

# L<sup>A</sup>T<sub>E</sub>X Notes v 1.24

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2009 6 7

<sup>1</sup><http://www.dralpha.com/>



L<sup>A</sup>T<sub>E</sub>X  
2

2002

Microsoft Word Visio

Linux L<sup>A</sup>T<sub>E</sub>X  
2005

lshort L<sup>A</sup>T<sub>E</sub>X

HTML Java

FrontPage Dreamweaver JBuilder

L<sup>A</sup>T<sub>E</sub>X

Word

Word

Word

EndNote

L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X

3

4

序		iii
<b>1</b>	<b>简介</b>	<b>1</b>
1.1	.....	1
1.2	.....	3
1.3	.....	4
1.4	.....	5
<b>2</b>	<b>入门</b>	<b>7</b>
2.1	Hello, World! .....	7
2.2	.....	8
2.2.1	.....	8
2.2.2	.....	10
2.3	L <sup>A</sup> T <sub>E</sub> X .....	11
2.4	.....	11
2.4.1	.....	11
2.4.2	.....	12
2.4.3	.....	13
2.5	.....	14
2.5.1	.....	14
2.5.2	.....	14
2.5.3	.....	15

---

2.6	.....	16
2.6.1	.....	16
2.6.2	.....	17
2.6.3	.....	17
2.6.4	.....	18
2.6.5	.....	19
2.6.6	.....	19
2.7	.....	19
2.8	.....	20
2.8.1	mbox fbox .....	20
2.8.2	makebox framebox .....	20
2.8.3	parbox minipage .....	20
<b>3</b>	<b>数学</b>	<b>23</b>
3.1	.....	23
3.2	.....	24
3.2.1	.....	24
3.2.2	.....	24
3.2.3	.....	25
3.2.4	.....	25
3.2.5	.....	26
3.2.6	.....	26
3.2.7	.....	27
3.2.8	.....	28
3.2.9	.....	28
3.3	.....	28
3.4	.....	29
3.4.1	.....	29
3.4.2	.....	29
3.5	.....	30
3.6	.....	31

---

<b>4</b>	<b>插图</b>	<b>33</b>
4.1	.....	33
4.1.1	EPS .....	34
4.1.2	Driver .....	34
4.1.3	.....	35
4.2	.....	36
4.2.1	.....	36
4.2.2	.....	37
4.2.3	figure .....	38
4.2.4	.....	39
4.3	.....	42
4.4	METAPOST .....	42
4.4.1	.....	43
4.4.2	.....	44
4.4.3	.....	45
4.4.4	.....	46
4.4.5	.....	49
4.5	PSTricks .....	51
4.5.1	.....	51
4.5.2	.....	52
4.5.3	.....	55
4.5.4	.....	57
4.6	PGF .....	58
4.6.1	.....	58
4.6.2	.....	59
4.6.3	.....	60
4.6.4	.....	61
4.6.5	.....	62
<b>5</b>	<b>表格</b>	<b>65</b>
5.1	.....	65
5.2	.....	67

---

5.3	.....	68
5.4	.....	70
5.5	.....	71
<b>6</b>	<b>杂项</b>	<b>75</b>
6.1	.....	75
6.2	.....	76
6.3	.....	76
6.3.1	BibTeX .....	76
6.3.2	natbib .....	78
6.4	.....	80
6.5	.....	81
<b>7</b>	<b>中文</b>	<b>85</b>
7.1	.....	85
7.2	.....	86
7.3	CJK .....	87
<b>8</b>	<b>字体</b>	<b>89</b>
8.1	.....	89
8.2	.....	90
8.2.1	.....	90
8.2.2	.....	90
8.2.3	.....	91
8.3	.....	92
8.3.1	DVI .....	92
8.3.2	dvips .....	92
8.3.3	dvipdfm(x) .....	93
8.4	TrueType .....	93
8.4.1	.....	93
8.4.2	ttf2tfm .....	94
8.4.3	.....	94
8.4.4	ttf2pk .....	95

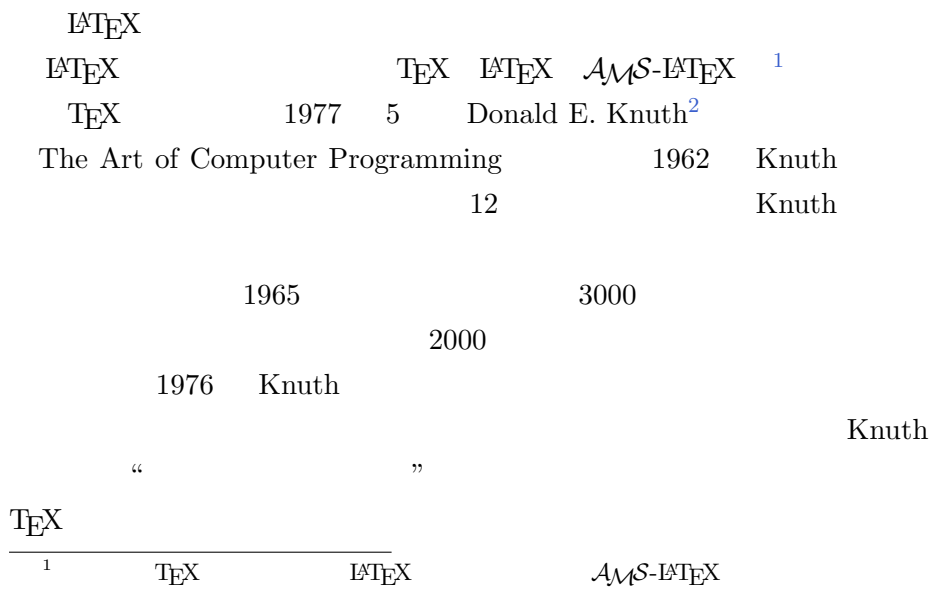


8.4.5 `dvipdfmx` . . . . . 95

跋 97



## 1.1 历史回顾



---

1978 T<sub>E</sub>X Knuth 1982  
 T<sub>E</sub>X  
 1990 T<sub>E</sub>X v3.0 Knuth bug T<sub>E</sub>X  
 3  
 π 3.141592 Knuth  
 T<sub>E</sub>X  
 METAFONT  
*e* 2.71828  
 T<sub>E</sub>X  
 Knuth T<sub>E</sub>X  
 Plain T<sub>E</sub>X  
 T<sub>E</sub>X  
 Plain T<sub>E</sub>X Leslie Lamport<sup>4</sup> 80  
 T<sub>E</sub>X L<sup>A</sup>T<sub>E</sub>X 1992 L<sup>A</sup>T<sub>E</sub>X v2.09 Lamport  
 Frank Mittelbach The LaTeX Team  
 1994 L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>  
 L<sup>A</sup>T<sub>E</sub>X 3  
 American Mathematical Society AMS  
 T<sub>E</sub>X Michael Spivak  $\mathcal{A}\mathcal{M}\mathcal{S}$ -T<sub>E</sub>X Plain T<sub>E</sub>X  
 1983–1985 AMS  
 L<sup>A</sup>T<sub>E</sub>X Mittel-  
 bach Rainer Schöpf LaTeX Team New  
 Font Selection Scheme for L<sup>A</sup>T<sub>E</sub>X NFSS AMS  
 AMSFonts L<sup>A</sup>T<sub>E</sub>X 1989  $\mathcal{A}\mathcal{M}\mathcal{S}$ -L<sup>A</sup>T<sub>E</sub>X  $\mathcal{A}\mathcal{M}\mathcal{S}$ -  
 L<sup>A</sup>T<sub>E</sub>X 1990  $\mathcal{A}\mathcal{M}\mathcal{S}$   
 L<sup>A</sup>T<sub>E</sub>X

---

<sup>3</sup> Fundamental Algorithms Seminumerical Algorithms  
 Sorting and Searching Combinatorial Algorithms Syntactic  
 Algorithms 2015 Theory of Context-free Lan-  
 guages Compiler Techniques

## 1.2 优点和缺点

guage	$\LaTeX$	WYSIWYG	Markup Lan-
Word <sup>5</sup>			MS
	$\LaTeX$		
•			
•			
•			parse
•			
•	$\LaTeX$		
	$\LaTeX$		
•			
•			
•			
•			
•			
	MS Word	Web	HTML/Web
	$\LaTeX$		HTML
render	DVI	$\LaTeX$	
	HTML	$\LaTeX$	DVI
	$\LaTeX$		

---

<sup>5</sup> Word

field code

L<sup>A</sup>T<sub>E</sub>X

“ ” “ ”

2000

Lamport

“

”

“

L<sup>A</sup>T<sub>E</sub>X

6

‘Dark Side’

”

### 1.3 软件准备

L<sup>A</sup>T<sub>E</sub>X

implement

distribution

Java

Linux

SUN

IBM

BEA

Java

JVM

Java

Linux

Red Hat/

Fedora

Ubuntu

SuSE

#### 1.1: L<sup>A</sup>T<sub>E</sub>X

---

Windows	<a href="#">MikTeX</a>	<a href="#">TeXnicCenter</a>	<a href="#">WinEdt</a>
Unix/Linux	<a href="#">TeX Live</a>	<a href="#">Emacs</a>	<a href="#">vim</a> <a href="#">Kile</a>
Mac OS	<a href="#">MacTeX</a>	<a href="#">TeXShop</a>	

---

L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X

1.1

L<sup>A</sup>T<sub>E</sub>X

---

<sup>6</sup>TeX/L<sup>A</sup>T<sub>E</sub>X  
Knuth

## 1.4 学习方法

[L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>](#) <sup>[1]</sup> Tobias Oetiker A (Not So) Short Introduction to  
[lshort](#) [L<sup>A</sup>T<sub>E</sub>X](#)  
 Frank Mittelbach The [L<sup>A</sup>T<sub>E</sub>X Companion](#) <sup>[2]</sup>  
[L<sup>A</sup>T<sub>E</sub>X](#) <sup>[3]</sup> [lshort](#)  
 7  
[Comprehensive TeX Archive Network](#) [CTAN](#) [TeX Users Group](#)  
[TUG](#)  
[TUG](#) [CTeX](#) [FAQ](#) <sup>[4;5]</sup>  
[T<sub>E</sub>X](#) [BBS TeX](#) [CTeX](#)

## 参考文献

- [1] Tobias Oetiker. *A (Not So) Short Introduction to LaTeX2ε*, 2008. URL <http://www.ctan.org/tex-archive/info/lshort/english/>.
- [2] Frank Mittelbach, Michel Goossens, Johannes Braams, David Carlisle, and Chris Rowley. *The L<sup>A</sup>T<sub>E</sub>X Companion (Tools and Techniques for*

- Computer Typesetting*). Addison-Wesley, 2nd edition, 2004. URL <http://www.amazon.com/exec/obidos/tg/detail/-/0201362996/>.
- [3] . 大家来学 $LaTeX$ , 2004. URL <http://edt1023.sayya.org/tex/latex123/>.
- [4] UK TeX User Group. UK List of TeX Frequently Asked Questions. URL <http://www.tex.ac.uk/faq/>.
- [5] TeX . CTeX , 2005. URL <http://www.ctex.org/CTexFAQ/>.



