# LaTeX experience for beginners

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# Overview



## Course content...

- Typeset a simple text and equations.
- Common functions and features.
- The online LaTeX-IDE "*overleaf*".

## *NOT* course content...

- Writing own classes
- Exotic tips and tricks
- Use of complex latex packages (e.g. *pstricks*)

# Who we are


Fachschaft
official
esentation
octoral
ndidates
www.fsdr.at
/fs.doktorat

# Who we are

## Representation of doctoral candidates at TU Wien

- Counselling (opening hours, via e-mail, individual meetings)
- Providing information (e.g. newsletter, website, . . . )
- Organising workshops (e.g. LaTeX, . . . )
- Co-designing the curriculum within the curriculum committee[1]
- Contact to rectorate, senate, professors and works council[2]
- Writing official statements on drafts of federal laws[3]
- Organising social events

[1] Studienkommission
[2] Betriebsrat
[3] Stellungnahmen zu Gesetzesentwürfen

# What is LaTeX?

TeX[1] is a typesetting program created by Donald E. Knuth in 1977.

LaTeX[2] Collection of macros to simplify TeX created by Leslie Lamport.

The combination is the de facto standard in STEM[3] publications. (e.g. Springer, Elsevier, . . . )

Programming LaTeX is WYSIWYAF-style (What you see is what you asked for) in contrast to the known WYSIWYG-style of creating documents.
→ Content and style are separated.

[1] TeX is pronounced "Tech" with a "ch" as in the German word "Ach" or in the Scottish "Loch".

[2] LaTeX is pronounced "Lay-tec" or "Lah-tech".

[3] science, technology, engineering and mathematics

# Why LaTeX

- Better looking documents
- Automatic features: Enumeration, List of Content/Figures/Tables/TODOs, hyphenation
- Portability
- *Equations*
- *Hacks!*

Result: Professional typeset document

# Power of LaTeX

- Basically a markup language
- Plenty of document classes like:
  - Articles
  - Books
  - Letters
  - Slides, ...
- Multi column documents
- A plethora of mathematical and international language symbols
- Convenient typeset of equations
- Convenient integration of source code
- Precise design of elements like tables or figures

# What do you need to create LaTeX documents

- Text editor: better an IDE
- TeX / LaTeX distribution.
- PDF-Viewer
- Documentation
  e.g. Not so short Introduction to LaTeX $2_\varepsilon$[4].

Here we use an online IDE. Otherwise we recommed

Windows: MikTeX & TeXstudio / VSCode (with "LaTeX Workshop" extension)

