

\LaTeX Workshop

Heuse Maxime

Workshop slides with examples and illustrations
LSM Investment Club

October 14, 2025



Overview

1. Introduction
2. Getting started
3. The Basics
4. Good Practices
5. Advanced Topics
6. Recap & conclusion
7. Bonus : CV, Slides, Templates, Useful doc



About Me

Maxime Heuse

-  Master's in Mathematical Engineering
-  Control and Finance Engineer | Quantitative Research Enthusiast
-  130+ LaTeX projects: reports, slides, and thesis templates
-  Main experiences:
 - Head of quantitative analysis department (LSM Investment Club)
 - Data-driven state estimation for nonlinear systems (Master's Thesis)
-  maximeheuse@gmail.com





Examples of projects in L^AT_EX

Black & Schleser PDE

Maxime Hesse

yields the following explicit iteration scheme:

$$v^{n+1}_m = \frac{1}{2}(\alpha v^2 - \beta n)v^m_{m-1} + (1 - \alpha v^2 - \beta) v^m_m + \frac{1}{2}(\alpha v^2 + \beta n)v^m_{m+1}. \quad (4)$$

Using the initial and boundary conditions, v^0_0 , v^0_N , and v^0_m are known for all $n = 0, \dots, N$ and $m = 0, \dots, M$. The algorithm therefore computes the solution at time step $m+1$ directly from step m .

In matrix form, this scheme can be written as

$$v^{n+1} = Av^n + z^n, \quad m = 0, \dots, M-1, \quad (5)$$

where

$$A = \begin{pmatrix} d_1 & u_2 & 0 & \cdots & 0 \\ l_1 & d_2 & u_3 & & \vdots \\ 0 & l_2 & \ddots & \ddots & 0 \\ \vdots & & \ddots & \ddots & u_{N-1} \\ 0 & \cdots & 0 & l_{N-2} & d_{N-1} \end{pmatrix}, \quad z^n = \begin{pmatrix} l_0 v^0_0 \\ \vdots \\ 0 \\ u_N v^0_N \end{pmatrix},$$

with coefficients

$$\begin{aligned} d_n &= 1 - \alpha v^2 - \beta, & n &= 1, \dots, N-1, \\ u_n &= \frac{1}{2}(\alpha(n-1)^2 + \beta(n-1)), & n &= 2, \dots, N, \\ l_n &= \frac{1}{2}(\alpha(n+1)^2 - \beta(n+1)), & n &= 0, \dots, N-2. \end{aligned}$$

A well-known drawback of the explicit scheme is its potential instability if the grid is not chosen carefully. According to [2] (see also [5]), stability is guaranteed provided that

$$0 < \Delta t < \frac{1}{\sigma^2(N-1) + 0.5r} \quad (6)$$

Other stability conditions can be found, for instance, in [7].

Implementing this scheme with the conditions defined in the previous section yields the following numerical results:

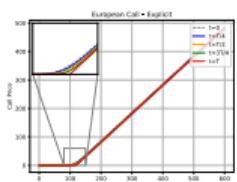


Figure 2: Call option values obtained with the explicit finite-difference scheme.

Model Parameters

Parameter	Value	Unit
I_m	20.25	H
R_s	16.4	Ω
K_m	0.0233	V/(rad/s)
K_t	0.0183	N·m/A
J	9	g·cm ²
b	0.0064	N·m/(rad/s)

Table 4.2: Sys 1 — Parameters of the DC motor model.

State-Space Model

Let the state vector be $x = [\dot{\theta}, \ddot{\theta}]^T$, input vector $u = [T_r, V_r]^T$, and output $y = i$. The continuous-time state-space model is (developed in [franklin]):

$$\begin{bmatrix} \dot{\theta} \\ \ddot{\theta} \end{bmatrix} = \begin{bmatrix} -\frac{J}{R_s} & -\frac{K_m}{R_s} \\ 0 & \frac{1}{J} \end{bmatrix} \begin{bmatrix} \theta \\ \dot{\theta} \end{bmatrix} + \begin{bmatrix} -\frac{1}{R_s} & 0 \\ 0 & \frac{1}{K_m} \end{bmatrix} \begin{bmatrix} T_r \\ V_r \end{bmatrix} \quad (4.1.1)$$

Using the parameters from Table 4.2 and a sampling period $\Delta T = 0.001$ s, the system is discretized as:

$$x_{k+1} = \begin{bmatrix} 0.9951 & 0.2269 \\ -0.0177 & 0.8672 \end{bmatrix} x_k + \begin{bmatrix} -0.4158 & 0.0038 \\ -0.0038 & 0.0301 \end{bmatrix} u_k \quad (4.1.2)$$

$$y_k = \begin{bmatrix} 0 & 1 \end{bmatrix} x_k + v_k \quad (4.1.3)$$

This system is referred to as Sys 1 in the following sections.

4.1.2 Kalman Filter Results

Input Signals. The system is excited using the same input sequence as in [6].



Figure 4.2: Sys 1 — Input signals used for system excitation.

The initial state is set to $x_0 = [0 \ 0]^T$. The model-based Kalman Filter (MBKF), described in Section 2.1, is applied using the matrices in Equations (4.1.2) and (4.1.3). The primary estimation target is the angular velocity $\dot{\theta}$.

Chapter 1

Introduction

1.1 Context

In the world of modern control and estimation, the state-space model is king. It offers a structured way to describe how dynamic systems behave over time. At the heart of this framework sits the Kalman Filter (Kalman Filter (KF)), a mathematical workhorse that has become a cornerstone in engineering and applied sciences. Under the assumptions of linearity and Gaussian noise, it's not just useful—it's optimal.

But... In real-world scenarios, such accurate models are not always available. Building them can be difficult, time-consuming, or simply infeasible.

The gap has spurred a surge of interest in data-driven approaches [11][14][15][16][17], methods that learn system behavior directly from measured data, skipping the need for detailed models. In this thesis, we explore how such data-driven strategies can be incorporated into the Kalman filtering framework. Our goal is to assess how they stack up against classical, model-based techniques.

1.2 State of the Art

1.2.1 Filtering

Introduction

The word “filtering” pops up in many fields. In signal processing, it is about enhancing or removing parts of a signal. In mathematics, it is tied to linear structures. But in the context of control and estimation, our focus here, it means something else entirely: estimating the hidden state of a system based on noisy and partial observations.

