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The New NPS LATEX Report and Thesis Format

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Monterey, California. Naval Postgraduate School

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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THE NEW NPS LATEX REPORT AND THESIS FORMAT

by

Simson L. Garfinkel
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October 5, 2011

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14. ABSTRACT

This paper the NPS LaTeX templates that can be used to produce a master's thesis, a Ph.D. dissertation, and a technical report. The template can produce a variety of documents, including unclassified, For Official Use Only (FOUO), and classified. Additional information on using LaTeX is also provided.

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Table of Contents

Abstract

This paper the NPS LaTeX templates that can be used to produce a master's thesis, a Ph.D. dissertation, and a technical report. The template can produce a variety of documents, including unclassified, For Official Use Only (FOUO), and classified. Additional information on using LaTeX is also provided.

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CHAPTER 1:
Introduction to LaTeX

LaTeX is a text formatting system created by Leslie Lamport in the early 1980s. The program is based on the TeX text formatting system created by Donald Knuth in 1978. With LaTeX you create your document by editing a text input file using a program such as EMACS, `vim`, or another editor. You then give this input file to LaTeX (or, more accurately, to a program called `pdflatex`). This program then literally *compiles* your input file into a PDF file.

Although most documents at NPS are prepared with Microsoft® Word, LaTeX is widely used outside of NPS in the sciences to create conference papers, journal articles, and even full-length books. The program is especially popular in computer science. With the NPS template you can use LaTeX to produce an NPS thesis. Because LaTeX provides for consistent formatting and automatic updating of references, many students who write technical documents at NPS that use LaTeX find that they save time—even when they take into account the time that they spend learning to use LaTeX in the first place!

1.1 Reasons to use LaTeX

There are many reasons to use LaTeX for preparing a technical report, journal article, or master's thesis:

- Formatting for paragraphs, quotations, lists, tables, and so on are performed automatically. The numbers used for numbered sections are automatically updated when new material is added or when sections are used. As a result, formatting is more consistent with LaTeX than with Microsoft® Word.
- References within your document to numbered chapters, appendices, sections, figures, tables, equations and references are updated automatically each time a PDF file is produced.
- Unlike Microsoft® Word, LaTeX gives you precise control over the placement of the text on the page. You can easily make global changes to your document and have them reflected everywhere.
- The BibTeX system produces consistent citations and bibliography. References are pulled from a bibliographic database that is maintained separately. Records for the bibliographic database can be downloaded from many online services, helping to assure that they are consistent. The citation format is maintained separately from the citation contents, making it easy to change citation styles when submitting to different conferences or journals.
- LaTeX allows you to directly include other files at the time that the PDF is created. This makes it easy to automatically incorporate the results of experiments or graphing programs directly into your final document, without having to retype anything. Software code can be included with pretty syntax and line numbers from the original files.

- `pdflatex`, the version of LaTeX we recommend at NPS, also allows you to embed attachments into the PDF file. This makes it easy to preserve your experimental data, spreadsheets, or other information.
- Because the LaTeX input file is plain ASCII, you can store your document using a revision control system such as Subversion [1]. This allows multiple people to work on the same document at the same time; Subversion automatically merges the changes together. If you save your thesis work daily, it is possible retrieve previous revisions of your thesis and undo changes made.
- LaTeX is free software and runs on PCs, Macs, and Unix systems. This means that you can produce your documents on practically every computer you have, without having to purchase anything else.

NPS has developed this template for preparing NPS reports and theses. If you are using LaTeX at NPS, there are many reasons for using the report template:

- The template has been in use since 2007. Numerous NPS faculty members have worked with the NPS Thesis Processor to assure that the documents produced are acceptable for student and faculty use.
- The template supports the creation of unclassified, For Official Use Only (FOUO), and classified documents. In particular, the template supports classification labels for paragraphs, captions, and references.
- The cover page, signature page, and Standard Form 298 are automatically generated.
- Combined with the program Subversion (SVN), the template makes it possible for students and their advisors to collaborate on a document without the need to pass files back and forth.

1.2   The Purpose of this Document

This document does not to duplicate the depth of information available on LaTeX, but does provide you with the minimum amount of information required to use LaTeX to produce a master's thesis or technical report at NPS.

If you wish to learn more about LaTeX, there are many good reference books and online tutorials for LaTeX.

We recommend:

1. `http://en.wikibooks.org/wiki/LaTeX`, a wikibook that discusses many aspects of LaTeX.
2. `http://www.ctan.org/`, the Comprehensive TeX Archive Network, a collection of modules and documentation for extending LaTeX.
3. `http://en.wikipedia.org/wiki/Comparison_of_TeX_editors`, a web page on Wikipedia that discusses different programs available for editing LaTeX input files.
4. `http://tex.stackexchange.com/`, a question-and-answer website for TeX and LaTeX

problems.

1.3   Installation

Before you can use LaTeX, you will need to install two critical pieces of software:

1. The LaTeX system itself.
2. A program for editing the `.tex` input files.

Here once again there are many options. For both LaTeX and text editors there are both free and commercial distributions. This document makes specific recommendations that were known to work as of the document's date of publication. You are free to explore on your own as well.

1.3.1   Installation on MacOS 10.5 and above

There are many ways to get LaTeX running on the Mac. The easiest is to download an installer for the most recent distribution from `http://www.tug.org/mactex`.

For ease-of-use, we recommend installing from TuG using MacTEX. TUG's MacTEX distribution will install LaTeX in the `/usr/texbin/pdflatex` directory and will update your startup files to include this directory in your path. If you chose this strategy, be sure to click "Customize" in the installer and select that all of the optional packages be installed:

You can also install the program from sources using the MacPorts or Fink installer system, but this is not recommended.

