

# The `asymptote` package

John Bowman, Tom Prince, and Will Robertson

2024/02/26      v1.38

## Abstract

This package provides integration of inline and external Asymptote graphics within a  $\text{\LaTeX}$  document.

## Contents

### 1 Introduction

This is the documentation for the  $\text{\LaTeX}$  package `asymptote` which accompanies the Asymptote drawing package. For further details on Asymptote, please see its documentation in `asymptote.pdf`.

### 2 User syntax

#### 2.1 Package loading and options

The package may take two options at load time: `inline` or `attach`. These options can also be set at any time with the `\asysetup{<options>}` command, or specified individually in the optional argument to each `asy` environment or `asyinclude` command.

The `inline` option uses Asymptote's 'inline' mode whereby included graphics have their labels typeset in the environment of the document they are contained within. Otherwise the Asymptote graphics are self-contained and their formatting is independent of the document.

The `attach` option allows generated graphics to be embedded within the PDF using the `attachfile2` package; please load that package separately if you wish to use it. The `attach` option takes precedence over the `inline` option.

This package produces quite a number of output files, which by default are created in the same directory as the  $\text{\LaTeX}$  document that is being compiled. To keep things more tidy, you can specify an output directory for these files by defining the `\asydir` command. For example, if you wish to store the figure files in the subdirectory `asytmp/`, then you would write `\renewcommand\asydir{asytmp}`.

Alternatively (and tentatively), you may write `dir=asytmp` in either the `asy` environment options or the options to `\asysetup`.

## 2.2 Commands for inserting Asymptote graphics

The main environment defined by the package is the `asy` environment, in which verbatim Asymptote code is placed that will be compiled for generating a graphic in the document. For example,

```
\begin{figure}
\begin{asy}[ <options> ]
<ASYMPTOTE CODE>
\end{asy}
\caption{...}\label{...}
```

If you have Asymptote code in a separate file, you can include it with the `\asyinclude[<options>]{<filename>}` command.

For Asymptote code that should be included in *every* graphic, define it using the `asydef` environment.

## 2.3 Graphics options

Both the `asy` environment and the `\asyinclude` command take optional parameters for controlling aspects of the graphics creation. In addition to locally setting `inline` and `attach`, the following options may also be used:

**width** Width of the figure

**height** Height of the figure

**keepAspect** Maintain aspect ratio [default true]

**viewportwidth** Viewport width for 3D figures

**viewportheight** Viewport height for 3D figures

These may also be set globally using the `\asysetup` command.

## 3 Processing the document

After running  $\text{\LaTeX}$  on the document, it is necessary to process the Asymptote graphics so they can be included in the next compilation. The simplest procedure is a recipe such as

```
pdflatex mydoc
asy mydoc-*.asy
pdflatex mydoc
```

This technique will recompile each graphic every time, however. To only recompile graphics that have changed, use the `latexmk` tool. Asymptote is distributed with a `latexmkrc` configuration file; place this file in a place where `latexmk` will find it and your document may be compiled, including the `asy` compilations, with `latexmk mydoc` or `latexmk --pdf mydoc`.

## 4 Implementation

```
1 \def\Asymptote{\tt Asymptote}}
2 \InputIfFileExists{\jobname.pre}{\typeout{No file \jobname.pre.}}
```

### 4.1 Allocations

#### Allocations

```
3 \newbox\ASYbox
4 \newdimen\ASYdimen
5 \newcounter{asy}

6 \newwrite\AsyStream
7 \newwrite\AsyPreStream

8 \newif\ifASYinline
9 \newif\ifASYattach
10 \newif\ifASYkeepAspect
11 \ASYkeepAspecttrue
```

### 4.2 Packages

```
12 \RequirePackage{keyval}
13 \RequirePackage{ifthen}
14 \RequirePackage{graphicx}
```

**Emulating packages** We cannot assume that Asymptote users have recent  $\mathrm{T}_{\mathrm{E}}\mathrm{X}$  distributions. (E.g., Fedora until recently still shipped  $\mathrm{t}_{\mathrm{E}}\mathrm{X}$ .) So load `ifpdf` and `ifxetex` if they exist; otherwise, emulate them.

