\textbf{\LaTeXeX\ Graphics with PStricks}

This presentation is also available online. Please visit my home page and follow the links.

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1. Resources

(a) ImageMagick is a collection of (free) image manipulation tools. You can find out more by visiting

\texttt{http://www.imagemagick.com}

(b) The \LaTeXeX\ Graphics Companion.
   - Paperback: 608 pages
   - Publisher: Addison-Wesley Pub Co. 1st edition (April 15, 1997)
   - ISBN: 0201854694

(c) The \LaTeXeX\ Graphics Companion (2nd Edition).
   - Paperback: 976 pages
   - Publisher: Addison-Wesley Professional; 2 edition (August 12, 2007)
   - ISBN: 0321508920

(d) The PStricks web site.

\texttt{http://www.pstricks.de}

(e) PostScript(R) Language Tutorial and Cookbook (also called the “The Blue Book”)
   - Paperback: 256 pages
   - Publisher: Addison-Wesley Professional (January 1, 1985)
   - ISBN: 0201101791

2. \texttt{PStricks}

(a) We start with some examples.
\[ r = 1 + 2 \sin \theta \]

Figure 3: Polar Graphs

Figure 4: Area between two curves.

Figure 5: Polar Grid

Figure 6: A pair of vectors
Figure 7: Vector addition with a grid.

Figure 8: Sketching a cylinder.

Figure 9: Position Vectors
$c = 0.01$
$c = 0.025$
$c = 0.05$
$c = 0.075$
$c = 0.1$
$c = 0.11$
$c = 0.125$

Figure 13: Lagrange Multipliers

Figure 14: Exposed Solid
3. PSTricks

To use PSTricks you must include the following lines in the preamble of your document.

\begin{verbatim}
\usepackage{pst-eucl}
\usepackage{calc}
\usepackage{pstricks-add}
\usepackage{pstricks}
\usepackage{pstricks-add}
\usepackage{pst-all}
\RequirePackage{pst-xkey}
\end{verbatim}

We should mention that there have been some incompatibilities between the pstcol package (used by PSTricks) and the graphics packages mentioned above.

Using colors with PSTricks is similar to what has already been discussed. The real power of the PSTricks package is the ability to create graphics using LaTeX-like syntax.

(a) Preliminaries

PSTricks provides users with the capability to draw using the familiar syntax of \LaTeX. For example:

\begin{verbatim}
\psline[linecolor=blue,linewidth=1.5pt](-3,1)(2,2)
\end{verbatim}

The previous example might be easier to understand if we include more detail in the sketch. Thus:

\begin{verbatim}
\psline[linecolor=blue,linewidth=1.5pt](-3,1)(2,2)
\showgrid
\end{verbatim}
Here's a curve. Notice that the points used can be turned on (as shown) or off.

\begin{pspicture}(-6, -6)(6, 6)
    \showgrid
    \pscurve[linecolor=red,linewidth=1.5pt,showpoints=true](1,0)(0,2)(3,1)(6,6)
\end{pspicture}

We begin by setting the default unit(s) in PSTricks using the command \texttt{\textbackslash pset\{unit=1cm\}}. This is actually the default value.

\begin{pspicture}(-6, -6)(6, 6)
    \showgrid
    \pscurve[linecolor=red,linewidth=1.5pt,showpoints=true](-6,1)(0,2)(3,1)(6,6)
    \psbezier[style=myCurveStyle,linecolor=green]{-}(-4,1)(-2,3)(1,-4)(5,5)
\end{pspicture}

There are built-in shapes

\begin{pspicture}(-6, -6)(6, 6)
    \showgrid
    \psellipse[linecolor=blue,linewidth=1.5pt](1,0)(1,1.5)
    \psdots[linecolor=red,linewidth=1.25pt](0,0)
    \uput{6pt}[180](0,0){$(0,0)$}
\end{pspicture}

where the values $\texttt{xmin}$, $\texttt{ymin}$, etc. have been defined previously as

\begin{verbatim}
def xmin(-6) def xmax(6)
def ymin(-6) def ymax(6)
\end{verbatim}
Here is a circle centered at \((-2, -1)\) of radius 2.

