

Introduction to LaTeX

Peter Steinke

October 7, 2015

What is LaTeX? Why LaTeX?

- ▶ document markup language (like HTML)
- ▶ focus on content not on the visual presentation
- ▶ Initially it's harder to use than Microsoft[®] Word
- ▶ but writing complicated technical reports with maths becomes easier
- ▶ provide scientific features
- ▶ Easy way to write big documents
- ▶ widely used in the scientific area

Tools

- ▶ General: you need a LaTeX distribution
 - ▶ generate pdf directly with a text editor and **pdflatex**
- ▶ **Linux**
 - ▶ distribution: **TeX Live**
 - ▶ IDE (example): **Kile**
- ▶ **Windows**
 - ▶ distribution: **MiKTeX**
 - ▶ IDE (example) **TeXnicCenter**
- ▶ **Mac OS**
 - ▶ distribution: **MacTeX**
 - ▶ IDE (example) **TeXShop**

LaTeX is a way of writing documents that is more like writing a program than using Word. Initially it's harder than Word, but once you start writing complicated technical reports with maths it becomes easier. This session will show you how to use most of the features you'll need.

```
1 \documentclass{article}
2 \begin{document}
3 LaTeX is a way of writing
4 documents that is more like
5 writing a program than using
6 Word. Initially it's harder than
7 Word, but once you start writing
8 complicated technical reports
9 with maths it becomes easier.
10 This session will show you how
11 to use most of the features
12 you'll need.
13 \end{document}
```

The Document Styles

`\documentclass[option1,option2,...]{document style}`

- ▶ document styles: report, article, beamer ...
- ▶ options:
 - ▶ 11pt
 - ▶ Specifies a size of type known as eleven-point, which is ten percent larger than the ten-point type normally used.
 - ▶ 12pt
 - ▶ Specifies a twelve-point type size, which is twenty percent larger than ten-point.
 - ▶ twocolumn
 - ▶ Produces two-column output.
 - ▶ a4paper
 - ▶ This ensures that the page is appropriately positioned on A4 size paper.

Document Structure

- specify presentation date, title and author name

```
\documentclass{article}  
\date{October 2015}  
\title{Introduction to LaTeX}  
\author{Peter Steinke}  
\begin{document}  
\maketitle  
\begin{abstract}  
A short introduction to LaTeX  
\end{abstract}  
\end{document}
```

Document Structure

- ▶ specify presentation date, title and author name
- ▶ beginning of the document

```
\documentclass{article}  
\date{October 2015}  
\title{Introduction to LaTeX}  
\author{Peter Steinke}  
\begin{document}  
\maketitle  
\begin{abstract}  
A short introduction to LaTeX  
\end{abstract}  
\end{document}
```

Document Structure

- ▶ specify presentation date, title and author name
- ▶ beginning of the document
- ▶ generate title page

```
\documentclass{article}  
\date{October 2015}  
\title{Introduction to LaTeX}  
\author{Peter Steinke}  
\begin{document}  
  \maketitle  
  \begin{abstract}  
    A short introduction to LaTeX  
  \end{abstract}  
\end{document}
```

Document Structure

- ▶ specify presentation date, title and author name
- ▶ beginning of the document
- ▶ generate title page
- ▶ **abstract**

```
\documentclass{article}  
\date{October 2015}  
\title{Introduction to LaTeX}  
\author{Peter Steinke}  
\begin{document}  
\maketitle  
\begin{abstract}  
A short introduction to LaTeX  
\end{abstract}  
\end{document}
```

Document Structure

- ▶ specify presentation date, title and author name
- ▶ beginning of the document
- ▶ generate title page
- ▶ abstract
- ▶ **end of the document**

```
\documentclass{article}  
\date{October 2015}  
\title{Introduction to LaTeX}  
\author{Peter Steinke}  
\begin{document}  
\maketitle  
\begin{abstract}  
A short introduction to LaTeX  
\end{abstract}  
\end{document}
```

Preamble

Introduction to LaTeX

Peter Steinke

October 2015

Abstract

A short introduction to
LaTeX

```
1 \documentclass{article}
2 \date{October 2015}
3 \title
4 {Introduction to LaTeX}
5 \author{Peter Steinke}
6 \begin{document}
7 \maketitle
8 \begin{abstract}
9 A short introduction to LaTeX
10 \end{abstract}
11 \end{document}
```