This might sound abstract, but it is not. Imagine driving with a GPS. You see a dot on your screen moving smoothly along a map. That dot represents an estimate of your position, derived from noisy GPS signals. How does it know where you are with such precision? Behind the scenes, filters like the Kalman Filter are hard at work.

State-Space Representation

To model physical systems like robots, vehicles, or power grids, we often use the language of state-space models. These models describe how the system evolves over time based

Sec 2 - Getting Started



Create Overleaf Account

Go to the website Overleaf.

The screenshot shows the Overleaf sign-up page. It features a header with the Overleaf logo and a "Create an account" button. Below this are two large circular buttons for "Continue with Google" and "Continue with ORCID". Underneath these are fields for "Email" and "Password", both with "Forgot password?" links. A large green "Create account" button is centered below the password field. To the right of the sign-up form is a preview window showing a LaTeX document with sections like "Computational Techniques in Astronomy" and "Case Study: Image Analysis of Galactic Structures". At the bottom of the sign-up form, there's a link to "Already have an account? Log in" and a note about terms of service.

The screenshot shows the Overleaf dashboard. At the top, there's a search bar with placeholder text "Search all projects...". Below the search bar is a section titled "All projects" with a list of recent activity. Each project entry includes the title, owner (indicated by a small profile icon), last modified date, and a "More" actions menu. The projects listed include "LACTU 2220 - Project", "Resume - BSI", "Resume - LSM", "Pensa - BSI PDF", "Master thesis - Presentation - MH (Copy)", "Newsletter Asut 2025", "LACTU2220-Presentation - August", "Econometrics - Report - Marine Heuzé", "Job Preparation", and "Master thesis - Presentation - MH". The dashboard also features a sidebar with "All projects", "Your projects", "Shared with you", "Archived projects", and "Trashed projects". On the right side, there are links for "Product", "Solutions", "Templates", "Pricing", and a "Contact sales" button.

Blank Project



We can now create our first *Blank Project*.

The screenshot shows the Overleaf web interface. On the left, there's a sidebar with navigation links: 'New project' (highlighted in green), 'Blank project', 'Example project', 'Upload project', 'Import from GitHub', and sections for 'Tutorials', 'Journal articles', 'Books', 'Formal letters', 'Assignments', 'Posters', 'Presentations', 'Reports', 'CVs and résumés', 'Theses', and 'View all'. Below these are icons for user profile and search, and the text 'DIGITAL SCIENCE'. The main area is titled 'All projects' and contains a table with 15 rows. The columns are 'Title', 'Owner', 'Last modified', and 'Actions'. The last row is partially visible. A search bar at the top says 'Search in all projects...'. At the bottom right of the main area, it says 'You're on the free plan' and has an 'Upgrade' button.

Title	Owner	Last modified	Actions
LACTU 2220 - Project	You	6 days ago by You	[Actions]
Resume - BEI	You	6 days ago by You	[Actions]
Resume - L3MI - Joke	You	15 days ago by You	[Actions]
Perso - ES POE	You	25 days ago by You	[Actions]
Master thesis - Presentation - MH (Copy)	You	a month ago by leslenkaanto	[Actions]
Newsletter Asut 2025	You	a month ago by You	[Actions]
LACTU2220-Presentation - August	You	a month ago by audren.balon	[Actions]
Econometrie - Report - Maxime Hesse	You	2 months ago by You	[Actions]
Report Final - Actions LSMIC	You	2 months ago by You	[Actions]
Job Preparation	You	3 months ago by You	[Actions]
Master thesis - Presentation - MH	You	3 months ago by You	[Actions]
Master thesis - Dissertation - T30C	You	4 months ago by You	[Actions]

Blank Project



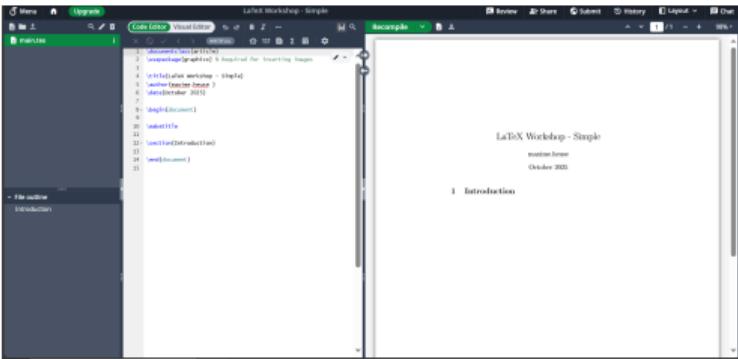
This is what the project looks like at first:

The screenshot shows a LaTeX editor interface with two main panes. The left pane is a code editor titled "LaTeX Workshop - Simple" containing the following LaTeX code:

```
1 \documentclass{article}
2 \usepackage{graphicx} % Required for inserting images
3 
4 \title{LaTeX workshop - Simple}
5 \author{matthias lehne}
6 \date{\today}
7 
8 \begin{document}
9 
10 \maketitle
11 
12 \section{Introduction}
13 
14 \end{document}
```

The right pane is a preview window titled "LaTeX Workshop - Simple" showing the rendered document. It displays the title "LaTeX workshop - Simple", the author "matthias lehne", the date "October 2015", and the section "1. Introduction".

Overleaf Structure



Try to point out the following elements:

- New file
- New folder
- Recompile
- Download
- Share
- History
- Visual editor
- File outline



Packages

```
1 % EPL master thesis covers template
2 \documentclass[EPL-master-thesis-covers-EN]
3 % Text and Formatting
4 \usepackage{blindtext}
5 \usepackage{titlesec}
6 \usepackage{xcolor}
7 \usepackage[normalem]{ulem}
8 \usepackage{verbatim}
9
10 % Layout and Structure
11 \usepackage{geometry}
12 \geometry{margin=1in}
13 \usepackage{multicol}
14 \usepackage{tocloft}
15
16 % Math
17 \usepackage{amsmath}
18 \newcommand{\equation}{\begin{equation}\begin{aligned}}
19 \newcommand{\ansymbol}{\end{aligned}\end{equation}}
20
21 % Figures and Graphics
22 \usepackage{graphicx}
23 \usepackage{subcaption}
24 \usepackage{float}
25
26 % Algorithms
27 \usepackage{algorithm}
28 \usepackage{algpseudocode}
29 \usepackage[linesnumbered,ruled,vlined]{algorithm2e}
30
31 % References and Links
32 \usepackage[colorlinks=true,
33 linkcolor=blue,linktocpage=true,
34 citecolor=blue,linkcolor=white,
35 urlcolor=blue]{hyperref}
36 \usepackage[backend=biber,style=numeric]{biblatex}
```

Packages are like books in a library. You can use what's inside only if you read it. Overleaf can use functions/environments of packages only if you give access to them.

