

# (A Short) Introduction to $\text{\LaTeX}$

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Lakshmi Prasad Natarajan  
Dept. of Electrical Engineering  
Indian Institute of Technology Hyderabad  
[lakshminatarajan@iith.ac.in](mailto:lakshminatarajan@iith.ac.in)



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

- L<sup>A</sup>T<sub>E</sub>X is a typesetting system
  - ▶ places and lays out text and figures on a page to create a document ready for printing
- L<sup>A</sup>T<sub>E</sub>X provides **Division of Labor**
  - ▶ **You produce the content** (as a .tex file)  
Content: The text and figures to be displayed  
Use any text editor or graphics editor you like to produce content
  - ▶ **L<sup>A</sup>T<sub>E</sub>X will typeset and format the text** (compile the .tex file)  
How the content is visually arranged  
Font family used, consistent title/section/subsection fonts  
Spacing between sections and paragraphs, etc.
- This is not a WYSIWYG (what you see is what you get) processor

# Why L<sup>A</sup>T<sub>E</sub>X ?

- 1 Produces high-quality typography (especially math content)

$$f(\theta, \mathbf{X}) = \lim_{n \rightarrow \infty} \int_{-n\pi}^{n\pi} \cos(z + \theta) e^{z\mathbf{X}} dz$$

- 2 Division of labor allows us to concentrate first on the content, rather than the presentation. It is easy to modify the presentation consistently at a later point in time.
- 3 Produces exactly the same output document irrespective of the operating system/computer (cross-platform)
- 4 L<sup>A</sup>T<sub>E</sub>X is free

## Why you should not use L<sup>A</sup>T<sub>E</sub>X

- You do not have full control over formatting/appearance
- When the content is simple (not math heavy), using word processors might be a faster solution

# Basic Steps in Creating a Document using L<sup>A</sup>T<sub>E</sub>X

## ① Create a '.tex' file

- ▶ Use any text editor for this (gedit, KWrite, vim, Emacs, Notepad++)
- ▶ Includes the content to be placed in the final document, links to external graphics files
- ▶ Also contains 'markup': tags to stylize text (bold, italics), organize the text (title, sections, paragraphs), create mathematical symbols & equations, create and use references, etc.

## ② Typeset using L<sup>A</sup>T<sub>E</sub>X

- ▶ Compile your .tex file from a terminal  
`$ latex filename.tex`    `$ pdflatex filename.tex`
- ▶ You need to 'install latex' to use these commands
- ▶ latex produces a .dvi file which you convert to '.ps' or '.pdf'
- ▶ pdflatex generates a '.pdf' file

## ③ View the document using a pdf viewer

- ▶ Use any pdf viewer you like (okular, evince, etc)
- ▶ Convenient if the viewer auto-reloads when the pdf file is modified on disk (evince, okular, SumatraPDF)

# Basic Steps – Comments

- latex command must be followed with dvips, ps2pdf  
`latex school.tex → dvips school.dvi → ps2pdf school.ps`
- If latex or pdflatex command produces error messages
  - ① make note of line number and error message
  - ② type 'x' and press enter to close the error message
  - ③ debug '.tex' file and run latex again
- Embed all fonts used to generate the pdf file in the pdf document  

```
$ latex school.tex # generates school.dvi
$ dvips school.dvi # generates school.ps
$ ps2pdf -dPDFSETTINGS=/prepress -dEmbedAllFonts=true school.ps
```
- To verify if all fonts are embedded  

```
$ pdffonts school.pdf
# lists all fonts used in the pdf document and
# whether each is embedded in the pdf file
```

# Integrated Development Environments for using L<sup>A</sup>T<sub>E</sub>X

IDE's provide a single environment where you can edit the .tex file, compile it using `latex` command and (in some cases) view the output pdf file.

