

# Introduction to L<sup>A</sup>T<sub>E</sub>X

## A Method for Scientific Writing

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# Introduction

- ▶ What, Why, Where and How of  $\text{\LaTeX}$
- ▶ Writing  $\text{\LaTeX}$  (Basics)
  - ▶ Comments
  - ▶ Commands
  - ▶ Document Structure
- ▶ Elements
  - ▶ Text Formatting
  - ▶ Tables and Lists
  - ▶ Graphics, Images & Figures in  $\text{\LaTeX}$
  - ▶ Maths

# Common Problems in Typesetting Documents with Word

- ▶ Poor typographic control.
- ▶ "Badness" is difficult to resolve.
- ▶ Image embedding (instead of external links) and limited image editing options.
- ▶ Unexpected surprises when using external text.
- ▶ Unprofessional look.

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

T<sub>E</sub>X is software developed by Donald Knuth for typesetting documents.

- ▶ low level markup language and compiler
- ▶ very powerful, but difficult to use

L<sup>A</sup>T<sub>E</sub>X is a collection of software built around T<sub>E</sub>X to make life easier

- ▶ macros and scripts to convert L<sup>A</sup>T<sub>E</sub>X commands to T<sub>E</sub>X
- ▶ many packages for doing complex formatting/layouts

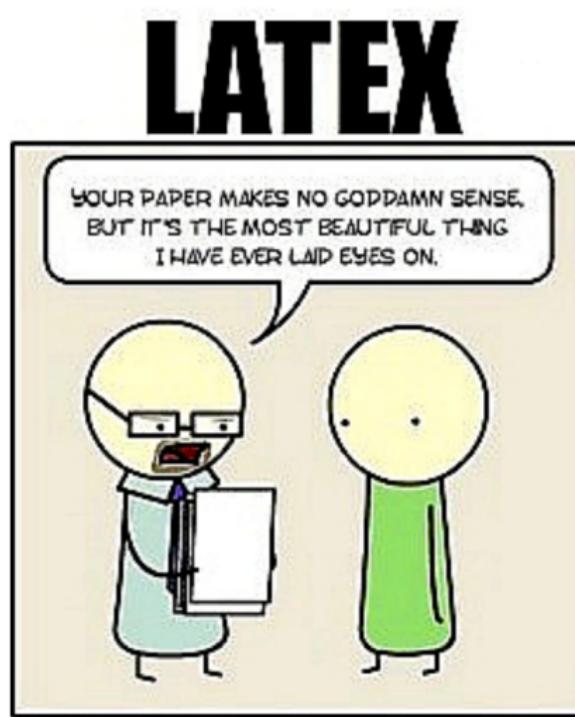


# Why L<sup>A</sup>T<sub>E</sub>X?

- ▶ Allows you to concentrate on content and structure, rather than layout and presentation
- ▶ Keeps formatting consistent throughout the document
- ▶ No design or typography knowledge required
- ▶ Excellent for writing mathematical expressions or equations
- ▶ Long and complex documents can be created easily
- ▶ Free!

# Why LATEX?

... It looks great.



## Why not $\text{\LaTeX}$ ?

- ▶ Can't easily see how document looks as we write it
- ▶ Need to learn  $\text{\LaTeX}$  before you can create anything
- ▶ Lose some control over formatting and layout
- ▶  $\text{\LaTeX}$  is not the prettiest or simplest language out there

# Where do we get $\text{\LaTeX}$ ?

$\text{\LaTeX}$  is freely available from a number of different sources. There are many different implementations and collections of packages online.

