TexTool Package Handbook

A Comprehensive LaTeX Package for Mathematical Typesetting and Figure Management

Version 4.0 - Robust Edition

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Contents

1 Introduction

The `textool` package is a comprehensive LaTeX package designed to streamline academic writing, particularly in mathematics and technical fields. It provides:

- Extensive mathematical symbol libraries with consistent naming conventions
- Simplified figure and multi-figure insertion commands
- Optional theorem environments (opt-in)
- Optional algorithm support (opt-in)
- Enhanced equation formatting tools
- Probability and statistical operators
- Color definitions for presentations
- Robust compatibility with other packages

1.1 What's New in Version 4.0

Important

Version 4.0 introduces significant changes to improve compatibility and stability:

- **Opt-in model**: Theorems and algorithms are now OFF by default
- **Enhanced compatibility**: Better conflict resolution with other packages
- **Tabularx support**: Fixed array package loading for tabularx compatibility
- **Robust loading**: Conditional checks prevent redefinition conflicts

1.2 Installation

Place `textool.sty` in your LaTeX project directory or in your local `texmf` tree. Then load it in your document preamble with the desired options:

```
% Basic usage (math symbols and figures only)
\usepackage{textool}

% With theorem environments
\usepackage[theorems]{textool}

% With algorithm support
\usepackage[algorithms]{textool}

% With both theorems and algorithms
\usepackage[theorems,algorithms]{textool}

% Minimal mode (math only, no graphics)
\usepackage[minimal]{textool}
```

Option	Default	Description
`theorems`	OFF	Enables theorem environments (theorem, lemma, etc.)
`algorithms`	OFF	Enables algorithm and pseudocode support
`minimal`	OFF	Loads only core math features, no graphics

Table 1: Package options in textool v4.0

1.3 Package Options

1.4 Package Philosophy

The package follows these design principles:

1. **Safety First**: Opt-in model prevents conflicts with user definitions
2. **Consistency**: All symbols follow predictable naming patterns
3. **Simplicity**: Complex tasks require minimal syntax
4. **Compatibility**: Works alongside other standard packages
5. **Completeness**: Provides comprehensive symbol coverage
6. **Robustness**: Conditional loading prevents redefinition errors

2 Mathematical Symbols

2.1 Symbol Naming Convention

TexTool provides systematic access to mathematical symbols using consistent prefixes:

Prefix	Meaning	Example
`mb`	Blackboard bold	`\mbR` $\rightarrow \mathbb{R}$
`ccal`	Calligraphic	`\ccalF` $\rightarrow \mathcal{F}$
`bb`	Bold	`\bbx` $\rightarrow \mathbf{x}$
`bbar`	Bar over symbol	`\bbarx` $\rightarrow \bar{x}$
`hhat`	Hat over symbol	`\hhatx` $\rightarrow \hat{x}$
`td`	Tilde over symbol	`\tdx` $\rightarrow \tilde{x}$

Table 2: Symbol prefix conventions

2.2 Blackboard Bold Letters

Used primarily for number sets and spaces:

Example

```
$\mbR$ % Real numbers
$\mbC$ % Complex numbers
$\mbN$ % Natural numbers
$\mbZ$ % Integers
$\mbQ$ % Rational numbers
$\mbP$ % Probability space
```

Result: $\mathbb{R}$, $\mathbb{C}$, $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{Q}$, $\mathbb{P}$

2.3 Calligraphic Letters

Used for spaces, algebras, and special sets:

Example

```
$\ccalF$ % Sigma-algebra
$\ccalH$ % Hilbert space
$\ccalL$ % Linear operators
$\ccalM$ % Manifold
```

Result: $\mathcal{F}$, $\mathcal{H}$, $\mathcal{L}$, $\mathcal{M}$

2.4 Bold Symbols

For vectors and matrices:

Example

```
$\bbx \in \mbR^n$ % Vector x
$\bbA \bbx = \bbb$ % Matrix equation
$\bbalpha, \bbbeta, \bbgamma$ % Bold Greek
```

Result: $\mathbf{x} \in \mathbb{R}^n$, $\mathbf{Ax} = \mathbf{b}$, $\boldsymbol{\alpha}, \boldsymbol{\beta}, \boldsymbol{\gamma}$

2.5 Decorated Symbols

Command	Description	Output
`\bbarX`	Bar over X	$\bar{X}$
`\hhatX`	Hat over X	$\hat{X}$
`\tdX`	Tilde over X	$\tilde{X}$
`\bbarx`	Bar over x	$\bar{x}$
`\hhatx`	Hat over x	$\hat{x}$
`\tdx`	Tilde over x	$\tilde{x}$
`\bbargamma`	Bar over gamma	$\bar{\gamma}$
`\hhattheta`	Hat over theta	$\hat{\theta}$
`\tdsigma`	Tilde over sigma	$\tilde{\sigma}$

