

\LaTeX Tutorial

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Outline

\LaTeX : What is it?

Preliminaries and \LaTeX commands

The \LaTeX input file

- ▶ L^AT_EX is a typesetting package that is used to make high quality documents
- ▶ It can be used to make scientific and mathematical documents
- ▶ It can be used to make letters, books, and many other types of documents (e.g. this presentation!)

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L^AT_EX is available for most computers, from PC to Mac to UNIX

We are not here to learn how to install and set up a L^AT_EX system, but to learn how to write a document so that it can be processed by L^AT_EX.

T_EX is a computer program created by Donald E. Knuth to typeset text and mathematical formulae.

L^AT_EX enables the author to typeset and print their work at the highest typographical quality, using a predefined, professional layout.

L^AT_EX uses the T_EX formatter as its typesetting engine.

\LaTeX vs. MS Word and OpenOffice

Word processors (e.g. MS Word and OpenOffice) are WYSIWYG programs.

\LaTeX is a WYSIWYW program. \LaTeX does the role of formatting and designing the document. (You do not see the final product until you compile the document!)

But \LaTeX is only a program, and the user/author has to provide information about the structure of the document using \LaTeX commands.

So why use \LaTeX ?

With WYSIWYG systems, authors often generate aesthetically pleasing documents with very little or inconsistent structure.

\LaTeX prevents such formatting errors by forcing the author to declare the logical structure of the document. \LaTeX then chooses the most suitable layout and use of the page.

Advantages

- ▶ Complex mathematical formulae are supported in a simple way
- ▶ Users only need to learn a few basic commands to specify the structure of the document
- ▶ Complex structures like footnotes, bibliographies, tables of contents, etc. are easily generated
- ▶ Internal referencing within a document is incredibly easy
- ▶ Free add-on packages exist (e.g. to typeset a particular bibliography format)
- ▶ Documents look professional!

Disadvantages

- ▶ Designing a completely new document layout is difficult
- ▶ The learning curve can be steep for those who do grasp the concept of logical markup right away

Preliminaries

Whitespace

- ▶ *Whitespace* characters such as blank, tab, or space are treated the same by \LaTeX
- ▶ *Whitespace* at the start of a line is usually ignored
- ▶ A single line break is treated as *Whitespace*
- ▶ An empty line between two lines of text defines a paragraph
- ▶ Several empty lines are treated the same as *one* empty line

Special characters

- ▶ The following symbols are reserved by \LaTeX and have special meaning:

\$ % ^ & _ { } ~ \

L^AT_EX commands

- ▶ L^AT_EX commands are case sensitive
- ▶ commands start with a `\` and then have a name consisting of letters only
- ▶ commands are terminated by a space, a number or any other 'non-letter'
- ▶ Some commands require a parameter given between `{ }`
- ▶ Some commands take optional parameters between `[]`
e.g. `\command[optional parameters]{parameter}`

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- ▶ Some commands take optional parameters between `[]`
e.g. `\command[optional parameters]{parameter}`
- ▶ Many commands exist in a 'starred variant', where the '*' is appended to the command name
e.g. `\section*{Introduction}`

Comments...just like MATLAB

- ▶ \LaTeX comments are indicated by %
- ▶ You can also indicate multiple lines of comments by using the **comment** environment

e.g.

```
\begin{comment}
```

Everything written within the environment begin and end is a comment!

```
\end{comment}
```

or

```
\includegraphics{myFigure.pdf} % This is also a comment.
```

\LaTeX input file

When \LaTeX processes an input file it expects a few commands in a certain order:

1. `\documentclass{...}` % this specifies the document type
2. `\usepackage{...}` % this adds functionality
3. `\begin{document}` % start the body of the text
4. `\end{document}` % end the body of the text; anything after this is ignored by \LaTeX

A simple example

Make a file called `myFirstLatex.tex`¹ and put the following in the file.

```
\documentclass{article}
\begin{document}
This is my first \LaTeX document.
\end{document}
```

Then run the command `pdflatex myFirstLatex.tex` in the command line (or compile this with your preferred \LaTeX IDE.)

¹You can go to *Example1/* in the *Resources/* folder in the git repository to find `myFirstLatex.tex`.

The output

This is my first L^AT_EX document.

The output

This is my first L^AT_EX document.

We notice the poor spacing between L^AT_EX and document. How can we fix this?

Fixing the simple example

Make a file called `mySecondLatex.tex`¹ and put the following in the file.

```
\documentclass{article}
\usepackage{xspace}
\begin{document}
This is my first \LaTeX \xspace document.
\end{document}
```

Then run the command `pdflatex mySecondLatex.tex` in the command line (or compile this with your preferred \LaTeX IDE.)