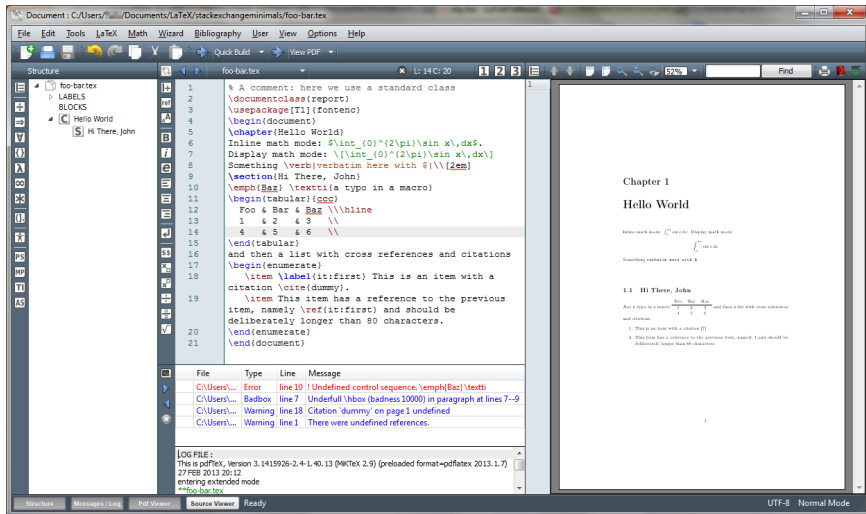
Additional features: spell check, shortcuts for inserting latex commands, syntax highlighting, manage bookmarks, maintain bibliography etc.

Sample IDE's (not at all exhaustive)

- Texstudio, Texmaker, Texworks, TeXnicCenter, WinEdt
- Kile, Gummi
- LyX (more graphical, closer to WYSIWYG)
- ShareLaTeX, Overleaf (online, collaboration with peers)

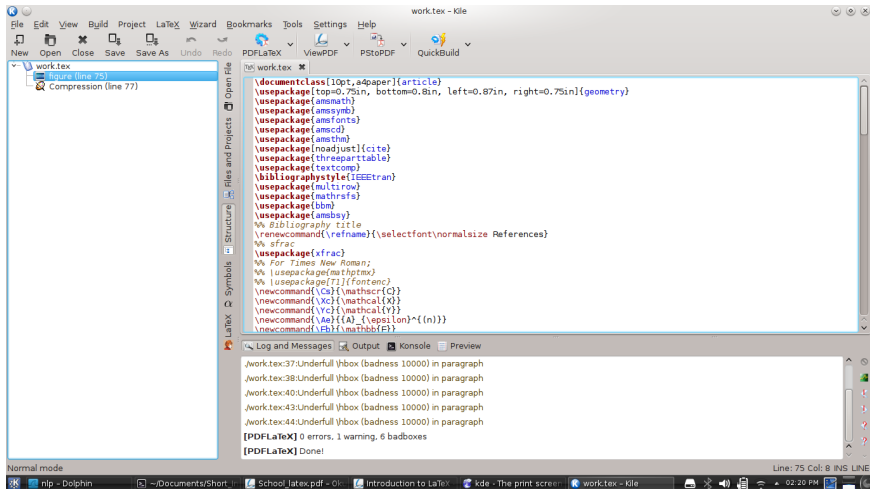
Most of this can also be done with your favorite text editor with the help of some readily available plugins

# IDE's for L<sup>A</sup>T<sub>E</sub>X



Screenshot of Texmaker (courtesy: [tex.stackexchange.com](http://tex.stackexchange.com))