Table 3: Decorated symbol examples

3 Probability and Statistics

3.1 Expectation Operators

TexTool provides multiple expectation notations:

Example

```
$\E{X}$          % E[X]
$\Ec{X}$         % E(X) with parentheses
$\Eb{X^2}$       % E with big brackets
$\EB{X^2}$       % E with Big brackets
$\EE{Y}{X|Y}$    % E_Y[X|Y] conditional expectation
```

Result: $\mathbb{E}[X]$, $\mathbb{E}(X)$, $\mathbb{E}\big[X^2\big]$, $\mathbb{E}\Big[X^2\Big]$, $\mathbb{E}_Y[X|Y]$

3.2 Probability Operators

Example

```
$\Pr{X > 0}$      % P[X > 0]
$\Prc{A \cup B}$  % P(A union B) with parentheses
$\Pb{X = k}$      % P with big brackets
$\PP{X}{Y|X}$     % P_X[Y|X] with subscript
```

Result: $\Pr X > 0$, $\mathbb{P}(A \cup B)$, $\mathbb{P}\big[X = k\big]$, $\mathbb{P}_X[Y|X]$

3.3 Statistical Functions

Example

```
$\Var{X}$          % Variance
$\Covp{X}{Y}$      % Covariance
$\ind{x > 0}$      % Indicator function
$\Ind{A}$          % Alternative indicator
$\Ent{X}$          % Entropy H[X]
$\KL{P}{Q}$        % KL divergence
$\MI{X}{Y}$        % Mutual information
```

Result: $\operatorname{Var}[X]$, $\operatorname{Cov}[X,Y]$, $\mathbb{I}\{x > 0\}$, $\mathbf{1}\{A\}$, $\mathsf{H}[X]$, $D_{\mathrm{KL}}(P \parallel Q)$, $\mathsf{I}(X;Y)$

4 Figure Management

Important

Figure commands are available by default unless you use the `minimal` option.

4.1 Single Figures

TexTool simplifies figure insertion with brace-based syntax:

Example

```
% Basic figure (80% width)
\fig{{image.png},{Caption text},{label}}

% Custom width figure
\figw[0.6]{{image.png},{Caption text},{
    label}}

% Exact placement figure
\figH{{image.png},{Caption text},{label}}

% Figure without caption
\fignc{{image.png},{label}}
```

Tip

Labels are automatically prefixed with `fig:`, so you reference them as `\ref{fig:label}`

4.2 Multi-Figure Grids

TexTool supports grid layouts from 1×2 up to 4×4:

4.2.1 2×2 Grid Example

```
\mcfigTwoByTwo{{Overall caption},{main-label}}
{{img1.png},{Caption 1},{label1}}
{{img2.png},{Caption 2},{label2}}
{{img3.png},{Caption 3},{label3}}
{{img4.png},{Caption 4},{label4}}
```

4.2.2 Available Grid Commands

Command	Grid Layout
`\mcfigOneByTwo`	1×2 (2 images)
`\mcfigTwoByTwo`	2×2 (4 images)

Table 4: Multi-figure grid commands (partial list)

Tip

The package provides many more grid layouts. Check the source code for the complete list of available `mcfig` commands.

4.3 Spacing Control

Adjust spacing in multi-figure layouts:

```
\setSubfigTopSkip{10pt}    % Space above figures
\setSubfigBottomSkip{5pt}  % Space between rows
\setSubfigCapSkip{3pt}     % Space below captions
```

5 Theorem Environments (Optional)

Warning

Theorem environments are OFF by default in v4.0!
You must explicitly enable them with `\usepackage[theorems]{textool}`

5.1 Enabling Theorems

To use theorem environments, you must load the package with the `theorems` option:

Example

```
% Enable theorems
\usepackage[theorems]{textool}

% Or with algorithms too
\usepackage[theorems,algorithms]{textool}
```

5.2 Available Environments

When enabled, TexTool provides pre-styled theorem environments:

Example

```
\begin{theorem}
        Every continuous function on a
           compact set is uniformly
           continuous.
\end{theorem}

\begin{lemma}
        If $f$ is differentiable, then $f$
            is continuous.
\end{lemma}

\begin{definition}
        A set $S$ is \emph{compact} if
           every open cover has a finite
           subcover.
\end{definition}
```

5.3 Complete List of Theorem Environments

5.4 Custom Proof Environment

The `myproof` environment is always available (doesn't require the `theorems` option):

Environment	Purpose
`theorem`	Major results
`lemma`	Supporting results
`proposition`	Standalone statements
`corollary`	Direct consequences
`definition`	Formal definitions
`remark`	Clarifying comments
`assumption`	Stated assumptions
`observation`	Notable observations
`fact`	Known facts
`property`	Mathematical properties
`test`	Test cases

