

# The `asymptote` package

John Bowman, Tom Prince, and Will Robertson

2016/11/26     v1.33

## 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 \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{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.

```
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     }%
41     \long\def\@tempa####1\ENDCATCHFILEMARKER{%
42       \endgroup
43       \def##1{####1}%
44     }%
45     ##3%
46     \expandafter\@tempa\@input ##2\relax
47   }
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{asytote}{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   \usepackage{everypage}
85 \else
86   \ifpdf
87     \ASYPDFtrue
88   \fi
89 \fi
90 \ifASYPDF
91   \def\AsyExtension{pdf}
92 \else
93   \def\AsyExtension{eps}
94 \fi

```

## 4.5 Bug squashing

```

95 \def\unquoteJobname#1"#2"#3\relax{%
96   \def\rawJobname{#1}%
97   \ifx\rawJobname\empty
98     \def\rawJobname{#2}%
99   \fi
100 }
101 \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

```

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

```

```

110 \expandafter\fixstar\rawJobname*\relax
    Work around bug in dvips.def: allow spaces in file names.
111 \def\Gininclude@eps#1{%
112   \message{<#1>}%
113   \bgroup
114   \def\@tempa{!}%
115   \dimen@\Gin@req@width
116   \dimen@ii.1bp\relax
117   \divide\dimen@\dimen@ii
118   \@tempdima\Gin@req@height
119   \divide\@tempdima\dimen@ii
120   \special{PSfile=#1\space
121     llx=\Gin@llx\space
122     lly=\Gin@lly\space
123     urx=\Gin@urx\space
124     ury=\Gin@ury\space
125     \ifx\Gin@scalex\@tempa\else rwi=\number\dimen@\space\fi
126     \ifx\Gin@scaley\@tempa\else rhi=\number\@tempdima\space\fi
127     \ifGin@clip clip\fi}%
128   \egroup
129 }

```

## 4.6 Input/Output

```

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

132 \def\WriteAsyLine#1{%
133   \immediate\write\AsyStream{\detokenize{#1}}%
134 }

135 \def\globalASYdefs{}
136 \def\WriteGlobalAsyLine#1{%
137   \expandafter\g@addto@macro
138   \expandafter\globalASYdefs
139   \expandafter{\detokenize{#1^^J}}%
140 }

```

## 4.7 Commands for verbatim processing environments

```

141 \def\ProcessAsymptote#1{%
142   \begingroup
143   \def\CurrentAsymptote{#1}%
144   \let\do\@makeother \dospecials
145   \@makeother^^L% and whatever other special cases
146   \catcode'\ =10
147   \endlinechar'\^^M \catcode'\^^M=12 \xAsymptote
148 }

```

Need lots of comment chars here because *(line end)* is no longer a space character.

```

149 \begingroup
150   \catcode'\^^M=12 \endlinechar=-1\relax%
151   \gdef\xAsymptote{%

```

```

152   \expandafter\ProcessAsymptoteLine%
153 }
154 \gdef\ProcessAsymptoteLine#1^~M{%
155   \def\@tempa{#1}%
156   {%
157     \escapechar=-1\relax%
158     \xdef\@tempb{\string\end\string\{\CurrentAsymptote\string\}}%
159   }%
160   \ifx\@tempa\@tempb%
161     \edef\next{\endgroup\noexpand\end{\CurrentAsymptote}}%
162   \else%
163     \ThisAsymptote{#1}%
164     \let\next\ProcessAsymptoteLine%
165   \fi%
166   \next%
167 }
168 \endgroup
169 \def\asy@init{%
170   \def\ASYlatexdir{%
171     \ifx\asylatexdir\empty\else
172       \def\ASYlatexdir{\asylatexdir/}%
173     \fi
174     \ifx\asydir\empty\else
175       \def\ASYasydir{\asydir/}%
176     \fi
177   \def\ASYprefix{\ASYlatexdir\ASYasydir}%
178 }

```

## 4.8 User interface

```

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

```

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