When you are reading documentation on LaTeX or reading forum discussions, always pay attention to which packages are used:

Mathematical expressions
Subscripts and superscripts
Brackets and Parentheses
Matrices
Fractions and Binomials
Aligning equations
Operators
Spacing in math mode
Integrals, sums and limits
Display style in math mode
List of Greek letters and math symbols
Mathematical fonts
Using the Symbol Palette in Overleaf

Figures and tables

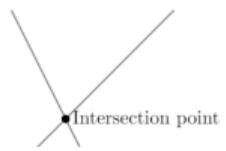
Tables
Positioning Images and Tables
Lists of Tables and Figures
Drawing Diagrams Directly in LaTeX
TikZ package

Firstly, load the `tikz` package by including the line `\usepackage{tikz}` in the preamble of your graphic using the `tikzpicture` environment.

```
\documentclass{article}
\usepackage{tikz}
\begin{document}
\begin{tikzpicture}
\draw[gray, thick] (-2,-4) -- (2,-4);
\draw[gray, thick] (-1,-1) -- (2,2);
\filldraw[black] (0,0) circle (2pt) node[anchor=west]{Intersection point};
\end{tikzpicture}
\end{document}
```

Open this example in Overleaf

This example produces the following output:



Sec 3 - The Basics



Text formatting - bold

Result:

Bold text

\textbf{L^AT_EX} code:

```
\textbf{Bold} text
```

Required package: None



Text formatting - italic

Result:

Italic text

\textit{`Latex` code:}

```
\textit{Italic} text
```

Required package: None



Text formatting - underline

Result:

Underlined text

\ATEXcode:

\underline{Underlined} text

Required package: None



Text formatting - highlight

Result:

Highlighted text

\ $\text{\texttt{ATEX}}$ code:

```
\hl{Highlighted} text
```

Required package: soul



Text formatting - color

Result:

Colored text

\textcolor{red}{Colored} text

```
\textcolor{red}{Colored} text
```

Required package: color



Text formatting - footnotes

\LaTeX code:

```
Automatically computed footnote\footnote{Here!}  
Manually computed footnote! \footnote[36]{There}
```

Result:

Automatically computed footnote¹
Manually computed footnote! ³⁶

¹Here!

³⁶There



Text formatting - example

LATEXcode:

```
\textbf{Lorem ipsum} dolor sit amet, \textit{consectetur adipiscing elit},  
\textcolor{blue}{sed do eiusmod} \hl{tempor incididunt} ut  
labore et dolore magna aliqua\footnote{Source: https://www.lipsum.com/}.
```

Result:

Lorem ipsum dolor sit amet, *consectetur adipiscing elit*, **sed do eiusmod** **tempor**
incididunt ut labore et dolore magna aliqua².

²Source: <https://www.lipsum.com/>



Text Structure

The first element one sees in a report is the title page.

LEPL1234 – L^AT_EXWORKSHOP

Project 24-25

Student 1 Noma

Student 2 Noma

August 2025



Text Structure - Title Page

\TeXcode:

```
\title{Title}
\author{Student Name}
\date{October 2025}

\begin{document}

\maketitle

Some text

\end{document}
```

Result:

Title

Student Name

October 2025

Some text



Text Structure - Sections

Contents

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		30

The structure of reports in LaTeX is easily done via **Sections** and **Subsections**.



Text Structure - Sections

Result:

\LaTeXcode:

```
\section{Main Section}  
\subsection{Subsection}  
\subsubsection{Subsubsection}
```

1 Main Section

1.1 Subsection

1.1.1 Sub sub section



Result:

Main Section

Subsection

Sub sub section

L^AT_EX code:

```
\section*{Main Section}
\subsection*{Subsection}
\subsubsection*{Subsubsection}
```



Text Structure - Lists

Sometimes, one would like to list parameters as follows:

- S = price of the underlying asset,
- σ = constant volatility of the underlying asset,
- r = risk-free interest rate.



Text Structure - List itemize

\LaTeX code:

```
\begin{itemize}
    \item First element
    \item Second element
    \item Third element
\end{itemize}
```

Result:

- First element
- Second element
- Third element



Text Structure - List enumerate

Result:

\LaTeX code:

```
\begin{enumerate}
    \item First element
    \item Second element
    \item Third element
\end{enumerate}
```

1. First element
2. Second element
3. Third element



Math in \LaTeX

There are many different ways to include mathematical formulas in \LaTeX .
We can either write **inline math**, where the math is directly written within the text.

Example: The stock is modeled by a GBM $\frac{dS_t}{S_t} = \mu dt + \sigma dW_t$. This is a very common choice.

Or it can be written in **display mode**.

Example: The stock is modeled by a GBM.

$$\frac{dS_t}{S_t} = \mu dt + \sigma dW_t \tag{1}$$

This is a very common choice.



Usually, **display mode** is always preferred as it provides cleaner writing.