Table 5: Theorem-like environments (when enabled)

Example

```
\begin{myproof}
        Let $x \in S$. By assumption...
        Therefore, the statement holds.
\end{myproof}

\begin{myproof}[of Theorem 3.1]
        Using the previous lemma...
\end{myproof}
```

6 Algorithm Support (Optional)

Warning

Algorithm support is OFF by default in v4.0!
You must explicitly enable it with `\usepackage[algorithms]{textool}`

6.1 Enabling Algorithms

To use algorithm environments, load the package with the `algorithms` option:

Example

```
% Enable algorithms
\usepackage[algorithms]{textool}

% The package will load algpseudocode and
    algorithm
% unless algorithmic is already loaded
```

6.2 Compatibility Notes

Important

The package intelligently detects existing algorithm packages:

- If `algorithmic` is already loaded, `algpseudocode` will be skipped
- If neither is loaded, `algpseudocode` is preferred
- The `algorithm` float environment is loaded if available

7 Equation Environments

7.1 Standard Equation Helpers

Example

```
% Aligned equation with number
\feq{
        f(x) &= x^2 + 2x + 1 \\
        &= (x + 1)^2
}

% Aligned equation without number
\nfeq{
        g(x) &= \sin(x) + \cos(x) \\
        &= \sqrt{2}\sin(x + \pi/4)
}
```

7.2 Slide Equation Environments

For presentations and slides:

Environment	Description
`slideeq`	Regular equation for slides
`nslideeq`	Equation without numbering
`sslideeq`	Small size equation
`fslideeq`	Footnote size equation
`slidealign`	Aligned equations
`nslidealign`	Aligned without numbering
`sslidealign`	Small aligned equations
`fslidealign`	Footnote size aligned

8 Color and Formatting

Important

Colors and formatting commands are not available in `minimal` mode.

8.1 Predefined Colors

TexTool defines several colors for highlighting:

Example

```
\red{Error message}
\blue{Information}
\green{Success}
\grey{Disabled text}
\highlight{Important}
\todo{Remember this}
```

8.2 Arrow Bullets

For itemized lists with arrows:

Example

```
\begin{itemize}
        \arritem First point
        \ai Second point (short form)
        \item[\darrbullet] Two-way
           relationship
\end{itemize}
```

9 List Environments

9.1 Custom List Environment

The `mylist` environment provides controlled spacing:

Example

```
\begin{mylist}
        \item First item with proper
           spacing
        \item Second item
        \item Third item
\end{mylist}
```

9.2 Exercise Environment

For homework and exercises:

Example

```
\exercise{Prove the fundamental theorem of
    calculus}

\exercisepart{State the theorem}
The theorem states that...

\exercisepart{Provide the proof}
We begin by considering...

\exercisepart{Give an example}
Consider $f(x) = x^2$...
```

10 Text Commands

10.1 Mathematical Text

TexTool provides text commands for use in math mode:

Command	Output
\rank	rank
\diag	diag
\tr	tr (trace)
\st	s.t. (subject to)
\sign	sign
\argmax	argmax
\argmin	argmin

10.2 Section Commands

Custom section formatting:

```
\mysubsection{Section Title}
\mysubsubsection{Subsection Title}
```

11 Advanced Examples

11.1 Complete Mathematical Document

Example

```
\documentclass{article}
\usepackage[theorems]{textool}  % Enable theorems

\begin{document}

        \begin{theorem}
                Let $\bbX \in \mbR^{n \times m}$ be a random matrix with
                $\E{\bbX} = \bbM$ and $\Var{\bbX_{ij}} = \sigma^2$.
                Then $\bbarX = \frac{1}{nm}\sum_{i,j} \bbX_{ij}$
                converges to $\tr(\bbM)/nm$ as $n,m \to \infty$.
        \end{theorem}

        \begin{myproof}
                By the law of large numbers, we have
                \feq{
                        \Pr{\left|\bbarX - \E{\bbarX}\right| > \epsilon}
                        &\leq \frac{\Var{\bbarX}}{\epsilon^2} \\
                        &= \frac{\sigma^2}{nm\epsilon^2} \to 0
                }
                as $n,m \to \infty$.
        \end{myproof}

\end{document}
```

11.2 Using Different Package Options

Example

```
% For a math-heavy document without figures
\documentclass{article}
\usepackage[minimal]{textool}

% For a document with theorems but no algorithms
\documentclass{article}
\usepackage[theorems]{textool}

% For a complete document with all features
\documentclass{article}
\usepackage[theorems,algorithms]{textool}

% When using other theorem packages
\documentclass{article}
\usepackage{amsthm}  % Load your theorem package first
\usepackage{textool} % textool won't redefine theorems
```

12 Troubleshooting

12.1 Common Issues

Warning

Missing Theorem Environments: In v4.0, theorems are OFF by default. If you get "undefined environment" errors, add the `theorems` option: `\usepackage[theorems]{textool}`

Warning

Algorithm Package Conflicts: The package checks for existing algorithm packages. If you need `algorithmic` instead of `algpseudocode`, load it before textool.