You are free to download and install a tool for editing the `.tex` and `.bib` files. However, you can also edit these files using EMACS, an editor that is built-in to MacOS.

1.3.2   Installing on Linux

For most Linux systems there is a complete LaTeX distribution that can be downloaded as part of the `texlive-latex3` package. This package can be downloaded in source from the `http://tug.org/` website and compiled locally, or installed directly using a package management command. In either case you will need to the installation as the superuser; this is typically done with the `sudo` command.

For Debian or Ubuntu Linux, use the `apt-get` command:

```
% sudo apt-get install texlive-latex3
```

For Fedora, RedHat, or Centos, use the `yum` command:

```
% sudo yum install texlive-latex3
```

We have noticed that the install command occasionally fails. If it does, try it again. If that still does not work, you will want to download and install from source.

1.3.3 Installation on Microsoft® Windows

One of the most popular distributions for Microsoft® Windows machines is called MiKTeX, which can be downloaded from `http://www.miktex.org/`.

1.3.4 Creating classified documents

If you are producing a classified thesis, you should download and install the complete distribution on the computers authorized to handle classified information. This will minimize any additional package installation needed for producing your thesis.

1.4 Additional Applications for LaTeX

In addition to downloading and installing LaTeX, you will need an editor for editing the `.tex` input files. These programs are sometimes called *front ends*, although the term is imprecise and probably incorrect. You can use *any* editor for editing a `.tex` file, even Microsoft® Word. Indeed, most of the front ends for LaTeX are really just text editors with syntax highlighting, although some will automatically compile your document and even jump to errors in the input file when they are encountered.

1.4.1 Selection of an Editor

Text editors offer a variety of features. Some are easier for beginners, such as Notepad++, LEd, TeXnicCenter. Advanced editors for skilled users include emacs, vim, and Texlipse. A thorough comparison of text editor options are available at `http://en.wikipedia.org/wiki/Comparison_of_TeX_editors` and the users should choose the one they prefer the most. Learning about the various features of the text editors can really improve your writing efficiency.

If you are running LaTeX on MacOS, you already have a powerful editor installed on your computer: EMACS, which can be run from within the Macintosh Terminal application. You can run the tutorial for EMACS by starting Terminal, typing `emacs` and enter at the command prompt, and then typing control-h followed by a "`t`" to start the tutorial.

1.4.2 LyX: An alternative LaTeX system

LyX is a program that provides a WYSIWYG[1] graphical user interface for LaTeX. Instead of editing the `.tex` file directly, however, you edit an intermediate form which is a restricted set of LaTeX. LyX then runs LaTeX for you and produces the results.

While LyX is easier to use than LaTeX, it does not have the power or the flexibility.

LyX is free and open source, and available for a variety of platforms, including Mac, Windows, and Linux. It is actively supported, and a new version 2.0 release with more features is

---

[1]What You See Is What You Get

scheduled for release in 2011. LyX provides a GUI interface for floating figures and tables, formatting, fonts, labels, chapters, sections, subsections, math equations, tables, and much more. It also has built-in features for supporting BibTeX bibliographies, citations, and cross-references, and generally supports anything that can be done with LaTeX.

LyX can be downloaded from `http://www.lyx.org/` and is available for Linux, MacOS and Windows. If you want spell-checking, you will also need to installed the *aspell* package.

An NPS thesis and dissertation template developed by CDR Michael Bilzor is available for use with LyX. It can be be obtained from `http://simson.net/npsthesis/lyxthesis.zip`.

Further information about the LyX template can be found in Appendix A.

1.4.3 Selection of an editor

Text editors offer a variety of features. Some are easier for beginners, such as Notepad++, LEd, TeXnicCenter. Advanced editors for skilled users include EMACS, `vim`, and Texlipse. A thorough comparison of text editor options are available at `http://en.wikipedia.org/wiki/Comparison_of_TeX_editors` and the users should choose the one they prefer the most. Learning about the various features of the text editors can really improve your writing efficiency.

1.5 Running LaTeX

LaTeX is a command-line program that converts your `.tex` file into a PDF file for display in Adobe Acrobat or a similar `.pdf` viewing programs. However, LaTeX is actually a set of programs. For creating a thesis at NPS you will use several programs:

`pdflatex` This program read the input file (e.g., `thesis.tex`) and produces a PDF file (e.g., `thesis.pdf`) as an output. This program also produces a number of intermediate files (`thesis.aux`, `thesis.bbl`, `thesis.toc`, etc.).

`latex` This is an older version of the `pdflatex` program that produces `.dvi` files. The `.dvi` file must then be transformed into either a `.ps` or a `.pdf` file. In practice you should not run `latex` unless you need to use a special graphics module called `PStricks`. That module is beyond the scope of this document.

`bibtex` This program reads the `thesis.bbl` file and produces a bibliography in a file called `thesis.bst` which includes the bibliography. The `thesis.bst` then gets read the next time `pdflatex` is run.

`authorindex.pl` a program in perl that produces the author index from the `thesis.bbl` file. The authorindex is saved in the file `thesis.ain`.

`fixbbl.py` It turns out that there is a bug in BibTeX which causes URLs longer than 53 characters to be improperly split. This program unsplits them. You do not need to use this program if you do not have long URLs in bibliographic entries

Normally you would run LaTeX commands in this order:

1. `pdflatex thesis`

2. `bibtex thesis`
3. `python fixbbl.py thesis`
4. `pdflatex thesis`
5. `pdflatex thesis`

Running `pdflatex` the additional times ensures that internal document references are correct. The first run of `pdflatex` updates the `.aux` files. The subsequent runs ensure the output is correct on these references. Some editors, such as TeXlipse, will run these commands as needed on behalf of the user. Each command has a `thesis` argument, which is referring to the file `thesis.tex` without the `.tex` file extension.