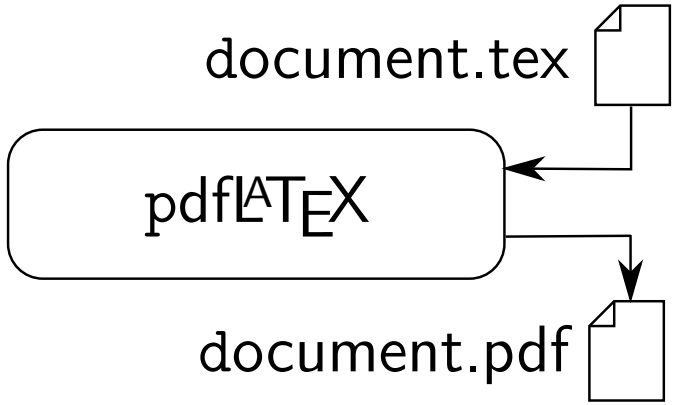
Linux: TeXlive & TeXstudio / VSCode

Mac: MacTeX & TeXstudio / VSCode

[4] https://ctan.org/pkg/lshort

# From the sourcecode to the document

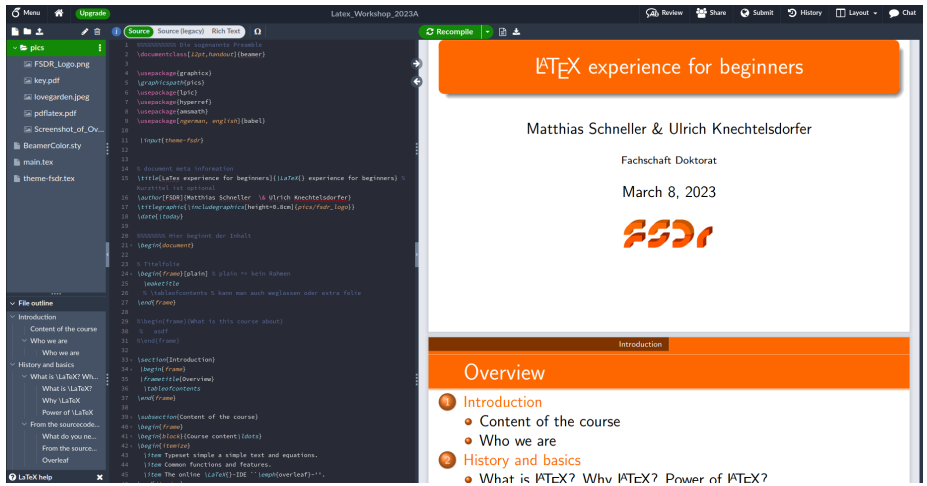
- LaTeXis a markup language
  - → compile it to get a PDF document (like you are used to from programming languages)
- Multiple compilers exist
  - LaTeX
  - pdfLaTeX
  - luaLaTeX
  - XeTeX
- Good news: We don't care! (today)



# Overleaf

- Cloud based LaTeX-editor
- runs on the web-browser
- allows collaborative work
- basic usage is free; all the features come with a subscription that TU Wien provides (`https://de.overleaf.com/edu/tuw`)

→ ideal for this workshop



# Learning by doing!

## Now: hands on!

- Create an account on `https://www.overleaf.com`
- We guide you through your first document.

## Goals:

- account at overleaf
- generated project
- compiled “Hello world” document

# The structure of a .tex file

- Document class

```
\documentclass[ 10pt | 12pt , a4paper | letterpaper , onecolumn | twocolumn ,...]{ article | book | report | dinbrief | beamer }
```

- Modules

\usepackage[ *options* ]{ *module name* }

...

- Document body

\begin{document}

...

\end{document}

- Data

\title{ *title of the masterpiece* }
\author{ *name(s) of the author(s)* }
\date{ *date* }

- Title, table of contents

\maketitle
\tableofcontents

# Spaces & page breaks

## Spaces

- ```
  It doesn't matter      how    many
       spaces    you        write.
  ```

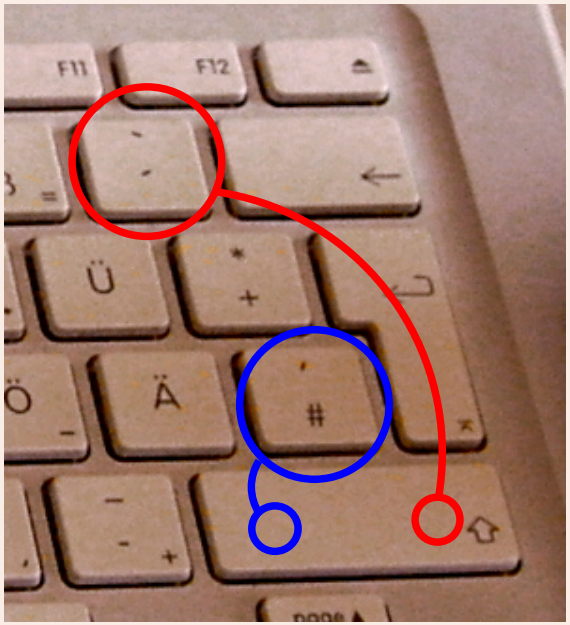
  It doesn't matter how many spaces you write.
- A blank line starts a new paragraph.