## 2.1 Hello, World!

hello\_world.tex

LaTeX

```
%hello_world.tex
\documentclass{article}
\begin{document}
  Hello, World!
\end{document}
```

2.2.1

LaTeX

DVI

DVI

.tex

()

```
latex hello_world(.tex)
```

.log

```
! LaTeX Error:
...
! Emergency stop.
...
No pages of output.
Transcript written on hello_world.log.
```

```
Output written on hello_world.dvi (1 page, 232 bytes).
Transcript written on hello_world.log.
```

```
LaTeX          DVI          MiKTeX      yap
```

```
yap hello_world(.dvi)
```

## 2.2 格式及其转换

### 2.2.1 页面描述语言

Page Description Language PDL

LaTeX

DVI PostScript PDF

#### PostScript

dot matrix

“ ”

plotter

1976

Xerox

John Warnock

Forth

PostScript PS

Evans & Sutherland 1978

Warnock

Warnock Martin Newell  
tin

JaM John and Mar-  
InterPress

MaJ

1982

Warnock

Chuck Geschke

Adobe

Newell

Adobe

1984 Adobe PS Steve Jobs  
 PS Apple LaserWriter  
 80  
 90 PS PS

## PDF

1993 Adobe Portable Document For-  
 mat PDF 2007 ISO 32000 PDF  
 PS

- PDF PS

- PDF [8.2](#)

- PDF

- PDF

PDF  
 Acrobat Adobe Acrobat Reader Adobe  
 Reader PDF PS

## DVI

Knuth T<sub>E</sub>X XGP  
 PDP-6 1979 David Fuchs<sup>1</sup> T<sub>E</sub>X  
 Device Independent format DVI  
 DVI driver  
 PS PDF PNG SVG DVI  
 PS PDF

---

<sup>1</sup>Fuchs 1978 Knuth

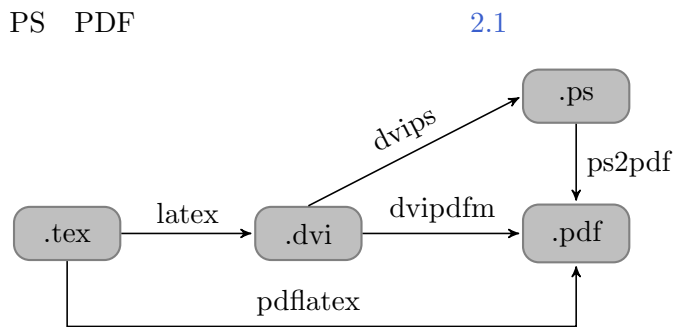
T<sub>E</sub>X Adobe  
 Red Diaper Baby Haiku Tunnel

## Ghostscript

PS		Raster Image Processor	RIP
	RIP		firmware <sup>2</sup>
Ghostscript		RIP	RIP
	EPS	PS	PDF
			Ghostscript
Windows	Unix/Linux	Mac OS	
	GUI	GSview	Ghostview gv

### 2.2.2 格式转换

DVI PS PDF



2.1:

	driver	dvips	DVI	PS	dvipdf	DVI
PDF		dvipdfm	dvipdfm			
1999			dvipdfm		dvipdfmx	
		7.1				
pdfTeX	driver		DVI	TeX		
PDF	pdfTeX	pdfL <sup>A</sup> TeX	L <sup>A</sup> TeX	PDF		
		dvipdfmx				
	DVI			PDF		

```
dvipdfm hello_world(.dvi)
```

<sup>2</sup> RIP

RIP

	PS	Ghostscript
PDF		.ps

```
dvips hello_world(.dvi)
ps2pdf hello_world.ps
```

pdfL<sup>A</sup>T<sub>E</sub>X

```
pdflatex hello_world(.tex)
```

## 2.3 L<sup>A</sup>T<sub>E</sub>X 语句

L <sup>A</sup> T <sub>E</sub> X		statement	
command	data	comment	
		environment	\
		%	
2.1			

## 2.4 文档结构

### 2.4.1 文档类、序言、正文

L<sup>A</sup>T<sub>E</sub>X

preamble

```
\begin{document} \end {document}
“ ”
```

```

\documentclass[options]{class} %
\usepackage[options]{package} %
...
\begin{document} %
...
\end{document}

```

documentclass      article report book  
[2.1](#)

2.1:

---

10pt, 11pt, 12pt	10pt	L <sup>A</sup> T <sub>E</sub> X			
letterpaper, a4paper		letter			
notitlepage, titlepage			article		noti-
	tlepage	report	book		titlepage
onecolumn, twocolumn					
oneside, twoside		article	report		book
landscape					
openany, openright			report	book	report
	openany	book		openright	
draft					draft

---

L<sup>A</sup>T<sub>E</sub>X      package

C/C++    #include    Java    import

## 2.4.2 标题、摘要、章节

`\maketitle`

```
\title{  }
\author{  }
\today
\maketitle
```

```
\begin{abstract}
...
\end{abstract}
```

```
\chapter{...}
\section{...}
\subsection{...}
\subsubsection{...}
```

`article`      `chapter`

`report`   `book`

### 2.4.3 目录

`\tableofcontents`

`LATEX`

`\setcounter`

```
\tableofcontents
\setcounter{tocdepth}{2}
```

\*

```
\chapter*{...}
\section*{...}
\subsection*{...}
```

```
\listoffigures
\listoftables
```

L<sup>A</sup>T<sub>E</sub>X

## 2.5 文字排版

### 2.5.1 字符输入

```

LATEX          inline          \$....\$
# $ % ^ & _ { } ~ \
\textbackslash          \          \
C          \n          TEX          Pascal
```

```
\# \$. \% \^{} \& \_ \{ \} \~{} \textbackslash
```

### 2.2

Scott

Pakin The Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List [\[1\]](#)

### 2.5.2 换行、换页、断字

```

LATEX          \          \newline
\newpage
LATEX          Hyphenate
BASIC          blar-blar-blar          -
```

```
\hyphenation{BASIC blar-blar-blar}
```



2.2:

---

©	<code>\textcopyright</code>	å	<code>\aa</code>	June 7, 2009	<code>\today</code>
®	<code>\textregistered</code>	Å	<code>\AA</code>	TEX	<code>\TeX</code>
°C	<code>^\circ\$C</code>	æ	<code>\ae</code>	L <sup>A</sup> T <sub>E</sub> X	<code>\LaTeX</code>
¥	<code>\textyen</code>	ø	<code>\o</code>	L <sup>A</sup> T <sub>E</sub> X 2 <sub>ε</sub>	<code>\LaTeXe</code>
£	<code>\pounds</code>	ö	<code>\"o</code>	METAFont	<code>\MF</code>
€	<code>\texteuro</code>	ô	<code>\^o</code>	METAPOST	<code>\MP</code>
...	<code>\dots</code>	õ	<code>\~o</code>		

---

### 2.5.3 字样、字号

L<sup>A</sup>T<sub>E</sub>X

3

2.3

2.4

10pt 11pt 12pt tiny

5pt 6pt 6pt

L<sup>A</sup>T<sub>E</sub>X`\emph`

2.3:

---

<code>\textrm{...}</code>	roman	<code>\textbf{...}</code>	<b>bold face</b>
<code>\textsf{...}</code>	sans serif	<code>\textit{...}</code>	<i>italic</i>
<code>\texttt{...}</code>	typewriter	<code>\textsl{...}</code>	<i>slanted</i>
<code>\emph{...}</code>	<i>emphasized</i>	<code>\underline{...}</code>	<u>underline</u>
<code>\textsc{...}</code>	SMALL CAPS		

---

2.4:

	10pt	11pt	12pt
<code>\tiny</code>	5pt	6pt	6pt
<code>\scriptsize</code>	7pt	8pt	8pt
<code>\footnotesize</code>	8pt	9pt	10pt
<code>\small</code>	9pt	10pt	11pt
<code>\normalsize</code>	10pt	11pt	12pt
<code>\large</code>	12pt	12pt	14pt
<code>\Large</code>	14pt	14pt	17pt
<code>\LARGE</code>	17pt	17pt	20pt
<code>\huge</code>	20pt	20pt	25pt
<code>\Huge</code>	25pt	25pt	25pt

## 2.6 常用命令环境

### 2.6.1 列表

L<sup>A</sup>T<sub>E</sub>X

itemize enumerate description

```
\begin{itemize}
  \item C++
  \item Java
  \item HTML
\end{itemize}
```

- C++
- Java
- HTML

```
\begin{enumerate}
  \item C++
  \item Java
  \item HTML
\end{enumerate}
```

1. C++
2. Java
3. HTML

```
\begin{description}
  \item{C++}
  \item{Java}
  \item{HTML}
\end{description}
```

```
C++
Java
HTML
```

### 2.6.2 对齐

$\LaTeX$

fully justified

```
\begin{flushleft}
  \\\
\end{flushleft}
```

```


```

```
\begin{flushright}
  \\\
\end{flushright}
```

```


```

```
\begin{center}
  \\\
\end{center}
```

```


```

### 2.6.3 摘录

$\LaTeX$

quote quotation verse quote

quotation quote

verse quote

```
\begin{quote}
```

```
\end{quote}
```

```
\begin{quotation}
```

```
\end{quotation}
```

```
\begin{verse}
```

```
\end{verse}
```

#### 2.6.4 原文照排

```
LaTeX \verb  
verbatim *
```

```
\verb|command|  
\begin{verbatim}  
printf("Hello, world!");  
\end{verbatim}  
\begin{verbatim*}  
printf("Hello, world!");  
\end{verbatim*}
```

```
command  
printf("Hello, world!");  
printf("Hello, world!");
```

## 2.6.5 交叉引用

section subsection figure table  
 cross referencing  
 $\LaTeX$  `\label{marker}`  
`\ref{marker}`  
`\pageref{marker}`

```
\label{sec}\\
...\\
\pageref{sec} \ref{sec}
```

...  
[19](#) [2.6.5](#)

latex pdflatex

```
LaTeX Warning: There were undefined references.
...
LaTeX Warning: Label(s) may have changed. Rerun to get cross-
references right.
```

## 2.6.6 脚注

footnote :

```
\footnote{
}
```

[a](#)

[a](#)

## 2.7 长度单位

$\LaTeX$  [2.5](#) point  
 big point Adobe PS em  
 11pt 1em 11pt

2.5:

in	pt	point, 1/72.27 in	em	M
cm	bp	big point, 1/72 in	ex	x
mm	pc	pica, 12 pt	mu	math unit 1/18 em

## 2.8 盒子

$\LaTeX$

box

HTML

CSS

### 2.8.1 mbox 和 fbox

$\LaTeX$

`\mbox`

`\fbox`

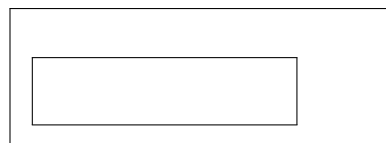
```
\mbox{010 6278 5001}
\fbox{010 6278 5001}
```

