

A \LaTeX Tutorial

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Introduction

Documents

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Goals of this presentation

- **Not** comprehensive
- Starting reference to show that \LaTeX isn't *that* scary
- Provide some tips & tricks
- Tons of useful \LaTeX tutorials by [Overleaf](#)

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Why \LaTeX is cool

Some Important Person

May 13, 2022

What is L^AT_EX?

- From [Encyclopædia Britannica](#):

“TeX, a page-description computer programming language developed during 1977–86 by Donald Knuth, a Stanford University professor, to improve the quality of mathematical notation in his books. Text formatting systems [...] embed plain text formatting commands in a document, which are then interpreted by the language processor to produce a formatted document for display or printing.”

- L^AT_EX is the corresponding software package
- TeX consists of the greek letters τ , ϵ , χ , and is pronounced “lay-tech”

A L^AT_EX document

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```
\documentclass[12pt]{article}

% remaining preamble goes here

\begin{document}

% content goes here

\end{document}
```

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Creating a title

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```
\documentclass[12pt]{article}

\title{Automatic Material Classification}
\author{Unal Artan \thanks{Thank you to Natalie & Johann}}
\date{August 24, 2021}

\begin{document}

\maketitle
...
```

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Adding sections

...

```
\section{Wavelet Analysis}
```

Researchers began studying wavelets in the 30s, because of their inherent cuteness in comparison to waves.

```
\subsection{Digression}
```

Would that this were a whiteboard instead \ldots

```
\end{document}
```

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Automatic Material Classification

Unal Artan *

August 24, 2021

1 Wavelet Analysis

Researchers began studying wavelets in the 30s, because of their inherent cuteness in comparison to waves.

1.1 Digression

Would that this were a whiteboard instead ...

*Thank you to Natalie & Johann

Commonly used syntax

`\usepackage{...}` import a L^AT_EX package in preamble
`\include{...}` insert L^AT_EX code from another file in-place

comments	<code>% ...</code>
bold	<code>\textbf{...}</code>
<i>italic</i>	<code>\textit{...}</code> or <code>\emph{...}</code>
<u>underline</u>	<code>\underline{...}</code>
inline equations	<code>\$...\$</code>
block equations	<code>\$\$...\$\$</code> or <code>\[...\]</code>
“quotes”	<code>`...`</code> or <code>``...``</code>
...and many more!	<code>\ldots</code>

Dimensions and layout

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Dimension	Description
pt	point, smallest unit of measure
in	inch (72.27 pt)
cm	centimeter
mm	millimeter
em	relative to current point size (e.g., for 11pt font, 1em = 11pt)
en	half the width of em

Command	Description
\vspace{...}	add vertical space
\hspace{...}	add horizontal space

Typesetting notes

- Extra spaces between words are ignored
- An empty line starts a new **paragraph**
- Two backslashes (\\\) **forces** a line break, but does not start a new paragraph (i.e., no indent)
- Periods with trailing whitespace are treated as **end of sentence**, which can be escaped by a trailing backslash (e.g., i.e.\\)
- Tilde (~) inserts **non-breaking whitespace**
- Adding an asterisk (*) after some environment names will hide their numbering (e.g., section*, figure*, equation*)
- Curly braces ({...}) may be used as blocks for formatting

Lists

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Packages:

`enumitem` custom enumerations/nesting

Commands:

`itemize` bullet points

`enumerate` numbered lists

`description` description lists (used here)

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```
\begin{itemize}
  \item Lima
  \item Navy
  \item Kidney
  \begin{itemize}
    \item [yes] Bean
    \item [no] Stone
  \end{itemize}
\end{itemize}
```

- Lima
- Navy
- Kidney
 - yes Bean
 - no Stone

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Enumerate

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```
\begin{enumerate}
    \item One
    \item Two
    \item Three
    \begin{enumerate}
        \item Three Eh
        \item Three Bee
    \end{enumerate}
\end{enumerate}
```

