

The folarrow package, light version

Manual of the `lite` option

Yuwsuke Kieda

2026-10-10 v20261010.0

A Japanese version of this manual is `folarrow-lite-ja.pdf`.

1 Overview

`folarrow` is a package that makes arrows with three slanted strokes on the shaft, which denote the projection of a foliated bundle, available in `amscd`, `xy-pic` and `tikz-cd` diagrams and in inline math. This manual describes its light version (the `lite` option).

```
\usepackage[lite]{folarrow}
```

The light version uses no file other than `folarrow.sty` (no Lua module, measured data or arrow fonts) and draws every arrow as the usual arrow of each package with three slanted strokes drawn over it. Use it, for example, when you do not want the arrow fonts embedded in the PDF.

2 Preparation

- Install the `folarrow` package (if your $\text{\TeX}$ distribution includes it, it can be used as it is).
- $\text{\LaTeX}$ 2022-06-01 or later is required. The package loads `pict2e` and `graphics` (both are in $\text{\TeX}$ Live). For diagrams, load the ones of `amscd`, `xy-pic` and `tikz-cd` that you use.
- It works with $\text{pdf}\text{\LaTeX}$, $\text{Lua}\text{\LaTeX}$, $\text{Xe}\text{\LaTeX}$ and $\text{up}\text{\LaTeX}+\text{dvipdfmx}$. With $\text{up}\text{\LaTeX}$, give the `dvipdfmx` option to the document class.

3 Loading

```
\usepackage{amscd}           % only the ones you use
\usepackage[all]{xy}
\usepackage{tikz-cd}
\usepackage[lite]{folarrow}
```

`amscd`, `xy-pic` and `tikz-cd` may be loaded before or after `folarrow`. `lite` can only be given when loading the package (it cannot be changed later with `\folarrowsetup`). The shape keys of the strokes (section 5) may be given together with `lite`.

```
\usepackage[lite, gap=0.45]{folarrow}
```

4 Commands

4.1 `amscd`

Add `F` right after the `@` of the usual arrows `@>>>`, `@<<<`, `@VVV` and `@AAA` to get the strokes. Labels are given in the same way as for the usual arrows.

`@F>>>`, `@F<<<` horizontal (right, left)
`@FVVV`, `@FAAA` vertical (down, up)

4.2 xy-pic

Place the object `fol` on an arrow with `|`, as in `\ar[d]|\@{fol}`. The arrow is not broken, and it also works on diagonal arrows. Enclose a label of the arrow in `\folpad` to give it a margin that clears the strokes.

```
\ar[d]|\@{fol}~{\folpad{\pi}}
```

4.3 tikz-cd

Add `foliated` to the options of the arrow. Labels clear the strokes automatically.

```
\arrow[d, foliated, "\pi"]
```

4.4 Inline math

<code>\folrightarrow</code>	right arrow (<code>\longrightarrow</code> with the strokes)
<code>\folleftarrow</code>	left arrow (<code>\longleftarrow</code> with the strokes)
<code>\foldownarrow</code> , <code>\foluparrow</code>	down arrow, up arrow
<code>\xfolrightarrow[below]{above}</code>	right arrow that stretches with the labels
<code>\xfolleftarrow[below]{above}</code>	left arrow that stretches with the labels

All of them are relations (`\mathrel`) and can be used in subscripts. The stretchable arrows are used like `\xrightarrow` of `amsmath` and are never shorter than `\longrightarrow`.

5 Adjusting the strokes

Use package options or `\folarrowsetup`. `\folarrowsetup` inside a group affects only that group.

Key	Default	Meaning
<code>span</code>	1.0	length of the strokes (ratio to the arrowhead width; $> 0, \leq 10$)
<code>lean</code>	0.25	slant (offset along the arrow relative to the length; -5 to 5)
<code>gap</code>	0.35	spacing of the strokes (ratio to the arrowhead width; 0 to 10)
<code>shift</code>	0	shift from the middle toward the tail (ratio to the arrowhead width; -10 to 10)
<code>thickness</code>	(empty)	line thickness; if empty, the shaft thickness (estimated)

6 Examples

Each example can be compiled by copying it, from `\documentclass` to `\end{document}`, into a file. The results were actually typeset (with the margins cropped). To make sure that no other files are used, they were compiled with no file of `folarrow` other than `folarrow.sty` available.

