

# Creating documents in $\text{\LaTeX}$ — a basic tutorial

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- If there's no way around...

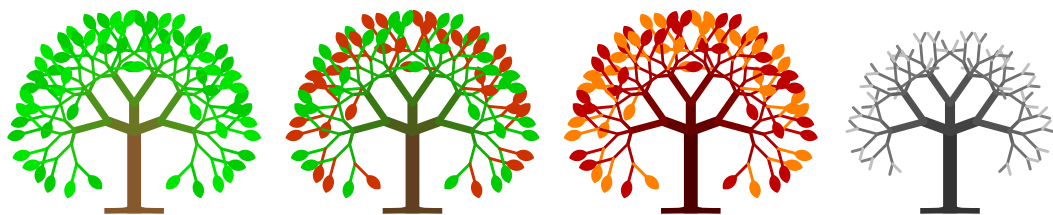
## 10 Envoi

- Thank you for the music

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

## L<sup>A</sup>T<sub>E</sub>X — A document preparation system

- L<sup>A</sup>T<sub>E</sub>X is a *markup* language that allows you to write documents focusing on contents instead of formatting
- You don't have to worry about fonts or section/figures/tables/citation numbering
  - L<sup>A</sup>T<sub>E</sub>X will do it automatically for you
- All formatting will be taken care of by *packages*, or libraries you can load at the beginning of the document
- $\Rightarrow$  you can then focus on your text, which is the most important part of your document, leaving all the “makeup” to L<sup>A</sup>T<sub>E</sub>X
- L<sup>A</sup>T<sub>E</sub>X follows the WYMIWYG (*What you MEAN is what you get*) concept
  - instead of the WYSIWYG (*what you SEE is what you get*) concept used by most word processors
    - which, usually, are more like WYSIWYTYG (*what you see is what you THINK you get...*)



(trees generated using the tikzsymbols package)

# Distributions

- In order to run L<sup>A</sup>T<sub>E</sub>X in your computer, you need a L<sup>A</sup>T<sub>E</sub>X *distribution*
  - There are several options; the two given below are the most widespread

## Selected L<sup>A</sup>T<sub>E</sub>X distributions:

- TeXLive (linux) — <https://www.tug.org/texlive>



- MikTeX (windows) — <https://miktex.org>



- All popular Linux distributions (ubuntu, arch, opensuse, fedora, mandriva, etc.) have preset L<sup>A</sup>T<sub>E</sub>X platforms in their repositories
- MikTeX is also very easily installed on windows
- There are also, nowadays, online L<sup>A</sup>T<sub>E</sub>X platforms that you can use without download or install
  - but a very fast internet connection is recommended to avoid frustration and annoyance
- The distributions listed above are free and open source

# Editors

- A  $\text{\LaTeX}$  IDE (integrated development environment) is highly recommended, especially for newbies

## Selected $\text{\LaTeX}$ IDEs:

- TeXStudio — <https://www.texstudio.org>



- TeXMaker — <http://www.xmlmath.net/texmaker>



- TeXWorks — <http://www.tug.org/texworks>



- LyX — <https://www.lyx.org>



- Authorea (online) — <https://www.authorea.com>



- Overleaf (online) — <https://www.overleaf.com>



- To use any of them, you MUST first install a  $\text{\LaTeX}$  distribution
  - except the online IDEs, of course
- All editors listed above are free; some are also open source

# Preamble and body

- A typical  $\text{\LaTeX}$  document: a file with `.tex` extension
- it has two major parts: a *preamble* and a *body*

```

1 \documentclass[options]{class type}
2
3 % This is the document PREAMBLE
4 % here go configuration packages and commands
5
6 % all LaTeX commands start with a \ (backslash)
7 % everything following a % is a comment
8 % you can insert comments anywhere in the document
9 % if you want a % to appear in your text, escape it using \%
10
11 % the document class is always the first line of your document
12 % you can define some options that affect the formatting of the chosen class type
13 % some class types: article, book, report
14 % common options: 10pt|11pt|12pt (font size), oneside|twoside (use one or both sides
   ↪ of the paper)
15
16 \begin{document}
17
18 % This is the body of your document
19 % Your text, tables, figures, etc. (generically, your content) go here
20
21 \end{document}

```

# Packages

- In the preamble are loaded packages (libraries) that affect and provide new commands
  - for instance, font packages, math packages, bibliography packages, etc.
- Packages are loaded with the command `\usepackage[options]{package name}`