**Windows** proTeXt is a good solution for Windows, providing MiKTeX.

**Mac OSX** MacTeX provides TeXLive.

**Linux** Most distributions will come with  $\text{\LaTeX}$  ready installed but if not you can install TeXLive.

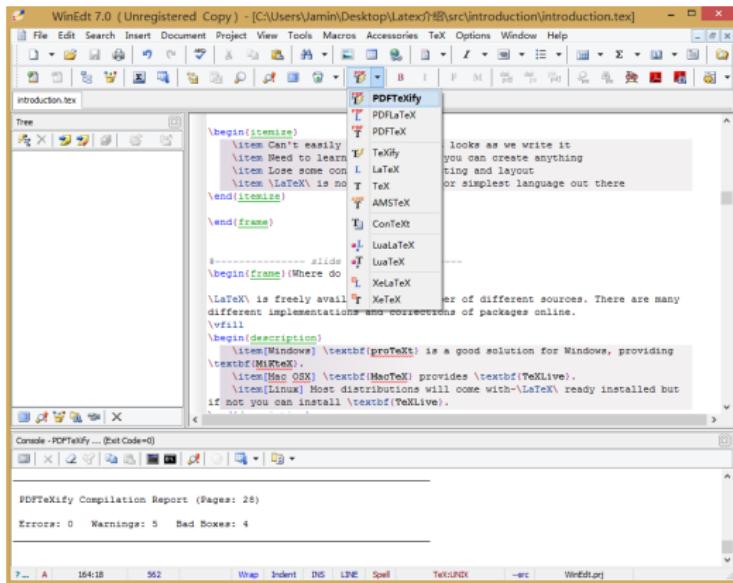
Some websites like Overleaf provide online platforms for "Real-time Collaborative Writing and Publishing".

CTeX (Chinese TeX) is a nice choice for Chinese users.

# How do we use LATEX?

Creating documents with LATEX is simple:

1. Write our document as plain text in a '.tex' file, using LATEX commands to structure and format it
2. Compile our '.tex' file to produce the output



# First (basic) L<sup>A</sup>T<sub>E</sub>X Example

```
\documentclass{article}  
\begin{document}  
    Hello World!  
\end{document}
```

Hello World!

# Writing L<sup>A</sup>T<sub>E</sub>X (Basics) – Comments, Commands

## ► Comments

The '%' character is used to create comments in L<sup>A</sup>T<sub>E</sub>X.

```
%This is a comment and will not be shown.
```

```
Here is some text in our file that will be shown. %but the rest  
of the line will not be.
```

```
Here is some text in our file that will be shown.
```

## ► Commands

L<sup>A</sup>T<sub>E</sub>X commands have an effect on the text in the document. Some commands have additional arguments or optional parameters. The general syntax for a L<sup>A</sup>T<sub>E</sub>X command is:

```
\commandname [opt1, opt2, ...]\{arg1\}\{arg2\}...
```

# Writing L<sup>A</sup>T<sub>E</sub>X (Basics) – Document Structure

Every L<sup>A</sup>T<sub>E</sub>X document must have a certain structure:

```
\documentclass{...}
\usepackage{...}
\begin{document}
...
\end{document}
```

The \documentclass{...} command tells L<sup>A</sup>T<sub>E</sub>X which type of document we are creating, and how it should be set up and formatted.

Often, the default set of commands available to L<sup>A</sup>T<sub>E</sub>X cannot solve all of our problems alone. You will need \usepackage{...} command to include extra packages.

Documents can be divided into different parts, chapters or sections.

# Document Structure Example

L<sup>A</sup>T<sub>E</sub>X Template for IEEEtran Journals

<https://www.overleaf.com/2397145spfqnq#6206035>

Bare Demo of IEEEtran.cls for Journals

```
\documentclass[journal]{IEEEtran}
%usepackage{cite}
%usepackage{fnpct}
%usepackage{fncv}
%usepackage{fncv}
%usepackage{fncv}
%usepackage{fncv}
%usepackage{fncv}
\begin{document}
%[bare Demo of IEEEtran.cls for Journals]
%[author: Michael Shell, Member, IEEE, John Doe, Fellow, OSA, and Jane Doe, Life Fellow, IEEE]
%[affiliations: Michael Shell is with the Department of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA, 30332 USA e-mail: (see http://www.michaelshell.org/contact.html)]%c-this % stops a space
%[thanks: J. Doe and J. Doe are with Anonymous University.]%c-this % stops a space
%[manuscript received April 19, 2005; revised December 27, 2012.]
%[The paper headers]
%[Author(s) of Journal Class Files, -vol.-11, No.-4, December-2012]%
%[Shell (Makeover.cls)]%text{[et al.]} Bare Demo of IEEEtran.cls for Journals
% make the title area
\maketitle
% begin abstract
\begin{abstract}
% abstract goes here.
\end{abstract}
% Note that keywords are not normally used for peerreview papers.
\begin{keywords}
% IEEEtran, journal, latex, paper, template.
\end{keywords}
% IEEEpaperstart{[title]} this demo file is intended to serve as a "starter file"
% IEEE journal papers produced under \LaTeX{} using
% IEEEtran.cls version 1.8 and later.
\IEEEpaperstart{December 27, 2012}
I wish you the best of success.
\hfills
\hfills December 27, 2012
\subsubsection{Subsection Heading Here}
\subsubsection{Subsubsection Heading Here}
\subsubsection{Subsubsubsection Heading Here}
\end{document}
```

