

L^AT_EX 2_ε Workshop

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How do you write a document?

Looks good but
no structure



“WYSWYG”
Worse at both

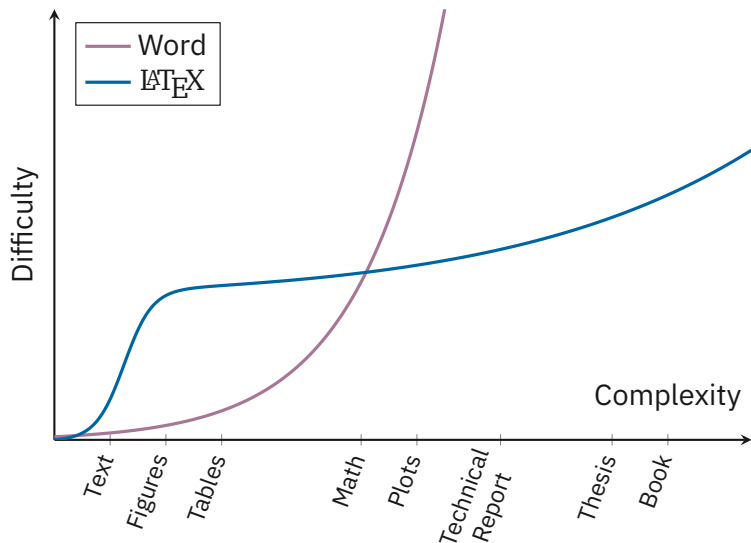


Declarative,
structured

$\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X } 2_{\epsilon}$



Why engineers should know \LaTeX



Goal: Learn to typeset something like this

The last equality follows by observing that $(\Omega \setminus B_R(\mathbf{r}_0)) \cap B_R(\mathbf{r}_0) = \emptyset$, and the argument above. The RHS is the electric flux generated by a charged sphere, and so:

$$\Phi(R) = \frac{Q(R)}{\varepsilon_0} = \frac{1}{\varepsilon_0} \int_{B_R(\mathbf{r}_0)} \rho(\mathbf{r}') \, d\mathbf{r}' = \frac{1}{\varepsilon_0} \rho(\mathbf{r}'_c) |B_R(\mathbf{r}_0)| \quad \text{with } r'_c \in B_R(\mathbf{r}_0)$$

Where the last equality follows by the mean value theorem for integrals. Finally for the Squeeze theorem and the continuity of ρ :

$$\nabla \cdot \mathbf{E}_0(\mathbf{r}_0) = \lim_{R \rightarrow 0} \frac{\Phi(R)}{|B_R(\mathbf{r}_0)|} = \frac{\rho(\mathbf{r}_0)}{\varepsilon_0}$$

7.2 Deriving Coulomb's law from Gauss's law

Strictly speaking, Coulomb's law cannot be derived from Gauss's law alone, since Gauss's law does not give any information regarding the curl of \mathbf{E} (see Helmholtz decomposition and Faraday's law). However, Coulomb's law can be proven from Gauss's law if it is assumed, in addition, that the electric field from a point charge is spherically symmetric (this assumption, like Coulomb's law itself, is exactly true if the charge is stationary, and approximately true if the charge is in motion).

About this presentation

Content

- \LaTeX is *learn by doing*
- Will be mostly examples
- Sorry for the crowded slides

Example

Things in green boxes are examples

Tip

Things in red boxes are tips or extras

Do yourself a favor

Use the International US Keyboard Layout

~ 1	! 1 1	@ 2 2	# 3 3	\$ £ 4	% 5	^ 6 ¼	& 7 ½	* 8 ¾	() 9 ‘	, 0 ’	- ¥ -	+ ÷ =	← Backspace	
Tab ↔	Q Ä	W Å	E É	R ®	T Þ	Y Ü	U Ú	I Í	O Ó	P Ö	{ }	[«] »	 _
Caps Lock ⇧	A Á	S Š	D Đ	F	G	H	J	K	L Ø	:	°	" "	' '	Enter ↵
Shift ⇧	Z Æ	X	C Ç	V	B	N Ñ	M	< Ç	>	?	/	¿	Shift ⇧	
Ctrl	Win Key	Alt							Alt Gr	Win Key	Menu	Ctrl		

History of T_EX, what should you use?