1. One
2. Two
3. Three
 - 3.a Three Eh
 - 3.b Three Bee

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Tables

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Packages:

array tables with fixed-width cells

tabularx tables with fixed page width

multirow merge rows/columns

Commands:

tabular table environment

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Tables

```
\begin{tabular}{ | r | l | l | l | }
```

```
Signal & Description & Range \\
```

```
$\theta_l$ & lift & [0, 604] mm \\
```

```
$\theta_d$ & dump & [0, 396] mm \\
```

```
\end{tabular}
```

Signal	Description	Range
θ_l	lift cylinder	[0, 604] mm
θ_d	dump cylinder	[0, 396] mm

Packages:

`amsmath` core math functionality

`amssymb` extended mathematical symbols set

`cases` piecewise notation

`algorithm2e` algorithm environment

Commands:

`equation` equation environment

`split` multiline equation environment

`align` multiple aligned equations environment

`[pbv matrix]` matrices (similar syntax to tables)

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Common equation syntax

Description	Code	Output
subscript	<code>x_y</code>	x_y
superscript	<code>x^y</code>	x^y
grouping	<code>x^{y+z}</code>	x^{y+z}
fraction	<code>\frac{x}{y}</code>	$\frac{x}{y}$
square root	<code>\sqrt{x+y}</code>	$\sqrt{x+y}$
greek letters	<code>\alpha \beta \gamma</code>	$\alpha \beta \gamma$
spacing	<code>\; \: \, \! \!</code>	contextual

Equations

```
\begin{equation}
\beta(s) = \int^{\infty}_{-\infty} CWT(s, \tau) \; d\tau
\label{eq:CWTint}
\end{equation}
```

$$\beta(s) = \int_{-\infty}^{\infty} CWT(s, \tau) \; d\tau \quad (1)$$

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Multiline equations

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```
\begin{equation}
\begin{split}
a_{1, X} &= a_{1,x} \cos{\alpha} - a_{1,z} \sin{\alpha} \\
&= 42
\end{split}
\end{equation}
```

$$a_{1,X} = a_{1,x} \cos \alpha - a_{1,z} \sin \alpha \quad (2)$$
$$= 42$$

Matrices

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```
\[
\begin{bmatrix}
0 & -1 & 0 & 0 \\
1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{bmatrix}
\]
```

$$\begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Matrices

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```
\[  
 \begin{bmatrix}  
 0 & -1 & 0 & 0 \\  
 1 & 0 & 0 & 0 \\  
 0 & 0 & 1 & 0 \\  
 0 & 0 & 0 & 1  
 \end{bmatrix}  
\]
```

$$\begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Exactly!

Figures and references

Packages:

`graphicx` including `graphics`

`biblatex` bibliography management

`hyperref` hyperlinks

Commands:

`includegraphics` `include graphics` ...

`addbibresource` add bibliography (.bib) file

`printbibliography` insert bibliography

`cite` in-text citation

`href` create hyperlink

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Creating a figure I

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```
\begin{figure}[t]
    \centering
    \includegraphics[height=0.65\textheight]{%
        figures/loader_diagram.png}
}
\caption{The Kubota R520s robotic 1-tonne-capacity wheel loader that was
    used for field experiments.}
\label{fig:loader}
\end{figure}
```