# Screenshot of Kile IDE





## Using a text editor + latex plugins

The image shows a Vim editor window displaying the source code of a LaTeX Beamer presentation. The file is named `School_latex.tex` and is located at `~/Documents/Short_Introduction_to_LaTeX/Work`. The code is a Beamer preamble, defining document class, packages, and themes. The editor's status bar at the bottom shows the current file is `1: School_latex.tex`. The top of the window shows the Vim menu bar with options like File, Edit, View, Bookmarks, Settings, and Help. The left sidebar shows a tag list with entries for `School_latex.tex` and `1: School_latex.tex`.

```

File Edit View Bookmarks Settings Help
~/Documents/Short_Introduction_to_LaTeX/Work: vim - Konsole
1: School_latex.tex 2: ~/D/S/S/school.tex
Press <F1> to display help
School_latex.tex (/home/nlp
sections
. (A Short) Introduction
graphics
Graphics_PDF/III_Hyd Lo
Graphics_PDF/TeXmaker.p
16
17 \documentclass[compress,10pt,xcolor=dvipsnames]{beamer}
18 \usepackage{beamerthemesplit}
19 \usepackage{fancyhdr}
20 \usepackage{cite}
21 \usepackage{english}{babel}
22 \usepackage{mathtools}
23 \usepackage{amsfonts}
24 \usepackage{amssymb}
25 \usepackage{mathrsfs}
26 \usepackage{color}
27 \usepackage{multirow}
28 \usepackage{hhline}
29 \usepackage{xfrac}
30
31 %% Graphics %%
32 \usepackage{graphicx}
33 \usepackage{caption}
34
35 %% shaded boxes %%
36 \usepackage{fancybox}
37
38 %% framed text %%
39 \usepackage{framed}
40
41 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
42 %% Upright fonts in Theorem
43 \setbeamertheme{theorems}[normal font]
44
45 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
46 %% Theme
47 \usetheme{Pittsburgh}%%{Pittsburgh} %%Madrid
48 \usecolortheme{wolverine} %%crane %%beaver
49
2, Tag List 1: School_latex.tex
~/Documents/Short_Introduction_to_LaTeX/Work: vim
Graphics PDF - Dolphin ~/Documents/Short_Intro... School_latex.pdf - Okular kde - The print screen key work.tex - kile 02:25 PM
```

## Vim with 'taglist' and 'exuberant ctag' plugins for navigation

L<sup>A</sup>T<sub>E</sub>X Usage: <https://caffeinatedcode.wordpress.com/2009/11/16/simple-latex-ctags-and-taglist/>

# Installing L<sup>A</sup>T<sub>E</sub>X

Usually installed as [distribution](#): collection of packages, fonts, compilers

- ① GNU/Linux, Windows, Mac: TeX Live
- ② Windows: MikTeX, proTeXt
- ③ Mac: MacTeX

One usually installs the following to start using L<sup>A</sup>T<sub>E</sub>X

- ① A distribution (TeX Live, MikTeX , MacTex etc.)
- ② An IDE or a text editor (Texmaker, Kile, Emacs etc.)  
(plugins for the text editor are optional)
- ③ A document viewer (SumatraPDF, evince, etc.)  
(if the IDE does not have an inbuilt viewer)

# References and Resources

## References

- T. Oetiker, H. Partl, I. Hyna and E. Schlegl, “The not so short introduction to  $\text{\LaTeX}$  2 $\epsilon$ ,” version 5.06, 2016, <https://tobi.oetiker.ch/lshort/lshort.pdf>
- Wikibook module on  $\text{\LaTeX}$ , <https://en.wikibooks.org/wiki/LaTeX>
- ShareLaTeX Documentation <https://www.sharelatex.com/learn/>
- IEEE Author Digital Tools [http://www.ieee.org/publications\\_standards/publications/authors/authors\\_journals.html](http://www.ieee.org/publications_standards/publications/authors/authors_journals.html)  
**Extensive guidelines for preparing IEEE-style documents**
- M. Shell, *The IEEEtran Homepage*, <http://www.michaelshell.org/tex/ieeetran/>
- $\text{\LaTeX}$  Cheat Sheet, <https://wch.github.io/latexsheet/>

## Resources

- Comprehensive  $\text{\TeX}$  Archive Network, <http://ctan.org/>
- Numerous  $\text{\LaTeX}$  user groups and forums
- ..and Google

## ① A Simple $\text{\LaTeX}$ Document

## ② Graphics

## ③ Bibliography

## ④ Math Symbols – Typesetting

## ⑤ Miscellaneous

# A simple '.tex' file

## school.tex

```
\documentclass{article}
\begin{document}
There is so much more to be done.
\end{document}
```

## compile school.tex using pdflatex

```
$ pdflatex school.tex
This is pdfTeX, Version 3.14159265-2.6-1.40.15
(TeX Live 2015/dev/Debian) (preloaded format=pdflatex)
 restricted \write18 enabled.
entering extended mode
.
.
..lots of other information..
.
.
Output written on school.pdf (1 page, 13336 bytes).
Transcript written on school.log.
```

# An IEEE-style Document

Place the file 'IEEEtran.cls' in your working directory

school.tex

```
\documentclass[journal]{IEEEtran}
\begin{document}
There is so much more to be done!
\end{document}
```

This produces a double column document with 10pt font.