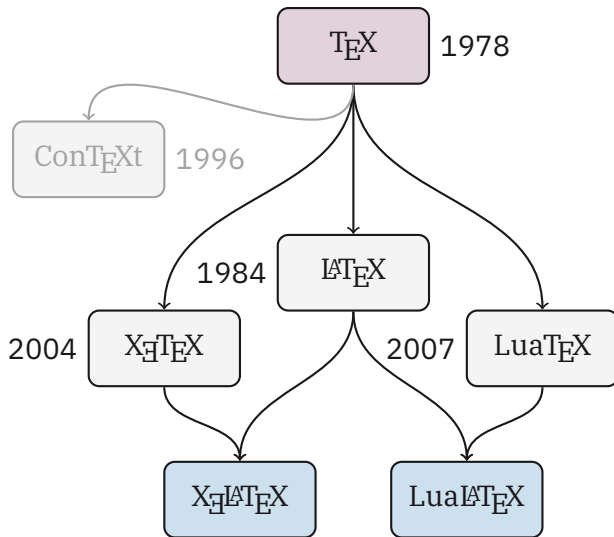
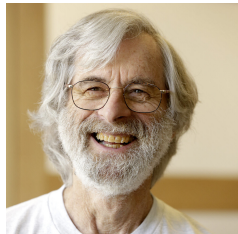


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- 3 Mathematics
- 4 Bibliography management
- 5 Extras

Commands aka Macros

\command [*options*] {*parameters*}

```
\documentclass[a4paper]{article}
```

```
\LaTeX{}
```

```
\newpage
```

Special characters

Reserverd characters

\$ % ^ & _ { } ~ \

Replacement macros

```
\# \$ \% \^{} \& \_ \{ \}  
\textasciitilde{}  
\textbackslash{}  

```

Environments

```
\begin{environment} [options]
```

```
...
```

```
\end{environment}
```

```
\begin{document}    \end{document}
```

```
\begin{quote}    \end{quote}
```

```
\begin{math}    \end{math}
```

Document structure

```
1 \documentclass[a4paper]{article}
2
3 % preamble
4 \title{A very simple document}
5 \author{Naoki Pross}
6 \date{\today}
7
8 % content
9 \begin{document}
10
11 \maketitle
12 ...
13
14 \end{document}
```

Spacing and newlines

In general

\LaTeX does not care too much about whitespace

```
1 I can put           however many spaces      here.  
2 However if I leave   an empty   line, like  this  
3  
4 LaTeX will in indent this sentence because  
5 it is a new paragraph.
```

I can put however many spaces here. However if I leave an empty line, like this.

LaTeX will in indent this sentence because it is a new paragraph.

What is CTAN

The Comprehensive T_EX Archive Network is a set of Internet sites around the world that offer T_EX-related material for download.

Very big projects (like a thesis or book)

```
1 \documentclass{thesis}
2 \usepackage{tex/mystyle}
3 % preamble ...
4
5 \begin{document}
6   \maketitle
7   \tableofcontents
8
9   \include{tex/intro}
10  \include{tex/purpose}
11  % ...
12 \end{document}
```

```
mybigproject/
├─ mybigproject.tex
├─ fig/
│   └─ engine-diagram.eps
└─ tex/
    ├─ mystyle.sty
    ├─ intro.tex
    ├─ purpose.tex
    └─ ...
```


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Emphasis, Bold, Italic, ...

```
1 This is \emph{emphatized}.
2 You may also use
3 \textbf{Bold},
4 \textit{Italic},
5 \textsf{Sans-Serif},
6 \textsc{SmallCaps},
7 \textrm{Roman},          % with serif
8 \texttt{Typewriter}.    % monospaced
```

This is *emphatized*. You may also use **Bold**, *Italic*, Sans-Serif, SmallCaps¹, Roman or Typewriter.

¹The font used in this presentation does not have smallcaps shapes

Lists

```
1 \begin{itemize}
2   \item Tomatoes
3   \item Peppers
4   \item Broccoli
5 \end{itemize}
```

```
1 \begin{enumerate}
2   \item Discover coffee
3   \item Get addicted
4   \item Congratulations
5 \end{enumerate}
```

Itemize

- Tomatoes
- Peppers
- Broccoli

Enumerate

- 1 Discover coffee
- 2 Get addicted
- 3 Congratulations

Description

```
1 \begin{description}
2   \item[Programmer] A person who is paid to
      professionally scream at a computer.
3
4   \item[Manager] A person who appears to know how
      all tasks should be accomplished but can't
      actually do any of those tasks themselves.
5 \end{description}
```

Programmer A person who is paid to professionally scream at a computer.

Manager A person who appears to know how all tasks should be accomplished but can't actually do any of those tasks themselves.

Table 1: Floats placing permissions

Specifier	Permission
h	Place around here
t	At the top of the page
b	At the bottom of the page
p	On a special page containing only floats
!	“I don’t care if it will be ugly”
H ²	Place exactly here (may look very ugly)

²Requires the “float” package, i.e. “\usepackage{float}”

Tables and tabular

```
1 \begin{table}[h]
2   \caption{Not up to date numbers}
3   \begin{tabular}{l r r}
4     \toprule
5     Country & Infected & Deaths \\
6     \midrule
7     China    & 80'652 & 3'070 \\
8     South Korea & 7'041 & 44 \\
9     Italy    & 5'833 & 233 \\
10    \bottomrule
11  \end{tabular}
12 \end{table}
```

Pro Tip

Add “`\usepackage{booktabs}`” to use rulers.