Preamble

Introduction to LaTeX

Peter Steinke

October 6, 2015

Abstract

A short introduction to
LaTeX

```
1 \documentclass{article}
2 \date{\today}
3 \title
4 {Introduction to LaTeX}
5 \author{Peter Steinke}
6 \begin{document}
7 \maketitle
8 \begin{abstract}
9 A short introduction to LaTeX
10 \end{abstract}
11 \end{document}
```

General Structure of LaTeX Commands

- ▶ Commands start with an `'\'`
- ▶ followed by the options in `[ ... ]`
- ▶ the command environment is enclosed with `{ ... } .`
- ▶ example: `\sqrt[5]{4+x}`

General Structure of LaTeX Commands

- ▶ Environments start with `\begin{EnvironmentName}`,
- ▶ followed by the options in `[ ... ]`
- ▶ and end with `\end{EnvironmentName}`.
- ▶ example:

```
\begin{figure}[t]
```

```
...
```

```
\end{figure}
```

Simple Text

You can write plain text simply as it is, without concerning about whitespaces or indentation.
Next line after manual break.

```
1 \documentclass{article}
2 \begin{document}
3 You can write plain text simply
4 as it
5 is,
6 without concerning
7 about whitespaces
8
9 or
10
11 indentation.\\
12 Next line after manual break.
13 \end{document}
```

Simple Text

`\textbf{bold face}` `\textit{italic}` `\color{color}`

Cheesecake is a dessert consisting of a *topping* made of **soft, fresh** cheese (not always cream cheese),

```
1 \documentclass{article}
2 \begin{document}
3 \textbf{Cheesecake} is a dessert
4 consisting of a \textit{topping}
5 made of \color{red}soft, fresh
6 \color{black}cheese (not always
7 cream cheese), ... \dots
8 \end{document}
```

Simple Text

quotation marks “This is in quotation marks”

half spaces . . . “time limit is set to 100 s, 100 s or 100s”

Prof. Dr. Max Muster

```
1 \documentclass{article}
2 \begin{document}
3 quotation marks “This is in
4 quotation marks”
5
6 half spaces\,\dots
7 “time limit is set to 100\s,
8 100 s or 100s”
9
10 Prof.\,Dr. Max Muster
11 \end{document}
```

Special Character

character	LaTeX command	note
\	\textbackslash	\backslash in math mode
<	\textless	not necessary in math mode
>	\textgreater	not necessary in math mode
~	\textasciitilde	
-	\-	
§	\S	
\$	\\$	
&	\&	
#	\#	
{ ... }	\{ ... \}	
%	\%	
ä	\“a	

Font sizes

<code>\tiny</code>	microscopic font
<code>\scriptsize</code>	very tiny font (subscripts)
<code>\footnotesize</code>	tiny font (footnotes)
<code>\small</code>	small font
<code>\normalsize</code>	normal font
<code>\large</code>	large font
<code>\Large</code>	larger font
<code>\LARGE</code>	very large font
<code>\huge</code>	huge font
<code>\Huge</code>	very huge font

Note: use `{\small foo bar}` to declare the scope

Text Layout

- ▶ A pagebreak ends the page and stretch the vertical space page such that the last sentences is in the last line of the page.
- ▶ Newpage also ends the page and but fills the rest of the vertical space with empty lines.

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- ▶ `\nopagebreak[priority 1 to 4]` where 4 forbids a page break

Text Layout

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- ▶ Newpage also ends the page and but fills the rest of the vertical space with empty lines.
- ▶ `\pagebreak[priority 1 to 4]` where 4 enforces a page break
- ▶ `\nopagebreak[priority 1 to 4]` where 4 forbids a page break
- ▶ `\newpage` enforce to start a new page
- ▶ `\begin{samepage}`
Here a new page starts only between two paragraphs and not between two sentences.
`\end{samepage}`

Text Layout

```
\begin{flushleft}
```

```
...
```

```
\end{flushleft}
```

```
\begin{flushright}
```

```
...
```

```
\end{flushright}
```

```
\begin{center}
```

```
...
```

```
\end{center}
```

Sections

<code>\section{Title}</code>	1 Title
<code>\section*{NoNumbering}</code>	NoNumbering
<code>\subsection{Subtitle}</code>	1.1 Subtitle
<code>\subsubsection{Subsubtitle}</code>	1.1.1 Subsubtitle
<code>\paragraph{Paragraph}</code>	Paragraph
<code>\subparagraph{Subparagraph}</code>	Subparagraph
<code>\section{Next Title}</code>	2 Next Title

Note: use `\tableofcontents` like `\maketitle` to generate the table of contents.