1.6 Basic LaTeX formatting

Here is a simple document:

```
\documentclass{article}
\begin{document}
Hello World!
\end{document}
```

Normally with LaTeX, you just type text. Leave a blank line between each paragraph. LaTeX then formats it into beautiful paragraphs. LaTeX will ignore the space at the beginning of each line.

So if you type this:

```
\documentclass{article}
\begin{document}
In December 1951, in a move virtually unparalleled in the history of
academe, the Postgraduate School moved lock, stock and wind tunnel
across the nation, establishing its current campus in Monterey,
Calif.
    The coast-to-coast move involved 500 students, about 100
    faculty and staff and thousands of pounds of books and research
    equipment. Rear Adm.\ Ernest Edward Herrmann supervised the move that
    pumped new vitality into the Navy's efforts to advance naval science
    and technology.

% This is comment. Nobody will see it.

Today the school, known as the ''Naval Postgraduate School,'' is the
Navy's preeminent institution of graduate education and advanced
```

```
research. Approximately 1 in 10 of the students are in the top 10\% of
their classes.
\end{document}
```

LaTeX will format it into a document that looks like this:

In December 1951, in a move virtually unparalleled in the history of academe, the Postgraduate School moved lock, stock and wind tunnel across the nation, establishing its current campus in Monterey, Calif. The coast-to-coast move involved 500 students, about 100 faculty and staff and thousands of pounds of books and research equipment. Rear Adm. Ernest Edward Herrmann supervised the move that pumped new vitality into the Navy's efforts to advance naval science and technology.

Today the school, known as the "Naval Postgraduate School," is the Navy's preeminent institution of graduate education and advanced research. Approximately 1 in 10 of the students are in the top 10% of their classes.

This sample document illustrates a few important points about LaTeX:

- LaTeX will automatically re-wrap your text as necessary to format the paragraphs. Indention is determined by the style of the current document, not by whether or not you actually indent the paragraph.
- LaTeX ignores space at the beginning of lines; breaks between paragraphs are marked with blank lines.
- What you type is not what you get! In particular, opening double quote marks are typed as two backquotes (``) and closing double quote marks are entered as two apostrophes (''). You will also note that the period following Rear Adm. Ernest Edward Herrmann's name is followed by a backslash (\) and a space, rather than just a space. This tells LaTeX that the period does not mark the end of a sentence.
- Commands begin with a backslash (\) and contain only uppercase and lowercase letters.
- A command can have zero or more arguments. The arguments are enclosed within braces ({}). The \documentclass command begins the document; it's argument is the kind of document you are making.
- The \begin command introduces an *environment*. Every document has at last one environment, the document environment. Every \begin must have a matching \end that names the same environment. Environments can be nested.
- Comments can be embedded in your document with a percent sign (%). Anything after the percent sign will not print. To print a percent sign, prefix it with a backslash (\%).

1.7   Typing Special Characters

This section provides information on how to type special characters in LaTeX. In each section we will have a table that shows what to type and how it displays in your final PDF file. If the

above text were put into a table, it would look like this:

Typed	Displayed	Typed	Displayed
` `	"	, ,	"

The left entry of the table is the backquotes, which on the keyboard shares the tilde key. The right entry is the single quotes, which shares the double quote marks key.

1.7.1 Typing Quotes

To type quotes, you should not use the double-quote character. Instad, LaTeX uses the back quote (`) and the forward quote (') to type quotes.

Typed	Displayed	Typed	Displayed
`don't`	don't	`3'2"`	3'2"
` ``this'' `	"this"	`'is'`	'is'
` ``\,'special'\,'' `	" 'special' "		

1.7.2 Controlled Special Characters

Unlike Microsoft® Word and other programs, LaTeX uses special characters embedded in your text to control formatting. The most common of these characters is the backslash (\). All of special characters are listed below:

Special Character	Why it is special
\	Introduces a command
{	Introduces arguments in commands
}	Closes arguments in commands or the beginning of a group.
%	The comment character; LaTeX ignores the rest of the line.
#	Used for parameter substitution inside macros.
~	Enters a hard, non-breaking space
&	Used for delimiting columns in a table
$	Turns on/off math mode (see §1.9)
_	Used for subscript in math mode
^	Used for superscript in math mode

To enter the special characters into your document you must use a special sequence that beings with a backslash. Most (but not all) of these special sequences are the character itself. If you are curious, inside LaTeX, each of these sequences is actually a command that causes LaTeX to output the character that has been quoted:

Typed	Displayed	Typed	Displayed
\$	$	\&	&
\{	{	\}	}
\%	%	_	_
\#	#	\^{}	^
\~{}	~	$\backslash$	\

1.7.3 Accented, Dottless and Slashed Vowels

With LaTeX most accented vowls are entered combining an accent character with a vowel. The angstrom symbol is not, however, as shown below:

Typed	Displayed	Typed	Displayed
\'{o}	ó	\~{o}	õ
\'{o}	ó	\={o}	ō
\^{o}	ô	\.{o}	ȯ
\"{o}	ö	\d{o}	ọ
\c{o}	ǫ	\u{o}	ŏ
\b{o}	o̠		
\aa	å	\AA	Å
\i	ı	\j	ȷ
\o	ø	\O	Ø
\ae	æ	\AE	Æ
\oe	œ	\OE	Œ
\v{o}	ǒ	\H{o}	ő
\t{oo}	o͡o		

1.7.4 Symbols

LaTeX has literally hundreds of symbols that you can include in your document. These symbols include the copyright symbol, currency symbols, foreign language characters, and many more. Special characters are placed in documents using macros. This is how a text document can support a large variety of non-standard text characters. A complete guide to the available symbols in LaTeX is available online at `http://ctan.math.utah.edu/ctan/tex-archive/info/symbols/comprehensive/symbols-letter.pdf` .