Journal of \LaTeX{} Class Files, Vol. 11, No. 4, December 2012

## Bare Demo of IEEEtran.cls for Journals

Michael Shell, Member, IEEE, John Doe, Fellow, OSA, and Jane Doe, Life Fellow, IEEE

**Abstract**—**The abstract goes here.**

**Index Terms**—**IEEEtran, journal, \LaTeX{}, paper, template.**

### I. INTRODUCTION

This demo file is intended to serve as a "starter file" for IEEE journal papers produced under \LaTeX{} using IEEEtran.cls version 1.8 and later.

I wish you the best of success.

mds

December 27, 2012

#### A. Subsection Heading Here

Subsection text here.

*1) Subsubsection Heading Here:* Subsubsection text here.

#### II. CONCLUSION

The conclusion goes here.

#### APPENDIX A

PROOF OF THE FIRST ZONKLAR EQUATION

Appendix one text goes here.

#### APPENDIX B

Appendix two text goes here.

#### ACKNOWLEDGMENT

The authors would like to thank... [1]

#### REFERENCES

# Elements – Text Formatting

$\text{\LaTeX}$  has many text formatting options included by default that allow you to change text size, style and spacing.

This text is large

This text is tiny

```
{\Large This text is large} \\ {\tiny This text is tiny}
```

Sans Serif font

Teletype font

*Italic*

Small Capitals

**Bold**

Roman font

```
\textsf{Sans Serif font} \\ \texttt{Teletype font} \\ \textit{Italic} \\ \textsc{Small Capitals} \\ \textbf{Bold} \\ \textrm{Roman font}
```

We can *emphasise* a word in the sentence.

We can  $\text{\emph{emphasise}}$  a word in the sentence.

## Elements – Lists

$\text{\LaTeX}$  provides three different environments for defining lists:

**itemize** For basic bulleted lists

**enumerate** For numbered lists

**description** For lists with a label for each item

## itemize, enumerate, description

- ▶ the first item
- ▶ the second item
- ▶ the third item

```
\begin{itemize}
  \item the first item
  \item the second item
  \item the third item
\end{itemize}
```

1. the first item
2. the second item
3. the third item

```
\begin{enumerate}
  \item the first item
  \item the second item
  \item the third item
\end{enumerate}
```

- First the first item  
Second the second item  
Third the third item

```
\begin{description}
  \item[First] the first item
  \item[Second] the second
    item
  \item[Third] the third item
\end{description}
```

## Elements – Tables

The `tabular` environment allows us to create tables within our `LATEX` documents.

*Table* Example:

```
\begin{tabular}{ | l || c || r | }
    \hline
    some text & some text & this text \\
    a text & other text & more text \\
    another text & some text & some other text \\
    \hline
\end{tabular}
```

some text	some text	this text
a text	other text	more text
another text	some text	some other text

# Elements – Graphics, Images & Figures in L<sup>A</sup>T<sub>E</sub>X

Including graphics in our L<sup>A</sup>T<sub>E</sub>X document is relatively simple.

- ▶ Insertion

The `\includegraphics` command is used to insert an image file into your L<sup>A</sup>T<sub>E</sub>X document.

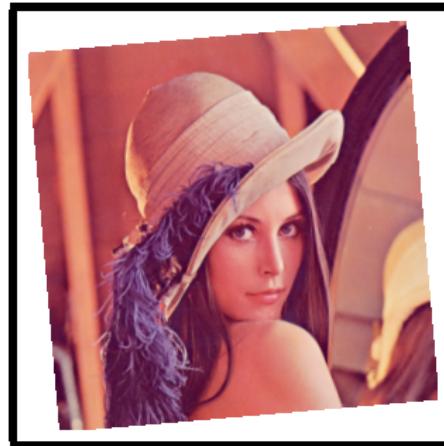
```
\includegraphics[opt1=val1, ..., ]{imagefile}
```