6.1 amscd

Compile: pdflatex ex01-amscd

```

\documentclass{article}

\usepackage{amscd}

\usepackage[lite]{follarrow}

\begin{document}

\[

\begin{CD}
V @>>> E\\
@. @FVV{\pi}V\\
@. M
\end{CD}

\quad

\begin{CD}
V @>>> E @>f>> E_1\\
@VVV @FV{\pi}VV @FAA{\pi_1}A\\
M @= M @F<<g< M_1
\end{CD}

\]

\end{document}

```

Result:

$$\begin{array}{ccccc} V & \longrightarrow & E & & V & \longrightarrow & E & \xrightarrow{f} & E_1 \\ & & \downarrow \pi & & \downarrow \pi & & \downarrow \pi & & \uparrow \pi_1 \\ & & M & & M & \xlongequal{\quad} & M & \xleftarrow[g]{} & M_1 \end{array}$$

6.2 xy-pic

Compile: pdflatex ex02-xypic

```

\documentclass{article}
\usepackage[all]{xy}
\usepackage[lite]{folarrow}
\begin{document}
\[
\mathrm{xy}
\begin{matrix}
V \ar[r] & E \ar[d] @{\mathrm{fol}}^{\mathrm{folpad}\pi} \\
& M
\end{matrix}
\\
\mathrm{xy}
\begin{matrix}
E \ar[r] @{\mathrm{fol}} & B \ar[d] @{\mathrm{fol}} \ar[dl] @{\mathrm{fol}} \\
M \ar[u] @{\mathrm{fol}} & N \ar[l] @{\mathrm{fol}}
\end{matrix}
\]
\end{document}

```

Result:

$$\begin{array}{ccc} V & \longrightarrow & E \\ & & \Downarrow \pi \\ & & M \end{array} \quad \begin{array}{ccc} E & \dashrightarrow & B \\ \Uparrow & \swarrow \dashrightarrow & \Downarrow \\ M & \dashleftarrow & N \end{array}$$

In T_EX Live 2025 and 2026, xy-pic itself fails with LuaL^AT_EX (unrelated to folarrow). Use xy-pic with pdfL^AT_EX or upL^AT_EX.

6.3 tikz-cd

Compile: `pdflatex ex03-tikzcd`

```

\documentclass{article}
\usepackage{tikz-cd}
\usepackage[lite]{foliarrow}
\begin{document}
\[
\begin{tikzcd}
V \arrow[r] & E \arrow[d, foliated, "\pi"] \\
& M
\end{tikzcd}
\\
\quad
\begin{tikzcd}
E \arrow[r, foliated] & B \arrow[d, foliated] \arrow[d1, foliated] \\
M \arrow[u, foliated] & N \arrow[l, foliated]
\end{tikzcd}
\\
\end{document}

```

Result:

$$\begin{array}{ccc} V & \longrightarrow & E \\ & \Downarrow \pi & \\ & M & \end{array} \quad \begin{array}{ccc} E & \dashrightarrow & B \\ \Uparrow & \swarrow & \Downarrow \\ M & \dashleftarrow & N \end{array}$$

6.4 Inline math

Compile: pdflatex ex04-inline

```
\documentclass{article}
\usepackage{amsmath}
\usepackage[lite]{folarrow}
\begin{document}
Let  $\pi$  be a foliated bundle.
Also  $M \leftarrow E$ ,  $E \rightarrow M$ ,  $M \rightarrowtail E$ ,
and in subscripts  $A_{E \rightarrowtail M}$ .
\[
E \xrightarrow{\pi} M, \quad \text{quad}
E \xrightarrow[\text{proj}]{\pi} M, \quad \text{quad}
M \xleftarrow{\pi} E
\]
{\Large  $E \rightarrow M$ ,  $E \rightarrowtail M$ }
\end{document}
```

Result:

Let $\pi: E \dashrightarrow M$ be a foliated bundle. Also $M \dashleftarrow E$, $E \nparallel M$, $M \nparallel E$, and in subscripts $A_{E \dashrightarrow M}$.