Typed	Displayed	Typed	Displayed
\l	ł	\L	Ł
\S	§	\ss	ß
\P	¶	\pounds	£
?`	¿	\copyright	©
!`	¡	\texttrademark	™
		\textregistered	®
\dag	†	\ddag	‡

1.8   Fonts

1.8.1   Changing Font Size

Although LaTeX allows you to use fonts of any size, the built-in templates provides eleven built-in sizes. These sizes automatically adjust depending on if you are creating a document with 12-point font (NPS standard), 11-point font, or 10-point font.
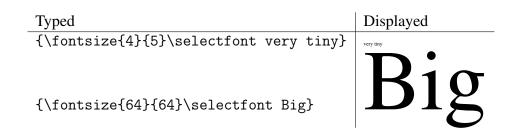
When you change the font size, that change stays in effect until you change it again. You can confine your font change by placing the text you want resized within braces, as shown in the example below.

Size	Point Size	Typed	Displayed
\tiny	6	{\tiny This is tiny}	This is tiny
\scriptsize	8	{\scriptsize scriptsize}	scriptsize
\footnotesize	10	{\footnotesize footnotesize}	footnotesize
\small	11	{\small This is small}	This is small
\normalsize	12	{\normalsize normalsize}	normalsize
\large	14	{\large This is large}	This is large
\Large	17	{\Large This is Large}	This is Large
\LARGE	20	{\LARGE This is LARGE}	This is LARGE
\huge	25	{\huge This is huge}	This is huge
\Huge	25	{\Huge This is Huge}	This is Huge

Notice that with the NPS template there is no difference between \huge and \Huge.

You can pick an arbitrary size by using the \fontsize and \selectfont commands. The \fontsize command takes two arguments: the size of the font and the size of the leading,

or the amount of space between lines. First the size is selected with the `\fontsize{i}{j}` command where i and j are expressed in points, then the font is selected with the `\selectfont` command, as shown below:

Typed	Displayed
`{\fontsize{4}{5}\selectfont very tiny}`	very tiny
`{\fontsize{64}{64}\selectfont Big}`	Big

1.8.2   Changing Font Style

Typed	Displayed
`\textrm{This is Roman}`	This is Roman
`\textbf{This is bold}`	**This is bold**
`\texttt{This is typewriter}`	This is typewriter
`\textsc{This is small capitals}`	THIS IS SMALL CAPITALS
`\textsl{This is slanted}`	*This is slanted*
`\textsf{This is sans serif}`	This is sans serif
`\textit{Italics}`	*Italics*
`\emph{This is emphasized}`	*This is emphasized*
`$\cal CALLIGRAPHICS$`	$\mathcal{CALLIGRAPHICS}$
`{\boldmath $\cal BOLD CALIGRAPHICS$}`	$\boldsymbol{\mathcal{BOLDCALIGRAPHICS}}$

Notice that the last two require math mode (see §1.9).

If you just want to put something into italics, you should use `\emph{text}`, which will produce *text*. The reason to use `\emph{}` and not `\textit{}` is that `\emph{}` will nest as necessary:

`\emph{You can even \emph{emphasize} a word within a sentence that is emphasized}`

produces:

You can even emphasize *a word within a sentence that is emphasized*

1.8.3   Choosing an Arbitrary Font

There are many ways that you can request arbitrary fonts, but they are all beyond the scope of this article. It is also possible to embed arbitrary Unicode within a LaTeX document, either by using a Unicode-aware version of LaTeX, or by saving your Unicode characters in a PDF file and including that file with the `\includegraphics{}` command.

1.9 Math

Typsetting mathematics is one of the primary design goals of LATEX. The program actually has more features for typsetting math than typsetting text. There is also a powerful set of mathematical extensions by the American Mathematical Society called `amsmath`. For more detailed information, please see:

- The LATEX wikibook, `http://en.wikibooks.org/wiki/LaTeX/Mathematics`.
- The User's guide for the `amsmath` package is available at: `ftp://ftp.ams.org/ams/doc/amsmath/amsldoc.pdf`
- The short math guide, available at `ftp://ftp.ams.org/ams/doc/amsmath/short-math-guide.pdf`.

What follows here is necessarily very brief.

1.9.1 Math Mode

To typset math you must enter math mode. There are two easy ways to enter math mode.

- You can put your math between two dollar signs. For example, entering `$1+1=2$` in your document will produce $1 + 1 = 2$.
- You can put the equation on a line by itself with the `\begin{equation}` and `\end{equation}` commands. This creates an *equation* environment, which is a block that is typeset in math mode and includes a numbered equation. For example:

```
\begin{equation}
1+1=2
\end{equation}
```

$$1 + 1 = 2 \tag{1.1}$$

1.9.2 Simple Math in Math Mode

As the examples above show, you can pretty much type simple math in math mode and get what you want. In general, variables (the letters a through z), the plus (+), minus (–) and equals (=) all just typeset properly when you type them between dollar signs. But there are some caveats:

- Spaces are ignored in math mode. If you want a space, you probably want to have multiple equations.
- If you wish to typeset a multiplication symbol, use `\times` instead of an asterisk (*).
- If you wish to typeset division, use `\div` or `\frac` instead of /.

The table below shows some examples:

Typed	Displayed
`$1+2=3$`	$1 + 2 = 3$
`$10\times10=100$`	$10 \times 10 = 100$
`$10  \times  10  =  100$`	$10 \times 10 = 100$
`$a=3$`	$a = 3$
`$a=f/m$`	$a = f/m$
`$a=f \div m$`	$a = f \div m$
`$a=\frac{f}{m}$`	$a = \frac{f}{m}$

Math mode is generally used in theses while in a paragraph to show a simple equation or discuss a symbol used in the *equation* environment. It adds a noticable distinction to the text that helps the reader to understand.