### 2.8.2 makebox 和 framebox

`\makebox` `\framebox`

l r s

```
% [ ] [ ] { }
\makebox[100pt][l]{ }
\framebox[100pt][r]{ }
```



### 2.8.3 parbox 和 minipage

`\parbox`

`\minipage`

t c b

```
% [ ]{ }{ }  
\parbox[c]{90pt}{  
  \
```



`\parbox`   `\minipage`   `\makebox`  
`\framebox`

## 参考文献

- [1] Scott Pakin. *The Comprehensive LaTeX Symbol List*, 2008. URL <http://www.ctan.org/tex-archive/info/symbols/comprehensive/>.





$$3x + 2y + z = 39$$

$$2x + 3y + z = 34$$

$$x + 2y + 3z = 26$$

—

$\mathcal{A}\mathcal{M}\mathcal{S}$ - $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$

amsmath

amsmath User's Guide <sup>[1]</sup>

George Grätzer<sup>1</sup> More Math into  $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ ,

4th Edition <sup>[2]</sup>

### 3.1 数学模式

$\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$

inline display

$\dots$

equation equation\*

\*

$\backslash\text{fbox}$

$\backslash\text{boxed}$

```

$E=mc^2$
\begin{equation}
E=mc^2
\end{equation}
\[ E=mc^2 \]
\[ \boxed{E=mc^2} \]

```

$$E = mc^2$$

$$E = mc^2 \quad (3.1)$$

$$E = mc^2$$

$$E = mc^2$$

## 3.2 基本原素

### 3.2.1 字母

3.1

3.1:

$\alpha$	<code>\alpha</code>	$\theta$	<code>\theta</code>	$o$	<code>o</code>	$\tau$	<code>\tau</code>
$\beta$	<code>\beta</code>	$\vartheta$	<code>\vartheta</code>	$\pi$	<code>\pi</code>	$\upsilon$	<code>\upsilon</code>
$\gamma$	<code>\gamma</code>	$\iota$	<code>\iota</code>	$\varpi$	<code>\varpi</code>	$\phi$	<code>\phi</code>
$\delta$	<code>\delta</code>	$\kappa$	<code>\kappa</code>	$\rho$	<code>\rho</code>	$\varphi$	<code>\varphi</code>
$\epsilon$	<code>\epsilon</code>	$\lambda$	<code>\lambda</code>	$\varrho$	<code>\varrho</code>	$\chi$	<code>\chi</code>
$\varepsilon$	<code>\varepsilon</code>	$\mu$	<code>\mu</code>	$\sigma$	<code>\sigma</code>	$\psi$	<code>\psi</code>
$\zeta$	<code>\zeta</code>	$\nu$	<code>\nu</code>	$\varsigma$	<code>\varsigma</code>	$\omega$	<code>\omega</code>
$\eta$	<code>\eta</code>	$\xi$	<code>\xi</code>				
$\Gamma$	<code>\Gamma</code>	$\Lambda$	<code>\Lambda</code>	$\Sigma$	<code>\Sigma</code>	$\Psi$	<code>\Psi</code>
$\Delta$	<code>\Delta</code>	$\Xi$	<code>\Xi</code>	$\Upsilon$	<code>\Upsilon</code>	$\Omega$	<code>\Omega</code>
$\Theta$	<code>\Theta</code>	$\Pi$	<code>\Pi</code>	$\Phi$	<code>\Phi</code>		

### 3.2.2 指数、下标、根号

```

^
-
\sqrt
{}

```

`\[x_{ij}]^2\quad \sqrt[2]{x}\]`

$$x_{ij}^2 \quad \sqrt[2]{x}$$

### 3.2.3 分数

`\frac`

`\dfrac`

`\tfrac`

`$$\frac{1}{2} \dfrac{1}{2}$$`  
`\[\frac{1}{2} \tfrac{1}{2}\]`

$$\frac{1}{2} \frac{1}{2}$$

$$\frac{1}{2} \frac{1}{2}$$

### 3.2.4 运算符

operator + - \* /

Scott Pakin The Comprehensive

L<sup>A</sup>T<sub>E</sub>X Symbol List [\[3\]](#)

`\[\pm \times \div \cdot \cap \cup \geq \leq \neq \approx \equiv\]`

$$\pm \times \div \cdot \cap \cup \geq \leq \neq \approx \equiv$$

`\sum \prod \lim \int`

`$$\sum_{i=1}^n i \prod_{i=1}^n \lim_{x \rightarrow 0} x^2 \int_a^b x^2 dx$$`  
`\[\sum_{i=1}^n i \prod_{i=1}^n \lim_{x \rightarrow 0} x^2 \int_a^b x^2 dx\]`

$$\sum_{i=1}^n i \quad \prod_{i=1}^n \lim_{x \rightarrow 0} x^2 \quad \int_a^b x^2 dx$$

$$\sum_{i=1}^n i \quad \prod_{i=1}^n \lim_{x \rightarrow 0} x^2 \quad \int_a^b x^2 dx$$

`\int`  
`\iint \iiint \iiiiint \idotsint`

$$\iint \iiint \iiiiint \int \dots \int$$

$$\iint \iiint \iiiiint \int \dots \int$$

### 3.2.5 分隔符

( ) [ ] \{\} \langle \rangle  
 $\mathbb{Z}$  | \ amsmath \lvert \rvert  
 $\mathbb{Z}$  \lVert \rVert  
 $\mathbb{Z}$  \big \Big \bigg \Bigg  
amsmath \left \right

$$\left( \left( \left( \left( \left( x + y \right) \right) \right) \right) \right) \left[ \left[ \left[ \left[ \left[ x + y \right] \right] \right] \right] \right] \left\{ \left\{ \left\{ \left\{ \left\{ x + y \right\} \right\} \right\} \right\} \right\}$$

$$\left\langle \left\langle \left\langle \left\langle \left\langle x + y \right\rangle \right\rangle \right\rangle \right\rangle \left\| \left\| \left\| \left\| \left\| x + y \right\| \right\| \right\| \right\| \left\| \left\| \left\| \left\| \left\| x + y \right\| \right\| \right\| \right\| \right\|$$

### 3.2.6 箭头

#### 3.2

`\leftarrow{x+y+z}\quad`  
`\rightarrow[x<y]{a*b*c}\`

$$\overleftarrow{x+y+z} \quad \overrightarrow{a*b*c}$$

$$x < y$$

3.2:

---

$\leftarrow$	<code>\leftarrow</code>	$\longleftarrow$	<code>\longleftarrow</code>
$\rightarrow$	<code>\rightarrow</code>	$\longrightarrow$	<code>\longrightarrow</code>
$\leftrightarrow$	<code>\leftrightarrow</code>	$\longleftrightarrow$	<code>\longleftrightarrow</code>
$\Leftarrow$	<code>\Leftarrow</code>	$\Lleftarrow$	<code>\Lleftarrow</code>
$\Rightarrow$	<code>\Rightarrow</code>	$\Rrightarrow$	<code>\Rrightarrow</code>
$\Leftrightarrow$	<code>\Leftrightarrow</code>	$\Leftrightarrow$	<code>\Leftrightarrow</code>

---

## 3.2.7 标注

3.3

accent

3.4

3.3:

---

$\acute{x}$	<code>\acute{x}</code>	$\tilde{x}$	<code>\tilde{x}</code>	$\mathring{x}$	<code>\mathring{x}</code>
$\grave{x}$	<code>\grave{x}</code>	$\breve{x}$	<code>\breve{x}</code>	$\dot{x}$	<code>\dot{x}</code>
$\bar{x}$	<code>\bar{x}</code>	$\check{x}$	<code>\check{x}</code>	$\ddot{x}$	<code>\ddot{x}</code>
$\vec{x}$	<code>\vec{x}</code>	$\hat{x}$	<code>\hat{x}</code>	$\overset{\cdot}{x}$	<code>\overset{\cdot}{x}</code>

---

3.4:

---

$\overline{xxx}$	<code>\overline{xxx}</code>	$\overleftrightarrow{xxx}$	<code>\overleftrightarrow{xxx}</code>
$\underline{xxx}$	<code>\underline{xxx}</code>	$\underleftrightarrow{xxx}$	<code>\underleftrightarrow{xxx}</code>
$\overleftarrow{xxx}$	<code>\overleftarrow{xxx}</code>	$\overbrace{xxx}$	<code>\overbrace{xxx}</code>
$\overleftarrow{xxx}$	<code>\overleftarrow{xxx}</code>	$\underbrace{xxx}$	<code>\underbrace{xxx}</code>
$\overrightarrow{xxx}$	<code>\overrightarrow{xxx}</code>	$\widetilde{xxx}$	<code>\widetilde{xxx}</code>
$\overrightarrow{xxx}$	<code>\overrightarrow{xxx}</code>	$\widehat{xxx}$	<code>\widehat{xxx}</code>

---

### 3.2.8 省略号

`\dots` `\cdots` `\vdots` `\ddots` `\cdots`  
`\dots`

$\dots \quad \cdots \quad \vdots \quad \ddots$
--

### 3.2.9 空白间距

3.5

\!

3.5:

<code>\,</code>	3/18 em	<code>\quad</code>	1 em
<code>\:</code>	4/18 em	<code>\qquad</code>	2 em
<code>\;</code>	5/18 em	<code>\!</code>	-3/18 em

## 3.3 矩阵和行列式

`array` `{ccc}`  
`l c r` `\&`

```
\[\begin{array}{ccc}
x_1 & x_2 & \dots \\
x_3 & x_4 & \dots \\
\vdots & \vdots & \ddots \\
\end{array}\]
```

$x_1$	$x_2$	$\dots$
$x_3$	$x_4$	$\dots$
$\vdots$	$\vdots$	$\ddots$

`amsmath` `pmatrix` `bmatrix` `Bmatrix` `vmatrix`  
`Vmatrix` `array` `()` `[]` `{}` `||` `||||`  
`smallmatrix`

## 3.4 多行公式

amsmath

### 3.4.1 长公式

multline

```
\begin{multline}
x=a+b+c+\\
d+e+f+g
\end{multline}
```

$$\begin{aligned}
 x &= a + b + c + \\
 & d + e + f + g \quad (3.2)
 \end{aligned}$$

split  
equation

split    \\

&

```
\[ \begin{split}
x=&a+b+c+\\
&d+e+f+g
\end{split} \]
```

$$\begin{aligned}
 x &= a + b + c + \\
 & d + e + f + g
 \end{aligned}$$

### 3.4.2 公式组

gather

align

```
\begin{gather}
a=b+c+d+\\
x=y+z
\end{gather}
```

$$\begin{aligned}
 a &= b + c + d & (3.3) \\
 x &= y + z & (3.4)
 \end{aligned}$$

```
\begin{align}
a&=b+c+d+\\
x&=y+z
\end{align}
```

$$\begin{aligned}
 a &= b + c + d & (3.5) \\
 x &= y + z & (3.6)
 \end{aligned}$$

```
multiline gather align *
```

```
cases
```

```
\[ y=\begin{cases}
-x & x<0\\
x & x\geq 0
\end{cases} \]
```

$$y = \begin{cases} -x & x < 0 \\ x & x \geq 0 \end{cases}$$

### 3.5 定理和证明

```
LATEX \newtheorem
```

```
\newtheorem{ }[ ]{ }[ ]
```

```
section
```

```
\newtheorem{definition}{ }[section]
\newtheorem{theorem}{ }[section]
\newtheorem{lemma}[theorem]{ }
\newtheorem{corollary}[theorem]{ }
```

```
\begin{definition}
Java
\end{definition}
```

**定义3.5.1.** *Java*是一种跨平台的编程语言。

```
\begin{theorem}
\end{theorem}
```

**定理3.5.1.** 咖啡因会使人的大脑兴奋。

```
\begin{lemma}
\end{lemma}
```

**引理3.5.2.** 茶和咖啡都会使人兴奋。



```
\begin{corollary}

\end{corollary}
```

推论3.5.3. 晚上喝咖啡会导致失眠。

```
proof
QED2
```

```
\begin{proof}[ “ ” ]

\end{proof}
```

命题“物质无限可分”的证明。

□

## 3.6 数学字体

### 3.6

amsmath

3.6:

---

<code>\mathbf</code>	<code>\mathit</code>	<code>\mathsf</code>	<code>\mathcal</code>	<code>\mathbb</code>
XNZRC	<b>XNZRC</b>	<i>XNZRC</i>	XNZRC	$\mathcal{XNZRC}$

---

## 参考文献

- [1] AMS. *amsmath User's Guide*, 2002. URL <http://www.ams.org/tex/amslatex.html>.
- [2] George Grätzer. *More Math into LaTeX*. Springer, 4th edition, 2007. URL <http://www.amazon.com/exec/obidos/tg/detail/-/0387322892/>.
- [3] Scott Pakin. *The Comprehensive LaTeX Symbol List*, 2008. URL <http://www.ctan.org/tex-archive/info/symbols/comprehensive/>.

