Export to LaTeX (for LaTeX2e)

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1 Introduction

Maple V Release 3 introduces the capability of exporting the contents of a Maple worksheet into a file suitable for processing by the LaTeX document formatting system.

The text regions of the Maple worksheet and the various algebraic output regions are automatically written to a file along with appropriate latex macros so that the contents of the worksheet can then be formatted and printed using LaTeX. Of particular interest is the fact that the math typeset regions, including the multi-line displays, are reformatted to the user specified column width using Maple's LaTeX math formatting capabilities[1]. This feature automatically carries out linebreaking of large mathematical formulae in LaTeX.

The automatically generated LaTeX source document (say "worksheet.tex") has a structure similar to that shown below.

```
\documentclass{article}
\usepackage{maplems}
\begin{document}
First paragraph of text.

Second paragraph of text. This is a test file.
\begin{mapleinput}
(a + b);
\end{mapleinput}
\begin{maplelatex}
\[
{a} + {b}
\]
\end{maplelatex}
We can display mathematics in a variety of forms.
\begin{mapleinput}
Int( 1/(1 + x^4),x);
\end{mapleinput}
\begin{maplelatex}
\[
{\displaystyle \int} {\displaystyle \frac {1}{1 + {x}^{4}}}\,{d}{
x}
```

[1] This is an entirely new mechanism based on Maple's high resolution math formatting technology. It is separate from Maple's library level `latex( )` command which can still be used to format individual expressions.

```
\]
\end{maplelatex}
\begin{mapleinput}
value(");
\end{mapleinput}
\begin{maplelatex}
\begin{eqnarray*}
\lefteqn{{\displaystyle \frac {1}{8}}\,\sqrt {2}\,{\rm ln}
 \left( {\vrule height0.89em width0em depth0.89em} \right. \,
{\displaystyle \frac {{x}^{2} + {x}\,\sqrt {2} + 1}{{x}^{2} - {x}
\,\sqrt {2} + 1}}\, \left. {\vrule
height0.89em width0em depth0.89em} \right)  +
{\displaystyle \frac {1}{4}}\,\sqrt {2}\,{\rm arctan} \left(
{\vrule height0.41em width0em depth0.41em} \right. \,{x}\,\sqrt {
2} + 1\, \left. {\vrule height0.41em width0em depth0.41em}
 \right) } \\
 & & \mbox{} + {\displaystyle \frac {1}{4}}\,\sqrt {2}\,{\rm
arctan} \left( {\vrule height0.41em width0em depth0.41em}
 \right. \,{x}\,\sqrt {2} - 1\, \left. {\vrule
height0.41em width0em depth0.41em} \right) \mbox{\hspace{88pt}}
\end{eqnarray*}
\end{maplelatex}
And more...   TTY based output is handled as
\begin{mapleinput}
Int((x+a)^3,x=a..b);
\end{mapleinput}
\begin{maplettyout}
                         b
                         /
                        |          3
                        |   (x + a)  dx
                        |
                       /
                       a
\begin{maplettyout}
We can even include a plot.
\mapleplot{worksht.ps1}
\maplesepline
\end{document}
%% End of Maple V Session Output
```

Maple's text regions from the original worksheet become ordinary LaTeX paragraphs. Except for embedded graphics, the other regions (Maple input, Maple typeset mathematics output, and Maple character based mathematics output) are formatted using an appropriate LaTeX environment.

If you wish the text regions to be processed as is, with no special meaning assigned to LaTeX characters such as _ or ^, use the package option *worksheet* as in

```
\usepackage[worksheet]{maplems}
```

The *maplems* style sets up page sizes, headers and footers, and then uses the style package *mapleenv* to tell LaTeXhow to format each of these special environments. Thus, the document can be printed as is. The document can also be enhanced by editing in standard LaTeX constructs. Experienced LaTeX

users can redefine these style macros to achieve specific effects and Most mathematics publishers have their own style macros that can be modified to work in conjunction with these macros.