An example without math mode is f(t), but simply placing dollar signs around the $f(t)$ adds clarity to the reader; this is a function of the independent variable t, but not t (outside of math mode).

1.9.3 Parenthesis and Brackets

You can use regular parentheses in math mode, but they do not stack nicely:

Typed	Displayed
`$((1))$`	$((1))$
`$[((1))]$`	$[((1))]$

You probably want the outer brackets and parenthesis to be bigger than the inner ones. You can do that using the `\left` and `\right` commands. Following these macros is another character, such as a parenthesis or bracket. These macros place the correctly sized specified character into the equation. They will automatically get bigger as necessary, especially in the *equation* environment.

For example, here is what you get with the conventional parenthesis:

```
\begin{equation}
A = ( \sum_{i=1}^{10}i\times\sin(i) )
\end{equation}
```

$$A = (\sum_{i=1}^{10} i \times \sin(i)) \tag{1.2}$$

15

```
\begin{equation}
A = \left( \sum_{i=1}^{10}i\times\sin(i) \right)
\end{equation}
```

$$A = \left(\sum_{i=1}^{10} i \times \sin(i) \right) \tag{1.3}$$

1.9.4 Superscripts and subscripts

When in math mode, the caret (^) is used for superscript and the underbar (_) is used for subscript (this is why the characters are special). The characters only superscript or subscript the following character; if you want to superscript or subscript multiple characters you need to make them a group by enclosing them in braces.

Here are some examples:

Typed	Displayed
`$a^2+b^2=c^2$`	$a^2 + b^2 = c^2$
`$N_A$ is Avogadro's constant`	N_A is Avogadro's constant
`$A^{B^C}$`	A^{B^C}
`$A^{B^{C^D}}$`	$A^{B^{C^D}}$
`$a_k$ and $b_k$`	a_k and b_k
`$a_k$ and $b_k$`	a_k and b_k

Many math symbols use subscripts and superscripts to represent a common group. This includes \int which is used to create integrals and \sum which is used to create sums. Below are some examples with the Fourier series.

Typed	Displayed
`$a_k=\frac{1}{\pi}` `\int_{-\pi}^{\pi}f(x)\cos(kx)dx$`	$a_k = \frac{1}{\pi} \int_{-\pi}^{\pi} f(x)\cos(kx)dx$
`$b_k=\frac{1}{\pi}` `\int^{\pi}_{-\pi}f(x)\sin(kx)dx$`	$b_k = \frac{1}{\pi} \int_{-\pi}^{\pi} f(x)\sin(kx)dx$
`$f(x)=\sum_{k=-\infty}^{\infty}` `c_k e^{-jkx}$`	$f(x) = \sum_{k=-\infty}^{\infty} c_k e^{-jkx}$

The `\sum` and `\int` symbols will display differently in an *equation* environment:

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} [a_k \cos(kx) + b_k \sin(kx)] \tag{1.4}$$

We used this code to type Equation (1.4) verbatim:

```
\begin{equation}
f(x)=\frac{a_0}{2} + \sum_{n=1}^{\infty}
    \left[a_k \cos(kx) + b_k \sin(kx)\right]
\label{eqn:fourier}
\end{equation}
```

There are several important math mode conclusions to draw from these examples:

- Simple one letter subscripts and superscripts do not need to be enclosed by curly braces, but multiple character ones must.
- There is a difference between `cos(kx)` and `\sin(kx)` on italics.
- Subscripts and superscripts in math mode are to the right of the sum and integral characters; however, in the equation environment they are above and below. In the other uses (exponentials, etc.), the results are the same in either mode.
- The order of appearance of subscript than superscript or vice versa does not change the results.

The `amsmath` package has quite an extensive list of provided environments to suit the specific needs of any author (non-numbered, multiple-lined, aligned subequations, etc.). Its user guide is an excellent reference and provides many examples.

Although math mode may seem cumbersome at first, its syntax does become second nature and very sophisticated equations can be generated, if needed. Consult the user manuals and references provided in §1.9.

1.10   Spacing, Frameboxes, and Centering

1.10.1   Controlling Spaces

Typed	Displayed
`\,` (a slash followed by a comma)	produces a small space.
`\ ` (a slash followed by a space)	produces a standard word space.
`\@` (a slash followed by an at sign)	produces an intersentence space.

Table 1.1: Spacing options for special circumstances

In Table 1.1, the small space and standard word space is used between the words in the right column. An intersentence space is needed to correct the following error where a sentence ends in a capital letter.

1.10.2   Controlling Line Breaks and Spacing

You can force a blank line using \\ and have the option to force a specific length using \\[3pt].

Typed	Displayed
`This is\\`	This is
`an example.`	an example.
`This is\\[3pt]`	This is
`an example.`	an example.

You can add or remove space on a page with \enlargethispage. For example, to squeeze another line onto the current page, insert this command onto the page:

```
\enlargethispage{1pc}
```

You can also shorten a page by a line, forcing a dangling widow onto the next page:

```
\enlargethispage{-1pc}
```

You can insert vertical or horizontal space (or take it away) with this. For example:

```
\vspace{1in}\hspace{2in}Here is some text moved two inches.
```

Here is some text moved two inches.

This might be used to place text at a specific spot on a page under a special circumstance.