In due course, delete this code and just load the packages.

```
15 \IfFileExists{ifpdf.sty}{
16   \RequirePackage{ifpdf}
17 }{
18   \expandafter\newif\csname ifpdf\endcsname
19   \ifx\pdfoutput\@undefined\else
20     \ifcase\pdfoutput\else
21       \pdftrue
22     \fi
23   \fi
24 }

25 \IfFileExists{ifxetex.sty}{
26   \RequirePackage{ifxetex}
27 }{
28   \expandafter\newif\csname ifxetex\endcsname
29   \ifx\XeTeXversion\@undefined\else
30     \xetextrue
31   \fi
32 }
```

`\CatchFileDef` Used for `\asyinclude`. Note that the fallback definition is not as robust as the one provided by `catchfile`.

```
33 \IfFileExists{catchfile.sty}{
34   \RequirePackage{catchfile}
35 }
```

```

36 \newcommand\CatchFileDef[3]{%
37   \begingroup
38   \everyeof{%
39     \ENDCATCHFILEMARKER
40     \noexpand
41   }%
42   \long\def\@tempa####1\ENDCATCHFILEMARKER{%
43     \endgroup
44     \def##1{####1}%
45   }%
46   ##3%
47   \expandafter\@tempa\@@input ##2\relax
48 }
49 }

```

### Ensuring attachfile2 is loaded if [attach] is requested

```

50 \newif\if@asy@attachfile@loaded

51 \AtBeginDocument{%
52   \ifpackageloaded{attachfile2}{\@asy@attachfile@loadedtrue}{}%
53   \let\asy@check@attachfile\asy@check@attachfile@loaded
54 }

55 \newcommand\asy@check@attachfile@loaded{%
56   \if@asy@attachfile@loaded\else
57     \PackageError{asyptote}{You must load the attachfile2 package}{^^J%
58       You have requested the [attach] option for some or all of your^^J%
59       Asymptote graphics, which requires the attachfile2 package.^^J%
60       Please load it in the document preamble.^^J%
61   }%
62   \fi
63 }

64 \newcommand\asy@check@attachfile{%
65   \AtBeginDocument{\asy@check@attachfile@loaded}%
66   \let\asy@check@attachfile\@empty
67 }

```

### Macros

```

68 \def\csarg#1#2{\expandafter#1\csname#2\endcsname}

```

## 4.3 Package options

```

69 \DeclareOption{inline}{%
70   \ASYinlinetrue
71 }
72 \DeclareOption{attach}{%
73   \asy@check@attachfile
74   \ASYattachtrue
75 }
76 \ProcessOptions*

77 \def\asylatexdir{}
78 \def\asydir{}
79 \def\ASYasydir{}

```

```
80 \def\ASYprefix{}
```

## 4.4 Testing for PDF output

Note this is not quite the same as `\ifpdf`, since we still want PDF output when using XeTeX.

```
81 \newif\ifASYPDF
82 \ifxetex
83   \ASYPDFtrue
84 \else
85   \ifpdf
86     \ASYPDFtrue
87   \fi
88 \fi
89 \ifASYPDF
90   \def\AsyExtension{pdf}
91 \else
92   \def\AsyExtension{eps}
93 \fi
```

## 4.5 Bug squashing

```
94 \def\unquoteJobname#1"#2"#3\relax{%
95   \def\rawJobname{#1}%
96   \ifx\rawJobname\empty
97     \def\rawJobname{#2}%
98   \fi
99 }
100 \expandafter\unquoteJobname\jobname""\relax
```