## Other commonly used class options

- [conference] – for IEEE conferences, double column, 10pt
- [12pt,onecolumn,draftcls] – single column, double spaced, 12pt

# Title, authors, affiliation, abstract

```
\documentclass[journal]{IEEEtran}

\title{(A Short) Introduction to \LaTeX}

\author{Lakshmi Prasad N
\thanks{Dr. Natarajan is from the Department of Electrical
Engineering, Indian Institute of Technology Hyderabad,
Sangareddy 502285, Telangana, India
(email: lakshminatarajan@iith.ac.in).}
}

\begin{document}

\maketitle

\begin{abstract}
This is a short introduction to \LaTeX,
with an emphasis on the IEEE-style documents.
\end{abstract}

There is so much more to be done!

\end{document}
```

- What if the first line is replaced with `\documentclass{article}`

# White Spaces and New Lines

## White Spaces & New Lines in the source file (.tex file)

This is a very long line, and it will be automatically wrapped by the latex compiler.

This is a very long line, and it will be automatically wrapped by the latex compiler.

Line breaks in the source file, *with no white space in between*, do not produce a new paragraph. Following lines in the source file yield the same output as above

This is a very long line, and it will be automatically wrapped by the latex compiler.	% This is a comment line This is a very long line, and it will be % This part will be ignored automatically %% These are comments too %% Even this one!! wrapped by the latex compiler.
--	---

White spaces within a line of the source file will be ignored.



# New Lines and New Paragraphs

## New Lines

Double lines at the end of a line, \\ or using the command 'newline' \newline will create a new line in the document.

Double lines at the end of a line, or using the command 'newline' will create a new line in the document.

## New Paragraph

We can create a new paragraph by introducing a line break in the source file.

This is a new paragraph. Another way to create a new paragraph is using the 'par' command. \par This is the third paragraph

We can create a new paragraph by introducing a line break in the source file.

This is a new paragraph. Another way to create a new paragraph is using the 'par' command.

This is the third paragraph

# White Spaces in the Document

- We can manually introduce horizontal and vertical white spaces in the document.
- In most cases, it is not necessary (& not recommended) to alter the spacing manually.
  - ▶ L<sup>A</sup>T<sub>E</sub>X takes care of the layout

## Commands

- Horizontal space:  
Travel around the `\hspace{5mm}` world in 80 days  

Travel around the    world in 80 days
- Vertical space: `\vspace{3mm}`
- Non breakable space: Theorem~7 produces 

Theorem 7

  - ▶ No hyphenation
- Use inter-word spacing: viz.\ CMOS, BJT

## Units of length

- in (inches), mm, cm, pt (= 1/72.27 in), and many more
- Spacing can be negative too  
Crowded `\hspace{-4mm}` words  $\Rightarrow$ 

Crowded words

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# Graphics & Figures

- Graphic formats supported
  - ▶  $\text{\LaTeX}$  : EPS, PS formats (good for vector graphics)  
some publications require you to use graphics in eps or ps formats
  - ▶ pdflatex : JPG, PNG (bit map images), PDF (good for vector images)  
EPS must be converted to PDF (use epstopdf script)
- Can add captions to images.  
Can scale and rotate images, adjust placement and alignment.  
Wrap text around figures.
- The `graphicx` package is required to handle images
- We can **label** a figure and use the label to **refer** to the figure from main text.
- But first..  
.. move the image file to your working directory, or  
place it in a special folder (say `/pictures`) in the working directory  
(good practice, especially if a large number of figures are to be used)

