

# The `asymptote` package

John Bowman, Tom Prince, and Will Robertson

2015/05/10      v1.29

## 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}{\}{}{}
```

### 4.1 Allocations

#### Allocations

```
3 \newbox\ASYbox
4 \newcounter{asy}
5 \newwrite\AsyStream
6 \newwrite\AsyPreStream
7 \newif\ifASYinline
8 \newif\ifASYattach
9 \newif\ifASYkeepAspect
10 \ASYkeepAspecttrue
```

### 4.2 Packages

```
11 \RequirePackage{keyval}
12 \RequirePackage{ifthen}
13 \RequirePackage{color,graphicx}
```

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

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

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

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

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

```

32 \IfFileExists{catchfile.sty}{
33   \RequirePackage{catchfile}
34 }{
35   \newcommand\CatchFileDef[3]{%
36     \begingroup
37     \everyeof{%
38       \ENDCATCHFILEMARKER
39     }
40   }%
41   \long\def\@tempa###1\ENDCATCHFILEMARKER{%
42     \endgroup
43     \def##1{###1}%
44   }%
45   ##3%
46   \expandafter\@tempa\@input ##2\relax
47 }
48 }

```

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

```

49 \newif\if@asy@attachfile@loaded
50 \AtBeginDocument{%
51   \ifpackageloaded{attachfile2}{\@asy@attachfile@loadedtrue}{}%
52   \let\asy@check@attachfile\asy@check@attachfile@loaded
53 }
54 \newcommand\asy@check@attachfile@loaded{%
55   \if@asy@attachfile@loaded\else
56     \PackageError{asyptote}{You must load the attachfile2 package}{^^J%
57       You have requested the [attach] option for some or all of your^^J%
58       Asymptote graphics, which requires the attachfile2 package.^^J%
59       Please load it in the document preamble.^^J%
60   }%
61   \fi
62 }
63 \newcommand\asy@check@attachfile{%
64   \AtBeginDocument{\asy@check@attachfile@loaded}%
65   \let\asy@check@attachfile\@empty
66 }

```

### Macros

```

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

```

## 4.3 Package options

```

68 \DeclareOption{inline}{%
69   \ASYinlinetrue
70 }
71 \DeclareOption{attach}{%

```

```

72 \asy@check@attachfile
73 \ASYattachtrue
74 }
75 \ProcessOptions*
76 \def\asylatexdir{}
77 \def\asydir{}
78 \def\ASYasydir{}
79 \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.

```

80 \newif\ifASYPDF
81 \ifxetex
82   \ASYPDFtrue
83   \usepackage{everypage}
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\Ginclude@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 *(line end)* 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{%

```

```

218 \immediate\openout\AsyStream=\ASYasydir\jobname-\the\c@asy.asy\relax
219 \gdef\AsyFile{\ASYprefix\Jobname-\the\c@asy}%
220 \immediate\write\AsyStream{%
221     if(!settings.multipleView) settings.batchView=false;^^J%
222     \ifxetex
223         settings.tex="xelatex";^^J%
224     \else\ifASYPDF
225         settings.tex="pdflatex";^^J%
226     \fi\fi
227     \ifASYinline
228         settings.inlinetex=true;^^J%
229         deletepreamble();^^J%
230     \fi
231     defaultfilename="\Jobname-\the\c@asy";^^J%
232     if(settings.render < 0) settings.render=4;^^J%
233     settings.outformat="";^^J%
234     \ifASYattach
235         settings.inlineimage=false;^^J%
236         settings.embed=false;^^J%
237         settings.toolbar=true;^^J%
238     \else
239         settings.inlineimage=true;^^J%
240         settings.embed=true;^^J%
241         settings.toolbar=false;^^J%
242         viewportmargin=(2,2);^^J%
243     \fi
244     \globalASYdefs
245 }%
246 }
247 \def\asy@expand@keepAspect{%
248     \ifASYkeepAspect keepAspect=true%
249     \else keepAspect=false%
250     \fi%
251 }
252 \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).
253     \ifx\ASYwidth\@empty
254         \ifx\ASYheight\@empty
255             % write nothing!
256         \else
257             \immediate\write\AsyStream{size(0,\ASYheight,\asy@expand@keepAspect);}%
258         \fi
259     \else
260         \ifx\ASYheight\@empty
261             \immediate\write\AsyStream{size(\ASYwidth,0,\asy@expand@keepAspect);}%
262         \else
263             \immediate\write\AsyStream{size(\ASYwidth,\ASYheight,\asy@expand@keepAspect);}%
264         \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{asyptote}{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   }{%
      3D PRC figures require inline mode.
294     \IfFileExists{"\AsyFile.tex"}{%
295       \catcode'::=12
296       \@input"\AsyFile.tex"\relax
297     }{%
298       \PackageWarning{asyptote}{%
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\input\IfFileExists{%
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     {\ASYinlinetrue}
378     {\ASYinlinefalse}%
379 }
380 \define@key{ASYkeys}{attach}[true]{%
381   \ifthenelse{\equal{#1}{true}}
382     {\ASYattachtrue}
383     {\ASYattachfalse}%
384 }

```