$$E \xrightarrow[\text{proj}]{\pi} M, \quad E \dashrightarrow M, \quad M \dashleftarrow E$$

$$E \dashrightarrow M, \quad E \nparallel M$$

6.5 Adjusting the strokes

Compile: pdf_latex ex05-setup-en

```
\documentclass{article}
\usepackage{amscd}
\usepackage{tikz-cd}
\usepackage[lite]{folarrow}
\folarrowsetup{gap=0.45} % whole document: slightly wider spacing of the strokes
\begin{document}
\l[
\begin{CD} E\\ @FVV{\pi}V\\ M \end{CD}
\qqquad
{\folarrowsetup{span=1.5, lean=0.5} % only inside this group
\begin{CD} E\\ @FVV{\pi}V\\ M \end{CD}}
\qqquad
{\folarrowsetup{thickness=0.8pt}
\begin{tikzcd} E \arrow[d, foliated, "\pi"] \\ M \end{tikzcd}}
\qqquad
\begin{CD} E\\ @FVV{\pi}V\\ M \end{CD}
\r]
$E \rightarrowtail M$,
{\folarrowsetup{shift=0.5}$E \rightarrowtail M$},
$E \rightarrowtail M$
\end{document}
```

Result:

E	E	E	E
$\rightarrowtail^\pi$	$\rightarrowtail^\pi$	$\rightarrowtail^\pi$	$\rightarrowtail^\pi$
M	M	M	M
$E \dashrightarrowtail M, E \rightarrowtail M, E \dashrightarrowtail M$			

`\folarrowsetup{gap=0.45}` in the preamble affects the whole document. `\folarrowsetup` used inside a group (`{` and `}`) affects only that group, and the setting of the whole document is restored after the group. The diagrams are, from left to right: the setting of the whole document (`gap=0.45`); in addition `span=1.5`, `lean=0.5`; `thickness=0.8pt` (`tikz-cd`); back to the setting of the whole document. The inline arrows are, from left to right: the setting of the whole document; in addition `shift=0.5` (the strokes are moved toward the tail of the arrow); back to the setting of the whole document.

6.6 Times (newtx)

Compile: pdflatex ex06-times

```
\documentclass{article}
\usepackage{newtxtext,newtxmath}
\usepackage{amscd}
\usepackage{tikz-cd}
\usepackage[_lite]{foliarrow}
\begin{document}
\[
\begin{CD}
V @>>> E\\
@. @FVV{\pi}V\\
@. M
\end{CD}
\qquad
\begin{tikzcd}
V \arrow[r] & E \arrow[d, foliated, "\pi"] \\
& M
\end{tikzcd}
\]
Let  $\pi: E \twoheadrightarrow M$  and  $E \downarrow M$ .
\end{document}
```

Result:

$$\begin{array}{ccc}
 V & \longrightarrow & E \\
 & & \downarrow \pi \\
 & & M
 \end{array}
 \qquad
 \begin{array}{ccc}
 V & \longrightarrow & E \\
 & & \downarrow \pi \\
 & & M
 \end{array}$$

Let $\pi: E \twoheadrightarrow M$ and $E \downarrow M$.

6.7 Palatino (newpx)

Compile: `pdflatex ex07-palatino`

```
\documentclass{article}
\usepackage{newpxtext,newpxmath}
\usepackage{amscd}
\usepackage{tikz-cd}
\usepackage[_lite]{folarrow}
\begin{document}
\[
\begin{CD}
V @>>> E\\
@. @FVV{\pi}V\\
@. M
\end{CD}
\qquad
\begin{tikzcd}
V \arrow[r] & E \arrow[d, foliated, "\pi"] \\
& M
\end{tikzcd}
\]
Let  $\pi: E \twoheadrightarrow M$  and  $E \downarrow M$ .
\end{document}
```

Result:

$$\begin{array}{ccc}
 V & \longrightarrow & E \\
 & & \downarrow \pi \\
 & & M
 \end{array}
 \qquad
 \begin{array}{ccc}
 V & \longrightarrow & E \\
 & & \downarrow \pi \\
 & & M
 \end{array}$$

Let $\pi: E \twoheadrightarrow M$ and $E \downarrow M$.