## A few useful examples:

- `\usepackage[a4paper, margin=20mm]{geometry}` loads the geometry package and sets the paper size to A4 and all margins to 20 mm
- `\usepackage[utf8]{inputenc}` allows you to use accented characters (á, ã, ã, ä, ç, etc)
  - the option used (utf8) is for files set up with the unicode encoding (other encodings are also possible)
  - newest versions of  $\text{\LaTeX}$  are automatically set up for utf8 encoding (i.e., there is no need to call this package anymore)
- `\usepackage{setspace}` gives access to interline spacing
  - after loading the package, set the spacing used in the document with one of the following commands:
    - 1 `\singlespacing` (default)
    - 2 `\onehalfspacing`
    - 3 `\doublespacing`
- `\usepackage{graphicx}` permits the inclusion of figures (jpg, png, eps, pdf, etc.) in the document

# Non-english languages

- L<sup>A</sup>T<sub>E</sub>X automatically hyphenates your words
- Also, a few words (like chapter, section, page, etc.) and formatted date are sometimes used
  - but the default language is American English
- To change the language of the document, call the babel package in the preamble

```
1 % to hyphenate and translate keywords to brazilian portuguese (for instance)
2 \usepackage[brazil]{babel}
```



# Multi-file documents

- Your document can be spread through multiple files
- The master document calls other files with the `\input` command:

```
1 \documentclass[12pt]{article}
2
3 % preamble
4
5 \input{style.tex} % all packages and configuration commands
6
7 \begin{document}
8
9 % body
10
11 \input{chapter1.tex}
12
13 \input{chapter2.tex}
14
15 \end{document}
```

# Document title

- The title of your document comes from the following commands:

```

1 \title{My article}
2 \author{My name}
3 \date{time I wrote it} % if not given, results in the \today command's output
4
5 \maketitle % format and prints the title for you
6 % optionally, include titlepage among the \documentclass options for a title cover

```

- If you're using the beamer class (as I'm doing right now), you'll get something like this:

A wonderful talk

presented by myself

24<sup>th</sup> August, 2020

```

1 \title{A wonderful talk}
2 \author{presented by myself}
3
4 \maketitle

```

- title, author and date can be either in the preamble or in the body of the document
- maketitle must be issued from within the body of the document

# Chapters, sections and subsections

- Creating headings in your document is straightforward:

```

1 \chapter{My chapter} % beware: the article class has no chapters!
2 \label{cha:mycha}
3
4 \section{A section}
5 \label{sec:mysec}
6
7 \subsection{A sub-section}
8 \label{sub:mysubsec}
9
10 \subsubsection{A sub-sub-section}
11 \label{ssub:mysubsubsec}
12 % And that's enough for most purposes!
13 % If you really need more, there are packages that allow you to add more sublevels

```

- We'll soon learn what is the purpose of the several `\label` commands
  - they are optional and, for now, see them simply as tags to identify each heading

# Tables of contents

- You can add tables of contents and lists of tables and figures:

```
1 \tableofcontents
2
3 \listoffigures
4
5 \listoftables
```

- (Soon we'll see how to insert figures and tables to be shown in the lists above!)



# Basic formatting

A normal paragraph.

A centered paragraph.

Italics: *italicized text*.

Bold text: **boldface text**.

Font sizes:

text text text text text text text text text text

Notice the use of curly braces as delimiters for the scope of action of a command. If you want them to appear in the text, escape them: { e }

```

1 A normal paragraph.
2
3 \begin{center}
4 A centered paragraph.
5 \end{center}
6
7 Italics: \emph{italicized text}.
8
9 Bold text: \textbf{boldface text}.
10
11 Font sizes:
12
13 {\tiny text} {\scriptsize text} {\footnotesize text} {\small text}
14   ↳ {\normalsize text} {\large text} {\Large text} {\huge text}
15   ↳ text} {\Huge text}

```

Notice the use of curly braces as delimiters for the scope of action of a command. If you want them to appear in the text, escape them: { e }

# Environments

- Two useful environments:
  - (*environments* are constructions that format contents. They are invoked with a `\begin{env}` `\end{env}` clause)
- Bullet lists — `itemize` environment:

- Topic one
  - A subtopic
  - and another
- Topic two

```

1 \begin{itemize}
2     \item Topic one
3     \begin{itemize}
4         \item A subtopic
5         \item and another
6     \end{itemize}
7     \item Topic two
8 \end{itemize}

```

- Enumerated lists — `enumerate` environment:

- ① Topic one
  - ① A subtopic
  - ② and another
- ② Topic two

```

1 \begin{enumerate}
2     \item Topic one
3     \begin{enumerate}
4         \item A subtopic
5         \item and another
6     \end{enumerate}
7     \item Topic two
8 \end{enumerate}

```

- *Note:* you can mix the two kinds of list, if you want

# Create your own commands

- Let’s say you need to write something several times throughout your document
  - for instance, you have to write “X-ray diffractometry” quite a lot
- It would be nice to create a shortcut:

X-ray diffractometry is a an experimental technique...  
As we can see from the X-ray diffractometry results, ...

```

1 \newcommand{\XRD}{X-ray diffractometry}
2
3 \XRD{} is a an experimental technique\
   ↳ \ldots
4
5 As we can see from the \XRD{} results, \
   ↳ \ldots

```

- The “{}” after the call to the command is necessary, otherwise L<sup>A</sup>T<sub>E</sub>X would not insert a space after it
- Your commands can even have arguments:

From the composition of sample 2-5, we see that ...  
As we can see, the mechanical properties of sample  
Ti<sub>2.5</sub>Al<sub>5</sub> are not as high as ...

```

1 \newcommand{\sample}[2]{sample #1-#2}
2
3 From the composition of \sample{2}{5},
   ↳ we see that \ldots
4
5 As we can see, the mechanical properties
   ↳ of \sample{Ti2.5}{Al5} are not as
   ↳ high as\ldots

```

- *Note:* The `\newcommand` command is much more powerful than that!
- There is also a `\renewcommand` command that can be used to redefine an existing one



# Fonts

- There are lots of ways to change the fonts used in your document
- It is usually better to trust a package to do it for you!
- Consult the  $\LaTeX$  Font Catalogue (<http://www.tug.dk/FontCatalogue>)

## The $\LaTeX$ Font Catalogue

[FROM T<sub>1</sub> P<sub>1</sub>MS] [SERIF FONT] [SERIF FONT, SUB-CATEGORISED] [SANS-SERIF FONT] [TYPEWRITER FONT] [CALLIGRAPHIC, WITH AND WITHOUT FONT] [JURONAL FONT] [BLACKLET] [ABOUT THE  $\LaTeX$  FONT CATALOGUE] [PACKAGES THAT PROVIDE MATH SUPPORT]

### Fonts with math support

Antykwa Toruńska [OTF or TTF available]

The quick brown fox jumps over the sleazy dog

Antykwa Toruńska Condensed [OTF or TTF available]

The quick brown fox jumps over the sleazy dog

Antykwa Toruńska Light [OTF or TTF available]

The quick brown fox jumps over the sleazy dog

Antykwa Toruńska Light Condensed [OTF or TTF available]

The quick brown fox jumps over the sleazy dog

Arev

The quick brown fox jumps over the sleazy dog

Asana Math [OTF or TTF only]

The quick brown fox jumps over the sleazy dog

Baskervald X [OTF or TTF available]

The quick brown fox jumps over the sleazy dog

BaskervilleF [OTF or TTF available]

The quick brown fox jumps over the sleazy dog

Boisik

The quick brown fox jumps over the sleazy dog

Charter BT

The quick brown fox jumps over the sleazy dog

Computer Concrete with Concrete Math

The quick brown fox jumps over the sleazy dog

Computer Concrete with Euler Math

The quick brown fox jumps over the sleazy dog

Computer Modern

The quick brown fox jumps over the sleazy dog

Computer Modern Bright

The quick brown fox jumps over the sleazy dog

Computer Modern Sans Serif with Sansmathfonts

The quick brown fox jumps over the sleazy dog

DRM (Don's Revised Modern) [OTF or TTF available]

# Figures

- Figures and tables are inserted in the text as *floats*
  - so called because they are not part of the text flux, but are instead positioned as if hovering over the page
  - do not forget to include `\usepackage{graphicx}` in the preamble if you plan to use figures!

```

1 \begin{figure} % it's an environment!
2 \centering
3 \includegraphics[width=.9\textwidth]{
   ↪ comic1.png}
4 \caption{Taken from \url{http://
   ↪ phdcomics.com}}
5 \label{fig:comics}
6 \end{figure}