In matrix form, this scheme can be written as

$$v^{m+1} = Av^m + z^m, \quad m = 0, \dots, M-1, \quad (5)$$

where

$$A = \begin{pmatrix} d_1 & u_2 & 0 & \cdots & 0 \\ l_1 & d_2 & u_3 & & \vdots \\ 0 & \ddots & \ddots & \ddots & 0 \\ \vdots & & \ddots & \ddots & u_{N-1} \\ 0 & \cdots & 0 & l_{N-2} & d_{N-1} \end{pmatrix}, \quad z^m = \begin{pmatrix} l_0 v_0^m \\ 0 \\ \vdots \\ 0 \\ u_N v_N^m \end{pmatrix}.$$

with coefficients

$$\begin{aligned} d_n &= 1 - \alpha n^2 - \beta, & n &= 1, \dots, N-1, \\ u_n &= \frac{1}{2}(\alpha(n-1)^2 + \beta(n-1)), & n &= 2, \dots, N, \\ l_n &= \frac{1}{2}(\alpha(n+1)^2 - \beta(n+1)), & n &= 0, \dots, N-2. \end{aligned}$$

A well-known drawback of the explicit scheme is its potential instability if the grid is not chosen carefully. According to [2] (see also [5]), stability is guaranteed provided that

$$0 < \Delta t < \frac{1}{\sigma^2(N-1) + 0.5r}. \quad (6)$$



Math in L^AT_EX- Inline

Result:

Some useful formulas in **inline mode**:

L^AT_EX code:

```
\begin{itemize}
    \item $\frac{\text{Num}}{\text{Denom}}$ 
    \item $e^x$ 
    \item $\frac{\partial f}{\partial x}$ 
    \item $A \rightarrow B$ 
    \item $\neg A \Rightarrow B$ 
    \item $0 \geq -1$ and $0 \leq 1$ 
\end{itemize}
```

- $\frac{\text{Num}}{\text{Denom}}$
- e^x
- $\frac{\partial f}{\partial x}$
- $A \rightarrow B$
- $\neg A \Rightarrow B$
- $0 \geq -1$ and $0 \leq 1$



Math in L^AT_EX- Display

First way to do **display mode**:

L^AT_EXcode:

Numbered equation:

```
\begin{equation}
    x^{4-t} = 3
\end{equation}
```

Unnumbered equation:

```
\begin{equation*}
    x^{4-t} = 2
\end{equation*}
```

Result:

Numbered equation :

$$x^{4-t} = 3 \quad (1)$$

Unnumbered equation :

$$x^{4-t} = 2$$

Required package: amsmath



Math in L^AT_EX- Display

Second way to use **display mode** (multi-line equations):

L^AT_EXcode:

Aligned numbered equations :

```
\begin{align}
f(x) &= (x - a)^2 \\
&= x^2 - 2ax + a^2
\end{align}
```

Aligned unnumbered equations :

```
\begin{align*}
f(x) &= (x - a)^2 \\
&= x^2 - 2ax + a^2
\end{align*}
```

Result:

Aligned numbered equations :

$$\begin{aligned} f(x) &= (x - a)^2 \\ &= x^2 - 2ax + a^2 \end{aligned} \quad (1) \quad (2)$$

Aligned unnumbered equations :

$$\begin{aligned} f(x) &= (x - a)^2 \\ &= x^2 - 2ax + a^2 \end{aligned}$$

Required package: amsmath



Math in L^AT_EX- Special Characters

Some special characters:

L^AT_EXcode:

\&, \\
\%

Result:

&
%



Illustrations / Visualizations

In reports, you can present data in two different ways: using **tables** and **figures**.

Maturity (Years)	Coupon Rate (%)	Credit Spread (%)	Nominal (€)	Dirty Price (€)	Market Value (€)
4	2.00	0.50	400 000 000	92.14	368 561 160.59
7	4.50	2.25	700 000 000	89.85	628 924 015.69
10	3.50	1.25	900 000 000	85.26	767 312 507.31

Table 4: Summary of dirty prices and market values for each bond in the portfolio.

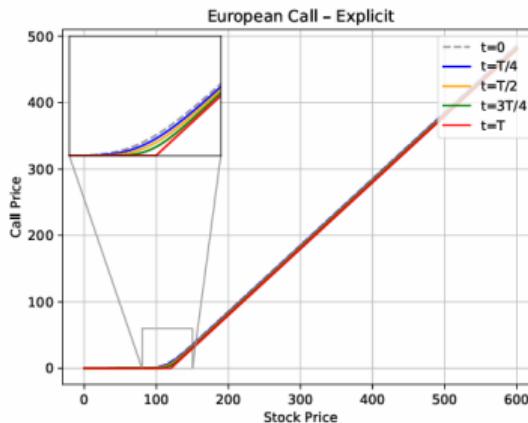


Figure 2: Call option values obtained with the explicit finite-difference scheme.



Illustrations / Visualizations - Tables

First, let us build a table with 4 columns and 3 rows.

\LaTeXcode:

```
\begin{table}[H]
    \centering
    \begin{tabular}{|c|c|c|c|}
        \hline
        Row 1 & a & b & c \\ 
        Row 2 & e & f & g \\
        Row 3 & i & j & k \\
        \hline
    \end{tabular}
    \caption{Caption}
    \label{tab:example}
\end{table}
```

Result:

Row 1	a	b	c
Row 2	e	f	g
Row 3	i	j	k

Table 1: Caption

Required package: float

Illustrations / Visualizations - Figures



L^AT_EX code:

```
\begin{figure}[H]
    \centering
    \includegraphics[width=0.5\linewidth]
    {Graphics/Explicit.pdf}
    \caption{Illustration}
    \label{fig:Illu}
\end{figure}
```

Result:

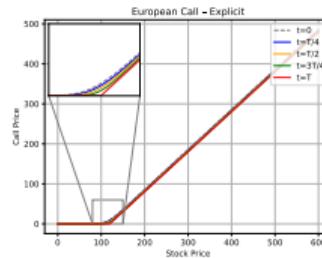


Figure: Illustration

Required packages: float, graphicx



Illustrations / Visualizations

At first, it might seem like complicated code. Good news: Overleaf has *auto-completion*! You just need to type the first few letters, and it will suggest how to complete the code for you.³

A screenshot of the Overleaf LaTeX editor interface. The cursor is at line 12, position 1, where the text '\begin{fi}' is typed. A dropdown menu shows suggestions: '\begin{figure}' and '\begin{fi} ...'. The menu is labeled 'env' on the right.

```
11  
12 \begin{fi}  
13 \begin{figure} ...  
14 \begin{fi} ...  
15
```

Figure: Overleaf suggests starting a "figure"

A screenshot of the Overleaf LaTeX editor interface. The cursor is at line 14, position 1, where the text '\includegraphics[width=0.5\linewidth]' is typed. A dropdown menu shows suggestions: 'Graphics/Explicit.pdf'. The menu is labeled 'file' on the right.

```
11  
12 \begin{figure}  
13   \centering  
14   \includegraphics[width=0.5\linewidth]  
15   \caption{Caption}  
16   \label{fig:placeholder}  
17 \end{figure}  
18
```

Figure: Overleaf suggests files for the figure

³This also works for equations, alignments, tables, etc.