\begin{pspicture}(-2,-1)(2)
\pscircle[linecolor=red,linewidth=1.5pt](-2,-1){2}
\end{pspicture}

Here is the same object filled-in and clipped.

\begin{pspicture}(-2,-1)(2)
\psclip{\myframe(-2,-1)(2)}
\pscircle*[linecolor=red,linewidth=1.5pt](-2,-1){2}
\pswedge*[linecolor=white](-2,-1){1}{15}{105}
\endpsclip
\end{pspicture}

Finally, we plot some functions. To do this we'll use some custom macros that give the user better control over the coordinate system.

\begin{pspicture}(-2,-1)(2)
\psclip{\myframe(-2,-1)(2)}
\psplot[style=myPlotStyle]{-2}{2}{x x^2}
\endpsclip
\end{pspicture}
And again, using better grid controls.

Here’s something useful for integration theory.
Here is the code:

```latex
\def\xmin{0}\def\xmax{6}
\def\ymin{0}\def\ymax{1}
\def\dommin{\xmin}\def\dommax{\xmax}
\VR{3in}{2.5in}
\newpsobject{newgrid}{psgrid}{%
gridlabels=0pt%
.griddots=0%
.gridwidth=0.5pt%
.gridcolor=gray%
.subgriddiv=4%
.subgridwidth=0.25pt%
.subgridcolor=red}%
\begin{pspicture}(\xmin,\ymin)(\xmax,\ymax)
\newgrid
%%%%%%%%%%%%%%%%%%%%
%% Axes and Ticks %%
%%%%%%%%%%%%%%%%%%%%
\SpecialCoor
%% Labels go here
\rput[lr](!\xmax\space\xmax\space\xmin\space sub 15 di v sub
\ymax\space\ymax\space\ymin\space sub 25 div sub){$y=\frac{1}{x}$}
\NormalCoor
\myaxes{<->}(0,0)(\xmin,\ymin)(\xmax,\ymax)
%% Change these as needed. #1 - start, #2 - end, #3 - increment
\xTickMarks{\xmin}{\xmax}{1}
\yTickMarks{\ymin}{\ymax}{1}
\psclip{psframe(\xmin,\ymin)(\xmax,\ymax)}%
%% Graphing directives go here, e.g.,
\psplot[style=myPlotStyle]
{0.1}{\xmax}{1 x div}
\endpsclip
\SpecialCoor
\psline[fillstyle=crosshatch]{-}(3,0)(3.5,0)(!3.5 1 3 div)(!3 1 3 div)(3,0)
\psline[fillstyle=crosshatch]{-}(3.5,0)(4,0)(!4 1 3.5 div)(!3.5 1 3.5 div)(3.5,0)
\psline[fillstyle=crosshatch]{-}(4,0)(4.5,0)(!4.5 1 4
\end{pspicture}
```
(c) Plotting Data from a File

Suppose that you wish to plot the following data.

\begin{array}{c|c}
0 & 0 \\
0.0628 & 0.06279 \\
0.1256 & 0.12533 \\
\vdots & \vdots \\
\end{array}

The following code does the trick.

```latex
\begin{pspicture}(%xmin,%ymin)(%xmax,%ymax)
\showgrid
\special{ps: /showgrid on}
%% Axes and Ticks %%
\myaxes{<->}(0,0)(%xmax,%ymax)
%% Graphical Objects %%
\psclip{\myframe(%xmin,%ymin)(%xmax,%ymax)}
\fileplot{plotData.txt}
\endpsclip
\SpecialCoor
\rput[lt](%!xmin %ymax sub 15 div \ymax \ymin space sub 25 div sub){$y=\sin x$}
\NormalCoor
\end{pspicture}
```

4. Several examples from geometry.
5. A few exotic tricks.

(a) A vector field.

(b) A three dimensional wedge.
(c) An ice-cream cone.

(d) A level surface.

\[ f(x, y, z) = c \]