2 Printing or Viewing a Maple LaTeX Document

In order to format and print the document `worksht.tex` you need a standard version of LaTeX and the two LaTeX style files `maplems.sty` and `mapleenv.sty` that are provided with this document. Documents which are modified by hand to include plots use the *epsfig.sty* LaTeX style package that is part of LaTeX2e. It uses the package options *dvips* and *oztex* to indicate which postscript driver is being used to handle any graphics embedded using the *mapleplot* macro.

If these style files are not installed in one of the locations automatically searched by your installation of LaTeX then they should appear in the same directory or folder as `worksht.tex`.

To print or view this LaTeX document we first produce a ".dvi" file. On a command based system you would normally type a command of the form

```
latex worksht.tex
```

On an "icon" based system you would start the LaTeX application and then use its menus to "open" the file "worksht.tex".

Finally, the resulting file "worksht.dvi" is then processed by another application such as "dvips" to send the document to the printer or to preview it on your screen.

3 How Maple's Export to LaTeX Works

The content of the original Maple worksheet is a sequence of regions. These are either *plain text* regions, *Maple input* regions, *Maple tty based output* (such as error messages) or the *typeset mathematical output*.

In addition, each platform dependent user interface permits the embedding of native graphics format files in the worksheet. These graphics may be generated by Maple, or by another application.

When a Maple worksheet is "exported to LaTeX", the text based regions, and the typeset mathematics are exported. All the embedded graphics regions of the worksheet are ignored. PostScript graphics can be included directly into your document by hand editing the resulting file to include references to plot files using the LaTeX macro `\mapleplot{}` that is provided with these styles.

To create a LaTeX version of your Maple worksheet proceed as follows:

1. Open the worksheet from within Maple and ensure that all the Maple results are up-to-date. If your worksheet is designed to execute the Maple commands in sequence top to bottom you can refresh your worksheet by selecting the *Execute All* option. (On the Macintosh version of Maple, simply select the entire worksheet and press enter.)

2. If your worksheet contains plot commands then re-executing the entire worksheet will regenerate those plots in separate windows. You can use the `plotsetup` command to cause those plot commands to generate plots to specific files. Alternatively, in Windows or with the Motif interface, they can be saved from the plot windows in PostScript to files of your choice.

3. To add these plots to your LaTeX document, use a plain text editor to insert appropriate commands of the form

```
\mapleplot{filename.ps}
```

where `filename.ps` is the user chosen name of the plot file. Typically, such commands are added immediately following the corresponding plot commands.

4. Use a plain text editor to elaborate on the annotations that are part of your document. For example, a new section heading "An Example" can be added directly to the worksheet simply by inserting a LaTeX command line of the form

```
\section{An Example}
```

directly into the exported document.

5. Process your LaTeX document with LaTeX.

4 LaTeX Styles

The style of your document can be changed simply by choosing a different LaTeX style. There are many different available styles, and most mathematics publishers can provide you with their own styles.

For example, to define an alternative document "style" you simply replace the existing style definition.

```
\documentclass{article}
\usepackage{maplems}
```

by (for example)

```
\documentclass[fullpage]{article}
\usepackage[mapleenv]
```

Here, the standard LaTeX "article" style has been modified by the contents of the two style files `fullpage.sty` and `mapleenv.sty`. The style "mapleenv" is necessary to provide the basic definitions for the special Maple environments but does not affect the basic page layout.

4.1 The Maple Style file `maplems.sty`

The "Export to LaTeX" file is created with the "article" style further modified by the style "maplems". The effect of using "maplems" is to define some special commands needed by Maple, and to set the default page layout settings. They are defined by the contents of the file `maplems.sty`. A copy of earlier versions of this file is found in the Maple directory `maple/etc`, (or the equivalent location on DOS and Macintosh platforms.) The changes that have been incorporated here are to make the change to latex2e.