<sup>2</sup> quod erat demonstrandum



A picture says more than a thousand words.

— Shakespeare

	Knuth	T <sub>E</sub> X	GIF	JPEG	PNG	EPS	
	DVI						Knuth
T <sub>E</sub> X		\special				Driver	
					“	”	
				DOS			

4.1 L<sup>A</sup>T<sub>E</sub>X 4.2  
4.4-4.6

## 4.1 图形格式

L <sup>A</sup> T <sub>E</sub> X	JPEG	PNG	EPS
PDF			
	JPEG	PNG	

### 4.1.1 EPS

80 PS PS PS Encapsulated PostScript EPS HTML ActiveX Java Applet JavaScript

DVI PS EPS L<sup>A</sup>T<sub>E</sub>X

### 4.1.2 Driver 们的口味

#### dvips

dvips PS EPS MiKTeX  
dvips JPEG PNG  
EPS

#### pdfL<sup>A</sup>T<sub>E</sub>X

pdfL<sup>A</sup>T<sub>E</sub>X JPEG PNG PDF EPS pdfL<sup>A</sup>T<sub>E</sub>X  
EPS PS  
1997 Hàn The Thành pdfT<sub>E</sub>X PS PDF Adobe  
PS PDF  
L<sup>A</sup>T<sub>E</sub>X epstopdf pst-pdf on the fly  
EPS PDF<sup>1</sup>  
EPS PDF

#### dvipdfm

dvipdfm JPEG PNG PDF EPS  
Ghostscript EPS PDF

---

<sup>1</sup> on the fly “ ”  
real time user  
transparent black box

```

    dvi2pdf    dvips    pdfLATEX

                                dvi2pdf
                                DVI
    latex    JPEG    PNG    driver

```

### 4.1.3 图形格式转换

“garbage in, garbage out”

#### JPEG 和 PNG 的范围框

```

                                DVI
                                driver    DVI
    bounding box    latex
                                bug
                                ebb
    graph.bb

```

```
ebb graph.jpg
```

#### 其它格式转为EPS

```

                                EPS    ImageMagick
a2ping/sam2p    bmeps    jpeg2ps    sam2p
    PS    Level 2                                EPS
                                Level 2    3    EPS
                                ImageMagick    convert

```

```
convert photo.jpg eps2:photo.eps
```

- 
- ” EPS PS PS Level 1 “ Level
1. PS Windows  
PS PS “HP Color LaserJet  
8550-PS” Adobe PS
2. “FILE” “Print to File”  
PS “Encapsulated PostScript (EPS)”
3. EPS
4. GSview EPS Options  
“EPS Clip” File “PS to EPS”  
EPS

### 其它格式转为 PDF

$\LaTeX$  `epstopdf` <sup>2</sup> EPS PDF  
PDF PDF

## 4.2 插入图形

### 4.2.1 插入命令

Yeah Knuth

`\special`

`\special`  $\LaTeX$  v2.09

`epsf psfig`  $\LaTeX$  2 <sub>$\epsilon$</sub>  `graphics graphicx`

`\includegraphics graphicx`

---

<sup>2</sup> `epstopdf`

```
\includegraphics[bb=0 0 410 307]{photo.jpg}
```

L<sup>A</sup>T<sub>E</sub>XL<sup>A</sup>T<sub>E</sub>X

EPS

```
\DeclareGraphicsExtensions{.eps,.mps,.pdf,.jpg,.png}  
\DeclareGraphicsRule{*}{eps}{*}{}
```

### 4.2.2 缩放、旋转

4.1 4.2

4.1: includegraphics

---

scale  
width  
height  
totalheight  
keepaspectratio

angle  
origin

---

4.2: includegraphics

---

viewport  
trim  
clip false  
true

---

### 4.2.3 figure环境

L<sup>A</sup>T<sub>E</sub>X      figure

```
\begin{figure}[htbp]%  
\centering  
\includegraphics[bb=0 0 410 307,scale=.8]{photo}  
\caption{10          Anna}  
\label{fig:anna}  
\end{figure}
```



4.1: 10          Anna



```

[htbp]
here top bottom float page

[h]
\centering
\caption{
label
caption
}
LATEX
LATEX

```

#### 4.2.4 插入多幅图形

并排摆放，共享标题

```

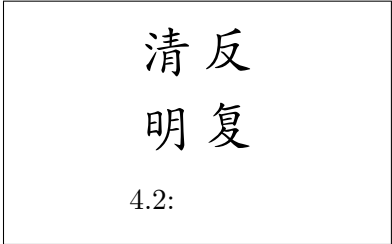
\includegraphics
figure

```

```

\begin{figure}[htbp]
\centering
\includegraphics{left}
\includegraphics{right}
\caption{
}
\end{figure}

```



并排摆放，各有标题

```

minipage
figure

```

```

\begin{figure}[htbp]
\centering
\begin{minipage}[t]{0.3\textwidth}
\centering
\includegraphics{left}
\caption{
}
\end{minipage}

```

```

\begin{minipage}[t]{0.3\textwidth}
  \centering
  \includegraphics{right}
  \caption{  }
\end{minipage}
\end{figure}

```

清  
明

4.3:

反  
复

4.4:

并排摆放，共享标题，各有子标题

```

subfig      \subfloat
subfloat                                \hspace

```

```

\usepackage{subfig}
...
\begin{figure}[htbp]
\centering
\subfloat[  ]{
  \label{fig:subfig_a}
  \includegraphics{left}
}
\hspace{80pt}
\subfloat[  ]{
  \label{fig:subfig_b}
  \includegraphics{right}
}
\caption{  }
\end{figure}

```

4.5a 4.5b

清 明 (a)	反 复 (b)
---------------	---------------

4.5:

改进的子图方法

\subfloat

minipage

```

\begin{figure}[htbp]
\centering
\subfloat[ ]{
\label{fig:improved_subfig_a}
\begin{minipage}[t]{0.3\textwidth}
\centering
\includegraphics{left}
\end{minipage}
}
\subfloat[ ]{
\label{fig:improved_subfig_b}
\begin{minipage}[t]{0.3\textwidth}
\centering
\includegraphics{right}
\end{minipage}
}
\caption{ }
\end{figure}

```



4.6:

### 4.3 图形绘制工具比较

	$\text{\LaTeX}$		METAPOST	PSTricks
PGF				
•	METAPOST		EPS	$\text{\LaTeX}$
	PSTricks	PGF		$\text{\LaTeX}$
•	METAPOST	MPS	PDF	pdf $\text{\LaTeX}$
	PSTricks	EPS	pdf $\text{\LaTeX}$	PGF
	driver			
•	PSTricks	PS		METAPOST
	PGF			
	$\text{\LaTeX}$		Unix/Linux	xfig
TpX		EPS	gnuplot	Windows
				Matlab

### 4.4 METAPOST

1989 John D. Hobby<sup>3</sup>

METAPOST METAPOST METAFONT

METAPOST METAFONT

---

<sup>3</sup>Hobby 1985

Knuth



```
mpost fig(.mp)
```

```
"fig.1 fig.2 ..."
```

```
LATEX \DeclareGraphicsExtensions
```

```
\DeclareGraphicsRule
```

```
METAPOST
```

```
"fig-
```

```
01.mps fig-02.mps ..."
```

```
filenametemplate "%j-%2c.mps"; %
```

```
filenametemplate "flowchart.mps" %
```

```
MPS GSview  
Adobe Reader
```

```
PDF
```

```
epstopdf flowchart.mps
```

#### 4.4.2 基本图形对象

直线

```
draw
```

```
METAPOST
```

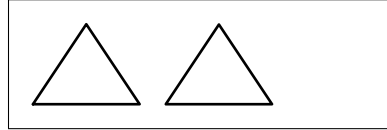
```
bp
```

```
2.5
```

METAPOST

:= =

```
draw (0,0)--(40,0)--(20,20)--(0,0);
u:=10pt; %
draw (5u,0)--(9u,0)--(7u,2u)--cycle;
```



path

cycle

closed path

### 4.4.3 点和线宽

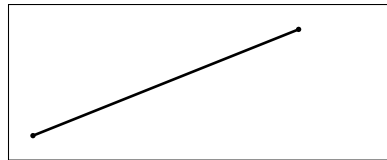
drawdot

METAPOST

0.5pt

0.5pt

```
draw (0,0)--(10u,4u);
pickup pencircle scaled 2pt;
drawdot (0,0);
drawdot (10u,4u);
```



pickup

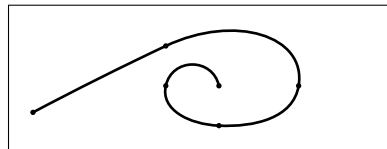
withpen

```
draw (0,0)--(10u,4u) withpen pencircle scaled 2pt;
```

### 曲线

-- ..

```
draw (0,.5u)..(5u,3u)..(10u,1.5u)..
(7u,0)..(5u,1.5u)..(7u,1.5u);
```



METAPOST

direction

Cubic Bézier

Tension

Curl

## 预定义图形

```

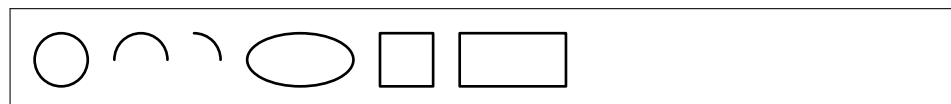
fullcircle
halfcircle quartercircle unitsquare

```

```

draw fullcircle scaled 2u;
draw halfcircle scaled 2u shifted (3u,0);
draw quartercircle scaled 2u shifted (5u,0);
draw fullcircle xscaled 4u yscaled 2u shifted (9u,0);
draw unitsquare scaled 2u shifted (12u,-u);
draw unitsquare xscaled 4u yscaled 2u shifted (15u,-u);