## Page breaks

- A page break is forced by `\clearpage`
- In two-sided documents use `\cleardoublepage`
- Floating structures are fitted in the text even if that means that they are on the new page: `\newpage`
  ```

# Important commands, special characters

## Good to know...




| | |
|---|---|
| `%` | Comment |
| `\\` | Line break |
| `\\[1cm]` | Line break + 1 cm vert. space |
| ``` ``...'' ``` | “english” quotes |
| `"`...`"'` | „german“ quotes |
| `\csquotes{...}` | select quotes based on babel |
| `\ldots` | three dots (...) |
| `\⟨space⟩` | space |
| `~` | nonbreaking space |

## The following characters are reserved in LaTeX

| Character: | \ | # | $ | % | ^ | & | _ | { | } | ~ |
|---|---|---|---|---|---|---|---|---|---|---|
| Escape: | `\textbackslash` | `\#` | `\$` | `\%` | `\^{}` | `\&` | `\_` | `\{` | `\}` | `\~{}` |

# Structuring

## Levels of structure

| numbered | non-numbered |
|---|---|
| \part{...} | \part*{...} |
| \chapter{...} | \chapter*{...} |
| \section{...} | \section*{...} |
| \subsection{...} | \subsection*{...} |
| \subsubsection{...} | \subsubsection*{...} |
| \paragraph{...} | \paragraph*{...} |
| \subparagraph{...} | \subparagraph*{...} |

A new paragraph is introduced by a blank line.

# Lists

## itemize

```
\begin{itemize}
    \item Blah
    \item Blubb
\end{itemize}
```

- Blah
- Blubb

## enumerate

```
\begin{enumerate}
  \item First
  \item Second
\end{enumerate}
```

1. First
2. Second

## description

```
\begin{description}
  \item[\TeX] D. Knuth
  \item[\LaTex] L. Lamport
\end{description}
```

TEX Donald Knuth

LATEX Leslie Lamport

# Learning by doing!

## Now: hands on!

- We create some structured text

## Goals:

- Some sections, subsections and paragraphs
- list of items
- table of content

# Tables

## The tabular-environment

```
\begin{tabular}{llcr}      ⟶ ⟶
\hline      horizontal separator
content & content & ... & content \\
\hline
content & content & ... & content \\
\hline
content & content & ... & content \\
\hline
\end{tabular}
```

### Column parameters

| | |
|---|---|
| `l` | left aligned column |
| `r` | right aligned column |
| `c` | centered column |
| `p{1cm}` | fixed width column (left aligned) |
| `\|` | vertical separator |
| *nothing* | no separator |

## Multicolumns

`\multicolumn{`*number of occupied columns*`}{`*new column format*`}{`*contents*`}`

Other environments: `tabular*`, `tabularx`, `longtable`, ...

# Math environments

## Inline math

Syntax `$...$` in TEX-Style or `\(...\)` in LATEX-Style.

Example
```
The hypotenuse was calculated using
\(\sqrt{a^2+b^2}\).
```
The hypotenuse was calculated using $\sqrt{a^2 + b^2}$.

## Math environments

```
\begin{...}
...
\end{...}
```

| environment | numbered | multi-line |
|---|---|---|
| displaymath | | |
| equation | • | |
| eqnarray | • | • |

# Extended Math environment - amsmath

## amsmath

```
\usepackage{amsmath}
```

## multiline, align, ...