Work around jobname bug in MiKTeX 2.5 and 2.6: Turn stars in file names (resulting from spaces, etc.) into minus signs

```
101 \def\fixstar#1*#2\relax{%
102   \def\argtwo{#2}%
103   \ifx\argtwo\empty
104     \gdef\Jobname{#1}%
105   \else
106     \fixstar#1-#2\relax
107   \fi
108 }
109 \expandafter\fixstar\rawJobname*\relax
```

Work around bug in dvips.def: allow spaces in file names.

```
110 \def\Gininclude@eps#1{%
111   \message{<#1>}%
112   \bgroup
113   \def\@tempa{!}%
114   \dimen@\Gin@req@width
115   \dimen@ii.1bp\relax
116   \divide\dimen@\dimen@ii
117   \@tempdima\Gin@req@height
118   \divide\@tempdima\dimen@ii
119   \special{PSfile=#1\space
120     llx=\Gin@llx\space
121     lly=\Gin@lly\space
```

```

122     urx=\Gin@urx\space
123     ury=\Gin@ury\space
124     \ifx\Gin@scalex\@tempa\else rwi=\number\dimen@\space\fi
125     \ifx\Gin@scaley\@tempa\else rhi=\number\@tempdima\space\fi
126     \ifGin@clip clip\fi}%
127 \egroup
128 }

```

## 4.6 Input/Output

```

129 \immediate\openout\AsyPreStream=\jobname.pre\relax
130 \AtEndDocument{\immediate\closeout\AsyPreStream}

131 \def\WriteAsyLine#1{%
132   \immediate\write\AsyStream{\detokenize{#1}}%
133 }

134 \def\globalASYdefs{}
135 \def\WriteGlobalAsyLine#1{%
136   \expandafter\g@addto@macro
137   \expandafter\globalASYdefs
138   \expandafter{\detokenize{#1^^J}}%
139 }

```

## 4.7 Commands for verbatim processing environments

```

140 \def\ProcessAsymptote#1{%
141   \begingroup
142   \def\CurrentAsymptote{#1}%
143   \let\do\@makeother \dospecials
144   \@makeother^^L% and whatever other special cases
145   \catcode'\ =10
146   \endlinechar'\^^M \catcode'\^^M=12 \xAsymptote
147 }

```

Need lots of comment chars here because  $\langle line\ end \rangle$  is no longer a space character.

```

148 \begingroup
149   \catcode'\^^M=12 \endlinechar=-1\relax%
150   \gdef\xAsymptote{%
151     \expandafter\ProcessAsymptoteLine%
152   }
153   \gdef\ProcessAsymptoteLine#1^^M{%
154     \def\@tempa{#1}%
155     {%
156       \escapechar=-1\relax%
157       \xdef\@tempb{\string\\end\string\{\CurrentAsymptote\string\}}%
158     }%
159     \ifx\@tempa\@tempb%
160       \edef\next{\endgroup\noexpand\end{\CurrentAsymptote}}%
161     \else%
162       \ThisAsymptote{#1}%
163       \let\next\ProcessAsymptoteLine%
164     \fi%
165     \next%
166   }
167 \endgroup
168 \def\asy@init{%

```

```

169 \def\ASYlatexdir{%
170 \ifx\asylatexdir\empty\else
171 \def\ASYlatexdir{\asylatexdir/}%
172 \fi
173 \ifx\asydir\empty\else
174 \def\ASYasydir{\asydir/}%
175 \fi
176 \def\ASYprefix{\ASYlatexdir\ASYasydir}%
177 }