# An Example

```
\documentclass[journal]{IEEEtran}

\usepackage{graphicx}
\graphicspath{{pictures/}}

\title{(A Short) Introduction to \LaTeX}
\author{Lakshmi Prasad N}

\begin{document}

\maketitle

\begin{abstract}
This is a short introduction to \LaTeX, with an emphasis on the IEEE-style documents.
\end{abstract}

There is so much more to be done! See Fig.~\ref{fig:first_image} below.

\begin{figure}[h]
\centering
\includegraphics[width=3.4in]{tetrahedron}
\caption{This is a tetrahedron, a three dimensional object.}
\label{fig:first_image}
\end{figure}

\end{document}
```

# Inserting Graphics

- Height and width:

```
\includegraphics[height=3in,width=3.4in]{tetrahedron}
```

- Positioning:

```
\begin{figure}[h] : position figure here (approximately)
```

```
\begin{figure}[t] : top of page (if this is good)
```

```
\begin{figure}[t!] : top of page (force)
```

```
\begin{figure}[b] : bottom of page (if this is good)
```

- Labelling and referencing:

```
\label{something} and Fig.~\ref{something} will also work
```

Good practice: label all figures with a common prefix

```
\label{fig:something}
```

- Can also place multiple figures in a single figure environment:

Require subfigure package

- Make sure the image does not exceed the document's column width

See yourfilename.log file and look for overfull warnings

Overfull \hbox (138.25755pt too wide) in paragraph at lines 21--22

# How to Generate Graphics

- Several options for creating images:  
Libreoffice Draw, Microsoft Visio, Inkscape, LaTeX Draw, GIMP
  - ▶ Draw has a  $\text{\LaTeX}$  plugin to insert math symbols in figures  
TeXMaths <http://roland65.free.fr/texmaths>
- Ensure that the page format of the created file 'fits' the image
- 'Export' figures from your graphics generating program
- Directly draw using  $\text{\LaTeX}$  commands!!
  - ▶ `picture` environment
  - ▶ Pgfplots and TikZ packages
  - ▶ See <http://texample.net> and <http://pgfplots.net>

## Other comments

- To correctly reference a labelled object, you have to run `latex` twice
- `psfrag` package lets us replace a text tag in an included eps file with a  $\text{\LaTeX}$  command
  - ▶ Very useful for inserting math symbols directly from `.tex` file

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# Bibliography through Embedded References

Include references towards the end of the .tex file  
(before `\end{document}`)

```
\begin{thebibliography}{9}  
\bibitem{RSM_Access_13}  
T. Rappaport, S. Sun, R. Mayzus, H. Zhao, Y. Azar, K. Wang, G. Wong, J. Schulz,  
M. Samimi, and F. Gutierrez, ‘‘Millimeter wave mobile communications for 5G  
cellular: It will work!’’ \emph{IEEE Access}, vol.~1, pp. 335--349, 2013.  
\bibitem{GeA_TWC}  
B. N. Getu and J. B. Andersen, ‘‘The MIMO cube - a compact MIMO antenna,’’  
\emph{IEEE Trans. Wireless Commun.}, vol.~4, no.~3, pp. 1136--1141, May  
2005.  
\end{thebibliography}
```

Appears in the document as

## REFERENCES

- [1] T. Rappaport, S. Sun, R. Mayzus, H. Zhao, Y. Azar, K. Wang, G. Wong, J. Schulz, M. Samimi, and F. Gutierrez, ‘‘Millimeter wave mobile communications for 5G cellular: It will work!’’ *IEEE Access*, vol. 1, pp. 335–349, 2013.
- [2] B. N. Getu and J. B. Andersen, ‘‘The MIMO cube - a compact MIMO antenna,’’ *IEEE Trans. Wireless Commun.*, vol. 4, no. 3, pp. 1136–1141, May 2005.

- Bibliographic references to books, journal publications, conference publications, online resources etc. must be each formatted in their own particular style

# How to cite a bibliographic reference

- Use the bibitem key to cite a particular reference in the main text  
The possibility of using millimeter wave frequencies in 5G networks was discussed in `\cite{RSM_Access_13}`.