¹You can go to *Example2* in the *Resources/* folder in the git repository to find `mySecondLatex.tex`.

The output

This is my first \LaTeX document.

The output

This is my first L^AT_EX document.

To see the manual for the *xspace* package type *texdoc xspace* at the command line.

Making your own L^AT_EX command

Make a file called `myThirdLatex.tex`¹ and put the following in the file.

```
\documentclass{article}
\usepackage{xspace}
\newcommand{\latex}{\LaTeX\xspace}
\begin{document}
This is my first \latex document.
\end{document}
```

Then run the command `pdflatex myThirdLatex.tex` in the command line (or compile this with your preferred L^AT_EX IDE.)

¹You can go to *Example3* in the *Resources/* folder in the git repository to find `myThirdLatex.tex`.

The output

This is my first L^AT_EX document.

A complete document

Make a file called myFourthLatex.tex¹ and put the following in the file.

```
\documentclass{article}
\usepackage{xspace}
\newcommand{\latex}{\LaTeX\xspace}
\author{Dylan Mikesell} % define the author
\title{\latex Tutorial} % define the title
% end the PREAMBLE
\begin{document}
\maketitle % generate the title
\tableofcontents % make a table of contents
\section{My first section} % make a section for the table of contents
% type some words
This is my first \latex document.
\section{Adios} % make a final section
\ldots{} and that's it.
\end{document}
```

The output

Contents	
1	My first section
2	Adios
1	My first section
This is my first L ^A T _E X document.	
2	Adios
... and that's it.	

1

Adding a figure

Open the file called myFifthLatex.tex.

```
\documentclass{article}
\usepackage{graphicx} % need to include the 'graphicx'
\graphicspath{{./Figs/}} % Tell LaTeX where it should look
for your figures...
\begin{document}
\maketitle...
This is my first \latex document. And this is my first
figure reference (Fig.~\ref{fig:firstFigure}).
\begin{figure}
\centering
\includegraphics[width=0.5\columnwidth]{LaTeXLogo.png}
\caption{This is my first figure.}
\label{fig:firstFigure}
\end{figure}
```


The output

The logo for LATEX, rendered in a blue, serif, all-caps font with a slight shadow effect.

Figure 1: This is my first figure.

1 My first section

This is my first L^AT_EX document. And this is my first figure reference (Fig. 1).

Adding a table

Open the file called mySixthLatex.tex.

```
\documentclass{article}
\usepackage{graphicx} % need to include the 'graphicx'
\graphicspath{{./Figs/}} % Tell LaTeX where it should look
for your figures...
\begin{document}
\maketitle...
This is my first table (Tab.~\ref{tab:firstTable}).
\begin{table}[b]
\begin{tabular}{l|c|r}
$a \approx b$ & $a \neq b$ & $a = \int_{t_0}^{t_1} \frac{g(t)}{t} dt$ \\
\textbf{column 1} & \textbf{column 2} & \textbf{column 3} \\
\end{tabular}
\caption{I just made my first table!}
\label{tab:firstTable}
\end{table}
```

The output

The LATEX logo is rendered in a large, blue, serif font. The letters are spaced out, with the 'A' and 'T' being significantly larger than the other letters, and the 'E' and 'X' being slightly smaller. The logo is centered on the page.

Figure 1: This is my first figure.

1 My first section

This is my first L^AT_EX document. And this is my first figure reference (Fig. 1).

This is my first table (Tab. 1).

$a \approx b$	$a \neq b$	$a = \int_b^{c^2} \frac{d\Omega}{\Omega}$
column 1	column 2	column 3

Table 1: I just made my first table!

Adding equations

Open the file called mySeventhLatex.tex.

```
$$ a = \frac{1}{N} $$
```

```
\begin{equation}  
A\mathbf{x} = \mathbf{y}  
\label{eqn:equation}  
\end{equation}
```

```
\begin{eqnarray}  
\nonumber  
A\mathbf{x} = \mathbf{y} \\\br/>while \ x_{i} \ge 0  
\label{eqn:eqnarray}  
\end{eqnarray}
```

The output



Figure 1: This is my first figure.

1 My first section

This is my first L^AT_EX document. And this is my first figure reference (Fig. 1).

This is my first table (Tab. 1).