Sec 4 - Good Practices



A Good Structure

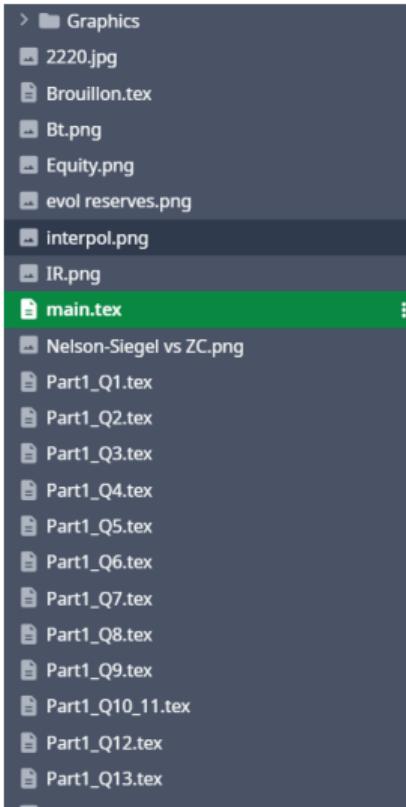
Why is it important?

- Easier debugging
- Quick access to the parts you need to modify
- Easy to share



A Good Structure

Bad example — No words needed.





A Good Structure

Recommended structure:

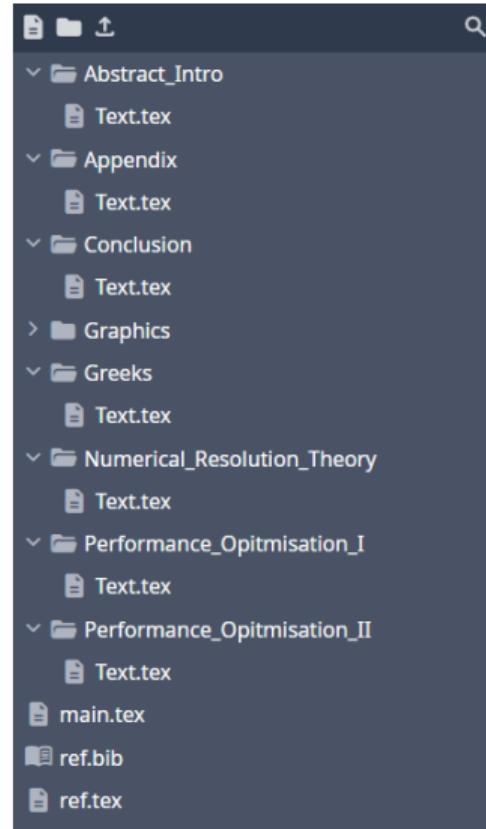
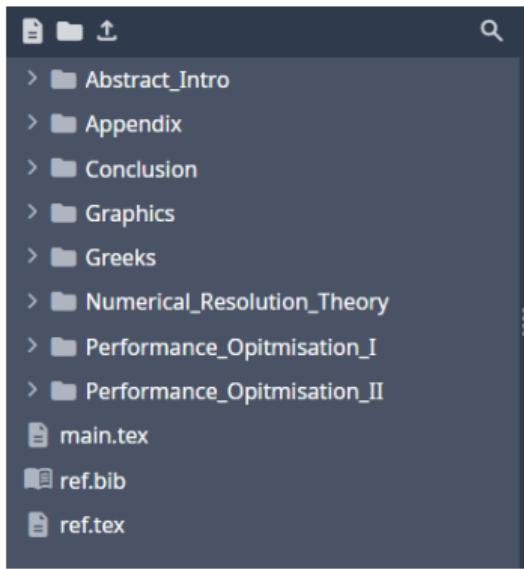
- One folder per section ("Sec 1", "Sec 2", ...)
- A folder named "*Graphics*"
- A folder named "*Appendices*"
- A main file "*main.tex*"
- Files required for automated bibliography (see following slides)



A Good Structure

Example:

1) The structure of the project





A Good Structure

With the structure defined above, my "*main.tex*" simply looks like this:

```
54 \date{September 2025}
55
56 \begin{document}
57
58 % Title Page
59 \begin{sffamily}
60 \maketitle
61 \thispagestyle{empty}
62
63 \%clearpage
64 \end{sffamily}
65
66 % Table of Contents
67 \tableofcontents
68 \newpage
69
70 \include{Abstract_Intro/Text}
71 \include{Numerical_Resolution_Theory/Text}
72 \include{Performance_Optimisation_I/Text}
73 \%include{Performance_Optimisation_II/Text}
74 \include{Greeks/Text}
75 \include{Conclusion/Text}
76
77 \newpage
78 \printbibliography
79
80
81 \end{document}
```



Formats

When using figures, import your images in .pdf format!



Compilation

Errors on Overleaf are not always easy to understand.

The following code:

\ATExcode:

```
\textbf{text}
```

produces the following:

The screenshot shows the Overleaf interface with three error messages displayed:

- No PDF**: This compile didn't produce a PDF. This can happen if:
 - There is an unrecoverable LaTeX error. If there are LaTeX errors shown below or in the raw logs, please try to fix them and compile again.
 - The document environment contains no content. If it's empty, please add some content and compile again.
 - This project contains a file called output.pdf. If that file exists, please rename it and compile again.
- Runaway argument.**: You have 1 free suggestion left.
 - (Next) bad \end{document}
 - | File ended while scanning use of \textbf{.
 - | circled text
 - | \par
 - | \end{main}.I suspect you have forgotten a ")", causing me to read past where you wanted me to stop. (See the [TeX FAQ](#) for more information). But I'll let the user do the饬ing.
[Expand](#)
- Emergency stop.**: You have 1 free suggestion left.
 - (Next) bad \end{document}
 - | File ended while scanning use of \textbf{.
 - | circled text
 - | \par
 - | \end{main}.I suspect you have forgotten a ")", causing me to read past where you wanted me to stop. (See the [TeX FAQ](#) for more information). But I'll let the user do the饬ing.
[Expand](#)

just because a “}” is missing.



Compilation

A good practice to avoid losing time debugging your report is to compile as often as possible. You can recompile your project using the green “Recompile” button or with Ctrl + S.

If you encounter an error, remember that you still have access to your compilation history!