```

Figure 1: Taken from <http://phdcomics.com>

- Note:* `\label` is just a name you give to the float.
  - you can use it to reference it in the text, as we'll see shortly
- you can also use `\begin{figure}[htbp]`, where h (here), t (top), b (bottom) and p (page) are indications to where  $\text{\LaTeX}$  should place your float (it will only follow your suggestion if and when it is possible)
  - you can omit any of the htbp letters, or even change their order
- Notice the command `\url{webaddress}` to format a clickable link to a webpage. You need to put `\usepackage{url}` in the preamble to use this feature

# Tabular material

- Table floats are set in a table environment
- The tabular environment is used to typeset a table

Table 1: List of equipments and suppliers

Equipment	Year	Vendor	PIC	Location
OM	2015	OptInc	Joe	A5
SEM	2012	ElectInc	Moe	B3
XRD	2014	XRDInc	Larry	A2

1

2

3

4

5

6

7

8

9

10

11

12

13

14

```

\begin{table}
\caption{List of equipments and
        ↪ suppliers}
\label{tab:dados}
\centering
\begin{tabular}{lcccc}
\hline
Equipment & Year & Vendor & PIC &
        ↪ Location \\
\hline
OM & 2015 & OptInc & Joe & A5\\
SEM & 2012 & ElectInc & Moe & B3\\
XRD & 2014 & XRDInc & Larry & A2\\
\hline
\end{tabular}
\end{table}

```

- Notice again the use of \label to tag the table float
- The [htbp] options are also available for tables

# Inline and display math

- There are inline (using \$ \$) and displayed formulas (with the equation environment):

A sphere of radius  $R$  has a volume  $V$  given by

$$V = \int_0^{2\pi} \int_0^\pi \int_0^R \rho^2 \sin \theta d\rho d\theta d\phi = \frac{4}{3} \pi R^3. \tag{1}$$

It is not difficult to evaluate the integral, if you know what to do.

The sum of the first  $n$  terms of an arithmetic progression is

$$S_n = \sum_{i=1}^n a_i = \frac{(a_1 + a_n)n}{2}, \tag{2}$$

in which  $a_i = a_{i-1} + (n-1)r$  (valid for  $2 \leq i \leq n$ , with  $a_1$  and  $r$  given constants). Legend has it that Gauss discovered this formula while still a schoolboy...

```

1 A sphere of radius $R$ has a volume $V$
  ↳ given by
2 \begin{equation}
3 V = \int_0^{2\pi} \int_0^\pi \int_0^R \rho^2 \sin \theta d\rho d\theta d\phi
  ↳ \int_0^{2\pi} \int_0^\pi \int_0^R \rho^2 \sin \theta d\rho d\theta d\phi
  ↳ d\theta d\phi
4 = \frac{4}{3} \pi R^3 \;,
5 \label{eq:vol}
6 \end{equation}
7 It is not difficult to evaluate the
  ↳ integral, if you know what to do.

1 The sum of the first $n$ terms of an
  ↳ arithmetic progression is
2 \begin{equation}
3 S_n = \sum_{i=1}^n a_i = \frac{(a_1 + a_n)n}{2} \;,
  ↳ \frac{(a_1 + a_n)n}{2} \;,
4 \end{equation}
5 in which $a_i = a_{i-1} + (n-1)r$ (
  ↳ valid for $2 \leq i \leq n$, with $a_1$
  ↳ and $r$ given constants).
  ↳ Legend has it that Gauss
  ↳ discovered this formula while
  ↳ still a schoolboy\ldots
  
```

# Some more options

- If you don't want to number a displayed equation, use `\[ \]`, instead of the equation environment

The sum of the first  $n$  terms of an arithmetic progression is given by

$$S_n = \sum_{i=1}^n a_i = \frac{(a_1 + a_n)n}{2},$$

in which  $a_i = a_{i-1} + (n-1)r$  (valid for  $2 \leq i \leq n$ , with  $a_1$  and  $r$  given constants). Legend has it that Gauss discovered this formula while still a schoolboy...

```

1 The sum of the first $n$ terms of an
  ↪ arithmetic progression is given by
2 \[
3 S_{n} = \sum_{i=1}^{n} a_{i} = \frac{(a
  ↪ _{1}+a_{n})n}{2} \,,
4 \]
5 in which $a_{i}=a_{i-1} + (n-1) r$ (
  ↪ valid for $2 \le i \le n$, with $a
  ↪ _{1}$ and $r$ given constants).
  ↪ Legend has it that Gauss
  ↪ discovered this formula while
  ↪ still a schoolboy\ldots

```

- The `amsmath` package (as always, in the preamble) gives you access to lots of new math-related stuff