6.8 A Japanese document (upL^AT_EX+dvipdfmx)

Compile: `uplatex ex08-uplatex && dvipdfmx ex08-uplatex`

```

\documentclass[dvipdfmx]{jlreq}
\usepackage{amscd}
\usepackage[all]{xy}
\usepackage{tikz-cd}
\usepackage[lite]{foliarrow}
\begin{document}
葉層構造をもつファイバー束 $\pi:E\rightarrow M$ を次の図式で表す.
\[
\begin{CD}
V @>>> E \\
@. @FVV \pi V \\
@. M
\end{CD}
\quad
\begin{array}{ccc}
& & \\
\text{\textit{xy}} & \text{\textit{matrix}} & \\
V \ar[r] & \& E \ar[d] @ \pi \circ \text{\textit{fol}} \circ \text{\textit{pad}} \circ \pi & \\
& & \& M
\end{array}
\quad
\begin{array}{ccc}
& & \\
\text{\textit{xy}} & \text{\textit{matrix}} & \\
V \ar[r] & \& E \ar[d, \text{\textit{foliated}}] @ \pi & \\
& & \& M
\end{array}
\end{array}
\]
\end{document}

```

Result:

葉層構造をもつファイバー束 $\pi: E \dashrightarrow M$ を次の図式で表す.

$$\begin{array}{ccc}
 V & \longrightarrow & E \\
 & \Downarrow \pi & \\
 & M &
 \end{array}
 \qquad
 \begin{array}{ccc}
 V & \longrightarrow & E \\
 & \Downarrow \pi & \\
 & M &
 \end{array}
 \qquad
 \begin{array}{ccc}
 V & \longrightarrow & E \\
 & \Downarrow \pi & \\
 & M &
 \end{array}$$

6.9 Lua^AT_EX and unicode-math

Compile: `lualatex ex09-lualatex`

```
\documentclass{article}
\usepackage{amscd}
\usepackage{tikz-cd}
\usepackage{unicode-math}
\setmathfont{latinmodern-math.otf}
\usepackage[lite]{foliarrow}
\begin{document}
\[
\begin{CD}
V @>>> E\\
@. @FVV{\pi}V\\
@. M
\end{CD}
\qquad
\begin{tikzcd}
V \arrow[r] & E \\
& \Downarrow \pi \\
& M
\end{tikzcd}
\]
Let  $\pi: E \rightarrowtail M$  and  $E \twoheadrightarrow M$ .
\end{document}
```

Result:

$$\begin{array}{ccc}
 V & \longrightarrow & E \\
 & & \Downarrow \pi \\
 & & M
 \end{array}
 \qquad
 \begin{array}{ccc}
 V & \longrightarrow & E \\
 & & \Downarrow \pi \\
 & & M
 \end{array}$$

Let $\pi: E \rightarrowtail M$ and $E \twoheadrightarrow M$.

6.10 Xe_{La}T_EX and unicode-math

Compile: `xelatex ex10-xelatex`

```
\documentclass{article}
\usepackage{amscd}
\usepackage{tikz-cd}
\usepackage{unicode-math}
\setmathfont{texgyrepagella-math.otf}
\usepackage[lite]{folarrow}
\begin{document}
\[
\begin{CD}
V @>>> E \\
@. @FVV{\pi}V \\
@. M
\end{CD}
\qqquad
\begin{tikzcd}
V \arrow[r] & E \arrow[d, foliated, "\pi"] \\
& M
\end{tikzcd}
\]
Let  $\pi: E \twoheadrightarrow M$  and  $E \downarrow M$ .
\end{document}
```

Result:

$$\begin{array}{ccc}
 V & \longrightarrow & E \\
 & \Downarrow \pi & \\
 & M &
 \end{array}
 \qquad
 \begin{array}{ccc}
 V & \longrightarrow & E \\
 & \Downarrow \pi & \\
 & M &
 \end{array}$$

Let $\pi: E \twoheadrightarrow M$ and $E \downarrow M$.