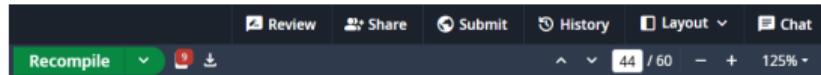


Figure: Recompile button and history



Comments

\TeXcode:

```
% Illustration of comments
\begin{equation}
    2x = 3x' - 2 \% ODE
\end{equation}
\begin{equation}
    2x = 3x' - 2 EDO
\end{equation}
```

Result:

$$2x = 3x' - 2 \tag{1}$$

$$2x = 3x' - 2 EDO \tag{2}$$



Stack Overflow and Documentation

If you want to try something new in \LaTeX , you will probably search online for “How to ... in \LaTeX .” I recommend looking at solutions posted on Stack Overflow, TeX Stack Exchange, and the official Overleaf documentation.

For example, let’s assume I want to insert a GIF in my report⁴.

The screenshot shows a search results page for "how to insert gif in latex" on the TeX - LaTeX Stack Exchange site. The results include:

- How to add a gif file to my LaTeX file?** (23 déc. 2010) Another method is to use `animate` package. You have to convert the animated gif to separate images first, using `ImageMagick`. 4 réponses
- Getting GIF and/or moving images into a LaTeX ...** 4 réponses 23 avr. 2015
- Insert GIF in LaTeX - TeX** 1 réponse 21 févr. 2019

Below these, there's a link to "Autres résultats sur tex.stackexchange.com".

Is it possible to insert a gif in latex (Overleaf)? (Stack Overflow, 1 réponse il y a 4 ans) I'm writing a latex file on Overleaf and I would `insert a gif image`. Is it possible? Because I didn't find any solutions. 1 réponse Meilleure réponse: I had the same problem and I solved it by converting the gif to a set of p...

How to add a gifanimation onto Beamer (post Adobe ... 1 réponse 9 août 2012

Is it possible to embed animated GIFs in PDFs ... 8 réponses 25 janv. 2012

Autres résultats sur stackoverflow.com

⁴Yes, it is possible — but use it only if strictly necessary for illustration purposes.

Sec 5 - Advanced Topics



References

In \LaTeX , you can create references to previous figures, equations, tables, or sections of your report.

$$\frac{\partial V}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS \frac{\partial V}{\partial S} - rV = 0, \quad (1)$$

where

- S = price of the underlying asset,
- σ = constant volatility of the underlying asset,
- r = risk-free interest rate.

Two additional parameters of particular importance are:

- K = strike price of the option,
- T = maturity of the contract.

In this report, we focus primarily on the valuation of European call options. Following [2], equation (1) can be written for a call as

$$\frac{\partial V}{\partial t}(S, t) - \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2}(S, t) - rS \frac{\partial V}{\partial S}(S, t) + rV(S, t) = 0. \quad (2)$$



References

In your figures, equations, sections, etc., include a descriptive label.

\texttt{LATEX} code:

```
\section{Section 1} \label{sec:first_section}  
...  
As described in Section \ref{sec:first_section}
```

Result:

1 Section 1

...

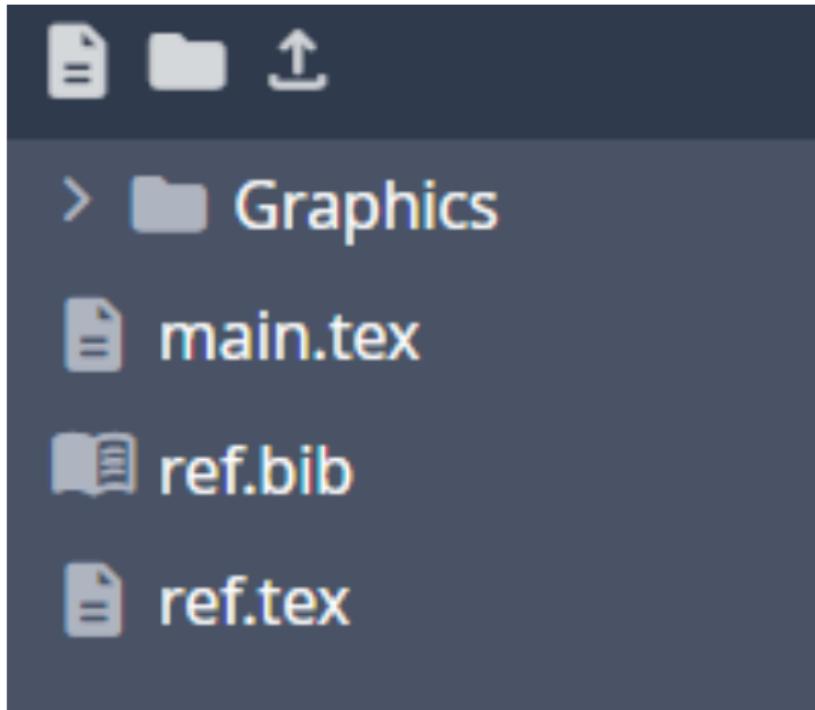
As described in section 1

Erratum : you also need package 'hyperref' !



Automated Bibliography

It is important to cite your sources — and it's very easy to do in \LaTeX .
First, create the following files next to your "*main.tex*":



Automated Bibliography



Your file "*ref.tex*" should look like this:

\LaTeX code:

```
\bibliographystyle{halpha}
\bibliography{ref}
\nocite{*}

\hspace{3cm}
```

And "*ref.bib*" contains your sources.
Here is an example:

```
1 @article{dura2010numerical,
2   title={Numerical approximation of Black-Scholes equat...,},
3   author={Dura, Gina and Mosneagu, Ana-Maria},
4   journal={Annals of the Alexandru Ioan Cuza University-},
5   Mathematics},
6   volume={56},
7   number={1},
8   pages={39--64},
9   year={2010}
 }
```

Figure: Example of a bibliographic source

Automated Bibliography



You can cite any source using the following syntax (see lines 3, 4, 13, and 14).

```
1 \documentclass[article]
2
3 \usepackage[backend=biber,style=numeric,citestyle=numeric]{biblatex}
4 \addbibresource{ref.bib}
5 \title{Title}
6 \author{Student Name}
7 \date{October 2025}
8
9 \begin{document}
10
11 \maketitle
12
13 According to this paper : \cite{dura2010numerical}
14 \printbibliography
15
16 \end{document}
```

According to this paper : [1]

References

- [1] Gina Dura and Ana-Maria Mosneagu. "Numerical approximation of Black-Scholes equation". In: *Annals of the Alexandru Ioan Cuza University-Mathematics* 56.1 (2010), pp. 39–64.

