A Latex Template and Mini Introduction

Clare E. Parnell

February 8, 2012

Abstract

This document has been generated as an aid to help new students learn a bit about Latex. It gives examples of the use of most things that you may well come across when writing a paper.

1 Introduction

Below are just some general, hopefully useful things, that you may or may not already know about Latex. Use this as a template to get you started if you have never used Latex before. Reading the ps or pdf file alone will not mean much, but hopefully the .tex file makes more sense.

1.1 Unix commands

The Unix commands needed to process your document and produce a postscript file:

- `latex file`: to process your .tex file
- `xdvi file`: to view your .dvi file
- `dvips file -o file.ps`: to create a .ps file

You should use these commands if you include .eps files as figures.

Alternatively, the Unix commands needed to process your document and produce a pdf file are:

- `pdflatex file`: to process your .tex file and create a .pdf file

You should use these commands if you include .png or .jpeg files, etc as figures.

1.1.1 Comment Statements

A `%` is a comment statement so be careful when you use one and make sure you write `\%` if you actually want a % in your text.

1.2 Sections

Sections, subsections or even subsubsection can be included using

```
\section{Introduction}
\subsection{Unix Commands}
\subsubsection{Comment Statements}
```

These give the (sub)sections as seen above.

Sections are usually numbered, but you can stop them being numbered by using, e.g.

```
\subsection*{Acknowledgements}
```

2 Fonts

It can be useful to highlight things by using `\emph` *to emphasis*, `\it` *to italize* or `\bf` **to make bold**.

Alternatively you may want to change the font size, e.g.

`{\tiny tiny}` gives tiny text
`{\large large}` gives large text
`{\Large Large}` gives Large text
`{\Huge Huge}` gives Huge text
`{\sc capitalized}` gives CAPITALIZED text.

There are many more font sizes which you can easily find by googling latex fonts.

3 Maths

Mathematics can be entered directly into the text like this `$x=y/2$` which gives $x = y/2$ or even `$x=\frac{y}{2}$` which gives $x = \frac{y}{2}$. Unfortunately, the latter screws up the line separation and has small text, so personally I think the former is easier to read and is neater.

Maths can also go on separate unnumbered lines as so

$$\frac{\mathrm{d}y}{\mathrm{d}x} = y^2 + (x/3)^3,$$

using `$$\frac{{\rm d}y}{{\rm d}x} = y^2+(x/3)^3,$$` or like this

$$\int y^2 \mathrm{d}y = \int z \mathrm{d}z. \tag{1}$$

by using

```
\begin{equation}
\int y^2 {\rm d}y = \int z {\rm d}z.
\end{equation}
```

As you can see by using the latter, which uses the *equation environment* the equation is numbered.

However, sometimes you need to write several lines of mathematics this can be done by using the *eqnarray environment* as follows:

```
\begin{eqnarray}
\int y^2 {\rm d}y &=& \int z {\rm d}z\;,\nonumber \\
\frac{1}{3}y^3 &=& \frac{1}{2}z^2 + C\;.
\end{eqnarray}
```

which gives

$$\begin{aligned} \int y^2 \mathrm{d}y &= \int z \mathrm{d}z \,, \\ \frac{1}{3}y^3 &= \frac{1}{2}z^2 + C \,. \end{aligned} \tag{2}$$

Note, the `&=&` make the equations line up at the =. Also, you can prevent every line being numbered. If you do not do these things, e.g.

```
\begin{eqnarray}
\int y^2{\rm d}y = \int z {\rm d}z\;, \\
\frac{1}{3}y^3 = \frac{1}{2}z^2 + C\;.
\end{eqnarray}
```

you get the following,

$$\int y^2 \mathrm{d}y = \int z \mathrm{d}z \,, \tag{3}$$

$$\frac{1}{3}y^3 = \frac{1}{2}z^2 + C \,. \tag{4}$$

Also remember to always use punctuation in your mathematics.

