LaTeX / LyX Tutorial

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Goal of this Mini-tutorial

- The goal of this tutorial is to teach you the **basics** of **LaTeX and LyX** to get you started into technical typesetting
- We will **not cover everything** of LaTeX or LyX, as that is impossible; but I will give you enough tools to write your BSc thesis.
- Sooner or later you will reach the boundary of what I have tought you, and hit some problem or thing you want to do, but can't. For this, I will teach you **how and where to look for help** on the internet

Contents

What is LaTeX?

- LaTeX is a *technical typesetting system*. That means that it can be used to generate **publication-quality documents**. And it is aimed at the technical / mathematical / physical world, specially at writing documents **full of mathematics.**
- **Document formatting** and **document content** are **two separate things**: the author needs not to care about the details of spacing, tabs, indentation, figure placement, section numbering, references, citations, etc: *everything is done automatically and consistently.*
- LaTeX is the *de facto* standard for all **scientific journals** worth their name, and it dominates the **academic world** (theses, reports, documentation, articles, etc). It is however not used in companies. $\rightarrow$ *Learn it only if you plan to work on research, mainly. Otherwise just use MS Word.*

How does LaTeX work?

- The author writes his document in *plain text*.
- A small number of tags are used to specify sections, references, etc.
- By clicking an icon on the editor or running a command, the pdf of the document is compiled:

```
1  \documentclass{article} % document declaration
2
3  \begin{document} % document body
4
5      \title{My Nice Document Example}
6      \author{Mario Merino}
7      \maketitle
8
9      \begin{abstract}
10     This is where an abstract would go...
11     \end{abstract}
12
13     \section{Introduction}
14
15     This is an example equation: $0 = 1 - \exp(i \pi)$.
16
17 \end{document}
18
```

My Nice Document Example

Mario Merino

February 16, 2014

Abstract

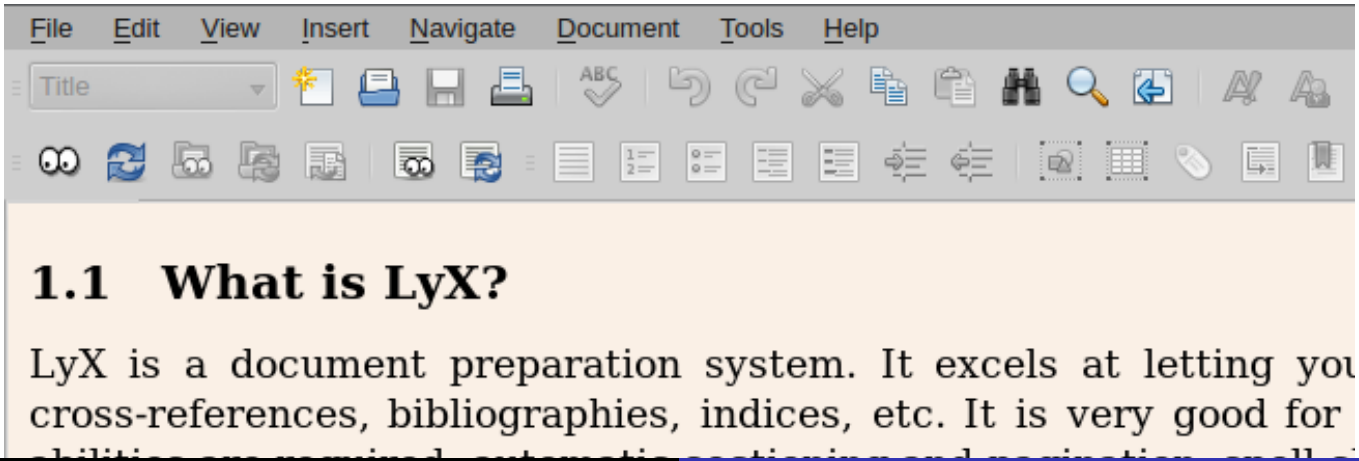
This is where an abstract would go...

1 Introduction

This is an example equation: $0 = 1 - \exp(i\pi)$.

What is LyX?