The possibility of using millimeter wave frequencies in 5G networks was discussed in [1].

- Citing specific page, theorem or figure

`See \cite[Theorem~2]{RSM_Access_13}`.  $\Rightarrow$  See [1, Theorem 2]

- Multiple citations

`See \cite{RSM_Access_13,GeA_TWC}`  $\Rightarrow$  See [1], [2]

- ▶ `\usepackage{cite}` represents multiple citations compactly

See [1], [2], [3], [4] becomes See [1]–[4]

# Bibliography using BibTeX I

- BibTeX automates formatting of citations and references.
  - ▶ Includes only those references that have been cited in the main body
  - ▶ Produces reference list in conformance to a required style (list references in the order of citation, italicize journal name, etc.)

## How to use BibTeX

- ① Create a database (.bib file) of items that you might cite in your document
  - ▶ One BibTeX entry per publication

```
@ARTICLE{NCL_IT_10,  
  author={Wooseok Nam and Sae-Young Chung and Lee, Yong H.},  
  journal={IEEE Transactions on Information Theory},  
  title={Capacity of the {Gaussian} Two-Way Relay Channel  
        to Within  $\frac{1}{2}$  Bit},  
  year={2010},  
  volume={56},  
  number={11},  
  pages={5488-5494},  
  doi={10.1109/TIT.2010.2069150},  
  ISSN={0018-9448},  
  month=nov,}
```
  - ▶ Declarations: @book (a book), @inproceedings (conference), @article (journal), etc.

# Bibliography using BibTeX II

- ▶ Some digital libraries offer BibTeX citations for download
- ② Use the database for citation in your '.tex' file
  - ▶ Place the following lines towards the end (before `\end{document}`)  
`\bibliographystyle{plain} %% bibliography style`  
`\bibliography{database} %% database.bib file`
- ③ Compile your document

```
$ pdflatex school.tex #creates a list of keys from .tex file
# latex will generate warnings at this step
# latex creates 'school.aux' file
Citation 'GeA_TWC' on page 1 undefined on input line 17.
$ bibtex school #identifies corrs. pub. in .bib file
# argument is 'school' or 'school.aux', NOT 'school.tex'
$ pdflatex school.tex #append references as bibliography
Label(s) may have changed. Rerun to get cross-references right.
$ pdflatex school.tex #identify correct labels & include in doc
```

  - ▶ bibtex needs to be run only when you modify your citations
  - ▶ You can create keyboard shortcuts to run these commands

# IEEE-style Bibliography

- 1 Place the IEEEtran.bst file in your working directory

- ▶ Download from IEEE, CTAN or Michael Shell's page
- ▶ Use only the latest version

- 2 Use IEEE bibliography style

```
\bibliographystyle{IEEEtran} %% IEEE bibliography style  
\bibliography{database} %% database.bib file
```

## Abbreviated titles of IEEE Journals and Magazines

- 3 Place IEEEabrv.bib file in your working directory & use

```
\bibliographystyle{IEEEtran} %% IEEE bibliography style  
\bibliography{IEEEabrv,database} %% IEEE abbreviations
```

- 4 Modify the journal field of bibitem entries

```
journal = IEEE_J_CASI yields IEEE Trans. Circuits Syst. I
```

To generate full titles use IEEEfull.bib instead of IEEEabrv.bib

# Bibliography – More Comments

- Capitalization in titles

`title={Introduction to LaTeX: A VLSI perspective}` yields

Introduction to latex: a vlsi perspective

Solution:

`title={Introduction to \LaTeX: \A \VLSI perspective}`

Introduction to LaTeX: A VLSI perspective

Note: Enclosing entire title in double braces not recommended

`title={{A VLSI book in LaTeX}}`

- Preparing final files for publication/arXiv

Move all bibliography into .tex file (embedded mode)

- ▶ BibTeX generates a '.bbl' with an explicit bibliography list conforming to the specified style
- ▶ Replace the `\bibliographystyle{..}` and `\bibliography{..}` lines in the '.tex' file with the contents of the '.bbl' file
- ▶ (You can now) Remove `IEEEtran.bst`, `IEEEabrv.bib` and `.bbl`, `.bib` and `.blg` files from your working directory

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# L<sup>A</sup>T<sub>E</sub>X Math Modes

- ① Inline math mode: use `$...$` to write math in line with the main text  
Since `$a^2+b^2=\sum_{i=0}^{\infty}\alpha^i$`, we deduce that the transistor amplifies the input signal.