Brackets are useful, but remember to say which are left-hand and which are right-hand brackets (i.e., use `\left(...\right)`) - this helps latex track brackets to make sure they

are paired and also allows them to be scaled appropriately.

$$\begin{aligned}
\int_0^{\pi}\left(\frac{2\tan\left(x-\pi/2\right)}{1+\tan^2\left(x-\pi/2\right)}\right){\rm d}x &= \int_0^{\pi}\left(\frac{2\frac{\sin(x-\pi/2)}{\cos(x-\pi/2)}}{1+\frac{\sin^2(x-\pi/2)}{\cos^2(x-\pi/2)}}\right){\rm d}x\;, \\
&= \int_0^{\pi}\left(\frac{2\sin\left(x-\pi/2\right)\cos\left(x-\pi/2\right)}{\cos^2\left(x-\pi/2\right)+\sin^2\left(x-\pi/2\right)}\right){\rm d}x\;, \\
&= \int_0^{\pi}\sin\left(2\left(x-\pi/2\right)\right){\rm d}x\;, \\
&= \left[-\frac{1}{2}\cos\left(2\left(x-\pi/2\right)\right)\right]_0^{\pi}\;, \\
&= -\frac{1}{2}\left[\cos\left(-\pi\right)-\cos\left(\pi\right)\right]\;, \\
&= -\frac{1}{2}\left[-1+1\right]=0\;. \qquad (5)
\end{aligned}$$

which was produced using

```
\begin{eqnarray}
\int\limits_{0}^{\pi}\left(
 \frac{2\tan\left(x-\pi/2\right)}{1+\tan^2\left(x-\pi/2\right)}\right){\rm d}x
 &=& \int\limits_{0}^{\pi}
 \left(\frac{2\frac{\sin\left(x-\pi/2\right)}{\cos\left(x-\pi/2\right)}}
 {1+\frac{\sin^2\left(x-\pi/2\right)}{\cos^2\left(x-\pi/2\right)}}\right)
 {\rm d}x\;, \nonumber \\
&=&\int_{0}^{\pi}\left(
 \frac{2\sin\left(x-\pi/2\right)\cos\left(x-\pi/2\right)}
 {\cos^2\left(x-\pi/2\right)+\sin^2\left(x-\pi/2\right)}\right)
 {\rm d}x\;, \nonumber \\
&=&\int\limits_{0}^{\pi}\sin\left(2\left(x-\pi/2\right)\right)
 {\rm d}x\;, \nonumber \\
&=&\left[-\frac{1}{2}\cos\left(2\left(x-\pi/2\right)\right)\right]_{0}^{\pi}
 \;,\nonumber \\
&=&-\frac{1}{2}\left[\cos\left(-\pi\right)-\cos\left(\pi\right)\right]
 \;, \nonumber \\
&=&-\frac{1}{2}\left[-1+1\right] = 0\;.
\end{eqnarray}
```

3.1 More Maths

It can be useful to make greek letters bold and to make nabla bold too, since after all it is a vector, but this is not possible with standard latex. Some additional useful maths commands require the use of the package *amsmaths* by adding `\usepackage{amsmath}` in the preamble.

- For a bold ∇ add the following after `\begin{document}`

  ```
  \newcommand{\boldnabla}{\mbox{\boldmath$\nabla$}}
  ```

  Then in the text a bold nabla can be produced using this `$\boldnabla$`.

- For a bold greek letter, e.g. a bold ϕ ($\boldsymbol{\phi}$) you can use the amsmath command

  ```
  {\boldsymbol{\phi}}
  ```

When I write lecture notes I use my own pre-defined commands a lot. These are defined in a separate file `math_def.tex`. And this file is read simply by adding the command `\input{math_def.tex}` in the preamble.

Not all journals like you doing this so I only use these commands when writing lecture notes, but something like this could be useful in a thesis.

e.g. I defined a new command `\diff`

```
\newcommand{\diff}[2]{\frac{{\rm d}#1}{{\rm d}#2}}
```

`\diff` allows me to get a derivative by typing
`\diff{y}{x}` instead of `\frac{{\rm d}y}{{\rm d}y}`.
It gives

4 Figures

Figure 1: Piccies of Ian on Sioux Wall

To include a figure you need to use the package *graphicx* by adding `\usepackage{graphicx}` in the preamble. The following produced Figure 1.

```
\begin{figure}[ht]
\centering
\scalebox{0.5}{\includegraphics{Ian_sioux}}
\caption{Piccies of Ian on Sioux Wall}
\label{fig_climb1}
\end{figure}
```

The `\label{fig_climb1}` above allows the figure to be labelled so it can then be referred to like this

```
Figure~\ref{fig_climb1} shows Ian climbing.
```

which gives: Figure 1 shows Ian climbing.

Figure 2: Piccies of Ian on Sioux Wall rotated by 270 degrees!.