7 Properties and limitations of the light version

- The width of the arrowhead and the line thickness (the reference for the size of the strokes) are read from the glyph bounding box with Xe_{La}T_EX and an OpenType math font (using `\XeTeXglyphbounds`), and estimated from the font dimensions otherwise.
- The strokes are placed at the center of the arrow's box. This may differ from the center of the arrow's ink (the part actually painted): for the inline arrows of 10 pt Computer Modern, `newtxmath`, `newpxmath` and `txfonts`, the offset was up to 0.3 pt along the arrow and 0.03 pt across it. With some fonts it is larger.
- The ends of the strokes are always butt.
- In bold, with `\boldmath` etc., the length and thickness of the strokes are also estimated from the font dimensions, so the strokes may be somewhat thin for the bold arrows.
- The result is an arrow with three strokes drawn over it, so copying it from the PDF gives the original arrow character (for `\foldownarrow`, the pieces of the delimiter).
- With Lua_{La}T_EX, the extensible $\uparrow$ of Luciole Math gives the error “Extensible recipe has no fixed parts” (a problem of the font; it happens without `folarrow` too). In the light version, `\foluparrow` and `@FAAA` of `amscd` give this error.
- In Pennstander Math, the large delimiters $\downarrow$ and $\uparrow$ are broken (a problem of the font). In the light version this shows as it is in `\foldownarrow`, `\foluparrow` and the vertical arrows of `amscd`.

- With Xe^LA^TE^X, OpenType fonts included in T^EX Live may not be found by their names. Specify them by file name, as follows.

```
\setmathfont{latinmodern-math.otf}
```

8 Notes

- A key value that is not a number or is out of range (see the table of section 5) gives an error showing the name and value of the key, and the previous value is kept.
- The commands can be used in the arguments of `\section`, `\caption`, etc. In `hyperref` bookmarks, the arrows become the characters $\rightarrow\leftarrow\downarrow\uparrow$.
- `amscd`, `xy-pic`, `tikz-cd` and `unicode-math` may be loaded before or after `folarrow`.
- In vertical writing with pT^EX/upT^EX and dvipdfmx, too, the strokes are rotated for vertical writing. To typeset diagrams in vertical writing, put them in a horizontal box such as `\hbox{\yoko ...}`.
- With babel’s spanish, `amscd` itself cannot be used (this happens without `folarrow` too). Use the `es-noquoting` option or `\deactivatequoting`.
- For colored arrows of `xy-pic`, give the color to the strokes too: `\ar@[red][r] |*[red]\dir{fol}`.
- At large sizes, load `amsmath` or `exscale` (so that the vertical arrows do not stay small).

9 Differences from the full version

The full version, without `lite`, uses the following files besides `folarrow.sty` for more accurate results.

	Full version	Light version (<code>lite</code>)
Files needed	<code>folarrow.sty</code> , <code>folarrow.lua</code> , tables of the measured data and the arrow fonts (<code>.def</code>), the arrow fonts (Type 1, OTF) and the map file	<code>folarrow.sty</code> only
Inline arrows	a single glyph of a font with the strokes (major fonts)	the strokes drawn over the arrow
Value as text	$\rightarrow\leftarrow\downarrow\uparrow$	the original arrow characters
Arrowhead width and line thickness	measured data, glyph shapes (Lua ^L A ^T E ^X , Xe ^L A ^T E ^X)	estimated (glyph shapes with Xe ^L A ^T E ^X)
Offset of the strokes from the center	at most 0.015 pt (inline arrows)	up to about 0.3 pt
Ends of the strokes	round or butt, following the tail of the arrow	always butt

The usage of the full version and the results of the verification are in the manual `folarrow-en.pdf`.

10 License and author

`folarrow.sty`, `folarrow.lua`, the `.def` files, the documentation and the tools are distributed under the MIT License (`LICENSE`). The arrow fonts (`fonts/`) were made from other fonts and keep the licenses of their original fonts (SIL Open Font License 1.1, GUST Font License, GNU GPL with font exception). The original font, original copyright notice and license of each font are listed in `licenses/FONTS.md`, and the license texts are in `licenses/`.

Author: Yuwsuke Kieda