Erratum : you also need to add package 'hyperref' !



Matrices and Vectors

In \LaTeX , both matrices and vectors are written in a similar way.

\LaTeX code:

```
\begin{align}
    A &= \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \\
    B &= \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}
\end{align}
```

Result:

$$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

$$B = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

Required package: amsmath

Additional note : Pay attention that indices of variables (for example 11 in a_{11}) are done via the special character underscore " _ ".



Algorithms

\TeXcode :

```
\begin{algorithm}
\caption{Algo 1}
\begin{algorithmic}
\State $i$ \gets 10
\If{$i \geq 5$}
    \State $i$ \gets $i - 1$
\Else
    \If{$i \leq 3$}
        \State $i$ \gets $i + 2$
    \EndIf
\EndIf
\end{algorithmic}
\end{algorithm}
```

Result :

Algorithm 1 Algo 1

```
i ← 10
if i ≥ 5 then
    i ← i - 1
else
    if i ≤ 3 then
        i ← i + 2
    end if
end if
```

Required packages :
algorithm, algpseudocode



Code - Easy

\ATEXcode :

```
\begin{lstlisting}
import random

def PrintHelloWorld():
    print("Hello, World!")

def AddTwoNumbers(a, b):
    return a + b
\end{lstlisting}
```

Result :

```
import random

def PrintHelloWorld():
    print("Hello , World!")

def AddTwoNumbers(a , b):
    return a + b
```

Required package : listings



Code - Advanced

Before starting your document, add :

\TeXcode (pt I)

```
\definecolor{dkgreen}{rgb}{0,0.6,0}
\definecolor{gray}{rgb}{0.5,0.5,0.5}
\definecolor{mauve}{rgb}{0.58,0,0.82}
\lstset{frame=tb,
language=python,
showstringspaces=false,
columns=flexible,
basicstyle={\small\ttfamily},
numbers=none,
numberstyle=\tiny\color{gray},
keywordstyle=\color{blue},
commentstyle=\color{dkgreen},
...
}
```

\TeXcode (pt II)

```
...
stringstyle=\color{mauve},
breaklines=true,
breakatwhitespace=true,
tabsize=3,
morekeywords={while, true},
numbers=left,
numberstyle=\tiny\color{gray},
stepnumber=1,
}
```

Code - Advanced



It seems complicated, but you get much nicer code.

```
import random

def PrintHelloWorld():
    print("Hello , World!")

def AddTwoNumbers(a , b):
    return a + b
```

Figure: Before

```
1 import random
2
3 def PrintHelloWorld():
4     print("Hello, World!")
5
6 def AddTwoNumbers(a, b):
7     return a + b
```

Figure: After

Sec 6 - Recap



Create a New Document

→ Blank Project



A Digital Science Solution

New project

Blank project

Example project

Upload project

Import from GitHub

Templates

Journal articles



Structure

Recommended structure:

- One folder per section ("Sec 1", "Sec 2", ...)
- A folder named "*Graphics*"
- A folder named "*Appendices*"
- A main file "*main.tex*"
- Files required for automated bibliography (see following slides)



Writing, References, and Sourcing

- Text formatting — basic commands
- Mathematics in \LaTeX
- Illustrations / Visualizations (tables, figures)
- Using references
- Citing your sources

Sec 7 - Bonus



Firstname Lastname

firstname.lastname@email.com | +00 000 00 00 00 | LinkedIn: username | GitHub: username

ABOUT ME

Motivated and analytical professional with a strong background in quantitative analysis and mathematical modeling. Passionate about applying data-driven methods to solve complex problems in finance, engineering, and technology. Adaptable, detail-oriented, and committed to continuous learning.

EDUCATION

University of Somewhere - *Master's Degree in Applied Mathematics and Engineering*

Sept 2023 – June 2025

City, Country

Relevant Courses: Optimization, Probability and Statistics, Financial Engineering, Machine Learning, Control Theory

University of Anywhere - *Bachelor's Degree in Engineering Science*

Sept 2020 – June 2023

City, Country

Relevant Courses: Linear Algebra, Numerical Methods, Data Analysis, Programming Fundamentals

EXPERIENCE

Quantitative Analyst Intern

April 2024 – Sept 2024

ABC Financial Group

- Assisted in developing pricing models for derivatives and risk metrics under stochastic volatility.
- Supported asset allocation and backtesting strategies using Python and R.

Teaching Assistant - Probability and Statistics

Sept 2023 – June 2024

University of Somewhere

- Guided undergraduate students through lab sessions and assignments.
- Created Python notebooks for interactive demonstrations of stochastic processes.

Junior Data Analyst

June 2021 – Aug 2022

XYZ Consulting

- Collected and analyzed financial data for market reports.
- Automated reporting workflows, reducing manual processing time by 40%.

PROJECTS

Interest Rate Modeling and Option Pricing

University Project

- Implemented Monte Carlo simulations for pricing interest rate derivatives under the Hull-White model.
- Developed scripts to compare analytical vs. numerical methods for option valuation.

Portfolio Optimization Dashboard

Personal Project

- Designed a web-based dashboard using Python, Dash, and Plotly for visualizing efficient frontiers.
- Integrated live financial data via APIs (Yahoo Finance, AlphaVantage).

Data-Driven Kalman Filter Implementation

Research Project

- Built a data-driven filtering approach for nonlinear systems using behavioral theory concepts.
- Compared results to classical Kalman Filter and Extended Kalman Filter performance.

TECHNICAL SKILLS AND LANGUAGES



Blocks of Highlighted Text

In this slide, some important text will be **highlighted** because it's important. Please, don't abuse it.

Block

Sample text

Alertblock

Sample text in red box

Examples

Sample text in green box. The title of the block is "Examples".

Multiple Columns

Heading

1. Statement
2. Explanation
3. Example

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer lectus nisl, ultricies in feugiat rutrum, porttitor sit amet augue. Aliquam ut tortor mauris. Sed volutpat ante purus, quis accumsan dolor.