Figures can be scaled, or even rotated using the commands *scalebox* and *rotatebox*, e.g.

```
\begin{figure}[ht]
\centering
\scalebox{0.5}{\rotatebox{270}{\includegraphics{Ian_sioux}}}
\caption{Piccies of Ian on Sioux Wall rotated by 270 degrees!.}
\label{fig_climb2}
\end{figure}
```

which produces Figure 2.

Including figures, called 'floats', can sometimes be tricky and you may need to work hard to get them where you want them. The following commands included in the preamble sometimes help:

```
\renewcommand{\floatpagefraction}{0.9}
\renewcommand{\textfraction}{0.1}
```

These define the fraction of a page available for floats and text.

5 Tables

Tables can also be included like the one below. Table 1 is produced using the following

	Results		
Time	Left	Middle	Right
2	here	there	everywhere
5	again	and again	and again
9			

Table 1: My results

```
\begin{table}[ht]
\centering
\begin{tabular}{c|ccc|}
 & \multicolumn{3}{c|}{Results} \\
Time & Left & Middle & Right \\
\hline
2 & here & there & everywhere\\
5 & again & and again & and again\\
9 & & &\\
\end{tabular}
\caption{My results} \label{tab_results}
\end{table}
```

6 Lists

It is useful to write things as a list from time to time using

```
\begin{itemize}
\item ...
\end{itemize}
```

or if you want thing numbered use *enumerate* instead or *itemize*. For instance, the following

```
\begin{itemize}
\item Apples can be
\begin{itemize}
\item red
\item green
\item yellow and mushy - yukk!
\end{itemize}
```

```
\item Bananas can be
\begin{enumerate}
\item yellow
\item green
\item black and mushy - yukkety yukk!
\end{enumerate}
\end{itemize}
```

produces

- Apples can be
  - red
  - green
  - yellow and mushy - yukk!
- Bananas can be
  1. yellow
  2. green
  3. black and mushy - yukkety yukk!

7 Bibliography

You are going to want to cite articles from journals and there are various ways but one of the best is to use bibtex. To do this create a .bib file (see `latex_template.bib` file for this document). The quickest way to create all these entries is use the 'bibtex entry' button on ADS, then to copy and paste.

You then need to use a bibtex package such as the package *natbib*. Include this in the preamble like this `\usepackage{natbib}`. Then add the following lines to the bottom of your .tex file, or wherever you want your list of references to go.

```
\bibliographystyle{plainnat.bst}        % suitable bib style file
\bibliography{latex_template}           % include your own .bib file
```

Then use the following Unix commands to process the .bib file:

`latex file`: to process your .tex file

`bibtex file`: to create the .bbl file

`latex file`: to process the .bbl file

`latex file`: you'll need to do this twice first time

Note, only the references of the papers you have cited appear not all the references in your bibtex file.

In the text references are cited as follows

```
\begin{center}
\begin{minipage}{7cm}
\cite{Haynes07b} describes a new method for finding null points from a
three-dimensionals grid of magnetic field components. The previous method
\citep{Greene92} suffers from false positives and false negatives, which
clearly is a problem. Magnetic feature tracking algorithms \citep{Deforest07}
and very useful for \ldots
\end{minipage}
\end{center}
```

which gives

> Haynes and Parnell (2007) describes a new method for finding null points from a three-dimensional grid of magnetic field components. The previous method (Greene, 1992) suffers from false positives and false negatives, which clearly is a problem. Magnetic feature tracking algorithms (DeForest et al., 2007) and very useful for ...

Note, when citing things that you need to use the correct cite command:

- `\cite{SolarMHD82}` gives Priest (1982)
- `\citep{SolarMHD82}` gives (Priest, 1982)

Many journals have their own style files which are useful to use if supplied.

Acknowledgments

Thanks Mum for the chocolate cake. :-)

References

C. E. DeForest, H. J. Hagenaar, D. A. Lamb, C. E. Parnell, and B. T. Welsch. Solar Magnetic Tracking. I. Software Comparison and Recommended Practices. *Astrophys. J.*, 666:576–587, September 2007. doi: 10.1086/518994.

J. M. Greene. Locating Three-Dimensional Roots by a Bisection Method. *J. Comp. Phys.*, 98:194–198, 1992.

A. L. Haynes and C. E. Parnell. A trilinear method for finding null points in a three-dimensional vector space. *Phys. Plasmas*, 14:2107–+, August 2007. doi: 10.1063/1.2756751.

E. R. Priest. Solar magneto-hydrodynamics. *Geophys.Astrophys. Fluid Dyn.*, 21, 1982.