```



## 4.4.4 图形控制

## 线型和箭头

```

draw (0,0)--(10u,0) dashed withdots;
draw (0,1u)--(10u,1u) dashed withdots scaled 2;
draw (0,2u)--(10u,2u) dashed evenly;
draw (0,3u)--(10u,3u) dashed evenly scaled 2;

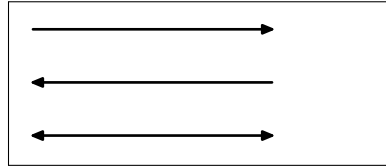
```





()

```
drawarrow (0,4u)--(9u,4u);
drawarrow reverse ((0,2u)--(9u,2u));
drawdblarrow (0,0)--(9u,0);
```



### 颜色和填充

```
METAPOST                                RGB
(0,0,0) (1,1,1) (1,0,0) (0,1,0) (0,0,1)
withcolor
fill
```

```
draw (0,4u)--(9u,4u) withcolor red;
draw (0,2u)--(9u,2u) withcolor green;
draw (0,0)--(9u,0) withcolor blue;
```



```
fill p scaled u;
fill p scaled u shifted (3u,0) withcolor red;
fill p scaled u shifted (6u,0) withcolor green;
fill p scaled u shifted (9u,0) withcolor blue;
```



filldraw

fill+draw

```
drawoption(withcolor blue);
```

## RGB

```
color c[];  
c1 := .9red + .6green + .3blue;  
c2 := (.9,.6,.3);
```

## 图形变换

## path

```
path p;  
p := (0,0)--(2,0)--(1,1.732)--cycle;  
draw p scaled u;  
draw p xscaled 2u yscaled u shifted (3u,0);  
draw p scaled u rotated 60 shifted (8u,0);
```



## 标注

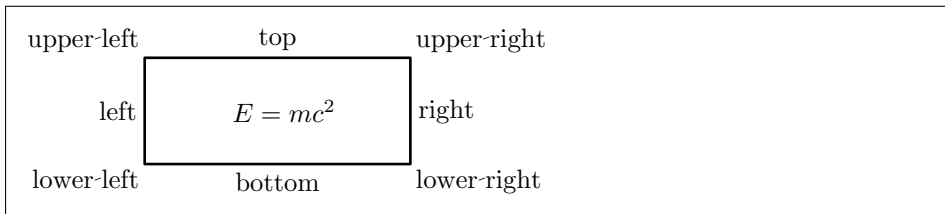
```
\label METAPOST  
btex etex TEX
```

```
draw unitsquare xscaled 10u yscaled 4u;  
label.top("top", (5u,4u));  
label.bot("bottom", (5u,0));  
label.lft("left", (0,2u));  
label.rt("right", (10u,2u));
```

```

label.ulft("upper left", (0,4u));
label.urt("upper right", (10u,4u));
label.llft("lower left", (0,0));
label.lrt("lower right", (10u,0));
label.rt(btex $E=mc^2$ etex, (3u,2u));

```



MPS

METAPOST

GSview

MPS

MPS

GSview

dvi2pdf

```

mpost \prologues:=2; input fig.mp

```

#### 4.4.5 编程功能

##### 数据类型和变量

METAPOST	10	numeric	pair	path	pen
color	cmykcolor	transform	string	boolean	picture
		u	numeric		
pair			path	pencircle	pen black
	color	scaled	rotated	shifted	transform
	numeric			1/65536	4096
				32768	
				4096	
				numeric	

```

numeric x,y,z;    %
numeric x1,x2,x3; %
numeric x[];      %

```

## 数学运算

METAPOST      + - \* /  
a++b       $\sqrt{a^2 + b^2}$       a+--b       $\sqrt{a^2 - b^2}$       4.3

4.3:

---

abs	mexp
round	mlog
ceiling	sind
floor	cosd
mod	normaldeviate
sqrt	uniformdeviate

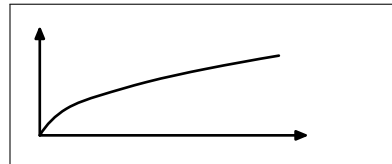
---

## 循环

```

draw (0,0) %
for x=1 upto 3:
  ..(x*x,x)*u
endfor;

```



1

upto

step 1 until

```

for x=1 step .5 until 3:

```

## 4.5 PSTricks

PSTricks	PS		$\LaTeX$
	PSTricks		Timothy Van Zandt <sup>5</sup>
	1997		Denis Girou Sebastian
Rahtz <sup>6</sup>	Herbert Voß		
	PSTricks		Van Zandt
PSTricks User's Guide	[3]	4.4	PsTricks

### 4.4: PSTricks

multido	pst-eucl
pst-plot	pst-math
pst-plot3d	pstricks-add

### 4.5.1 准备工作

PSTricks PSTricks 1cm

```
\usepackage{pstricks}
\psset{unit=10pt}
```

pspicture  $\LaTeX$

pspicture

```
\begin{pspicture}(0,0)(4,2)
...
\end{pspicture}
```

<sup>5</sup> Insead

<sup>6</sup>

	LaTeX	PSTricks	PS	dvips
dvipdfm	pdfLaTeX			driver
EPS				
	PSTricks		LaTeX	
DVI				

```

\documentclass{article}
\usepackage{pstricks}
\pagestyle{empty} %

\begin{document}
\psset{unit=10pt}
\colorbox{white}{%
  \begin{pspicture}(0,0)(4,2)%
    \psdot(0,0)%
    \psdots(0,2)(2,2)(4,2)%
  \end{pspicture}%
}
\end{document}

```

	DVI	EPS	-E	EPS
colorbox	EPS			

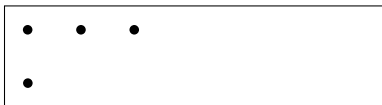
```
dvips pst_dots(.dvi) -E -o dots.eps
```

	pst-eps	PSTricks		
EPS		EPS		
	dvipdfmx	pst-eps	EPS	\rput \uput
	pst-plot	\psaxes		ps4pdf
tabularx				

#### 4.5.2 基本图形对象

点

```
\psdot(0,0)
\psdots(0,2)(2,2)(4,2)
```



### 直线、多边形、矩形

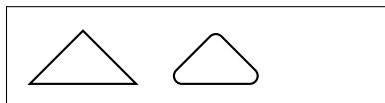
`\psline`

```
\psline(0,0)(2,2)(4,0)
\psline[linearc=.3](5,0)(7,2)(9,0)
```



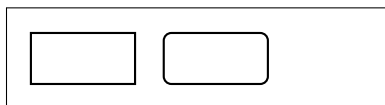
`\pspolygon`      `\psline`

```
\pspolygon(0,0)(2,2)(4,0)
\pspolygon[linearc=.3](5,0)(7,2)(9,0)
```



`\psframe`

```
\psframe(0,0)(4,2)
\psframe[framearc=.3](5,0)(9,2)
```

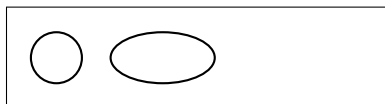


### 圆、椭圆、圆弧、扇形

`\pscircle`

`\psellipse`

```
\pscircle(1,1){1}
\psellipse(5,1)(2,1)
```



`\psarc`

`\psarcn`

`\pswedge`

```
\psarc(1,0){2}{0}{120}
\psarcn(5,0){2}{120}{0}
\pswedge(9,0){2}{0}{120}
```



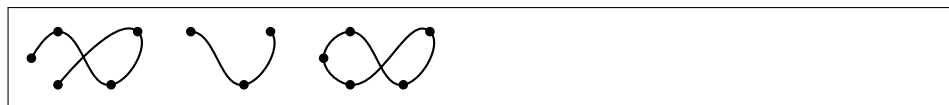
## 曲线

`\pscurve``\psecurve``\psccurve``showpoints=true`

```

\pscurve[showpoints=true](0,1)(1,2)(3,0)(4,2)(1,0)
\psecurve[showpoints=true](5,1)(6,2)(8,0)(9,2)(5,0)
\psccurve[showpoints=true](11,1)(12,2)(14,0)(15,2)(12,0)

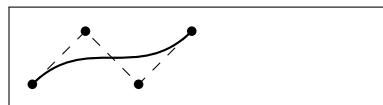
```

`\psbezier`

```

\psbezier[showpoints=true]
(0,0)(2,2)(4,0)(6,2)

```

`\psparabola`

```

\psparabola[showpoints=true]
(2,2)(1,0)

```



## 网格和坐标

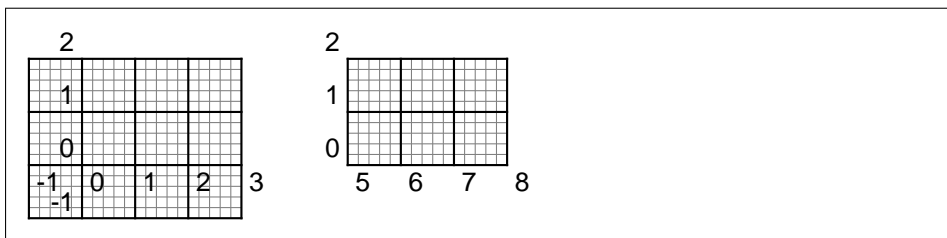
`\psgrid`

```

\psgrid(0,0)(-1,-1)(3,2)
\psgrid(5,0)(8,2)

```

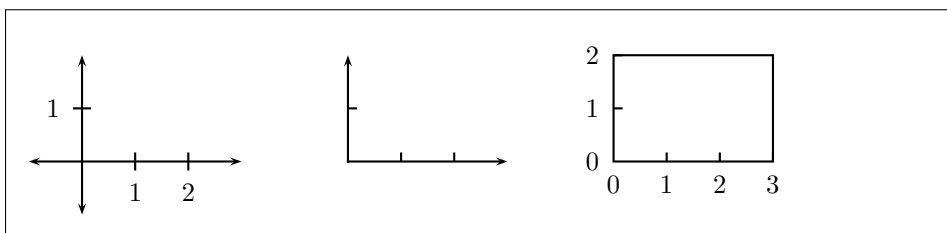


`\pst-plot``\psaxes``\psgrid`

```

\psset{unit=10pt}
\psaxes{<->}(0,0)(-1,-1)(3,2)
\psaxes[tickstyle=top,labels=none]{->}(5,0)(8,2)
\psaxes[axesstyle=frame,tickstyle=top]{->}(10,0)(13,2)

```



### 4.5.3 图形控制

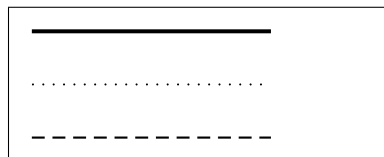
#### 线型和箭头

`PSTricks``0.8pt`

```

\psline[linewidth=1.5pt](0,4)(9,4)
\psline[linestyle=dotted](0,2)(9,2)
\psline[linestyle=dashed](0,0)(9,0)