Since  $a^2 + b^2 = \sum_{i=0}^{\infty} \alpha^i$ , we deduce that the transistor amplifies the input signal.

- ② Display mode: numbered equation on a line by itself  
We deduce that the transistor amplifies the input signal since  
`\begin{equation} \label{eq:key}`  
`a^2+b^2=\sum_{i=0}^{\infty}\alpha^i.`  
`\end{equation}`

We deduce that the transistor amplifies the input signal since

$$a^2 + b^2 = \sum_{i=0}^{\infty} \alpha^i. \tag{1}$$

To cite equations:

Using `\eqref{eq:key}` in Theorem `\ref{thm:main}`,...



# L<sup>A</sup>T<sub>E</sub>X Commands for Math Symbols

## Reference

- S. Pakin, “The Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List,” <http://tug.ctan.org/info/symbols/comprehensive/symbols-a4.pdf>

## Packages

$$\backslash\mathrm{usepackage}\{\mathrm{amsmath},\mathrm{amssymb},\mathrm{amsthm},\mathrm{amsfonts}\}$$

## Examples

<code>x_i^j</code>	$x_i^j$
<code>x_{i+2}^{5j}</code>	$x_{i+2}^{5j}$
<code>\sin(\theta)</code>	$\sin(\theta)$
<code>\frac{\Gamma}{K}</code>	$\frac{\Gamma}{K}$
<code>\sqrt[4]{e}</code>	$\sqrt[4]{e}$
<code>\sum_{n=0}^5 n^2</code>	$\sum_{n=0}^5 n^2$
<code>\mathbb{R}^n</code>	$\mathbb{R}^n$
<code>\{x^2 \mid x&gt;0\}</code>	$\{x^2 \mid x > 0\}$
<code>\langle x,y \rangle</code>	$\langle \boldsymbol{x}, \boldsymbol{y} \rangle$ %poor man's bold
<code>\langle \bm{x}, \bm{y} \rangle</code>	$\langle \boldsymbol{x}, \boldsymbol{y} \rangle$ %\usepackage{bm}

See also `\boldsymbol{}` – good for nesting

# Formatting and Aligning Equations

- L<sup>A</sup>T<sub>E</sub>X does not automatically format long equations into multiple lines. You have to do this yourself!

```
\begin{multline*}
```

```
f(x) = 1 + x + x^2 + x^3 + x^4 + x^5 + \\\ x^6 + x^7
```

```
\end{multline*}
```

$$f(x) = 1 + x + x^2 + x^3 + x^4 + x^5 + \\ x^6 + x^7$$

- Aligning multiple equations

```
\begin{align}
```

```
f(x) + g(x) &= h(x) \nonumber \\\
```

```
b(y) &= c(y) \label{eq:property}
```

```
\end{align}
```

$$\begin{aligned} f(x) + g(x) &= h(x) \\ b(y) &= c(y) \end{aligned} \tag{2}$$

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# Font Sizes & Faces

## Sizes

- `{\normalsize text}`, `{\small text}`, `{\footnotesize text}`, `{\tiny text}`  
Also: `\large`, `\Large`, `\LARGE`, `\huge`, `\Huge`
- As an environment: `\begin{small} ... \end{small}`
- Use `\fontsize{ }{ }` for arbitrary size specification

## Faces

- `\emph{Text}`, `\textbf{Text}`, `\TEXTSC{TEXT}`, `\textrm{Text}`,  
`\texttt{Text}`, `\textsf{Text}`

## Text Superscript in normal text

- `2$^{nd}$` yields  $2^{nd}$
- `2\textsuperscript{nd}` to obtain  $2^{nd}$

# Spacing

## Margins

- Can specify margin sizes using the geometry package
- Modification when using a specific style (say IEEEtran) not recommended

