Maxiplot: Maxima and Gnuplot in LaTeX.

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1 Introduction

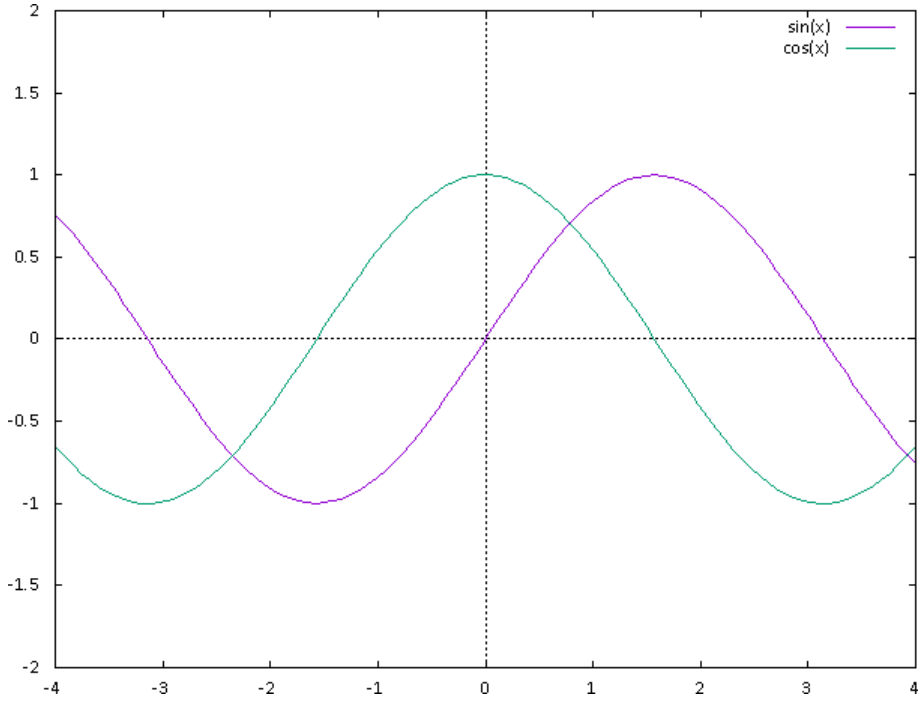
For those who do not know *Maxima*, it is a symbolic calculation program which can be used to compute derivatives and integrals, solve equations, find limits, work with vectors and matrices and create graphics, among many other things. It also adds the possibility to write programs, thus expanding its capabilities. As if all this was not enough, it is also released under the GNU General Public License and it can be downloaded for free at `http://maxima.sourceforge.net`, where there is also documentation in several languages (including Spanish).

The purpose of this LaTeX package is to provide "programming" capabilities importing the results, without the need of working with various files and interfaces. Maxima code can be included within the LaTeX document. When the document is processed, a file with extension `.mac` is generated, which can be directly processed by Maxima, creating another file with extension `.mxp`; when the LaTeX document is processed again, that file will be automatically inserted.

Gnuplot commands can also be inserted, thanks to some additional commands added by J. M. Mira. Thus, in addition to the auxiliary files already mentioned, another file with extension `.gnp` will be created, which after being processed by *Gnuplot* can be added to the document.

2 Gnuplot

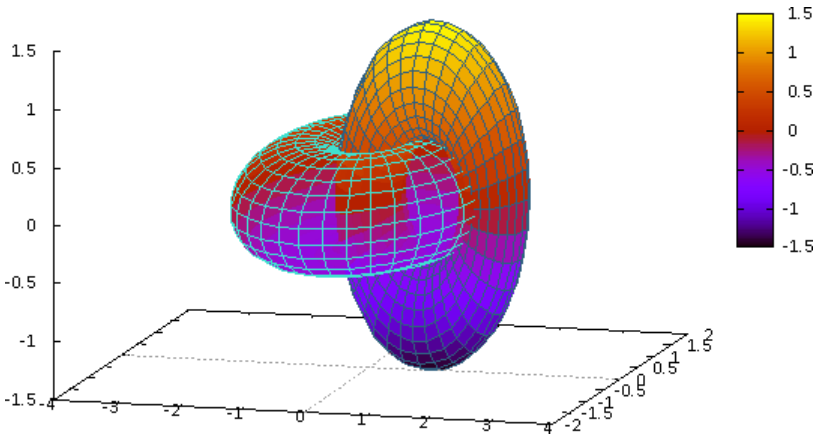
While *Maxima* can create graphics via *Gnuplot*, sometimes it might be preferable to work directly with this last program. In order to do that, the environments `gnuplot` and its verbatim version `vgnuplot` are used.



Here is a 3D example

```
\begin{gnuplot}
  set term png crop enhanced font "calibri, 10"
  set output "toros.png"
  set parametric
  set urange [0:2*pi]
  set vrange [-pi:pi]
  set isosamples 36,24
  set hidden3d
  set view 75,15,1,1
  unset key
  set ticslevel 0
  x1(u,v)=cos(u)+1*cos(u)*cos(v)
  y1(u,v)=sin(u)+1*sin(u)*cos(v)
  z1(u,v)=.5*sin(v)
  x2(u,v)=1+cos(u)+.5*cos(u)*cos(v)
  y2(u,v)=.5*sin(v)
  z2(u,v)=sin(u)+.5*sin(u)*cos(v)
  set multiplot
  splot x1(u,v), y1(u,v), z1(u,v) w pm3d, x2(u,v), y2(u,v), z2(u,v) w pm3d
  splot x1(u,v), y1(u,v), z1(u,v) lt 3,   x2(u,v), y2(u,v), z2(u,v) lt 5
\end{gnuplot}
\begin{center}
```

```
  \mxpIncludegraphics[scale=0.75]{toros.png}
\end{center}
```



Let us examine the `\mxpIncludegraphics` command: its usage is the same as `includegraphics` from package `graphicx`; in fact, it just makes sure that the graphic file exists before invoking that macro.

2.1 Problems

This is an experimental version; many of the capabilities of Maxima have not been tested and it has not been tried with the most important LaTeX packages. Thus, it will surely need some tweaking.

However, I think that most of the problems will appear when showing certain outputs. For instance, if the result of a computation is too long, it will not be easy to break it into several lines (except if one works in Maxima and then copies the result to the document, of course).

Other possible problems can be addressed from within the LaTeX document. By default, Maxima orders expressions by inverse alphabetical order; hence, if we type:

```
  $$\imaxima{tex(x+y+z+t=0)}$$
```

we get:

$$z + y + x + t = 0$$

That can be avoided by using Maxima functions `ordergreat` and `unorder`:

```
\imaximacmd{ordergreat(x,y,z,t)$}
$$\imaxima{tex(x+y+z+t=0)}$$
\imaximacmd{unorder()$}
```

Furthermore, if we would like to align several equations, we will need to dive a little deeper:

```
\begin{maximacmd}
  ordergreat(x,y,z)$
  :lisp(defprop mequal (&=) texsym)
\end{maximacmd}

\begin{maxima*}
  eq1:a-2*b=x+y,
  eq2:b=2*x-3*y+2*z,
  tex(eq1),
  print("\\\\"),
  tex(eq2)
\end{maxima*}

\begin{maximacmd}
  unorder()$
  :lisp(defprop mequal (=) texsym)
\end{maximacmd}
```

$$a - 2\,b = x + y \tag{1}$$

$$b = 2\,x - 3\,y + 2\,z \tag{2}$$

3 A few last words

As I mentioned before, this is an experimental package that will probably need some amendments and additions, so any ideas or comments will be welcome.

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(English translation by Jaime Villate)