- ▶ Options

<code>width=xx</code>	Specify the preferred width of the image
<code>height=xx</code>	Specify the preferred height of the image
<code>scale=xx</code>	Scale the image by the given factor
<code>angle=xx</code>	Rotate the image by the given number of degrees
<code>page=x</code>	Select a particular page from a .pdf file

## \includegraphics – example

```
\begin{center}
    \setlength\fboxrule{2pt}
    \fbox{\includegraphics[width=0.3\textwidth, angle=5]{img/background}}
\end{center}
```



## Elements – Maths

Typesetting maths is one of the major strengths of  $\text{\LaTeX}$ , and one of the main reasons for its popularity within the scientific community.

The `amsmath` package is frequently used to add to the built in maths typesetting capabilities of  $\text{\LaTeX}$ – all the discussion here will assume it has been used.

*Besides*, there are many more packages that can be useful for this type of scientific work. Just some are: `IEEEtran``tools`, `mathtools`, `mchem`.

# Maths Examples

## Inline maths

Inline maths is displayed within our text, such as  $a^3 + 6b$ .

Inline maths is displayed within our text, such as \begin{math} a^3 + 6b \end{math}.

## displaymath (without numbering)

Display maths is displayed separately from the text.

$$a^3 + 6b$$

Display maths is displayed separately from the text.  
\begin{displaymath}  
a^3 + 6b  
\end{displaymath}

## equation (with numbering)

Equation - separate, with numbering.

$$a^3 + 6b \quad (1)$$

Equation - separate, with numbering.  
\begin{equation}  
a^3 + 6b  
\end{equation}

# Special Documents

- ▶ Presentation
- ▶ Poster
- ▶ CV and cover letter
- ▶ Teaching stuff

John Smith  
*Curriculum Vitae*

## WORK EXPERIENCE

CURRENT, FROM JAN 2009

Trader at Enzo s.p.a., Milan

*Physical Natural Gas Trading*

Provided analysis of spreads, in particular time and location spreads, with emphasis on trading opportunities on the curve, also taking into account the availability of storage facilities. Became familiar with logistic implications of physical gas trading and developed knowledge of continental virtual hubs for gas exchange.

JULY 2008 – OCT 2008  
1<sup>st</sup> year Analyst at LEHMAN BROTHERS, London  
*Commodities Structured Trading*

Developed spreadsheets for risk analysis on exotic derivatives on a wide array of commodities (gas, oils, precious and base metals), managed blotter and secondary trades on structured zones, listed with Middle Office, Sales and Structuring for bookkeeping.

SUMMER 2007

Summer Intern at LEHMAN BROTHERS

*Capital Markets*

Received pre-placed offer from the Eastics Trading Desk as a result of my positive review. Rated "truly distinctive" for Analytical Skills and Teamwork.

Trader at Enzo s.p.a., Milan

*Physical Natural Gas Trading*

Provided analysis of spreads, in particular time and location spreads, with emphasis on trading opportunities on the curve, also taking into account the availability of storage facilities. Became familiar with logistic implications of physical gas trading and developed knowledge of continental virtual hubs for gas exchange.

JULY 2008 – OCT 2008  
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*Commodities Structured Trading*

Developed spreadsheets for risk analysis on exotic derivatives on a wide array of commodities (gas, oils, precious and base metals), managed blotter and secondary trades on structured zones, listed with Middle Office, Sales and Structuring for bookkeeping.

## EDUCATION

2011 - PRESENT Doctor of Philosophy  
Computer Sciences  
The University of California

2000 Master of Science  
Computer Science  
Computer Science  
The University of California

2009 Postgraduate Diploma  
Dissertation  
COMPUTER SCIENCE  
The University of California

2006 - 2008 Bachelor of Business Studies  
COMMERCE  
The University of California

2010 Faculty of Science Masters Scholarship  
The University of California

2008 Top Achiever Award – Commerce  
Business Association of California

## COMPUTER SKILLS

Basic Knowledge Java, Adobe Illustrator

Intermediate Knowledge PYTHON, HTML, MySQL,  
OpenOffice, Linux,  
Microsoft Windows  
Computer Hardware & Support

## COMMUNICATION SKILLS

CONFERENCES Oral Presentation at the California  
Computer Science Conference – 2010

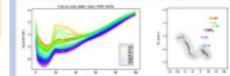
POSTERS Poster at the Annual Programming  
Conference in Oregon – 2009



Rob J Hyndman

Research publications (2008–2010)

## Forecasting functional data



Hyndman, R. J. and D. Booth (2008). Stochastic processes forecasts using functional data models for mortality, fertility and migration. *International Journal of Forecasting* 24(2), 323–340.