```

## 4.8 User interface

```

178 \newcommand\asy[1][]{%
179 \stepcounter{asy}%
180 \setkeys{ASYkeys}{#1}%

```

Disable the "inline" option if "attach" is enabled:

```

181 \ifASYattach
182 \ASYinlinefalse
183 \fi
184 \asy@init
185 \immediate\write\AsyPreStream{%
186 \noexpand\InputIfFileExists{%
187 \ASYprefix\noexpand\jobname-\the\c@asy.pre}{-}{-}%
188 }%
189 \asy@write@graphic@header
190 \let\ThisAsymptote\WriteAsyLine
191 \ProcessAsymptote{asy}%
192 }

193 \def\endasy{%
194 \asy@finalise@stream
195 \asy@input@graphic
196 }

197 \def\asy@write@graphic@header{%
198 \immediate\openout\AsyStream=\ASYasydir\jobname-\the\c@asy.asy\relax
199 \gdef\AsyFile{\ASYprefix\Jobname-\the\c@asy}%
200 \immediate\write\AsyStream{%
201 if(!settings.multipleView) settings.batchView=false;^^J%
202 \ifxetex
203 settings.tex="xelatex";^^J%
204 \else\ifASYPDF
205 settings.tex="pdflatex";^^J%
206 \fi\fi
207 \ifASYinline
208 settings.inlinetex=true;^^J%
209 deletepreamble();^^J%
210 \fi
211 defaultfilename="\Jobname-\the\c@asy";^^J%
212 if(settings.render < 0) settings.render=4;^^J%
213 settings.outformat="";^^J%
214 \ifASYattach
215 settings.inlineimage=false;^^J%
216 settings.embed=false;^^J%
217 settings.toolbar=true;^^J%

```

```

218     \else
219         settings.inlineimage=true;^^J%
220         settings.embed=true;^^J%
221         settings.toolbar=false;^^J%
222         viewportmargin=(2,2);^^J%
223     \fi
224     \globalASYdefs
225 }%
226 }
227 \def\asy@expand@keepAspect{%
228     \ifASYkeepAspect keepAspect=true%
229     \else keepAspect=false%
230     \fi%
231 }
232 \def\asy@finalise@stream{%
    Setting size(). Only inserted if one of the dimensions is set explicitly (i.e., if
    both height and width are not empty).
233     \ifx\ASYwidth\@empty
234         \ifx\ASYheight\@empty
235             % write nothing!
236         \else
237             \immediate\write\AsyStream{size(0,\ASYheight,\asy@expand@keepAspect);}%
238         \fi
239     \else
240         \ifx\ASYheight\@empty
241             \immediate\write\AsyStream{size(\ASYwidth,0,\asy@expand@keepAspect);}%
242         \else
243             \immediate\write\AsyStream{size(\ASYwidth,\ASYheight,\asy@expand@keepAspect);}%
244         \fi
245     \fi
    Setting viewportsize(). Same logic as for size().
246     \ifx\ASYviewportwidth\@empty
247         \ifx\ASYviewportheight\@empty
248             % write nothing!
249         \else
250             \immediate\write\AsyStream{viewportsize=(0,\ASYviewportheight);}%
251         \fi
252     \else
253         \ifx\ASYviewportheight\@empty
254             \immediate\write\AsyStream{viewportsize=(\ASYviewportwidth,0);}%
255         \else
256             \immediate\write\AsyStream{%
257                 viewportsize=(\ASYviewportwidth,\ASYviewportheight);}%
258         \fi
259     \fi
260     \immediate\closeout\AsyStream
261 }
262 \def\asy@input@graphic{%
263     \ifASYinline
264         \IfFileExists{"\AsyFile.tex"}{%
265             \catcode'\:=12\relax
266             \@input"\AsyFile.tex"\relax
267         }{%