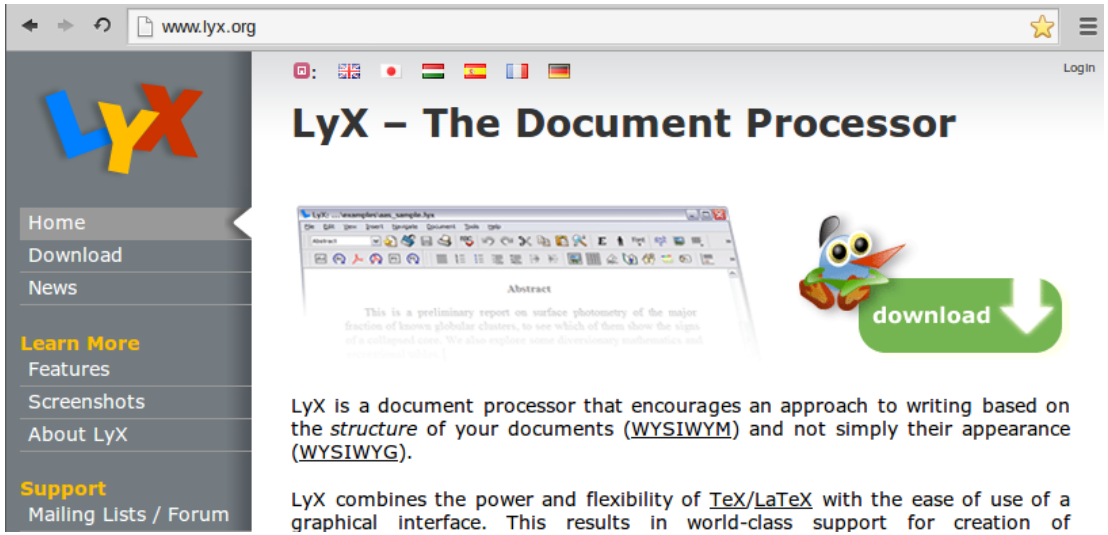
- LyX is an advanced LaTeX editor (front end) where the author doesn't need to write any code
- It is more user-friendly (specially for beginners), as it resembles usual word processors
- It is not WYSIWYG: the user still has to click a button to compile the pdf version of the document
- It is fully packed with options and menus to help in the writing of maths, references, bibliography, etc.



Installing LyX/LaTeX in Windows

The easiest to get a working LyX (and LaTeX) system is to install LyX: it will automatically install LaTeX (MiKTeX)

1. Head to `www.lyx.org` and download the file; double-click the exe, select the language and install folder
2. Accepting all installation defaults should be fine



If you only want LaTeX, install MiKTeX instead: `miktex.org`

Installing LyX/LaTeX in GNU-Linux

- For a full LyX-LaTeX system, open a terminal and type (it will automatically install LaTeX, too):

  sudo apt-get install lyx

- If you are only interested in LaTeX (texlive), type

  sudo apt-get install texlive

- or, if you want all the optional packages:

  sudo apt-get install texlive-full

- For this tutorial, we will use the same editor as in Windows, so please install TeXMaker

  sudo apt-get install texmaker

Compiling a document

- In LyX, generating the pdf is as simple as clicking the "View" button (also accessible through the View menu)
- In TeXworks, you just need to hit F1. You can CTRL+click the pdf to jump to the corresponding latex code!
- In general, you just open a terminal window and type "`pdflatex yourfilename.tex`". Other variants of this command exist.

LaTeX commands

- Every LaTeX command has this general structure:

```
\commandname[option1,...]{argument1}{argument2}{...}
```

- Commands are marked with an initial escape character "\"
- There can be a list of options in square brackets "[]"
- Arguments follow in braces "{}"
- Some commands don't have options or arguments
- LaTeX comments start with "%": *% This is a comment*

Before you begin

- An "enter" is just the same as a space: this means we can continue paragraphs (and commands) in new lines
- To break a paragraph, just leave an empty newline in between
- Extra spaces or newlines are ignored by LaTeX and LyX (as said, spacing and formatting is taken care of!)

Document structure

- A LaTeX file (extension .tex) starts with a class declaration (article, book, report...)

  \documentclass{article}

- Preamble follows: a number of commands to load additional packages, etc. Usually, at least these:

  \usepackage[utf8]{inputenc}
  \usepackage{graphicx,dcolumn,longtable,bm,paralist}
  \usepackage{amsmath,amssymb,amsfonts}

- Then, the body of the document itself, is contained within

  \begin{document}
  \end{document}

Making the title

Already inside the document "body":

- Title, author (and date) are declared as follows (within the document body)

```
\title{This is the title}
\author{Your Name}
\date{\today} % \today command inputs date
```

- Then, to tell LaTeX to generate the title, we write

```
\maketitle
```

Sections, subsections, etc

- Sectioning is easy. Just do this:

```
\section{Section title}
\subsection{A subsection}
This is just some paragraph, blablabla
\subsubsection{Example subsubsection}
```

1 Section title

1.1 A subsection

This is just some paragraph, blablabla

1.1.1 Example subsubsection

- The nice thing is that section numbering is automatic: if you now add a new section *above* the previous one and recompile, the numbers will change accordingly. Try it!

