter1}
```

will look for chapter1.tex in the same directory, where the thesis / report file is.

Chapter
Sections and subsections ... and subsubsections

For sections to be numbered and included in the table of contents, we have the following commands

```
%set section title
\section{This is a new section}

%set subsection title
\subsection{This is a new subsection}

%set sub-sub-section title
\subsubsection{This is a new sub-sub-section}
```

Also, in the preamble use the following command

```
\setcounter{secnumdepth}{4}
```

Multicolumn

Multiple columns can be set by using the `multicol` package. In the preamble:

```
\usepackage{multicol}
```

and in the body

```
\begin{multicols}{2}
  lots of text
\end{multicols}
```

Page breaks

In a thesis / dissertation, page breaks are of two types:

- Single page break \clearpage. Goes to the next page.
- Double page break \cleardoublepage. This is typically used for two-sided documents. Forces the compiler to direct output to the next odd-numbered page.

Quotes from a document I

If a certain quote has to be given from literature, it can be done as follows:

```
\begin{guote}
‘‘Voil\'{a}! In view, a humble vaudevillian veteran cast
vicariously as both victim and villain by the vicissitudes
 of Fate. This visage, no mere veneer of vanity,
 is a vestige of the vox populi, now vacant, vanished.
 However, this valourous visitation of a bygone
 vexation stands vivified and has vowed to vanquish
 these venal and virulent vermin vanguarding vice
 and vouchsafing the violently vicious and voracious
 violation of volition!''

 \hfill -- V for Vendetta (2006)
\end{quote}
```

Quotes from a document II

"Voilá! In view, a humble vaudevillian veteran cast vicariously as both victim and villain by the vicissitudes of Fate. This visage, no mere veneer of vanity, is a vestige of the vox populi, now vacant, vanished. However, this valourous visitation of a bygone vexation stands vivified and has vowed to vanquish these venal and virulent vermin vanguarding vice and vouchsafing the violently vicious and voracious violation of volition!"

– V for Vendetta (2006)

Outline

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The art of cross referencing
Setting the `label` for reference

- Use the `\label` command for setting up legends.
- Use the `\ref` command for referring to a legend.

For example

- For a figure, set the label after the `caption` by referring to it as `\label{fig:myfig}`.
- Refer to the legend by using `\ref{fig:myfig}`

Suggestion!

For figures use `\label{fig:myfig}`, for tables use `\label{tbl:mytable}`, for equations use `\label{eqn:myeqn}`, for chapters use `\label{chp:chapterN}` and for sections use `\label{sec:section_reference_name}`.

Example of cross referencing
Referring to a figure in a document

Figure 2: A muggle artefact found in the Dark Lord's bathroom

The investigator looked puzzled when he visited the house of the Dark Lord. He found a rubber duck (Figure [2]) in the bathroom, along with other suspicious objects.

```
\begin{figure}
\centering
\includegraphics[scale=0.2]{duck.jpg}
\caption{A muggle artefact found in
the Dark Lord's bathroom}
\label{fig:muggleduck}
\end{figure}

The investigator looked puzzled
when he visited the house of the
Dark Lord. He found a rubber duck
(Figure [\ref{fig:muggleduck}]) in
the bathroom, along with other
suspicious objects.
```

Example of cross referencing
Referring to a table

	Judge 1	Judge 2
Karishma	8	9
Kareena	9	10
Katrina	10	8

Table 2: Score of participants

During the contest, the judges took the time to evaluate the contestants on many factors. Finally, they tabulated the scores as in Table [2]

```
\begin{table}
\centering
\begin{tabular}{lcc}
\hline
{} &Judge 1 &Judge 2 \\
\hline
Karishma &8 &9 \\
Kareena &9 &10 \\
Katrina &10 &8 \\
\hline
\end{tabular}
\caption{Score of participants}
\label{tab:Scores}
\end{table}
During the contest, the judges took
the time to evaluate the contestants
 on many factors. Finally, they
 tabulated the scores as in Table
 [\ref{tab:Scores}]
```

Example of cross referencing
Referring to mathematical equations

Mathematically, the integral form of the continuity equation is:

$$\frac{dq}{dt} + \oiint_S \mathbf{j} \cdot d\mathbf{S} = \Sigma \qquad (3)$$

which in vector notation can also be written as

$$\frac{dq}{dt} + \oiint_S \vec{j} \cdot d\vec{S} = \Sigma \qquad (4)$$

The integral form of the continuity equation is given in equation (3) and the vector notation form is given in equation (4)

```
Mathematically, the integral form of the continuity
    equation is:
\begin{equation}
    \frac{d q}{d t} + \oiint_S\mathbf{j} \cdot
    d\mathbf{S} = \Sigma\label{eqn:integral_form}
\end{equation}
which in vector notation can also be written as
\begin{equation}
\frac{d q}{d t} + \oiint_S\vec{j} \cdot d\vec{S} = \Sigma
\end{equation}

The integral form of the continuity equation is given
in equation (\ref{eqn:integral_form}) and the vector
 notation form is given in equation
 (\ref{eqn:vector_form})
```

Bibliographic referencing
Parts

- Requirement of a file containing the names and id's of all the referencing (a .bib file) – to be created by the LaTeX user
- A bibliographic style file (a .bst file) - usually provided by the journal, or can also be created
- A bibliographic reference manager (if required) - Recommended software JabRef

Bibliographic referencing
A bibliographic entry

JabRef will create bibliographic entries for different types of references: articles, books, theses, reports, conference proceedings etc. An example:

```
@Article{FullerThompson1907,
  Title= {The Laws of Proportioning Concrete},
  Author= {Fuller, W. B. and Thompson, S. E.},
  Journal= {American Society of Civil Engineers},
  Year= {1907},
  Pages= {223--298},
  Volume= {33},
}
```

Bibliographic referencing
Enabling the citations

- In the preamble:

```
\usepackage{natbib}
```

- For author-year citations, surrounded by parenthesis e.g.
  (Fuller and Thompson, 1907) or Fuller and Thompson (1907)

```
\usepackage[round,authoryear,sort]{natbib}
```

- For numbered citations, as they appear, e.g. [3] we should have

```
\usepackage[square]{natbib}
```

```
%near the end of file before \end{document}
\bibliographystyle{asce}
%mybstfile.bib must exist in the same directory
\bibliography{mybstfile}
```

Bibliographic referencing
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```
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\bibliographystyle{asce}
%mybstfile.bib must exist in the same directory
\bibliography{mybstfile}
```

http://en.wikibooks.org/wiki/LaTeX/Bibliography_Management

Bibliographic referencing
Citing a document or a list of documents

The following commands are used to cite a document or a list of documents

- Citing it in running text e.g. Fuller and Thomson (1907) mentioned that . . .

```
\cite{FullerThompson1907}
```

- Citing it off text e.g. Concrete is said to be a mixture of sand and cement with many other particles (Fuller and Thompson, 1907).

```
\citep{FullerThompson1907}
```

- Citing multiple documents

```
\citep{FullerThompson1907,Hiffler2002,deLarrard1988}
```

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```
\citep{FullerThompson1907}
```

- Citing multiple documents

```
\citep{FullerThompson1907,Hiffler2002,deLarrard1988}
```

In the upcoming sessions

- Typesetting a presentation
- Alerts and colour themes
- Table of contents
- Sections
- Subfigures and subtables
- Pseudo animation

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