

LaTeX Basics: A Practical Guide

September 10, 2025

Contents

1 Introduction

LaTeX is a typesetting system designed for high-quality technical documents. This guide covers the core syntax and conventions used in this project so you can write and compile chapters efficiently.

2 Install and Compile

Install a TeX distribution (TeX Live/MacTeX/MiKTeX). Prefer XeLaTeX for Unicode support.

- English: `xelatex your_file.tex`
- Chinese: use `ctexart` class with `xelatex` or `lualatex`

2.1 Engines

- **pdfLaTeX**: classic and stable; limited for CJK; avoid for CN.
- **XeLaTeX (recommended)**: Unicode and system fonts; great for mixed languages.
- **LuaLaTeX**: modern and extensible; similar CN friendliness.

2.2 Compilation Tips

- Compile twice for cross-references to resolve.
- Use UTF-8 source encoding.
- Install missing packages via TeX Live Manager/MiKTeX Console.

3 Document Skeleton

Minimal English document preamble used in this repository:

Listing 1: Minimal preamble (EN)

```
1 \documentclass[11pt]{article}
2 \usepackage[margin=1in]{geometry}
3 \usepackage{amsmath,amssymb,amsthm,bm}
4 \usepackage{hyperref,graphicx,caption,listings,xcolor,float,placeins}
5 \graphicspath{{figures/}} % images under figures/
```

For Chinese documents use `ctexart`:

Listing 2: Minimal preamble (CN)

```
1 \documentclass[UTF8,zihao=-4]{ctexart}
2 \usepackage[a4paper,margin=2.5cm]{geometry}
3 \usepackage{amsmath,amssymb,amsthm,bm}
4 \usepackage{hyperref,graphicx,caption,listings,xcolor,float,placeins}
5 \graphicspath{{figures/}}
```

4 Text, Sections, and Lists

4.1 Headings and Styles

Use sectioning commands and basic text formatting:

Listing 3: Text and lists

```

1 \section{Title} \subsection{Subtitle} \subsubsection{Subsubtitle}
2 Bold: \textbf{...}, italics: \emph{...}, monospace: \texttt{...}
3 \begin{itemize} \item bullet A \item bullet B \end{itemize}
4 \begin{enumerate} \item first \item second \end{enumerate}

```

5 Math

Inline math uses $...$, display math uses `equation/align`:

Listing 4: Math examples

```

1 Inline:  $a^2 + b^2 = c^2$ .
2 \begin{equation}
3 \quad \sigma(z) = \frac{1}{1+e^{-z}}
4 \end{equation}
5 \begin{align}
6 \quad J(\mathbf{w}) &= \frac{1}{2} \lVert \mathbf{w} \rVert^2 + C \sum_i \xi_i \backslash
7 \quad \quad \quad \&\text{s.t. } y_i(\mathbf{w}^{\text{top}} \mathbf{x}_i + b) \geq 1 - \xi_i
8 \end{align}
9 Matrix:  $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ 

```

5.1 Quick Structures

- Fractions/sums/norms: $\frac{a}{b}$, $\sum_{i=1}^n$, $\lVert x \rVert_2$.
- Expectation/variance: $\mathbb{E}[X]$, $\text{operatorname{Var}}(X)$; Gaussian: $\mathcal{N}(\mu, \Sigma)$.
- Align: use `&` for alignment points and `\` for new lines.

6 Figures

Keep images in a local `figures/` folder and reference via `.`. Typical figure block:

Listing 5: Figure environment

```

1 \begin{figure}[H]
2 \centering
3 % \includegraphics[width=0.9\linewidth]{example.png}
4 \caption{Caption text}
5 \label{fig:example}
6 \end{figure}
7 \FloatBarrier

```

7 Tables

Listing 6: Table environment

```

1 \begin{table}[H]
2 \centering
3 \caption{Results} \label{tab:res}
4 \begin{tabular}{lcc}

```