```

182   \ifASYattach
183     \ASYinlinefalse
184   \fi
185   \asy@init
186   \immediate\write\AsyPreStream{%
187     \noexpand\inputIfFileExists{%
188       \ASYprefix\noexpand\jobname-\the\c@asy.pre}{-}{-}%
189   }%
190   \asy@write@graphic@header
191   \let\ThisAsymptote\WriteAsyLine
192   \ProcessAsymptote{asy}%
193 }
194 \def\endasy{%
195   \asy@finalise@stream
196   \asy@input@graphic
197 }

```

```

198 \def\asy@write@graphic@header{%
199   \immediate\openout\AsyStream=\ASYasydir\jobname-\the\c@asy\relax
200   \gdef\AsyFile{\ASYprefix\Jobname-\the\c@asy}%
201   \immediate\write\AsyStream{%
202     if(!settings.multipleView) settings.batchView=false;^^J%
203     \ifxetex
204       settings.tex="xelatex";^^J%
205     \else\ifASYPDF
206       settings.tex="pdflatex";^^J%
207     \fi\fi
208     \ifASYinline
209       settings.inlinetex=true;^^J%
210       deletepreamble();^^J%
211     \fi
212     defaultfilename="\Jobname-\the\c@asy";^^J%
213     if(settings.render < 0) settings.render=4;^^J%
214     settings.outformat="";^^J%
215     \ifASYattach
216       settings.inlineimage=false;^^J%
217       settings.embed=false;^^J%
218       settings.toolbar=true;^^J%
219     \else
220       settings.inlineimage=true;^^J%
221       settings.embed=true;^^J%
222       settings.toolbar=false;^^J%
223       viewportmargin=(2,2);^^J%
224     \fi
225     \globalASYdefs
226   }%
227 }
228 \def\asy@expand@keepAspect{%
229   \ifASYkeepAspect keepAspect=true%
230   \else keepAspect=false%
231   \fi%
232 }
233 \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).
234   \ifx\ASYwidth\@empty
235     \ifx\ASYheight\@empty
236       % write nothing!
237     \else
238       \immediate\write\AsyStream{size(0,\ASYheight,\asy@expand@keepAspect);}%
239     \fi
240   \else
241     \ifx\ASYheight\@empty
242       \immediate\write\AsyStream{size(\ASYwidth,0,\asy@expand@keepAspect);}%
243     \else
244       \immediate\write\AsyStream{size(\ASYwidth,\ASYheight,\asy@expand@keepAspect);}%

```



```

245     \fi
246 \fi

Setting viewportsize=(). Same logic as for size().
247 \ifx\ASYviewportwidth\@empty
248     \ifx\ASYviewportheight\@empty
249         % write nothing!
250     \else
251         \immediate\write\AsyStream{viewportsize=(0,\ASYviewportheight);}
252     \fi
253 \else
254     \ifx\ASYviewportheight\@empty
255         \immediate\write\AsyStream{viewportsize=(\ASYviewportwidth,0);}
256     \else
257         \immediate\write\AsyStream{%
258             viewportsize=(\ASYviewportwidth,\ASYviewportheight);}
259     \fi
260 \fi
261 \immediate\closeout\AsyStream
262 }

263 \def\asy@input@graphic{%
264     \ifASYinline
265         \IfFileExists{"\AsyFile.tex"}{%
266             \catcode'\:=12\relax
267             \@@input"\AsyFile.tex"\relax
268         }{%
269             \PackageWarning{asymptote}{file '\AsyFile.tex' not found}%
270         }%
271     \else
272         \IfFileExists{"\AsyFile.\AsyExtension"}{%
273             \ifASYattach
274                 \ifASYPDF
275                     \IfFileExists{"\AsyFile+0.pdf"}{%
276                         \setbox\ASYbox=\hbox{\includegraphics[hiresbb]{"\AsyFile+0".pdf}}%
277                     }{%
278                         \setbox\ASYbox=\hbox{\includegraphics[hiresbb]{"\AsyFile".pdf}}%
279                     }%
280                 \else
281                     \setbox\ASYbox=\hbox{\includegraphics[hiresbb]{"\AsyFile.eps"}}%
282                 \fi
283                 \textattachfile{\AsyFile.\AsyExtension}{\phantom{\copy\ASYbox}}%
284                 \vskip-\ht\ASYbox
285                 \indent
286                 \box\ASYbox
287             \else
288                 \ifASYPDF
289                     \includegraphics[hiresbb]{"\AsyFile".pdf}%
290                 \else
291                     \includegraphics[hiresbb]{"\AsyFile.eps"}%
292                 \fi

```