```
\begin{multline}
a+b+c+d+e+f\\
+i+j+k+l+m+n
\end{multline}
```

$$a+b+c+d+e+f \\ +i+j+k+l+m+n \quad (1)$$

```
\begin{align}
a_1& =b_1+c_1\\
a_2& =b_2+c_2-d_2+e_2
\end{align}
```

$$a_1 = b_1 + c_1 \quad (2)$$

$$a_2 = b_2 + c_2 - d_2 + e_2 \quad (3)$$

# Math syntax → Not so short Introduction ...

Subscript:

```
a_{k}
```

$a_k$

Superscript:

```
e^{i\omega t}
```

$e^{i\omega t}$

Fractions/roots:

```
\frac{x}{y}/
\dfrac{x}{y}
\sqrt[n]{x}
```

$\frac{x}{y}/\dfrac{x}{y}$
$\sqrt[n]{x}$

Vectors:

```
\vec{r}
```

$\vec{r}$

Greek alphabet:

```
\alpha\beta\gamma
```

$\alpha\beta\gamma$

Sums/integrals:

```
\sum_{n=0}^{4}a_{n}
```

$\sum_{n=0}^{4} a_n$

```
\sum\limits_{n=0}^{4}a_{n}
```

$\sum\limits_{n=0}^{4} a_n$

```
\int_{a}^{b}f(x)dx
```

$\int_a^b f(x)dx$

```
\int\limits_{a}^{b}f(x)dx
```

$\int\limits_a^b f(x)dx$

# Labels & references

- Labels can be placed using `\label{`*Labelname*`}`.
- Use `\ref{`*Labelname*`}` to refer to labelled sections.
- Works with sections, floats, equations, ...
- `\label` must always be placed after `\caption`!

## Example

```
\begin{equation}
\label{equ:hypoth}
c = \sqrt{a^{2} + b^{2}}
\end{equation}
We insert in equation
(\ref{equ:hypoth}) \ldots
```

$$c = \sqrt{a^2 + b^2} \qquad (4)$$

We insert in equation (4) ...

- Use `\usepackage{hyperref}` to turn all references into hyperlinks

# Learning by doing!

## Now: hands on!

- We create a table and some math

## Goals:

- short table
- inline equation
- outline equation

# Embedding Images

- For graphics, a package is needed
  `\usepackage{graphicx}`
- Embed graphics using
  `\includegraphics[`*options*`]{`*filename*`}`
  *options* controls the size and orientation of the included graphics.
- Keywords: `width`, `height`, `angle`, ...

## Examples

| | |
|---|---|
| `\includegraphics[width=4cm]{...}` | Image width 4 cm, original aspect |
| `\includegraphics[width=0.5\textwidth]{...}` | Image width = half text width, original aspect is kept |
| `\includegraphics[height=0.5\textheight]{...}` | Image height = half text height, original aspect is kept |
| `\includegraphics[width=2cm, height=3cm]` | 2 cm × 3 cm image aspect changed to 2:3 |
| `\includegraphics[angle=60]{...}` | rotated 60° counter clockwise |
| `\includegraphics[scale=2]{...}` | enlarged twice |

# Floats

There are two common kinds of floats: `figure` and `table`; essentially the same but numbered separately

## Syntax

```
\begin{figure}[position]
\includegraphics...
\caption{description...}
\end{figure}

\begin{table}[position]
\caption{description...}
\begin{tabular}...\end{tabular}
\end{table}
```

Position parameter

| | |
|---|---|
| h | *here* |
| t | top of the page |
| b | bottom of the page |
| p | own figures/tables page |
| ! | "force" position |

# Learning by doing!

## Now: hands on!

- We embed a figure.

## Goals:

- embedded figure
- figure in a float environment

# Display of code

The three main ways of displaying code are:

- in a `verbatim` block
- using `listings`
- using the `minted` environment

A detailed description can be found at
`https://www.overleaf.com/learn/latex/Code_listing`

# Thank you for your attention!

*"Science is what we understand well enough to explain to a computer. Art is everything else we do."*
*– Donald E. Knuth*

# Collection of helpful links

- https://www.overleaf.com/learn/latex/Chemistry_formulae
- https://www.overleaf.com/learn/latex/Bibliography_management_with_bibtex
- https://tobi.oetiker.ch/lshort/lshort.pdf
- https://www.overleaf.com/learn/latex/TikZ_package

# Spring Party!