Mathematics Mode

This is a function $f(x) = 3x + 2$

This is an equation:

$$x := \textit{abs}(y)$$

superscript and subscript

$$f(x) = x^2 + p_j$$

```
1 \documentclass{article}
2 \begin{document}
3 This is a function
4 $f(x) = 3 x + 2$
5
6 This is an equation:
7 \[x := \textit{abs}(y)\]
8
9 superscript and subscript
10 \[f(x) = x^2 + p_j\]
11 \end{document}
```

Mathematics Mode

The sum of something: $\sum_{i=1}^n x_i$

The same with limits $\sum_{i=1}^n x_i$

In an equation:

$$\sum_{i=1}^n x_i$$

```
1 \documentclass{article}
2 \begin{document}
3 The sum of something:
4 $\sum_{i=1}^n x_i$
5
6 The same with limits
7 $\sum\limits_{i=1}^n x_i$
8
9 In an equation:
10 \[\sum_{i=1}^n x_i\]
11 \end{document}
```

Mathematics Mode

There exists lots of special commands for the different mathematical symbols:

$$\cos \theta \cos \phi - \sin \theta \sin \phi$$

```
1 \documentclass{article}
2 \begin{document}
3 \[
4 \cos \theta \cos \phi -
5 \sin \theta \sin \phi
6 \]
7 \end{document}
```

Using `|` and the `\mid` command:

Let $\mathcal{C}$ be the set of all complements $\{\neg x \mid x \in \mathcal{V}\}$

Let $\mathcal{C}$ be the set of all complements $\{\neg x \mid x \in \mathcal{V}\}$

Mathematics Mode

Usefull helpers:

- ▶ tex.loria.fr/general/downes-short-math-guide.pdf
- ▶ <http://detexify.kirelabs.org/classify.html>

Lists

- ▶ enumerate
- ▶ itemize
- ▶ description

```
1 \documentclass{article}
2 \begin{document}
3 \begin{itemize}
4   \item enumerate
5   \item itemize
6   \item description
7 \end{itemize}
8
9 \end{document}
```

Lists

1. This is the first one
 - 1.1 This is the first subitem
 - 1.2 This is the second one
2. This is the second item

```
1 \documentclass{article}
2 \begin{document}
3 \begin{enumerate}
4 \item This is the first one
5 \begin{enumerate}
6 \item This is the first subitem
7 \item This is the second one
8 \end{enumerate}
9 \item This is the second item
10 \end{enumerate}
11 \end{document}
```

Lists

fly: A small animal
elephant: A large animal
dog: A medium-sized
animal

```
1 \documentclass{article}
2 \begin{document}
3 \begin{description}
4 \item[fly :]{A small animal}
5 \item[elephant :]{A large animal}
6 \item[dog :]{A medium-sized
7 animal}
8 \end{description}
9 \end{document}
```

Tabbing

Declare a tab stop with `\=` and a tab with `\>`

If it's raining
 then put on boots,
 take hat;
 else smile.
Leave house.

```
1 \documentclass{article}
2 \begin{document}
3 \begin{tabbing}
4   If \= it's raining \\
5   \> then \= put on boots, \\
6   \> \> take hat; \\
7   \> else \> smile. \\
8   Leave house.
9 \end{tabbing}
10 \end{document}
```

Tabular

1	2	3
4	5	6
7	8	9

```
1 \documentclass{article}
2 \begin{document}
3 \begin{tabular}{l c r }
4   1 & 2 & 3 \\
5   4 & 5 & 6 \\
6   7 & 8 & 9 \\
7 \end{tabular}
8 \end{document}
```