## Alignment

- `\begin{center} ...text... \end{center}`
- Left and right alignment: `flushright`, `flushleft`

## Multiple columns

- `columns` environment  

```
\begin{columns}

\begin{column}{0.4\textwidth}
Text in first column.
\end{column}

\begin{column}{0.4\textwidth}
Text in second column.
\end{column}

\end{columns}
```

## Spacing in Math Mode

- Increasing order: `\,`, `\:`, `\;`
- Negative spacing: `\!`
- Spacing between lines  

```
\begin{align*}
\frac{V}{I} &= R \quad \ll[1ex]
\frac{P}{I} &= IR
\end{align*}
```

# Bulleted & Numbered Lists

## Bulleted lists

```
\begin{itemize}  
\item First item.  
\item Second.  
    \begin{itemize}  
        \item Sub-item.  
    \end{itemize}  
\end{itemize}
```

- First item.
- Second.
  - ▶ Sub-item.

## Numbered lists

```
\begin{enumerate}  
\item First item.  
    \begin{enumerate}  
        \item Sub-item.  
    \end{enumerate}  
\item Second.  
    \begin{itemize} %%bulleted  
        \item Sub-item. %%sub-list  
    \end{itemize}  
\end{enumerate}
```

- ① First item.
  - ① Sub-item.
- ② Second.
  - ▶ Sub-item.

# Tables – tabular Environment

## A Simple Table

```
\begin{tabular}{|l|l|cc|}  
\hline  
Ratttt & Cat & &  $e^x$  \\  
Yes &  $x^{\log x}$  & & Nooo \\  
\hline  
\end{tabular}
```

Ratttt	Cat	$e^x$
Yes	$x^{\log x}$	Nooo

## Scaling the distance between rows

```
\renewcommand{\arraystretch}{1.25}  
\begin{tabular}{|l|l|cc|}  
\hline  
Ratttt & Cat & &  $e^x$  \\  
Yes &  $x^{\log x}$  & & Nooo \\  
\hline  
\end{tabular}
```

Ratttt	Cat	$e^x$
Yes	$x^{\log x}$	Nooo

# Tables – table Environment

## Captioning, Positioning and Labelling a Table

```
\begin{table}[h!] %%position
\centering        %%alignment
\renewcommand{\arraystretch}{1.25}
\begin{tabular}{||l|l|cc|}
\hline
Ratttt & Cat & &  $e^x$  \\
Yes &  $x^{\log x}$  & & Nooo \\
\hline
\end{tabular}
\caption{Insert Caption}
\label{tbl:sample}
\end{table}
```

Ratttt	Cat	$e^x$
Yes	$x^{\log x}$	Nooo

Insert Caption

Now `\ref{tbl:sample}` will produce Table 1

## Multiple rows and columns

- Multiple columns: use `\multicolumn` command
- Multiple rows: `\multirow` command,  
requires `\usepackage{multirow}`



# Customization – Macros

## New Commands

- Define a new command: `\newcommand{\Rb}{\mathbb{R}}`
- $\text{\LaTeX}$  will interpret `\Rb` as `\mathbb{R}`
- `\bm{x}` `\in` `\Rb^N`  $\Rightarrow$   $\boxed{x \in \mathbb{R}^N}$

## New Commands with Arguments

- Define a new command with two arguments:

`\newcommand{\rn}[2]{Rule Number #1.#2}`

- `\rn{7}{03}` states that  $\Rightarrow$   $\boxed{\text{Rule Number 7.03 states that}}$

# Customization – Macros

## New Environment

- Define a new environment:

```
\newenvironment{remark}{\begin{center}\begin{Large}}{\end{Large}\end{center}}
```

- This is a long line with lots of words in it. The following is an important remark.

```
\begin{remark}
```

This is important.

```
\end{remark}
```

This is a long line with lots of words in it. The following is an important remark.

This is important.

This is only an introduction. There is a lot more that L<sup>A</sup>T<sub>E</sub>X offers.

**Thank You!**