Tables and tabular

Example Table

Table 2: Not up to date numbers

Country	Infected	Deaths
China	80'652	3'070
South Korea	7'041	44
Italy	5'833	233

Figures

Cross-References

```
1 \section{Introduction}  
2 ... will be discussed in \S \ref{sec:nvstokes} ...  
3  
4 \section{Stokes equation} \label{sec:nvstokes}
```

Document

1 Introduction

... will be discussed in §4 ...

4 Stokes Equation

...

Pro Tip

Use prefixes such as `sec:`, `fig:`, `tab:`, `bib:`, `eqn:` to avoid mistakes.

Cross-References

```
1 \begin{figure} % or table
2   \includegraphics{...}
3   \caption{Reflection and
4     refraction of
5     electromagnetic
6     waves.}
7   \label{fig:refl}
8 \end{figure}
... as shown in figure
\ref{fig:refl} ...
```

Figure reference

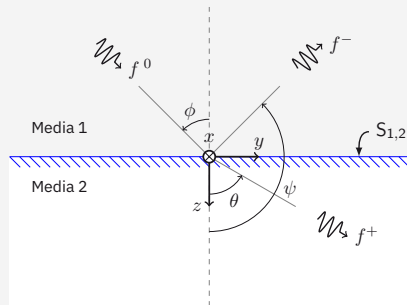


Figure 1: Reflection and refraction of electromagnetic waves.

... as shown in figure 1 ...

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Math environments

Environment	\LaTeX	\TeX ³
<code>math</code>	<code>\(... \)</code>	<code>\$... \$</code>
<code>displaymath</code>	<code>\[... \]</code>	<code>\$\$... \$\$</code>

³Don't use them in \LaTeX . **For real: don't use them.**

Example

```
1 The Pythagoran Theorem states that for a right
   triangle with sides \((a,b,c)\) there is the
   relation
2 \[
3   c^2 = a^2 + b^2
4 \]
```

The Pythagoran Theorem states that for a right triangle with sides a, b, c there is the relation

$$c^2 = a^2 + b^2$$

Spacing and text in math mode

Sub. and Superscript

```
1 \[  
2 c = \sqrt{a^2 + b^2 - 2ab \cos( \alpha_{ab} )}  
3 \]
```

Cosine theorem

$$c = \sqrt{a^2 + b^2 - 2ab \cos(\alpha_{ab})}$$

Sum and Integral

```
1 \[
2 % math community meme
3 \sum_{k = 1}^{\infty} k = - \frac{1}{12}
4 \hspace{1.5cm}
5
6 % fourier transform
7 F(\omega) = \int\limits_{-\infty}^{\infty}
8   f(t) e^{i\omega t} \mathrm{d}t
9 \]
```

$$\sum_{k=1}^{\infty} k = -\frac{1}{12}$$

$$F(\omega) = \int_{-\infty}^{\infty} f(t) e^{i\omega t} dt$$

Matrices

```
1 \[  
2   \mathbf{J} = \begin{pmatrix}  
3     0 & 1 \\  
4     1 & 0 \\  
5   \end{pmatrix}  
6 \]
```

The complex matrix

$$\mathbf{J} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \quad \mathbf{R}_\phi = e^{\phi \mathbf{J}}$$

Equations

```
1 Equation \ref{eqn:schroedinger} is the Schrödinger  
   Equation that describes the evolution of a  
   quantum state  $(\psi)$ .  
2  
3 \begin{equation} \label{eqn:schroedinger}  
4   i\hbar \partial_t \psi =  
5   - \frac{\hbar^2}{2m} \partial_x^2 \psi + V\psi  
6 \end{equation}
```

Equation 1 is the Schrödinger equation that describes the evolution of a quantum state ψ .

$$i\hbar \partial_t \psi = -\frac{\hbar^2}{2m} \partial_x^2 \psi + V\psi \quad (1)$$

Alignment

```
1 \begin{align*}
2   \nabla \mathbf{\dot{F}}(1,1)
3   &= \partial_x f + \partial_y f \\\
4   &= 2x + 3y^4 \\\
5   &= 2 + 3 \\\
6   &= 5
7 \end{align*}
```

$$\begin{aligned}\nabla \cdot \mathbf{F}(1,1) &= \partial_x f + \partial_y f \\ &= 2x + 3y^4 \\ &= 2 + 3 \\ &= 5\end{aligned}$$

Math styles

Learn by doing: try to typeset these

$$x_{t+1} = kx_t(1 - x_t)$$

$$H = - \sum_{x \in \mathbb{X}} p(x) \log p(x)$$

$$\mathcal{L}^{-1}[F] = \lim_{T \rightarrow \infty} \frac{1}{2\pi i} \int_{\gamma - iT}^{\gamma + iT} e^{st} F(s) \, ds$$

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The Bibliography

External bibliography

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Source code listings

Plots