1.10.3 Frameboxes and Centering

You can draw a box around text with:

```
\framebox[width]{textstring}
```

The [width] parameter is optional.

```
\framebox[15pc]{This is an important statement.}
```

$\boxed{\text{This is an important statement.}}$

You can center any text, table, figure, etc. with the *center* environment, using the following:

```
\begin{center}
\framebox{$a^2 + b^2 = c^2$}
\end{center}
```

$$\boxed{a^2 + b^2 = c^2}$$

This is a good way to indicate an important result in your work.

However, if you are entering a number of equations in your document, you may want to use the equation environment, which will provide numbered equations:

```
\begin{equation}
a^2 + b^2 = c^2
\end{equation}
```

$$a^2 + b^2 = c^2 \tag{1.5}$$

Unlike many things in LaTeX, the *framebox* and *equation* environments cannot be readily combined.

1.11 Lists

There are three kinds of lists that you may wish to make:

description lists are used for definitions, where a short phrase is bolded and the remainder text is the standard font (like this list).

enumerate lists are lists where each item is numbered and the ordering is relevant, like the steps of a recipe.

itemize lists are lists where each item is of equal importance.

Lists are implemented as LaTeX environments, which means that they begin with a \begin{*listname*} and end with an \end{*listname*}.

```
\begin{description}
\item[Earth] Third Planet.
\item[Mars] Fourth Planet.
\item[Venus] Second Planet.
\end{description}
```

Earth Third Planet.
Mars Fourth Planet.
Venus Second Planet.

```
\begin{enumerate}
\item Wake up.
\item Go to work.
\item Go home.
\item Go to sleep.
\item Repeat.
\end{enumerate}
```

1. Wake up.
2. Go to work.
3. Go home.
4. Go to sleep.
5. Repeat.

```
\begin{itemize}
\item Hamburgers
\item Hotdogs
\item Chips
\end{itemize}
```

- Hamburgers
- Hotdogs
- Chips

1.12 Labels and Captions

Labels are hidden markers in your .tex files created by the \label{name} command. These markers are never shown directly in the output files. However, correctly placing these markers in your file allows you to reference chapters, appendices, sections, figures, tables and equations. Label marker names can have a prefix such as chap:, sec:, fig:, tab: and eqn: to logically identify and sort labels. See §2.2 for information on how to reference labels.

Captions are the text that appears below a figure or table to provide context for the information presented. Captions are indicated by the command \caption{Sentence.} Sometimes longer captions can look poorly in the Lists of Figures and Tables, so a caption for the table can also be specified by using \caption[Short Sentence.]{Longer Sentence.} Examples of their use is included in Table 1.2

1.13 Tables

Tables provide a valuable means to display data in an organized manner. Using tables in LaTeX is easy once the syntax is understood, although tables can be incredibly complex as well. To see plenty of examples and explanation of options, visit http://en.wikibooks.org/wiki/LaTeX/Tables. There are also *many* add-on packages which provide additional functionality.

Here is a simple table:

```
\begin{center}
\begin{tabular}{|lcr}
Left Justified & Center Justified & Right Justified \\
\hline
Each & Column & Entry \\
Spaces      & Do not    & Matter \\
But         & May       & Assist you. \\
\end{tabular}
\end{center}
```

And here is how it formats:

Left Justified	Center Justified	Right Justified
Each	Column	Entry
Spaces	Do not	Matter
But	May	Assist you.

This basic example shows the minimum to have a table. There are 3 columns as identified by the format specification `lcr`. Each column is specified by a justification letter (l for left, c for centered, and r for right). The left side of the table has a vertical bar due to the pipe character (|). The \hline macro causes a horizontal line to be drawn across the table. Columns are indicated by the ampersands (&) and the amount of spaces used are not important. Thus, the spaces can be used to ensure your columns line up in your `.tex` file the way the table is intended to print. An empty cell is just ampersands separated by a space. To start a new row of the table, use the double backslash (\\); this can be done at the end of the current row.

Table 1.2 is an example table that shows how to incorporate several additional features. The *tabular* environment is inside of the *table* environment. The *table* environment treats the table as a floating entity of the document and LATEX will move it in the document to ensure it minimizes white space on pages. The [t!] option on the *table* environment tells LATEX that you wish to override its judgment on where to place the table and to place it at the top of the next page. Many people like using the [h!] format to put the table *here*, but that can produce ugly pages. A `caption` and `label` is provided. Additionally, math mode is used in cells of the table. It includes blank cells without \hline to give the appearance of multi-line entries.

```
\begin{table}[h!]
\centering
\begin{tabular}[t]{|l||r|r|r|r|r|r|r|}
```

```
\hline
Pulse  & Pulse  & PRF & Duty  & Coupler & Power & Average & Peak  \\
Width  & Length &     & Cycle & Losses  & Meter & Power   & Power \\
\hline
Long & $1.0 * 10^{-6} s $ & 750 Hz & $7.0 * 10^{-4} $ &
       49.1 dB & 3.4 dBm & 52.5 dBm & 73 dBm \\
& & & 31.075 dB & & & & 43 dBW \\
& & & & & & & 227.7 kW \\
\hline
Medium & $3.0 * 10^{-7} s $ & 1200 Hz & $2.0 * 10^{-4} $ &
         49.1 dB & 0 dBm & 49.1 dBm & 83 dBm \\
& & & 34.29 dB & & & & 53 dBW \\
& & & & & & & 218.27 kW \\
\hline
Short & $1.0 * 10^{-7} s $ & 2400 Hz & $1.9 * 10^{-4} $ &
        49.1 dB & -1 dBm & 48.1 dBm & 83 dBm \\
& & & 35.05 dB & & & & 53 dBW \\
& & & & & & & 206 kW \\
\hline
\end{tabular}
\caption{Example of a table with RADAR information}\label{tab:RADAR}
\end{table}
```