```

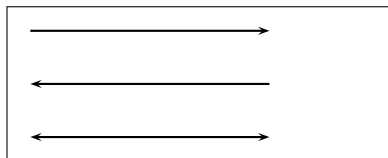
`\psset`

```

\psset{linewidth=1pt,linestyle=dashed}

```

```
\psline{->}(0,4)(9,4)
\psline{<-}(0,2)(9,2)
\psline{<->}(0,0)(9,0)
```



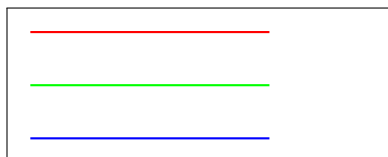
### 颜色和填充

PSTricks                    black darkgray gray lightgray white  
                                  red green blue cyan magenta yellow

```
\newgray{mygray}{.3}
\newrgbcolor{mycolor}{.3 .4 .5}
```

\psset

```
\psline[linecolor=red](0,4)(9,4)
\psline[linecolor=green](0,2)(9,2)
\psline[linecolor=blue](0,0)(9,0)
```



```
\pscircle[fillstyle=solid,fillcolor=red](1,1){1}
\pscircle[fillstyle=vlines](4,1){1}
\pscircle[fillstyle=hlines](7,1){1}
\pscircle[fillstyle=crosshatch](10,1){1}
```



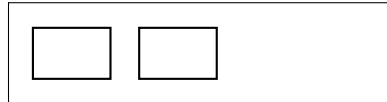
## 4.5.4 对象布局

## 平移

origin

\psset

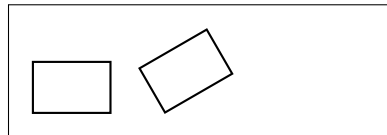
```
\psframe(0,0)(3,2)
\psframe[origin={4,0}](0,0)(3,2)
```



## 旋转

\rput

```
\psframe(0,0)(3,2)
\rput{30}(5,0){\psframe(0,0)(3,2)}
```



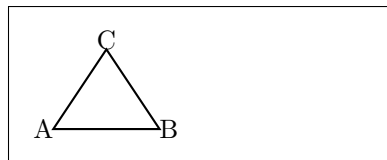
## 文字标注

\rput

t b

l r

```
\pspolygon(0,0)(4,0)(2,3)
\rput[r](0,0){A}
\rput[l](4,0){B}
\rput[b](2,3){C}
```

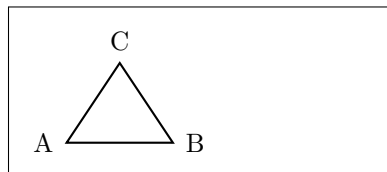


\rput

\uput

5pt

```
\pspolygon(0,0)(4,0)(2,3)
\uput[l](0,0){A}
\uput[r](4,0){B}
\uput[u](2,3){C}
```



`\uput` `\uput`  
`\rput`

4.5: uput

r	0°	ur	45°
u	90°	ul	135°
l	180°	dl	225°
d	270°	dr	315°

## 4.6 PGF

PGF Beamer Till Tantau<sup>7</sup> Tantau Beamer  
 2003 CTAN  
 2005 PGF Beamer  
 PGF Tantau TikZ  
 and PGF Manual <sup>[4]</sup>

### 4.6.1 准备工作

PGF `tikz` PGF TikZ  
 PGF `PGF driver`

```
\def\pgfsysdriver{pgfsys-dvipdfmx.def}
\usepackage{tikz}
```

PGF `1cm` PGF bug

```
\pgfsetxvec{\pgfpoint{10pt}{0}}
\pgfsetyvec{\pgfpoint{0}{10pt}}
```

<sup>7</sup> Lübeck

TikZ	tikz	tikzpicture
tikz		tikzpicture

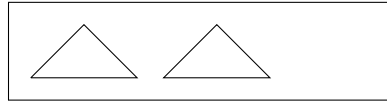
```
\tikz ... %
\begin{tikzpicture}
... %
\end{tikzpicture}
```

## 4.6.2 基本图形对象

直线、多边形、矩形

TikZ	METAPOST	cycle
------	----------	-------

```
\draw (0,0)--(4,0)--(2,3)--(0,0);
\draw (5,0)--(9,0)--(7,3)--cycle;
```

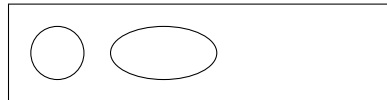


```
\draw (0,0) rectangle (4,2);
```

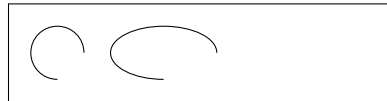


圆、椭圆、弧

```
\draw (1,1) circle (1);
\draw (5,1) ellipse (2 and 1);
```



```
\draw (2,1) arc (0:270:1);
\draw (7,1) arc (0:270:2 and 1);
```



## 曲线和抛物线

```
\draw (0,0) .. controls (2,2)
and (4,2) .. (4,0);
```



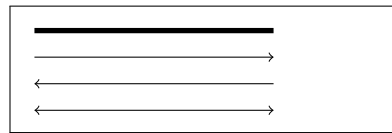
```
\draw (-1,1) parabola
bend (0,0) (1.414,2);
```



### 4.6.3 图形控制

#### 线型和箭头

```
\draw[line width=2pt] (0,0)--(9,0);
\draw[->] (0,1)--(9,1);
\draw[<-] (0,2)--(9,2);
\draw[<->] (0,3)--(9,3);
```



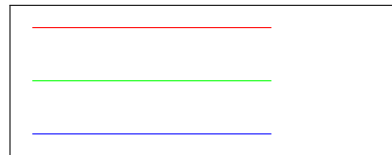
#### 颜色、填充、阴影

PGF

xcolor

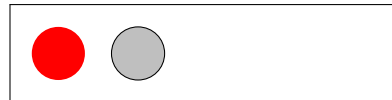
[5]

```
\draw[red] (0,4)--(9,4);
\draw[green] (0,2)--(9,2);
\draw[blue] (0,0)--(9,0);
```



\filldraw

```
\fill[red] (1,1) circle (1);
\filldraw[fill=lightgray,draw=black]
(4,1) circle (1);
```



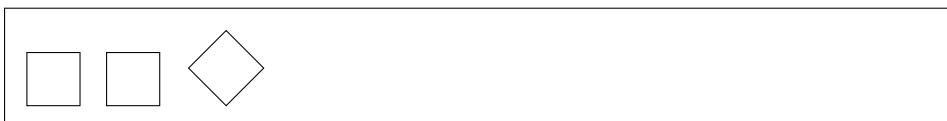
`\shade`

```
\shade (0,0) rectangle (2,2);
\shade[left color=red,right color=orange] (3,0) rectangle (5,2);
\shade[inner color=red,outer color=orange] (6,0) rectangle (8,2);
\shade[ball color=blue] (10,1) circle (1);
```



图形变换

```
\draw (0,0) rectangle (2,2);
\draw[xshift=30pt] (0,0) rectangle (2,2);
\draw[xshift=75pt,rotate=45] (0,0) rectangle (2,2);
```

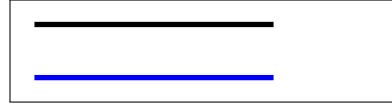


#### 4.6.4 样式

PGF   METAPOST   PSTricks   style  
HTML   CSS

```
\tikzset{
  myline/.style={line width=2pt},
  myblueline/.style={myline,blue}
}
```

```
\draw[myline] (0,2)--(9,2);  
\draw[myblueline] (0,0)--(9,0);
```



`\tikzset`

`tikzpicture`

```
\begin{tikzpicture}[  
  thickline/.style=2pt,  
  bluthickline/.style={thickline,color=blue}  
]  
...  
\end{tikzpicture}
```

#### 4.6.5 流程图

##### 节点

PGF

node

box

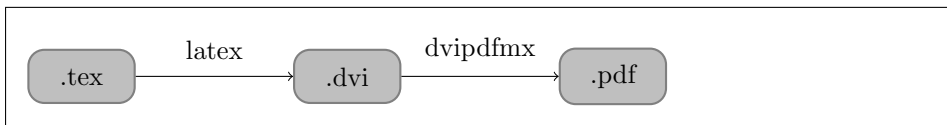
```
\tikzset{  
  box/.style={rectangle, rounded corners=6pt,  
    minimum width=50pt, minimum height=20pt, inner sep=6pt,  
    draw=gray,thick, fill=lightgray}  
}
```



```

\node[box] (tex) at(0,0) {.tex}; %
\node[box] (dvi) at(10,0) {.dvi}; %
\node[box] (pdf) at(20,0) {.pdf}; %
\draw[->] (tex)--(dvi); %
\draw[->] (dvi)--(pdf); %
\node at (5,1) {latex}; %
\node at (15,1) {dvipdfmx}; %

```



PGF

dvi
tex
50pt

10pt
pdf
dvi
50pt

edge

5pt

```

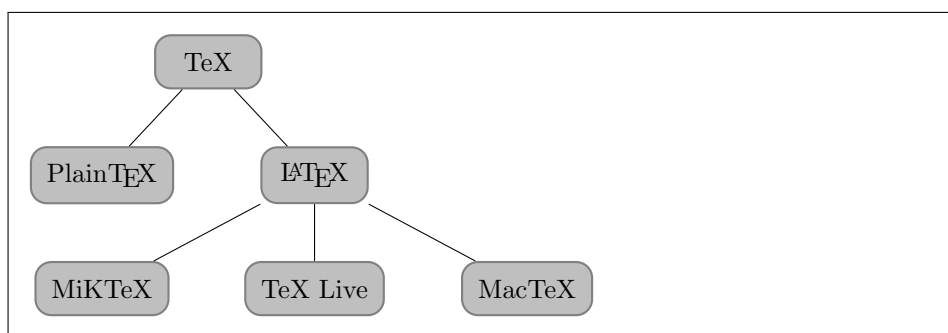
\node[box] (tex) {.tex};
\node[box,right=5 of tex] (dvi) {.dvi};
\node[box,right=6 of dvi] (pdf) {.pdf};
\path (tex) edge[->] node[above=.5] {latex} (dvi)
      (dvi) edge[->] node[above=.5] {dvipdfmx} (pdf);

```



树

```
\begin{tikzpicture}[sibling distance=80pt]
\node[box] {TeX}
  child {node[box] {Plain\TeX}}
  child {node[box] {\LaTeX}
    child {node[box] {MiKTeX}}
    child {node[box] {TeX Live}}
    child {node[box] {MacTeX}}
  };
\end{tikzpicture}
```



## 参考文献

- [1] Keith Reckdahl. *Using Imported Graphics in LaTeX and pdfLaTeX*, 2006. URL <http://www.ctan.org/tex-archive/info/epslatex/english/>.
- [2] John D. Hobby. *MetaPost: A User's Manual*, 2007. URL <http://www.ctan.org/tex-archive/graphics/metapost/>.
- [3] Timothy van Zandt. *PSTricks User's Guide*, 2007. URL <http://www.ctan.org/tex-archive/graphics/pstricks/base/doc/>.
- [4] Till Tantau. *TikZ and PGF Manual*, 2008. URL <http://sourceforge.net/projects/pgf/>.
- [5] Uwe Kern. *Extending LaTeX's Color Facilities: The xcolor Package*. CTAN, 2007. URL <http://www.ukern.de/tex/xcolor.html>.