```

293     \fi
294 }{%

3D PRC figures require inline mode.
295     \IfFileExists{"\AsyFile.tex"}{%
296         \catcode': =12
297         \@@input"\AsyFile.tex"\relax
298     }{%
299         \PackageWarning{asymptote}{%
300             file '\AsyFile.\AsyExtension' not found%
301         }%
302     }%
303 }%
304 \fi
305 }

306 \def\asydef{%
307     \let\ThisAsymptote\WriteGlobalAsyLine
308     \ProcessAsymptote{asydef}%
309 }

310 \newcommand\asyinclude[2][]{%
311     \begingroup
312     \stepcounter{asy}%
313     \setkeys{ASYkeys}{#1}%
314     \ifASYattach
315         \ASYinlinefalse
316     \fi
317     \asy@init
318     \immediate\write\AsyPreStream{%
319         \noexpand\input\IfFileExists{%
320             \ASYprefix\noexpand\jobname-\the\c@asy.pre}{\}%
321         }%
322     \asy@write@graphic@header
323     \IfFileExists{#2.asy}{%
324         \CatchFileDef\@tempa{#2.asy}{%
325             \let\do\@makeother
326             \dospecials
327             \endlinechar=10\relax
328         }%
329     }{%
330         \IfFileExists{#2}{%
331             \CatchFileDef\@tempa{#2}{%
332                 \let\do\@makeother
333                 \dospecials
334                 \endlinechar=10\relax
335             }%
336         }{%
337             \PackageWarning{asymptote}{file #2 not found}%
338             \def\@tempa{}%
339         }%
340     }%

```

```

341 \immediate\write\AsyStream{\unexpanded\expandafter{\@tempa}}}%
342 \asy@finalise@stream
343 \asy@input@graphic
344 \endgroup
345 }

346 \newcommand{\ASYanimategraphics}[5][[]]{%
347 \IfFileExists{_#3.pdf}{%
348 \animategraphics[#1][#2][_#3]{#4}{#5}%
349 }{}%
350 }

```

## 4.9 Keys for graphics processing

```

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

352 \define@key{ASYkeys}{dir}{%
353 \def\asydir{#1}%
354 }
355 \def\ASYwidth{}
356 \define@key{ASYkeys}{width}{%
357 \edef\ASYwidth{\the\dimexpr#1\relax}%
358 }
359 \def\ASYheight{}
360 \define@key{ASYkeys}{height}{%
361 \edef\ASYheight{\the\dimexpr#1\relax}%
362 }
363 \define@key{ASYkeys}{keepAspect}[true]{%
364 \ifthenelse{equal{#1}{true}}
365 {\ASYkeepAspecttrue}
366 {\ASYkeepAspectfalse}%
367 }
368 \def\ASYviewportwidth{}
369 \define@key{ASYkeys}{viewportwidth}{%
370 \edef\ASYviewportwidth{\the\dimexpr#1\relax}%
371 }
372 \def\ASYviewportheight{}
373 \define@key{ASYkeys}{viewportheight}{%
374 \edef\ASYviewportheight{\the\dimexpr#1\relax}%
375 }

376 \define@key{ASYkeys}{inline}[true]{%
377 \ifthenelse{equal{#1}{true}}
378 {\ASYinlinetrue}
379 {\ASYinlinefalse}%
380 }
381 \define@key{ASYkeys}{attach}[true]{%
382 \ifthenelse{equal{#1}{true}}
383 {\ASYattachtrue}
384 {\ASYattachfalse}%
385 }

```