Basic Report Template



1 First section

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

1.1 First Subsection

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

An image

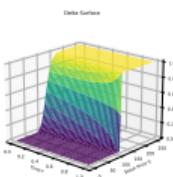


Figure 1: Caption

with some math

$$\frac{dS_t}{S_t} = \mu dt + \sigma dW_t \quad (1.1)$$

and some data

Maturity (Years)	Coupon Rate (%)	Credit Spread (%)	Nominal (€)	Dirty Price (€)	Market Value (€)
4	2.00	0.50	400 000 000	91.84	367 350 618.15
7	4.50	2.25	700 000 000	88.80	621 574 679.13
10	3.50	1.25	900 000 000	84.23	758 073 263.91

Table 1: Summary of dirty prices and market values for each bond in the portfolio.



Advanced Report Template

Project ABC

Student name

3 Third section

3.1 How to do references and citations

As seen in (1.1)

As we can see on 1

As the table 1 shows

According to paper [1] and [2]

3.2 More complicated maths

In matrix form, this scheme can be written as

$$v^{m+1} = Av^m + z^m, \quad m = 0, \dots, M-1, \quad (3.1)$$

where

$$A = \begin{pmatrix} d_1 & u_2 & 0 & \cdots & 0 \\ l_1 & d_2 & u_3 & & \vdots \\ 0 & \ddots & \ddots & \ddots & 0 \\ \vdots & & \ddots & \ddots & u_{N-1} \\ 0 & \cdots & 0 & l_{N-2} & d_{N-1} \end{pmatrix}, \quad z^m = \begin{pmatrix} l_0 v_0^m \\ 0 \\ \vdots \\ 0 \\ u_N v_N^m \end{pmatrix}.$$

with coefficients

$$\begin{aligned} d_n &= 1 - \alpha n^2 - \beta, & n &= 1, \dots, N-1, \\ u_n &= \frac{1}{2}(\alpha(n-1)^2 + \beta(n-1)), & n &= 2, \dots, N, \\ l_n &= \frac{1}{2}(\alpha(n+1)^2 - \beta(n+1)), & n &= 0, \dots, N-2. \end{aligned}$$

Useful Documents



LAT_EX Mathematical Symbols

The more unusual symbols are not defined in base L^AT_EX (NFSS) and require \usepackage{amssymb}

1 Greek and Hebrew letters

α	$\backslash\alpha$	κ	$\backslash\kappaappa$	ψ	$\backslash\psi$	\digamma	$\backslash\digamma$	Δ	$\backslash\Delta$	Θ	$\backslash\Theta$
β	$\backslash\beta$	λ	$\backslash\lambda$	ρ	$\backslash\rho$	ϖ	$\backslash\varpi$	Γ	$\backslash\Gamma$	Υ	$\backslash\Upsilon$
χ	$\backslash\chi$	μ	$\backslash\mu$	σ	$\backslash\sigma$	\varkappa	$\backslash\varkappa$	Λ	$\backslash\Lambda$	Ξ	$\backslash\Xi$
δ	$\backslash\delta$	ν	$\backslash\nu$	τ	$\backslash\tau$	φ	$\backslash\varphi$	Ω	$\backslash\Omega$		
ϵ	$\backslash\epsilon$	\circ	$\backslash\circ$	θ	$\backslash\theta$	ϖ	$\backslash\varpi$	Φ	$\backslash\Phi$	\aleph	$\backslash\aleph$
η	$\backslash\eta$	ω	$\backslash\omega$	υ	$\backslash\upsilon$	ϱ	$\backslash\varrho$	Π	$\backslash\Pi$	\beth	$\backslash\beth$
γ	$\backslash\gamma$	ϕ	$\backslash\phi$	ξ	$\backslash\xi$	ς	$\backslash\varsigma$	Ψ	$\backslash\Psi$	\daleth	$\backslash\daleth$
ι	$\backslash\iota$	π	$\backslash\pi$	ζ	$\backslash\zeta$	ϑ	$\backslash\vartheta$	Σ	$\backslash\Sigma$	\gimel	$\backslash\gimel$

2 L^AT_EX math constructs

$\frac{abc}{def}$	$\frac{abc}{xyz}$	\overline{abc}	$\overline{overline{abc}}$	\overrightarrow{abc}
f'	f'	\underline{abc}	$\underline{overline{abc}}$	\overleftarrow{abc}
\sqrt{abc}	$\sqrt{sqrt{abc}}$	\widehat{abc}	$\widehat{overbrace{abc}}$	$\widehat{underbrace{abc}}$
$\sqrt[3]{abc}$	$\sqrt[3]{sqrt[3]{abc}}$	\widetilde{abc}	$\widetilde{overbrace{abc}}$	$\widetilde{underbrace{abc}}$

3 Delimiters

```

| | { \{   | \lfloor   / / \Uparrow   \llcorner
| \vert } \} | \rfloor \backslash \uparrow \uparrow \lrcorner
| \| \langle \langle \lrcorner \lceil [ \Downarrow \Downarrow \ulcorner
| \Vert \rangle \rangle \lceil \rciel \rceil ] \downarrow \downarrow \urcorner

```

Use the pair `\left{s1` and `\right{s2}` to match height of delimiters s_1 and s_2 to the height of their contents, e.g.,

4 Variable-sized symbols (displayed formulae show larger version)

\sum	\prod	\int	\oint	\sqcup	\sqcap	\biguplus	\bigoplus	\bigvee	\bigveevee
\prod	\sum	\oint	\int	\sqcap	\sqcup	\bigcap	\bigotimes	\bigwedge	\bigwedgewedge
\coprod	\coprod	$\int\!\!\!\int$	$\oint\!\!\!\oint$	$\sqcup\!\!\!\sqcup$	$\sqcap\!\!\!\sqcap$	$\biguplus\!\!\!\biguplus$	$\bigoplus\!\!\!\bigoplus$	$\bigvee\!\!\!\bigvee$	$\bigvee\!\!\!\bigvee$

5 Standard Function Names

Function names should appear in Roman, not Italic, e.g.

Correct: $\sqrt{\tan(at-n\pi)} \rightarrow \tan(at - n\pi)$

Incorrect: $\tan(at - n\pi) \rightarrow \tan(at - n\pi)$



On GitHub

- Available in .zip format
- Explanation on how to download and open the files
- Available here: [GitHub Repository](#)

Thank you