Pulse Width	Pulse Length	PRF	Duty Cycle	Coupler Losses	Power Meter	Average Power	Peak Power
Long	$1.0 * 10^{-6} s$	750 Hz	$7.0 * 10^{-4}$ 31.075 dB	49.1 dB	3.4 dBm	52.5 dBm	73 dBm 43 dBW 227.7 kW
Medium	$3.0 * 10^{-7} s$	1200 Hz	$2.0 * 10^{-4}$ 34.29 dB	49.1 dB	0 dBm	49.1 dBm	83 dBm 53 dBW 218.27 kW
Short	$1.0 * 10^{-7} s$	2400 Hz	$1.9 * 10^{-4}$ 35.05 dB	49.1 dB	-1 dBm	48.1 dBm	83 dBm 53 dBW 206 kW

Table 1.2: Example of a table with RADAR information

1.14 Graphics

This section briefly describes graphics and LaTeX. For alternative treatments we recommend Höppner's "Strategies for including graphics in LaTeX documents" [3], and the book *The LaTeX Graphics Companion* [2].

Graphics are embedded using the `\includegraphics` command. It looks like this:

```
    \includegraphics[options]{filename}
```

Typical options that you can use are `width=XX` or `height=XX`. For example, to include an image, have it centered, and scale it to 3 inches, use this:

```
\begin{figure}
    \begin{center}
        \includegraphics[width=3in]{imagedirectory/file}
        \caption{Caption of the important figure.}
        \label{fig:importantfigure}
    \end{center}
\end{figure}
```

The `imagedirectory/file` notation indicates the images are in a subdirectory of `imagedirectory` and the file name is `file`. The file extension (`.jpg`, etc.) are optional.

Note: LATEX will not properly include graphics that have periods in their filenames in addition to the period that is used for the extension!

There are two kinds graphics that you can include in a LATEX document: vector and raster graphics:

Vector graphics are excellent for printing purposes. These images show up nicely on the computer screen and paper. The computer renders these dynamically. Several tools to generate vector graphics include `Inkscape` and `asymptote`. In general, you should convert vector graphics to a PDF file and embed it in your document using `\includegraphics`.

Raster graphics include `.bmp`, `.jpg`, `.png`, and `.gif` images. Formats without compression, including `.bmp` files generally will make your thesis file much larger. Some of these images show up poorly or pixelated in print copy. You should convert these files to `.jpg` or `.png` and embed them in your document with `\includegraphics`.

Professional looking figures and diagrams can be built using the `asymptote` package. This is a program and a LATEX package. The `asymptote` code that creates the drawing is included in the `.tex` file. The `asymptote` package creates an intermediate `.asy` file, which is just a copy of your asymptote code from the `.tex` file. Finally, an automated script, or you manually, executes the `asy` program which results in a `.pdf` file of your drawing. The `.pdf` file is then placed into your final document. See their website at `http://asymptote.sourceforge.net/` for details.

As some past background, many resources might refer the user to MetaPost, which was the original software to generate these figures. Asymptote is modernized and more powerful program; it is recommended over MetaPost.

Specific macros for including graphics will be discussed in Section 2.4.

1.15 BibTeX and Citations

Bibliography and citation are important in your thesis. Each department has different expectations on citation styles. Even if you select the wrong style initially, changing the format to the correct option is only a one-line change for LaTeX – unlike a complete nightmare for Microsoft® Word users.

See `http://en.wikibooks.org/wiki/LaTeX/Bibliography_Management` and
`http://stefaanlippens.net/bibentry`

Many common citation reference organizers and websites output BibTeX formatted citations in `.bib` files. This is a time saver, as rather than retyping information, you can download the `.bib` file and copy its contents into your thesis master `.bib` file. The master `.bib` file contains all of your citations, even ones that you have not yet cited. When you reference these citations in your thesis, BiBTeX can generate the references list for you. To cite a specific reference use the `\cite{name}` command. After your first run of `pdflatex`, you follow with the `bibtex` command as in §1.5.

CHAPTER 2:
The NPS LaTeX Template

This chapter describes how to get the template and how to use it.

2.1   Getting the Template

Get a copy of the `npsthesis.zip` distribution from `http://simson.net/npsthesis/npsthesis.zip`. Unpack this into a directory on your computer; Table 2.1 shows the important files that you will find.

`Makefile`	The Makefile to make the thesis
`authorindex.*`	The LaTeX authorindex package, for making the Referenced Authors page.
`chngcntr.sty`	The `chngcntr` package, for changing the way that LaTeX displays its counters.
`fixbbl.py`	A python program that removes the breaks in the `.bbl` file inserted by BibTeX.
`nps-plain.bst`	A BibTeX style file that makes references in a style that is acceptable to NPS for which the referneces appear sorted by author's last name.
`nps-plain-unsorted.bst`	A BibTeX style file that makes references in a style that is acceptable to NPS for which the references appear in the order of appearance.
`nps-plain-classified.bst`	A BibTeX style file that makes references in a style that is acceptable to NPS for a classified thesis. References are sorted by last name.
`nps-plain-classified-unsorted.bst`	A BibTeX style file that makes references in a style that is acceptable to NPS for a classified thesis. References appear in the order of appearance.
`nps_logo_3clr_cymk.pdf`	NPS Logo, 3 color
`thesis.bib`	Your thesis bibliography file
`thesis.tex`	Your thesis LaTeX source

Table 2.1: Files included with your distribution.

To create your thesis, start with the files `thesis.tex` and `thesis.bib` and edit them as necessary.

2.2 Editing the Temlate

The skeletal `thesis.tex` file consists of two main parts: the *prologue* (everything before the `\begin{document}`) and the *body* (everything between the `\begin{document}` and the `\end{document}`). The body is further split into two parts: the main body and the postmatter (the appendices, bibliography, and distribution list). You will typically create your thesis by editing each. Some students put their entire thesis into the `thesis.tex` file, while others put each chapter into its own `.tex` file and include them using the `\include{filename.tex}` command.