We can make an inline equation with $\$ \$$ any $\$ \$$, but the equation will not have a number associated with it. e.g.

$$a = \frac{1}{N}$$

We can add an equation using the equation environment (e.g. eq. 1).

```
\begin{equation}
A\mathbf{x} = \mathbf{y}
\label{eq:equation}
\end{equation}
```

$$Ax = y \tag{1}$$

We could also make an equation using the eqnarray environment (e.g. eq. 2).

```
\begin{eqnarray}
\text{\number}
A\mathbf{x} = \mathbf{y} \quad \backslash\backslash
\text{while } \mathbf{x}_i \geq 0 \quad \backslash\text{gw } 0
\label{eq:equation}
\end{eqnarray}
```

$$Ax = y \\ \text{while } x_i \geq 0 \tag{2}$$

$a \approx b$	$a \neq b$	$a = \int_b^c \frac{d\Omega}{dt} dt$
column 1	column 2	column 3

Table 1: I just made my first table!

Bibliography

1 My first section

You can reference Section 4 on page 4 by labeling your section and calling it, e.g.

```
\section{Check the hyperref package out!}  
\label{sec:hyper}  
  
Section~\ref{sec:hyper}  
  
page~\pageref{sec:hyper}
```

2 Bibtex

You can also reference the volcano tomography work of [Lees \(2007\)](#) using

```
\citet{Lees2007}
```

Check the `natbib` texdocs to see the complete list of citation styles. There is also a pdf in the main BSU_LaTeX_Thesis_Template folder.

3 How to make the bibliography

We can make the reference list with

```
\bibliography{myBibFile.bib}  
\bibliographystyle{authordate1}
```

where `myBibFile.bib` is my bibtex library file that contains:

```
@article{Lees2007,  
  author = {Lees, Jonathan M.},  
  doi = {10.1016/j.jvolgeores.2007.06.008},  
  isbn = {0377-0273},  
  issn = {03770273},  
  journal = {Journal of Volcanology and Geothermal Research},  
  number = {1-4},  
  pages = {37-56},  
  title = {{Seismic tomography of magmatic systems}},  
  volume = {167},  
  year = {2007}  
}
```

and `authordate1` is the format I want to use.

¹You can go to *Example8* in the *Resources/* folder in the git repository to find `myEightLatex.tex`.

4.1 Basic Citation Commands

The natbib package has two basic citation commands, `\citet` and `\citep` for textual and parenthetical citations, respectively. There also exist the starred versions `\citet*` and `\citep*` that print the full author list, and `\aut` and the abbreviated one. All of them may take one or two optional arguments to add some text before and after the citation.

```
\citet{Jen82}           ⇒ Jones et al., 1980
\citet[chap. 7]{Jen82}  ⇒ Jones et al., 1980, chap. 2]
\citep{Jen82}           ⇒ (Jones et al., 1980)
\citep[chap. 7]{Jen82}  ⇒ (Jones et al., 1980, chap. 2)
\citetext{[] {Jen82}}   ⇒ [see Jones et al., 1980]
\citetext[chap. 7]{Jen82} ⇒ [see Jones et al., 1980, chap. 2]
\citet*[Jen82]          ⇒ Jones, Baker, and Williams (1980)
\citep*[Jen82]          ⇒ (Jones, Baker, and Williams, 1980)
```

The starred versions can only list the full authors if the `.bst` file supports this feature (otherwise, the abbreviated list is printed).

In standard L^AT_EX, the `\cite` command can only take a single optional text for a note after the citation; here, a single optional text is a post-note, while two are the pre- and post-notes. To have only a pre-note, it is necessary to provide an empty post-note text, as shown above.

Multiple citations may be made as usual, by including more than one citation key in the `\cite` command argument. If adjacent citations have the same author designation but different years, then the author names are not repeated.

```
\citet{Jen81,Jen82}    ⇒ Jones et al. (1980); Jones et al. (1981)
\citep{Jen81,Jen82}    ⇒ (Jones et al., 1980; Jones et al. 1981)
\citep{Jen81,Jen82}    ⇒ (Jones et al., 1980, 1981)
\citep{Jen81a,Jen82}   ⇒ (Jones et al., 1980a,b)
```

The `se` examples are for author-year citation mode. In numerical mode, the results are different.

```
\citet{Jen82}           ⇒ Jones et al. [21]
\citet[chap. 7]{Jen82}  ⇒ Jones et al. [21, chap. 2]
\citep{Jen82}           ⇒ [21]
\citep[chap. 7]{Jen82}  ⇒ [21, chap. 2]
\citetext{[] {Jen82}}   ⇒ [see 21, 1980]
\citetext[chap. 7]{Jen82} ⇒ [see 21, chap. 2]
\citep{Jen81a,Jen82}    ⇒ [21, 22]
```

The authors can only be listed if the `.bst` file supports author-year citations. The standard `.bst` files, such as plain.bst are numerical only and transfer no author-year information to L^AT_EX. In this case, `\citet` prints “[author?] [21].”