This file has several sections, each setting a different group of style parameters. By changing these settings you can change aspects of the overall style. These can be changed by editing a copy of this file, or they can be reset directly in the "preamble" of your document (i.e., the part between the line beginning `\documentclass...` and the line `\begin{document}`) by adding commands such as

```
\setlength{\LeftMapleSkip}{0in}
```

(This particular command would cause the indentation of Maple commands to be set to 0 inches.)

Portions of these style files are shown below. The lines beginning with % are comments to TEXand LATEX.

4.1.1 The Page Headings

The page headings are set by the following commands. Some possible alternative styles are listed as comments.

```
% \pagestyle{noheadings}
% \pagestyle{plain}
\pagestyle{myheadings}
\markright{\protect\rule[-5pt]{\linewidth}{1pt}\hspace{-\linewidth}%
{\protect\large Maple V\ \  Release 3}}%
```

For example, to change to the "plain" page style add the line `\pagestyle{plain}` to the preamble of your document.

4.1.2 Page Dimensions and spacing

Next, some of the main page dimensions are reset.

```
% main document settings
%
\topmargin=     -0.2in
\textheight=    8.75in
\textwidth=     6.0in
\headheight=    2.5ex
\headsep=       0.17in
\oddsidemargin= 0.25in
\evensidemargin=\oddsidemargin
\parsep=        2ex   % space between item paragraphs
\parskip=       1.5ex     % space between paragraphs
```

To change these, again use `\setlength` in the preamble of your document.

4.1.3 Spacing and Sizes for the Maple Environments

Finally the LATEX macros defining the special Maple environments are read in and their user settable parameters are set to default values.

```
% parameters controlling the special maple environments
%
\input mapleenv.sty
\MaplePromptttrue      % generate a prompt at start of each line?
```

```
\MaplePromptString =  {\raise 1pt \hbox{$\scriptstyle>$\space}}
\AboveMapleSkip =     1ex plus 2 pt minus 1 pt
\BelowMapleSkip =     \AboveMapleSkip
\LeftMapleSkip  =     5ex
\AboveMaplePlot =     2\AboveMapleSkip
\BelowMaplePlot =     2\AboveMapleSkip
\MaplePlotHeight =    25ex
\MaplePlotWidth =     1.3\MaplePlotHeight
\edef\MaplePlotAngle{270}
\let\MapleSepLineWidth\linewidth  % \let so that it will be redefined
  % properly for narrow environments.
\MapleSepLineHeight = 1pt
\let\MapleFont\tt     % font used for input and ttyout
\let\MapleSize\small  % font size for input and ttyout
\MapleFirstLinefalse  % hides first \cr of \mapleinput
\MapleTab = 8       % spaces used by the tab character.
```

4.2 The Maple Style file `mapleenv.sty`

Use the style "mapleenv" in conjunction with your chosen style when all that you need is the definitions of the special regions. In this way, the special Maple environments are defined, but the basic page style and layout remains unmodified.

The special Maple environments and macros that are defined are:

```
\begin{mapleinput} ... \end{mapleinput}

\begin{maplettyout} ... \end{maplettyout}

\begin{maplelatex} ... \end{maplelatex}

\maplesepline
```

and

```
\mapleplot{plotfile.ps}
```

The definitions for these LaTeX environments are parameterized. By changing the parameters (in the same manner as done done in the file `maplems.sty`) you can affect details such as the amount of space above or below the environments, the amount of indentation used, the character used to identify prompts., etc. This can be done in the preamble of your document.

The two text based environments are special versions of LaTeX "verbatim" environments while the `maplelatex` environment is used to permit control of page breaking and the spacing above and below the environment.

The `\maplesepline` command is used to create separator lines such as found in the actual Maple worksheets. It has no arguments.

The `\mapleplot` macro is provided as an example of how to include graphs. It has one argument — the name of the file containing the PostScript description of the plot.

5 Summary

These style files are provided simply as samples of how to define such LaTeX environments. You may use them or modify them, subject to the conditions outlined in each file. Non-profit redistribution is also permitted.