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Creating a figure II

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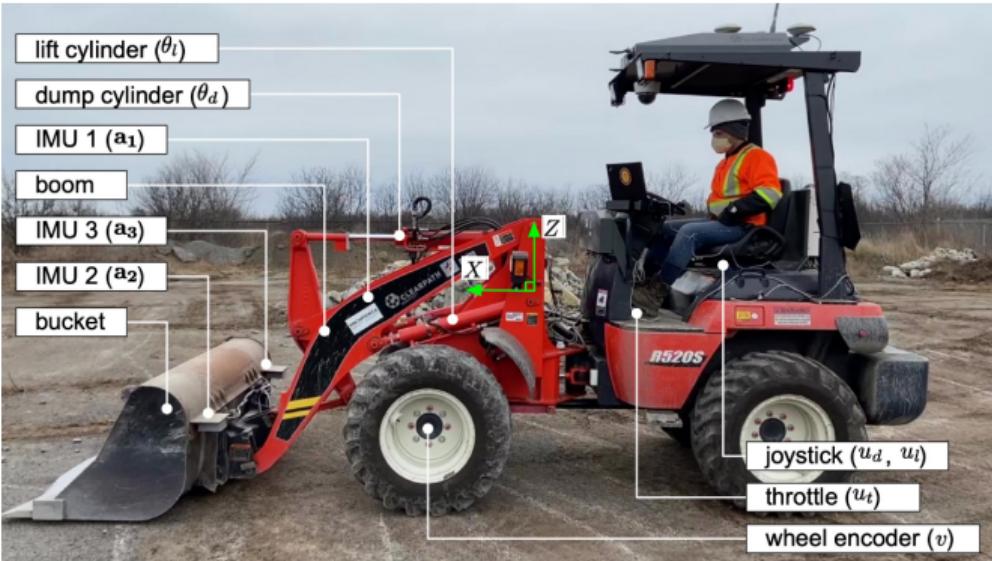


Figure 1: The Kubota R520s robotic 1-tonne-capacity wheel loader that was used for field experiments.

Label references

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```
| ``\dots the Kubota Loader in Figure~\ref{fig:loader}''
```

“...the Kubota Loader in Figure 1”

```
| ``see Equation~\ref{eq:CWTint}''
```

“see Equation 1”

Note: “fig:” and “eg:” are not necessary, but they help when writing. “ch:” and “sec:” are often used for chapters and sections.

Bibliography references

BibTeX entry (.bib files):

```
@inproceedings{artan2021,
    author      = {Artan, Unal and Fernando, Heshan and Marshall, Joshua A.},
    booktitle   = {2021 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)},
    title       = {Automatic Material Classification via Proprioceptive Sensing and Wavelet Analysis During
                  Excavation},
    year        = {2021},
    pages       = {612–617},
    doi         = {10.1109/AIM46487.2021.9517696}
}
```

Corresponding in-text citation:

```
“\dots due to breakthrough research \cite{artan2021}”
```

“...due to breakthrough research [1]”

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Inserting a bibliography

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```
| \bibliographystyle{ieeetr}  
| \bibliography{references.bib}
```

- [1] U. Artan, H. Fernando, and J. A. Marshall, “Automatic material classification via proprioceptive sensing and wavelet analysis during excavation,” in *2021 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, pp. 612–617, 2021.

Hyperlinks

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URL links:

```
| \href{https://ieeexplore.ieee.org/document/9517696}{Paper}
```

Paper

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Internal links:

```
| \hypertarget{link:thisPart}{This part}  
| \hyperlink{link:thisPart}{That part}
```

This part

That part

Custom commands

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```
| \newcommand{cmd}[args][default]{def}
```

cmd	name of the command
args	number of parameters
default	default value for optional first parameter #1
def	command body

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```
| \newcommand{\proot}[2][]{\sqrt[#{1}]{!}!}\sqrt[#{2}]{}
```

```
| [\proot[3]{x + y} + \proot{x}]
```

$$\sqrt[3]{x+y} + \sqrt{x}$$

Custom environments I

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```
| \newenvironment{name}[args][default]{begdef}{enddef}
```

name	name of the environment
args	number of parameters
default	default value for optional first parameter #1
begdef	\begin command body
enddef	\end command body

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Custom environments II

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Commands

```
\newenvironment{LARGEcenter}{\begin{center}\LARGE}{\end{center}}\begin{LARGEcenter}Thank you for your time!\end{LARGEcenter}
```

Any questions?