## 5.1 简单表格

`tabular`

|

&

`\hline`

l c r

```
\begin{tabular}{|l|c|r|}
\hline
& & & \\
\hline
Windows & MikTeX & TeXnicCenter & \\
\hline
Unix/Linux & TeX Live & Emacs & \\
\hline
Mac OS & MacTeX & TeXShop & \\
\hline
\end{tabular}
```

Windows	MikTeX	TeXnicCenter
Unix/Linux	TeX Live	Emacs
Mac OS	MacTeX	TeXShop

figure

L<sup>A</sup>T<sub>E</sub>X

table

```

\begin{table}[htbp]
\caption{          }
\label{tab:threesome}
\centering
\begin{tabular}{lll}
\hline
      & & \\
\hline
Windows & MikTeX & TeXnicCenter \\
Unix/Linux & TeX Live & Emacs \\
Mac OS & MacTeX & TeXShop \\
\hline
\end{tabular}
\end{table}

```

5.1:

---

Windows	MikTeX	TeXnicCenter
Unix/Linux	TeX Live	Emacs
Mac OS	MacTeX	TeXShop

---

booktabs [\[1\]](#)

```

\begin{table}[htbp]
\caption{          }
\centering
\begin{tabular}{lll}
\toprule
      & & \\
\midrule
Windows & MikTeX & TeXnicCenter \\
Unix/Linux & TeX Live & Emacs \\
\end{tabular}

```

```

Mac OS & MacTeX & TeXShop \\
\bottomrule
\end{tabular}
\end{table}

```

### 5.2: booktabs

---



---

Windows	MikTeX	TeXnicCenter
Unix/Linux	TeX Live	Emacs
Mac OS	MacTeX	TeXShop

---

## 5.2 表格宽度

l c r

p{ } }

```

\begin{table}[htbp]
\caption{          }
\centering
\begin{tabular}{p{100pt}p{100pt}p{100pt}}
\toprule
& & \\
\midrule
Windows & MikTeX & TeXnicCenter \\
Unix/Linux & TeX Live & Emacs \\
Mac OS & MacTeX & TeXShop \\
\bottomrule
\end{tabular}
\end{table}

```

tabularx

X

5.3:

---

---

Windows	MikTeX	TeXnicCenter
Unix/Linux	TeX Live	Emacs
Mac OS	MacTeX	TeXShop

---

```
\begin{table}[htbp]
\caption{          }
\centering
\begin{tabularx}{350pt}{lXlX}
\toprule
&                                     &
&                                     &
&                                     & \\
&                                     & \\
&                                     & \\
&                                     & \\
&                                     & \\
\bottomrule
\end{tabularx}
\end{table}
```

5.4:

---

## 5.3 跨行、跨列表格

```
\multicolumn
booktabs     \cmidrule
```

```

\begin{table}[htbp]
\caption{      }
\centering
\begin{tabular}{lll}
\toprule
& \multicolumn{2}{c}{      } \\
\cmidrule{2-3}
& & \\
\midrule
Windows & MikTeX & TeXnicCenter \\
Unix/Linux & TeX Live & Emacs \\
Mac OS & MacTeX & TeXShop \\
\bottomrule
\end{tabular}
\end{table}

```

5.5:

---



---

Windows	MikTeX	TeXnicCenter
Unix/Linux	TeX Live	Emacs
Mac OS	MacTeX	TeXShop

multirow      \multirow

```

\usepackage{multirow}
...
\begin{table}[htbp]
\caption{      }
\centering
\begin{tabular}{lllc}

```

```

\toprule
& & & \\
\midrule
Windows & MikTeX & TeXnicCenter &
\multirow{3}{*}{\centering } \\
Unix/Linux & TeX Live & Emacs \\
Mac OS & MacTeX & TeXShop \\
\bottomrule
\end{tabular}
\end{table}

```

5.6:

Windows	MikTeX	TeXnicCenter
Unix/Linux	TeX Live	Emacs
Mac OS	MacTeX	TeXShop

## 5.4 彩色表格

```

\colortbl [2] \columncolor
\rowcolor \cellcolor

```

```

\usepackage{colortbl}
...
\begin{table}[htbp]
\caption{ }
\centering
\begin{tabular}{lll}
\toprule
& & \\
\midrule
Windows & MikTeX & TeXnicCenter \\

```



```

\rowcolor[gray]{.8} Unix/Linux & TeX Live & Emacs \\
Mac OS & MacTeX & TeXShop \\
\bottomrule
\end{tabular}
\end{table}

```

5.7:

Windows	MikTeX	TeXnicCenter
Unix/Linux	TeX Live	Emacs
Mac OS	MacTeX	TeXShop

## 5.5 长表格

```

\endhead
\longtable [3] \endfirsthead
\endfoot \endlastfoot

```

```

\usepackage{longtable}
...
\begin{longtable}{ll}
\caption{ } \\
\toprule
& \\
\midrule
\endfirsthead
\midrule
& \\
\midrule
\endhead
\midrule
\multicolumn{2}{r}{ \dots } \\

```



## 参考文献

- [1] Simon Fear. *Publication Quality Tables in LaTeX*, 2005. URL <http://www.ctan.org/tex-archive/macros/latex/contrib/booktabs/>.
- [2] David Carlisle. *The colortbl Package*, 2001. URL <http://tug.ctan.org/tex-archive/macros/latex/contrib/colortbl/>.
- [3] David Carlisle. *The longtable Package*, 2004. URL <http://www.ctan.org/pkg/longtable>.



## 6.1 超链接

hyperref [\[1\]](#)

`\hyperref`                      label

```
\usepackage{hyperref}
...
\label{sec:hyperlink}
...
\ref{sec:hyperlink}
\hyperref[sec:hyperlink]{                      }
```

[6.1](#)

`\url`    `\href`

```
\url{http://www.dralpha.com/}
\href{http://www.dralpha.com/}{                      }
```

<http://www.dralpha.com/>

## 6.2 长文档

`\include`  
`\input`

```
%master.tex
\begin{document}
\include{chapter1.tex}
\include{chapter2.tex}
...
\end{document}
```

`syntonly`

```
\usepackage{syntonly}
...
\syntaxonly
```

## 6.3 参考文献

`thebibliography`      `\bibitem`      bibliography      L<sup>A</sup>T<sub>E</sub>X  
    `cite`

### 6.3.1 BibTeX

1985      Oren Patashnik<sup>1</sup>      Lamport      BibTeX<sup>[2]</sup>  
    Nicolas Markey      Tame the BeaST: The B to X of Bib-  
 TeX      [3]

---

<sup>1</sup>Wiki

Knuth  
 Knuth

Knuth

```

BibTeX .bib .bst
        .bst .bib
        .bib entry
        article
book conference manual misc techreport

        manual Markey_2005
.bib

```

### JabRef

```

@MANUAL{Markey_2005,
  title = {Tame the BeaST: The B to X of BibTeX},
  author = {Nicolas Markey},
  year = {2005},
  url = {http://www.ctan.org/tex-archive/info/bibtex/
        tamethebeast/}
}

```

```
\cite{Markey_2005}
```

```
[3]
```

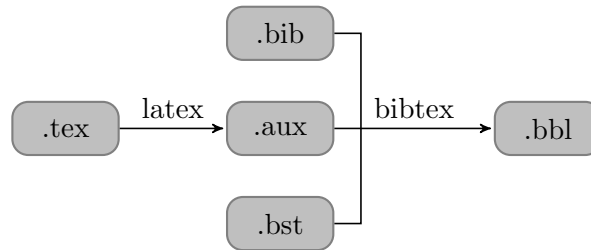
```
latex bibtex latex latex
```

1. latex .aux
2. bibtex .aux .bib .bst .bbl
 

```

thebibliography \bibitem

```
3. latex .aux
4. latex



6.1: BIBTEX

latex

bibtex

```

latex master(.tex)
bibtex chapter1(.tex)
latex master(.tex)
latex master(.tex)
  
```

### 6.3.2 natbib

- L<sup>A</sup>T<sub>E</sub>X

natbib [4]  
natbib

```

\usepackage{natbib}
...
\begin{document}
\bibliographystyle{plainnat}
\setcitestyle{square,aysep={},yysep={;}}
\bibliography{mybib.bib}
...
\end{document}
  
```

natbib plainnat abbrvnat unsrtnat

-

-





## 6.4 索引

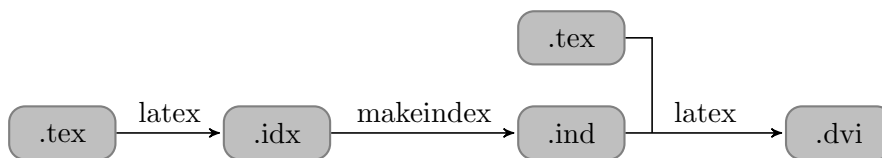
makeidx

makeindex

```
\usepackage{makeidx}
\makeindex
...
\begin{document}
\index{      }
...
\printindex
\end{document}
```

latex makeindex latex

1. latex .idx
2. makeindex .idx .ind
3. latex \printindex .ind  
DVI



6.2:

## 6.5 页面布局

$\LaTeX$	$\pagestyle$	$\pagenumbering$
header	footer	

6.2:  $\LaTeX$

---

empty  
plain  
headings  
myheadings

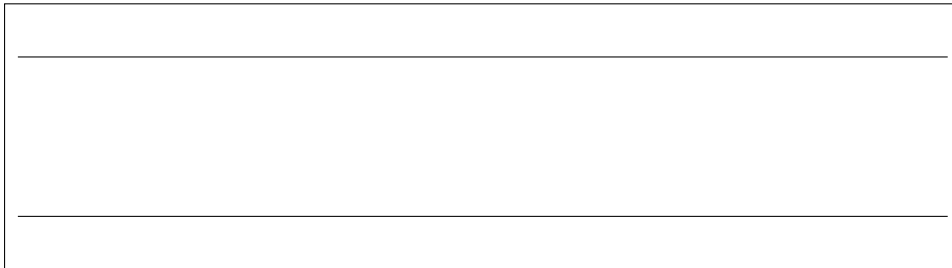
---

fancyhdr<sup>[5]</sup>

```

\usepackage{fancyhdr}
...
\pagestyle{fancy} %fancyhdr
\lhead{      }
\chead{      }
\rhead{      }
\lfoot{      }
\cfoot{      }
\rfoot{      }
\renewcommand{\headrulewidth}{0.4pt}
\renewcommand{\footrulewidth}{0.4pt}

```



```

\documentclass{LATEX}
\thechapter \thesection
Chapter Section \chaptername \sectionname
\leftmark \rightmark

fancyhdr plain
plain

```

```

\pagestyle{fancy}
\fancyhf{} %
\fancyhead[LE,RO]{\thepage} %
\fancyhead[RE]{\leftmark} %
\fancyhead[LO]{\rightmark} %
\fancypagestyle{plain}{ % plain
  \fancyhf{}
  \renewcommand{\headrulewidth}{0pt}
}

```

3.2

17

18

Chapter 3

Lamport

L<sup>A</sup>T<sub>E</sub>X

\leftmark \rightmark

\renewcommand

```
\markboth{main-mark}{sub-mark}
\markright{sub-mark}
```

```
\leftmark    main-mark                article
section      report  book      chapter    \rightmark
              article      subsection    report    book
section
              book                                #1
```

```
\renewcommand\chaptermark[1]{\markboth{\chaptername \thechapter.
#1}{}}
\renewcommand\sectionmark[1]{\markright{\thesection. #1}}
```

## 参考文献

- [1] Sebastian Rahtz and Heiko Oberdiek. *Hypertext Marks in LaTeX: A Manual for hyperref*, 2006. URL <http://www.tug.org/applications/hyperref/>.
- [2] Oren Patashnik. *BibTeXing*, 1988. URL <http://www.ctan.org/tex-archive/biblio/bibtex/contrib/doc/>.
- [3] Nicolas Markey. *Tame the BeaST: The B to X of BibTeX*. CTAN, 2005. URL <http://www.ctan.org/tex-archive/info/bibtex/tamethebeast/>.
- [4] Patrick W. Daly. *Natural Sciences Citations and References*, 2007. URL <http://www.mps.mpg.de/software/latex/localtex/locallltx.html>.
- [5] Piet van Oostrum. *Page Layout in LaTeX*, 2004. URL <http://tug.ctan.org/tex-archive/macros/latex/contrib/fancyhdr/>.