```

```

268     \PackageWarning{asymptote}{file ‘\AsyFile.tex’ not found}%
269   }%
270 \else
271   \IfFileExists{"\AsyFile.\AsyExtension"}{%
272     \ifASYattach
273       \ifASYPDF
274         \IfFileExists{"\AsyFile+0.pdf"}{%
275           \setbox\ASYbox=\hbox{\includegraphics[hiresbb]{\AsyFile+0.pdf}}%
276         }{%
277           \setbox\ASYbox=\hbox{\includegraphics[hiresbb]{\AsyFile.pdf}}%
278         }%
279       \else
280         \setbox\ASYbox=\hbox{\includegraphics[hiresbb]{\AsyFile.eps}}%
281       \fi
282       \textattachfile{\AsyFile.\AsyExtension}{\phantom{\copy\ASYbox}}%
283       \vskip-\ht\ASYbox
284       \indent
285       \box\ASYbox
286     \else
287       \ifASYPDF
288         \includegraphics[hiresbb]{\AsyFile.pdf}%
289       \else
290         \includegraphics[hiresbb]{\AsyFile.eps}%
291       \fi
292     \fi
293   }{%
294     \IfFileExists{"\AsyFile.tex"}{%
295       \catcode‘:=12
296       \@input"\AsyFile.tex"\relax
297     }{%
298       \PackageWarning{asymptote}{%
299         file ‘\AsyFile.\AsyExtension’ not found%
300       }%
301     }%
302   }%
303 \fi
304 }
305 \def\asydef{%
306   \let\ThisAsymptote\WriteGlobalAsyLine
307   \ProcessAsymptote{asydef}%
308 }
309 \newcommand\asyinclude[2][]{%
310   \begingroup
311   \stepcounter{asy}%
312   \setkeys{ASYkeys}{#1}%
313   \ifASYattach
314     \ASYinlinefalse
315   \fi
316   \asy@init
317   \immediate\write\AsyPreStream{%
318     \noexpand\InputIfFileExists{%
319       \ASYprefix\noexpand\jobname-\the\c@asy.pre}{-}{-}%

```

```

320 }%
321 \asy@write@graphic@header
322 \IfFileExists{#2.asy}{%
323   \CatchFileDef\@tempa{#2.asy}{%
324     \let\do\@makeother
325     \dospecials
326     \endlinechar=10\relax
327   }%
328 }{%
329   \IfFileExists{#2}{%
330     \CatchFileDef\@tempa{#2}{%
331       \let\do\@makeother
332       \dospecials
333       \endlinechar=10\relax
334     }%
335   }{%
336     \PackageWarning{asyptote}{file #2 not found}%
337     \def\@tempa{}%
338   }%
339 }%
340 \immediate\write\AsyStream{\unexpanded\expandafter{\@tempa}}%
341 \asy@finalise@stream
342 \asy@input@graphic
343 \endgroup
344 }

345 \newcommand{\ASYanimategraphics}[5][{}]{%
346   \IfFileExists{_#3.pdf}{%
347     \animategraphics[{#1}]{#2}{_#3}{#4}{#5}%
348   }{}%
349 }

```

## 4.9 Keys for graphics processing

```

350 \newcommand\asysetup[1]{\setkeys{ASYkeys}{#1}}

351 \define@key{ASYkeys}{dir}{%
352   \def\asydir{#1}%
353 }
354 \def\ASYwidth{}
355 \define@key{ASYkeys}{width}{%
356   \edef\ASYwidth{\the\dimexpr#1\relax}%
357 }
358 \def\ASYheight{}
359 \define@key{ASYkeys}{height}{%
360   \edef\ASYheight{\the\dimexpr#1\relax}%
361 }
362 \define@key{ASYkeys}{keepAspect}[true]{%
363   \ifthenelse{equal{#1}{true}}
364     {\ASYkeepAspecttrue}
365     {\ASYkeepAspectfalse}%
366 }
367 \def\ASYviewportwidth{}
368 \define@key{ASYkeys}{viewportwidth}{%
369   \edef\ASYviewportwidth{\the\dimexpr#1\relax}%
370 }

```

```

371 \def\ASYviewportheight{}
372 \define@key{ASYkeys}{viewportheight}{%
373   \edef\ASYviewportheight{\the\dimexpr#1\relax}%
374 }

375 \define@key{ASYkeys}{inline}[true]{%
376   \ifthenelse{equal{#1}{true}}
377     {\ASYinline true}
378     {\ASYinline false}%
379 }

380 \define@key{ASYkeys}{attach}[true]{%
381   \ifthenelse{equal{#1}{true}}
382     {\ASYattach true}
383     {\ASYattach false}%
384 }

```