Writing maths (I)

- To write maths within a paragraph ("inline equation"), put it inside $ ... $. *Example:*

  ... so this is some text with a formula: $\alpha = \sqrt{5}$...

- To write an independent equation ("display equation"), put it within \begin{equation} ... \end{equation}. *Example:*

```
\begin{equation}
   \alpha = \sqrt{5}
\end{equation}
```

By the way, anything that has this structure (\begin... \end) is called an **environment.** There are many.

Writing maths (II)

- Greek letters: just use their (English) name: \alpha, \beta, \gamma, \delta... Capital letters: \Gamma, \Delta
  $\rightarrow \alpha, \beta, \gamma, \delta, \ldots, \Gamma, \Delta$
- Fractions: \frac{num}{denom} (They look better in Display Equations). Ex. \frac{\phi}{2+\alpha}:

$$\frac{\phi}{2+\alpha}$$

- superscripts and subscripts: 2^4, a^{5+b}, b_i, b_{ini}, c^2_1 $\rightarrow 2^4, a^{5+b}, b_i, b_{ini}, c_1^2$
- Square roots, logs, sin, cos, lims, etc: \sqrt{2a}, \sin 5, \tan 2, \log \gamma, \ln a, \lim_{a \to 0} x
  $\rightarrow \sqrt{2a}, \sin 5, \tan 2, \log \gamma, \ln a, \lim_{a \to 0} x$
- Integrals: \int_{a}^{b} x^2 dx $\rightarrow \int_a^b x^2\,dx$

Writing maths (III)

- Make bold (for vector): \boldsymbol{u} $\rightarrow \boldsymbol{u}$
- Smart matching parentheses, brackets, etc: use \left(and \right); \left[and \right], \left\{ and \right\}
- Matrices and vectors (add \left(and \right) if you want the parentheses)

```
\left( \begin{array}{ccc}
a & b & c \\
d & e & f
\end{array} \right)
```

$$\left(\begin{array}{ccc} a & b & c \\ d & e & f \end{array} \right)$$

Writing maths (IV)

- Dots, hats, bars, and primes: \dot{a}, \ddot{b}, \hat{c}, \bar{d}, \tilde{e}, f\prime $\rightarrow \dot{a}, \ddot{b}, \hat{c}, \bar{d}, \tilde{e}, f'$
- Some useful symbols: \partial, \nabla, \infty, \Rightarrow, \cdot, \times, \leq, \geq, \equiv, \neq, \to, \sum, \prod, \in, \forall, \exists
  $\rightarrow \partial, \nabla, \infty, \Rightarrow, \cdot, \times, \leq, \geq, \equiv, \neq, \rightarrow, \sum, \prod, \in, \forall, \exists$
- Special math fonts: \mathbb{R}, \mathbb{C}, \mathcal{R}, \mathcal{F}, \mathscr{A} $\rightarrow \mathbb{R}, \mathbb{C}, \mathcal{R}, \mathcal{F}, \mathscr{A}$

Labels and References

To refer to a section, equation, image, or table, use labels and references:

- Put \label{labelname} within the environment or under the section you want to reference
- Write \ref{labelname} in the place where you want to have the number written

```
...
    \label{eq:myequation}
\end{equation}
...
As you can see in Eq. \ref{eq:myequation}, blabla
```

If you add more equations before that one, all numbers are automatically changed in next compile.

Bibliography (I)

Bibliography is not easy. It uses the system called "bibtex". You write all your bibliography entries in a separate ".bib" file, and call it at the end of your document:

```
...
\bibliographystyle{plain}
\bibliography{mybibtexfile.bib}
...
\end{document}
```