## 7.1 字符集和编码

Encoding	Character Set	Character
1963 ASCII	American Standard Code for Information Interchange	7 bit $2^7 = 128$
		8 byte
	International Organization for Standardization	ISO
ISO 8859	$2^8 = 256$	8859
	8859-1	8859-2
8859-16		
ISO	IBM	
	Code Page	1981
437	ASCII 850	852
	Console	MS-DOS
		IBM PC IBM Unix Shell
	IBM	OEM
	1252	1250
		ANSI 936 GBK

---

	950	Big5		932	SJIS		949	EUC-KR
1981							GB2312	
94 * 94		7445		6763			GB2312	
	EUC-CN				GB2312			GB2312
		HZ			GB2312			“ ”
1993		GBK		21886			21003	
		2000		GB18030		70244		27533
				GB18030				GB13000
1990	ISO				Universal Character Set			UCS
	ISO 10646							UCS-2
	UCS-4							
	ISO							The Unicode
	Consortium		1991		Unicode 1.0			
								Unicode 2.0
	Unicode		ISO 10646-1					
	Unicode			UTF-8	UTF-16	UTF-32		UTF-8
	8							Internet Engineering Task Force
	IETF			UTF-8				Internet
	Mail Consortium	IMC						UTF-8
				UTF-16		16		
	UCS-2	ASCII		UTF-32		32		UCS-4

## 7.2 中文解决方案

TeX

Knuth

TeX

L<sup>A</sup>TeX

<sup>1</sup>

CCT

Werner



Lemberg<sup>2</sup> CJK CCT CCT  
 CJK 2003 CJK  
 TeX L<sup>A</sup>T<sub>E</sub>X<sup>5</sup> <sup>3</sup> CTeX <sup>4</sup> China-  
 cwTeX<sup>3</sup> PUTeX<sup>6</sup>

MikTeX CCT CJK WinEdt

### 7.3 CJK的使用

CJK  
 CJK [1]  
 CJK CJK CJKutf8 UTF-8 CJK

```
\usepackage{CJK(utf8)}
...
\begin{document}
\begin{CJK}{<encoding>}{<family>}
...
\end{CJK}
\end{document}
```

	GBK	UTF8	family		
				GBK	UTF8
				CJK	UTF8
gbsn	gkai	CTeX	GBK	song	

---

<sup>2</sup>1968

<sup>3</sup>

<sup>4</sup>

<sup>5</sup>

<sup>6</sup>

fs            kai            hei            li            you

              CJKutf8            CJK                            UTF8

                          GBK                            UTF8

                                  ANSI                    UTF-8

```
\documentclass{article}
\usepackage{CJK}
\begin{document}
\begin{CJK}{GBK}{song}
      CJK            GBK            song
\end{CJK}
\end{document}
```

```
\documentclass{article}
\usepackage{CJKutf8}
\begin{document}
\begin{CJK}{UTF8}{gbsn}
      CJK            UTF-8            gbsn
\end{CJK}
\end{document}
```

## 参考文献

- [1]            . 我的*CJK*, 2004. URL <http://edt1023.sayya.org/tex/mycjk/>.

glyph typeface font glyph  
typeface  
font typeface

“ ” “ ”

## 8.1 字样

Serif Roman Sans Serif Mono-  
space Typewriter Serif  
Sans Serif  
Sans “ ” Monospace  
bold italic oblique  
Italic  
Serif Oblique slanted Sans Serif  
oblique italic

## 8.1:

	Serif	Sans Serif	Monospace
Mac OS	Times	Helvetica	Courier
Windows	Times New Roman	Arial	Courier New

## 8.2 字体格式

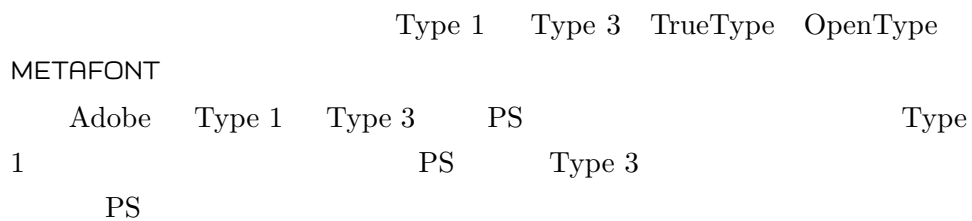
## 8.2.1 点阵字体和矢量字体



Bézier curves      raster

font hinting

## 8.2.2 常见字体



---

1991 Apple TrueType  
 TrueType  
 Type 1  
 TrueType  
 Typography AAT  
 1996 Adobe OpenType AAT  
 1984 Knuth METAFONT TrueType Open-  
 Type  
 METAFONT METAFONT  
 Knuth  
 60  
 Type 1 Type 3 metrics glyph  
 metrics AFM Adobe font metrics PFM printer font  
 metrics glyph PFA printer font ASCII PFB printer font  
 binary L<sup>A</sup>T<sub>E</sub>X metrics TFM TeX Font Metrics  
 TrueType .ttf OpenType .ttf .otf METAFONT  
 PK packed  
 raster  
 Type Type 1 Type 3 PK OpenType True-  
 OpenType TrueType

### 8.2.3 合纵连横

Adobe Type 1  
 Type 3 Apple TrueType 1991 TrueType  
 Adobe Type 1 TrueType  
 80 Adobe PS  
 Apple PS  
 TrueImage Apple Apple TrueType

---

Adobe 1996      AAT      OpenType      Adobe 2002      Apple  
 OpenType

### 8.3 字体应用

PS      Type 1      Type 3      PDF      TrueType  
 OpenType      latex      DVI      driver

#### 8.3.1 DVI

latex      L<sup>A</sup>T<sub>E</sub>X      DVI      .tfm      DVI  
 PK      .pk      DVI      DVI      METAFONT

#### 8.3.2 dvips

PK      dvips      .pk      METAFONT  
 ps2pdf      Type 3      -D      Type  
 3 PDF      Type 3      PS  
 GSview      Type 3      Adobe Reader      Acro-  
 bat      Adobe Type Manager      PS  
 Type 3      Type 3      PDF  
 dvips      -Ppdf      Type 1      PS      ps2pdf  
 Type 1      PDF  
 dvips      native      TrueType      TrueType  
 PK      Type 1  
 dvips      [1] 6

### 8.3.3 dvipdfm(x)

```

    dvipdfm    PK    Type 1                t1fonts.map
PK           Type 1                PDF                Type
1 dvipdfm                TrueType
    dvipdfmx                TrueType
                                Driver

```

## 8.4 TrueType 字体安装配置

```

    CJK        UTF-8        gbsn    gkai        GB2312
CTeX         GBK                UTF-8
    TrueType
    TrueType

1.          ttf2tfm    TFM

2.          .fd

3.    ttf2pk    DVI        dvips                ttf2pk
    PK

4.    dvipdfmx

```

### 8.4.1 目录和文件

```

TDS
MiKTeX

```

```

Install: D:\edit\MiKTeX 2.7
UserData: C:\Documents and Settings\Alpha\Local Settings\
    Application Data\MiKTeX\2.7
UserConfig: C:\Documents and Settings\Alpha\
    Application Data\MiKTeX\2.7

```

```
initexmf --edit-config-file=ttf2pk
```

### 8.4.2 ttf2tfm

```
SimSun18030.ttc 18030
```

UTF8

1.           .ttf            UserData/fonts/truetype/chinese/
2.                       .tfm    .enc
3.   \*.tfm        UserData/fonts/tfm/chinese/utf8song/
4.   \*.enc        UserData/fonts/enc/chinese/utf8song/

```
ttf2tfm SimSun18030.ttc -q -w utf8song@Unicode@
```

### 8.4.3 字体定义文件

CJK                   usong                                   utf8song\*.tfm

```
%UserData\tex\latex\CJK\UTF8\C70usong.fd
\ProvidesFile{c70usong.fd}
%character set: GB18030
%font encoding: Unicode
\DeclareFontFamily{C70}{usong}{\hyphenchar \font\m@ne}
\DeclareFontShape{C70}{usong}{m}{n}{<-> CJK * utf8song}{}
\DeclareFontShape{C70}{usong}{m}{it}{<-> CJK * utf8song}{}
\DeclareFontShape{C70}{usong}{bx}{n}{<-> CJKb * utf8song}{
    \CJKbold}
\endinput
```



#### 8.4.4 配置 ttf2pk

```

MiKTeX  ttf2pk          ttf2pk.ini
ttf2pk.cfg
ttf2pk.ini      .map          TrueType
PK
          ttf2pk    foo.map    bar.map

```

```

map foo.map
map bar.map

```

```

          ttf2pk.ini          ttfonts.map

```

```

%UserData\ttf2tfm\base\ttfonts.map
utf8song@Unicode@ SimSun18030.ttc

```

#### 8.4.5 配置 dvipdfmx

```

dvipdfmx      PDF          TrueType

```

```

%UserConfig\dvipdfm\config\dvipdfmx.cfg
f cid-x.map

```

```

%UserData\dvipdfm\config\cid-x.map
utf8song@Unicode@ unicode SimSun18030.ttc

```

## 参考文献

- [1] Tomas Rokicki. *Dvips: A DVI-to-PostScript Translator*, 2005. URL <http://tug.org/texinfohtml/dvips.html>.



Black, never back  
Word

L<sup>A</sup>T<sub>E</sub>X<sub>er</sub>

L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X

Once

“ ” MS

L<sup>A</sup>T<sub>E</sub>X<sub>er</sub>

Type 1 Type 3 TrueType OpenType

L<sup>A</sup>T<sub>E</sub>X Word

X<sub>E</sub>L<sup>A</sup>T<sub>E</sub>X Lua<sub>T</sub><sub>E</sub>X