Tabular

1	2	3
4	5	6
7	8	9

```
1 \documentclass{article}
2 \begin{document}
3 \begin{tabular}{l | c || r }
4   1 & 2 & 3 \\
5   4 & 5 & 6 \\
6   7 & 8 & 9 \\
7 \end{tabular}
8 \end{document}
```

Tabular

1	2	3
4	5	6
7	8	9

```
1 \documentclass{article}
2 \begin{document}
3 \begin{tabular}{l | c || r }
4   \hline
5   1 & 2 & 3 \\
6   4 & 5 & 6 \\
7   7 & 8 & 9 \\
8   \hline
9 \end{tabular}
10 \end{document}
```

Tabular

7C0	hexadecimal
3700	octal
11111000000	binary
1984	decimal

```
1 \documentclass{article}
2 \begin{document}
3 \begin{tabular}{|r|l|}
4   \hline
5   7C0 & hexadecimal \\
6   3700 & octal \\
7   11111000000 & binary \\
8   \hline \hline
9   1984 & decimal \\
10  \hline
11 \end{tabular}
12 \end{document}
```

Verbatim Environment

This could be anything

For example lots of spaces
 <- like this

Or c++ code

```
int testFunction(int a)
{
    return a++;
}
```

```
1 \documentclass{article}
2 \begin{document}
3 \begin{verbatim}
4 This could be anything
5
6 For example lots of spaces
7     <- like this
8
9 Or c++ code
10
11 int testFunction(int a)
12 {
13     return a++;
14 }
15 \end{verbatim}
16 \end{document}
```

Packages

- ▶ In LaTeX exists lots of extra packages that extend or modifies commands and environments.
- ▶ The packages are included before the beginning of the document in the preamble:

```
\usepackage{package_name}
```

Usefull packages

```
\usepackage{todonotes}  
\usepackage{hyperref}  
\usepackage{listings}  
\usepackage{graphicx}
```

`\todo{add some useful text here}`

example

add some useful text here

One morning, when Gregor Samsa woke from troubled dreams, he found himself transformed in his bed into a horrible vermin. He lay on his armour-like back, and if he lifted his head a little he could see his brown belly, slightly domed and divided by arches into stiff sections.

Click here to see the slide about *todonotes* again.

Click `\hyperlink{s:todonotes}{here}` to see the slide about `\textit{todonotes}` again.

Graphics

```
\includegraphics[height=0.3\textheight]{path/filename}
```

- ▶ Requires `\usepackage{graphicx}`
- ▶ Several file formats possible depending on dvi-driver. For pdfLaTeX pdf, png, jpg.
- ▶ Convert other formats e.g., with IrfanView or Gimp.
- ▶ always prefer vector graphics like pdf over pixel graphics
- ▶ other optional arguments like width, angle, size

Figures

```
\begin{figure}[t,b,p,h]  
  \includegraphics[height=0.3\textheight]{nicepic}  
  \caption{A nice picture }  
\end{figure}
```

- ▶ **t** on the top
- ▶ **b** on the bottom
- ▶ **p** on an own page
- ▶ **h** right here

Note that these are just suggestions to LaTeX.

Labels and References

- ▶ In LaTeX we can reference almost anything that is numbered, e.g. sections, tables, figures, equation . . .
- ▶ Since LaTeX manages the numbering we use labels instead of numbers to refer to a certain object.

`\label{key}` gives the object in the current context a key

`\ref{key}` refers to the number of object linked to the key

`\pageref{key}` refers to the page number of object linked to the key

Figures

```
\begin{figure}[t,b,p,h]
  \includegraphics[height=0.3\textheight]{nicedpic}
  \caption{A nice picture }
  \label{fig:example1}
\end{figure}
```

Figure 1: Example Figure

- ▶ Figure 1 on page 45 shows the example.
- ▶ **Figure~\ref{fig:example1} on page~\pageref{fig:example1} shows the example.**

Structure you LaTeX code

- ▶ use the `\input{file_name_with_no_extension}` command to include LaTeX code
- ▶ e.g.:
 - ▶ `\input{packages}`
 - ▶ `\input{sections/section1}`
 - ▶ `\input{sections/section2}`
 - ▶ `\input{sections/section3}`
 - ▶ `\input{graphics/overview}`
 - ▶ `\input{tables/results}`
 - ▶ ...

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