Hyndman, R. J. and Y. L. Shang (2008). Forecasting functional time series. *Statistica Neerlandica* 62(1), 13–27. DOI: 10.1002/stan.10008

Ehna, H., M. Akram, D. M. Gang, D. English, J. L. Hooper, A. M. Kangangi, and R. J. Hyndman (2010). Using functional data analysis and forecasting methods to predict trends of age-specific breast cancer mortality for the United States and England/Wales. *Journal of Epidemiology* 20(2), 155–165.

Hyndman, R. J. and I. Shang (2008). Robust point, envelope and diagnostic plots for functional data. *Journal of Computational & Graphical Statistics* 19(1), 39–60.

## Tourism forecasting

Athanasopoulos, G. and R. J. Hyndman (2004). Modeling and forecasting Australian domestic tourism. *Tourism management* 25(1), 19–31.

Athanasopoulos, G., R. A. Ahmed, and R. J. Hyndman (2009). Hierarchical forecasts for Australian domestic tourism. *International Journal of Forecasting* 25(1), 146–160.

## Other time series & forecasting

Hyndman, R. J. and V. Shahzad (2009). Automatic time series forecasting: the forecast package for R. *Journal of Statistical Software* 36(3).

Magnusson, L., J. W. Boland, and R. J. Hyndman (2008). Generation of synthetic sequences of highly temporally correlated time series. *Computometrics* 10(1), 1–16.

Wang, J. K. X., A. Sastri-Mais, and R. J. Hyndman (2009). Rule induction for forecasting method selection: meta learning the characteristics of ensemble series. *Neurocomputing* 72, 2070–2076.

Verbeek, J. R. J., R. J. Hyndman, C. Nissen, and R. D. Snyder (2009). Detecting and summarising changes in variables in time series. *Computometrics* 10(1), 106–125.



## Exponential smoothing



Hyndman, R. J., A. B. Koehler, R. D. Ord, and R. D. Snyder (2008). Forecasting with exponential smoothing: the state space approach. Berlin: Springer-Verlag.  
[www.exponentialsmoothing.net](http://www.exponentialsmoothing.net).

Gould, P., A. B. Koehler, F. Vald Arango, R. D. Snyder, J. K. Ord, and R. J. Hyndman (2008). Forecasting time series with multiple seasonal patterns. *European Journal of Operational Research* 193(1), 205–220.

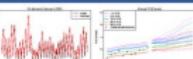
Hyndman, R. J., M. A. Kosten, and B. C. Archibald (2008). The admissible parameter space for exponential smoothing methods. *Annals of Statistical Mathematics* 60(4), 803–817. DOI: 10.1007/s10463-008-0146-4.

Akram, M., R. J. Hyndman, and R. J. Ord (2009). Exponential smoothing and non-negative data. *Australian & New Zealand Journal of Statistics* 4(4), 415–432.

Ord, J. K., A. B. Koehler, R. D. Snyder, and R. J. Hyndman (2009). A multivariate innovation state-space Bayesian model for short-term forecasting. *International Journal of Forecasting* 25(2), 533–535.

de Silva, A., R. J. Hyndman, and R. D. Snyder (2010). The sector innovations structural time series framework: a simple approach to multivariate forecasting. *Statistical modeling to appear*.

## Electricity demand forecasting



Hyndman, R. J. and S. Fan (2008). Density forecasting for long-term electric power demand. *IEEE Transactions on Power Systems*, to appear.

## Other applied statistics

Vafeiadis, I., P. Faloutsos, D. Carter, I. Polat, R. J. Hyndman, and K. Southgate (2010). Forecasting of inventory decision process optimisation using a multiobjective PSO and multiresponse MARS modelling. In: Proceedings 2010 IEEE congress on evolutionary computation, July 2010, Barcelona, Spain.

Questions?