In the original versions of natbib, the traditional `\cite` command was used for both textual and parenthetical citations. The presence of an empty optional

Bulleted list

```
\begin{itemize}
\item This is the default
bullet
\item[X] This is an X bullet
\item[\checkmark] This is
a \checkmark bullet from
\usepackage{amssym}
\end{itemize}
```

- ▶ This is the default bullet
- X This is an X bullet
- ✓ This is a ✓bullet from
`\usepackage{amssym}`

Enumerated list

```
\begin{enumerate}  
\item This is number 1  
\item This is number 2  
\item This is number 3  
\end{enumerate}
```

1. This is number 1
2. This is number 2
3. This is number 3

TikZ diagrams

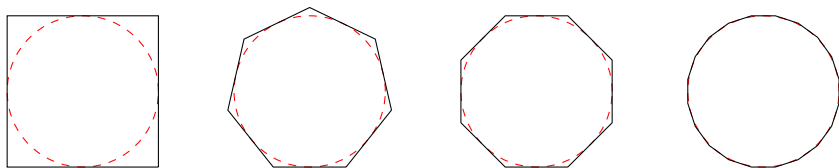


Figure: (from left to right) Polygons with 4 sides, 7 sides, 8 sides and 100 sides used to approximate the circle drawn in red.

```
\usepackage{tikz}
\usetikzlibrary{calc}
\newcommand{\polygon}[2]{%
  let \n{len} = {2*#2*tan(360/(2*#1))} in
  ++(0,-#2) ++(\n{len}/2,0) \foreach \x in {1,...,#1} { -- ++(\x*360/#1:\n{len})}}
...
\begin{tikzpicture}
\draw[red,dashed] (0,0) circle (1);
\draw (0,0) \polygon{4}{1};
\end{tikzpicture}
```

TikZ vector fields

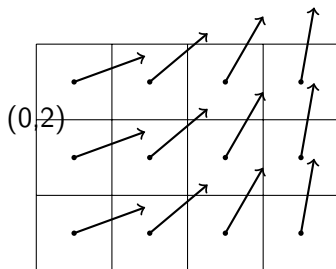


Figure: You can plot vector fields as well.

```
\begin{figure}
\begin{tikzpicture}
\draw (0, 0) grid (4, 3); % draw a grid
\foreach \x/\angle in {0.5/20, 1.5/40, 2.5/60, 3.5/80} { % loop over x and angle
  \foreach \y in {0.5, 1.5, 2.5} { % loop over y
    \fill (\x,\y) circle[radius=1pt]; % draw circle at grid center
    \draw[>,thick] (\x, \y) -- ++(\angle:1); % draw line with arrowhead
  }
}
\node[draw,text width=4cm] at (0,2) {(0,2)} % annotate the plot
\end{tikzpicture}
\caption{You can plot vector fields as well.}
\label{fig:vectors}
\end{figure}
```

Useful links

- ▶ [How to TikZ](#)
- ▶ [cross-referencing](#)
- ▶ [Math symbols](#)
- ▶ [Hyperlinks](#) (e.g. for *mailto:*)
- ▶ bsulatex@cgiss.boisestate.edu

T_EX automation

Aside from using *pdflatex*, *latex* or your built-in IDE compiler, there are few options out there to automate the L^AT_EX compiling process.

- ▶ *arara*
- ▶ *latexmk*
- ▶ *rubber*

The *Makefile* in your *src* or *Resources* folders use *latexmk*.

I use [Sublime Text](#) to create and edit my L^AT_EX files. I would call this a very intelligent text editor and it is platform independent. You can use this for any type of software development. There are also many *Interactive Development Environments* (IDEs) for L^AT_EX. You can find a very comprehensive list here [latexeditorsides](#).

- ▶ [TexShop](#) which comes by default with [MacTex](#) is commonly used on MAC OSX
- ▶ [TexStudio](#) is commonly used on the Windows OS
- ▶ [Kile](#) is only one of many IDEs for a Linux OS

Acknowledgments

A lot of the introductory material presented here was taken from Tobi Oetiker's *The Not So Short Introduction to \LaTeX* found [here](#).

BSU thesis template

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