# The \label — \ref system



Figure 2: Taken from <http://phdcomics.com>.

```
1 \begin{figure}
2 \centering
3 \includegraphics[width=.6\textwidth]{
  ↳ comic-strip.jpg}
4 \caption{Taken from \url{http://
  ↳ phdcomics.com}.}
5 \label{fig:comic}
6 \end{figure}
```

1 The situation we see depicted in Figure  
↳ \ref{fig:comic} happens quite  
↳ often in some cases\ldots

```
1 \begin{equation}
2 e^{i\pi} = -1
3 \label{eq:euler}
4 \end{equation}
5
6 Equation (\ref{eq:euler}) was first
  ↳ derived by Euler.
```

The situation we see depicted in Figure 2 happens quite often in some cases...

$$e^{i\pi} = -1$$

(3)

Equation (3) was first derived by Euler.

- The fig:, tab: or eq: prefixes are not mandatory, but they are helpful to differentiate among the several kinds of stuff a label can point to (chapter, section, subsection, equation, list item, figure, table, etc., etc., etc.)
- The \pageref{lab} command gives you the page in which \label{lab} is found

# Reference managers

- I strongly recommend you use a reference manager to keep track of your bibliography. Below are two excellent choices that work virtually in any operating system

## Selected reference managers:

- JabRef — <http://www.jabref.org>



- Mendeley — <https://www.mendeley.com>



# How to use Bib<sub>T</sub><sub>E</sub>X

- The most widespread citation tool for L<sub>A</sub>T<sub>E</sub>X is Bib<sub>T</sub><sub>E</sub>X (<http://www.bibtex.org>)
- all your bibliographical references should be in (one or more) bib files

Put the following commands where you want your list of references to appear:

```
1 \bibliography{mybibfile}  
2 \bibliographystyle{plain} % there are dozens of styles to chose from
```

- Then Bib<sub>T</sub><sub>E</sub>X does all the formatting work for you!



# A Bib $\text{\TeX}$ example

- For instance, let's say a file called `mybibfile.bib` constains the following entry (among others):

```

1 @article{ferreira2018,
2   author = {Ferreira, P. P. and
3             ↪ Santos, F. B. and Machado, A.
4             ↪ J. S. and Petrilli, H. M.
5             ↪ and Eleno, L. T. F.},
6   journal = {Phys. Rev. B},
7   pages = {045126},
8   title = {Insights into the
9            ↪ unconventional
10            ↪ superconductivity in {HfV$}
11            ↪ textcolor{2$Ga$}{4$} and {ScV
12            ↪ $}{2$Ga$_4$} from first-
13            ↪ principles electronic-
14            ↪ structure calculations},
15   volume = {98},
16   year = {2018}
17 }
```

- You can cite it in your work with the `\cite` command:

```

1 \documentclass[11pt]{article}
2
3 \begin{document}
4
5 Ferreira et al. \cite{ferreira2018} have
6   ↪ shown that\ldots
7
8 \bibliography{mybibfile}
9 \bibliographystyle{plain}
10 \end{document}
```

Ferreira et al. [1] have shown that...

## References

- [1] P. P. Ferreira, F. B. Santos, A. J. S. Machado, H. M. Petrilli, and L. T. F. Eleno. Insights into the unconventional superconductivity in  $\text{HfV}_2\text{Ga}_4$  and  $\text{ScV}_2\text{Ga}_4$  from first-principles electronic-structure calculations. *Phys. Rev. B*, 98:045126, 2018.

# ABNT<sub>E</sub>X2 — ABsurd Norms for L<sup>A</sup>T<sub>E</sub>X

- Info only relevant to people working/studying in Brazil, mainly universities or research institutes



<https://www.abntex.net.br>

- ABNT<sub>E</sub>X2 will take care of all weird formatting required by ABNT (Brazilian Bureau of Standards)
- on their website (link above) you'll find templates and tutorials

# Acknowledgements

Thank you for your attention!

## $\text{\LaTeX}$ is fun.

Find more help on:



<https://stackoverflow.com>



<https://ctan.org>



<https://www.latex-project.org>

Acknowledgements:



<http://www5.usp.br>



<http://site.eel.usp.br>



<http://www.ppgem.eel.usp.br>

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<http://www.demar.eel.usp.br/en/docentes/luiz-tadeu-fernandes-eleno.html>

This is version 1.1 of the tutorial. It can be freely distributed, but please point to the original project on github:

<https://github.com/luizeleno/LaTeX-tutorial-for-newbies>