Warning

Symbol Conflicts: If a symbol is already defined by another package, textool will skip that definition. Load textool after other math packages if you prefer its definitions.

Warning

Tabularx Compatibility: Version 4.0 loads the `array` package first to ensure tabularx compatibility.

12.2 Best Practices

1. **Package Order**: Load `textool` after basic math packages but before document-specific definitions
2. **Choose Options Carefully**: Only enable features you need (theorems, algorithms)
3. **Minimal Mode**: Use `minimal` option for documents without figures
4. **Theorem Conflicts**: If using another theorem package, don't enable the `theorems` option
5. **Check Console Output**: The package prints loading information to help debug issues

12.3 Package Loading Messages

When loaded, textool outputs helpful information:

```
==========================================
textool v4.0 Robust Edition loaded
Options: theorems=OFF (default), algorithms=OFF (
   default)
Array package loaded for tabularx compatibility
For basic use: \usepackage{textool}
With theorems: \usepackage[theorems]{textool}
==========================================
```

13 Migration Guide from Earlier Versions

13.1 From v1.x to v4.0

If you're upgrading from version 1.x, note these important changes:

Important

Breaking Changes:

- Theorems are now OFF by default - add `theorems` option
- Algorithms are now OFF by default - add `algorithms` option
- Some commands are now conditional to avoid conflicts

Old (v1.x)	New (v4.0)
`\usepackage{textool}` (got everything)	`\usepackage[theorems,algorithms]{textool}` (explicit opt-in)
Theorems always loaded	Theorems only with `theorems` option
Algorithms always loaded	Algorithms only with `algorithms` option

Table 6: Migration from v1.x to v4.0

Category	Common Commands
Package Loading	`\usepackage[options]{textool}`
Options	`theorems`, `algorithms`, `minimal`
Sets	`\mbR, \mbC, \mbN, \mbZ`
Vectors	`\bbx, \bby, \bbA`
Statistics	`\E{X}, \Var{X}, \Pr{A}`
Figures	`\fig{{file},{caption},{label}}`
Theorems*	`\begin{theorem}...\end{theorem}`
Greek	`\bbalpha, \tdbeta, \bbargamma`

Table 7: Quick reference (* = requires `theorems` option)

14 Quick Reference Card

14.1 Most Used Commands

A Complete Symbol Tables

A.1 All Blackboard Bold Symbols

$\mathbb{A}$	$\mathbb{B}$	$\mathbb{C}$	$\mathbb{D}$	$\mathbb{E}$	$\mathbb{F}$
$\mathbb{G}$	$\mathbb{H}$	$\mathbb{I}$	$\mathbb{J}$	$\mathbb{K}$	$\mathbb{L}$
$\mathbb{M}$	$\mathbb{N}$	$\mathbb{O}$	$\mathbb{P}$	$\mathbb{Q}$	$\mathbb{R}$
$\mathbb{S}$	$\mathbb{T}$	$\mathbb{U}$	$\mathbb{V}$	$\mathbb{W}$	$\mathbb{X}$
$\mathbb{Y}$	$\mathbb{Z}$				

A.2 All Bold Symbols

Uppercase:

A	**B**	**C**	**D**	**E**	**F**
G	**H**	**I**	**J**	**K**	**L**
M	**N**	**O**	**P**	**Q**	**R**
S	**T**	**U**	**V**	**W**	**X**
Y	**Z**				

Lowercase:

a	**b**	**c**	**d**	**e**	**f**
g	**h**	**i**	**j**	**k**	**l**
m	**n**	**o**	**p**	**q**	**r**
s	**t**	**u**	**v**	**w**	**x**
y	**z**				

B Version History

- **Version 1.0**: Initial release
- **Version 1.1**: Added compatibility checks, made all definitions conditional
- **Version 2.x**: Added conflict resolution mechanisms
- **Version 3.0**: Changed to opt-in model for safety
- **Version 4.0**:

- Fixed tabularx compatibility with array package
- Restored all features from original
- Enhanced robustness
- Improved package option system
- Better conflict detection
- Comprehensive loading messages

C License and Contact

This package is provided as-is for academic use. For questions, bug reports, or feature requests, please contact the author at the email address provided.

The package development follows the principle of maintaining backward compatibility while improving robustness and preventing conflicts with other commonly used packages.

End of TexTool Package Handbook v4.0