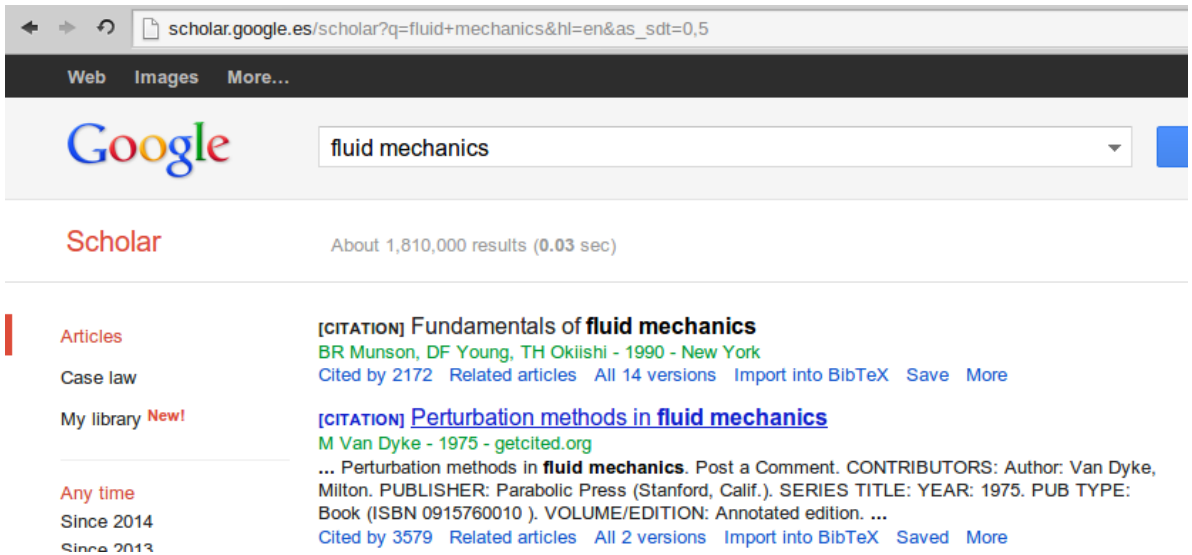
- This will automatically generate the bibliography for only the cited items. To cite an item, use \cite{item_key}

  ...as it can be read in Ref. \cite{vand75}...

Bibliography (II)

How do I prepare the bibtex file?

- The best way is to maintain only one file, and add the references that you have to use progressively.
- Google scholar (other places: scopus, WOK) is a good tool to find articles and books. And it let's you export the citation in bibtex format! Copy and add the citation to your bibtex file.



Bibliography (III)

What does the bibtex entry look like? Something like this:

```
@book{vand75,
title={Perturbation methods in fluid mechanics},
author={Van Dyke, Milton},
volume={28},
year={1975},
publisher={Parabolic Press Stanford}
}
```

- Important here is the first word after "book" or "article": this is the **bibtex key** for that item, which we will use to cite it in our document.

Bibliography (IV)

Additional steps required to make bibtex work: you must run:

bibtex my_document.aux

- (the "aux" file is a temporary file that is created when you first run pdflatex my_document.tex)
- Usually, to make sure latex updates all references after running bibtex we just run the sequence:

  pdflatex bibtex pdflatex pdflatex

- Most editors do this automatically (or can be configured to do it).

Images

To add an image, use this code:

```
\begin{figure}
   \centering
   \includegraphics[width=5cm]{figurefilename}
   \caption{Some description.  \label{fig:labelname}}
\end{figure}
```

- If you have loaded the graphicx package in the preamble, most file formats should work right away.
- Actually, you can insert images outside the **figure** environment
- There are different options (width, height...) for the \includegraphics command.

Tables

To add a table, use this code:

```
\begin{table}
\centering
  \begin{tabular}{| c || c |}
  \hline
  Fruit & Color \\
  \hline
  Banana & yellow \\
  Apple & green \\
  Blabla & blablabla \\
  \hline
  \end{tabular}
  \caption{A normal caption. \label{tablelabel}}
\end{table}
```

Fruit	Color
Banana	yellow
Apple	green
Blabla	blablabla

Table 1: A normal caption.

Creating a Table of Contents, and adding your own commands

- To input a table of contents, write
  \tableofcontents
  where you want it to be displayed.
- To create a command of your own (e.g. to save time writing something common), use \newcommand. *Examples*:
  \newcommand{\apr}{a^\prime}
  \newcommand{\eq}[1]{Equation (\ref{#1})}

(the [1] there means that your new command requires one argument, which is inserted at the position marked #1)

Where to get more information

Useful and reputable places to find more info:

- `http://en.wikibooks.org/wiki/LaTeX` – Nice reference with plenty of examples and corner cases
- `http://tex.stackexchange.com/` – If your question is not answered here, better consider another approach to solve your problem.

Books:

- The Not So Short Introduction to LaTeX2ε
- A Guide To LaTeX
- The LaTeX Companion
- In Spanish: El libro de LaTeX

Learning the basics

Now that you know some LaTeX, you are ready to use LyX

- LyX is very a friendly and robust way to run LaTeX. Of course, it lacks some flexibility of LaTeX itself

I will teach you **directly on the LyX interface**. We will cover:

- Creating and compiling a new document
- Document settings and preamble
- Adding math, images, tables, labels, refs, bibligraphy, cites, table of contents.
- Keyboard shortcuts to math: the most useful LyX feature
- View LaTeX source: the best way to learn LaTeX as you work in LyX
- Export LaTeX source: some times you just need to edit the LaTeX source (to do advanced stuff)

Thank you!

(by the way, this cool presentation
was created using the LaTeX "beamer" package)