The remainder of this section will show a skeletal thesis template for each of these three parts (the prologue, the main body and the postmatter), and then will explain the purpose of each command.

2.2.1 The thesis prologue

Below is the thesis prologue from the `thesis.tex` file, with all of the comments removed:

```
\documentclass[twoside,thesis,authorindex]{npsreport}
\securitybanner{}
\title{[TITLE]}
\author{[AUTHOR]}
\degree{Master of Science in [DEGREE]}
\degreeabbreviation{MS}
\department{Department of [DEPARTMENT]}
\thesisadvisor{[ADVISOR]}
\secondreader{[SECOND READER]}
\departmentchair{[DEPARTMENT CHAIR]}
\rank{[RANK]}
\prevdegrees{[UNDERGRADUATE DEGREE]}
\degreedate{[DEGREE DATE]}
\distribution{Approved for public release; distribution is unlimited}
\RPTpreparedFor{}
\abstract{
  [INSERT ABSTRACT HERE]
}
\ReportType{Master's Thesis}
\DatesCovered{2102-06-01---2104-10-31}
\SponsoringAgency{Department of the Navy}
\ReportClassification{Unclassified}
\AbstractClassification{Unclassified}
\PageClassification{Unclassified}
\SupplementaryNotes{ The views expressed in this thesis are those of
  the author and do not reflect the official policy or position of the
```

```
    Department of Defense or the U.S. Government.%
    \footnotesize IRB Protocol Number: XXXX}
\makeatletter\@removefromreset{footnote}{chapter}\makeatother
```

documentclass

The documentclass specifies the thesis to use the `npsreport.cls` file and all settings contained therein. It has several optional parameters, each separated by comma.

article, thesis, or dissertation choose the appropriate one for the case, most likely thesis.

twoauthors, threeauthors, or fourauthors only if you have several authors. Single authors need no option.

twoside prints on both sides of the same sheet of paper, recommended.

traditional prints in a style that the thesis processors have used. However, the newer style is approved and looks quite nice when no option is given.

singlespace if you prefer single-spaced paragraphs, though it may be a little harder to read.

classified if you are using an approved computer system to write your thesis on sensitive research.

authorindex if you are including an author index page of your thesis references.

twoadvisors if you have two advisors rather than a second reader.

tight Causes the spacing between paragraphs and paragraph indentation to be smaller than standard.

securitybanner

Leave blank unless producing a classified thesis. Whatever text appears between the braces is placed at the top and bottom of pages of the thesis.

title

Your thesis title phrase

degree Your planned NPS degree written out as in "Master of Science in Electrical Engineering" (no quotation marks)

degreeabbreviation

MA, MS, MBA, or other shorthand notation

prevdegrees

Written out as "B.S., Degree, School, Year" as in "B.S., Electrical Engineering, Clemson University, 2007" (no quotation marks)

degreedate

Written as "Month Year" as in "June 2011" (no quotation marks)

distribution

One of the approved Department of Defense distrubtion statements (A through F or Export Control). These are listed out on the thesis release form that must also be submitted with your thesis.

abstract

Your entire abstract goes here. New paragraphs can be started by a blank line, just like

the rest of your thesis.

supplementarynotes

If your thesis does not have an Institutional Review Board (IRB) protocol number, replace the XXXX with N/A, otherwise fill in the appropriate number. This is needed for thesis that use human subjects to collect data. Ask your advisor for more information if this applies.

2.2.2 The thesis main body

Below is the thesis body, with all of the comments that appear on lines by themselves removed:

```
\begin{document}
\NPScover                          % Cover
\NPSsftne                          % SF298
\NPSthesistitle                    % Title page
\NPSabstractpage                   % Abstract Page
\NPSfrontmatter                    % NPS front matter follows
\renewcommand{\chaptermark}[1]{
  \markboth{\MakeUppercase{\chaptername}\ \thechapter.\ #1}{}}
\NPSTableOfContents
\NPSListOfFigures
\NPSListOfTables
\NPSListOfAcronyms{
 \begin{description}
   \item[NPS] Naval Postgraduate School
   \item[USG] United States Government
 \end{description}
}
\acknowledgements{
  [ACKNOWLEDGEMENTS]
}
\NPSbody
\chapter{[CHAPTER ONE TITLE]}
[CHAPTER BODY]

This is the beginning of your thesis. Don't be a Micky
Mouse\cite{mm2}: Always have text between every head and subhead.
\section{Your First Section}
[Section One Body]
\section{Your Second Section}
[Section Two Body]
\section{Your Third Section}
[Section Three Body]
```

```
\chapter{[CHAPTER TWO TITLE]}
[CHAPTER BODY]
This is the beginning of the second chapter.
Always have text between every head and subhead.
\section{Your First Section}
[Chapter two Section One Body]
\section{Your Second Section}
[Chapter two Section Two Body]
\section{Your Third Section}
[Chapter two Section Three Body]
```

NPScover
> Prints the coversheet page.

NPSsftne
> Prints the Standard Form 298 completely filled out with the provided information.

NPSthesistitle
> Prints the signature page.

NPSabstractpage
> Prints the abstract page.

NPSfrontmatter
> Applies some thesis settings for the remainder of the document.

NPSTableOfContents
> Creates the Table of Contents that lists `chapters` and `subsections`.

NPSListOfFigures and NPSListOfTables
> These lists are automatically created based on the content of the thesis, using the *figure* and *table* environments.

NPSListOfAcronyms
> This has to be performed manually, unless you use the `acronym` package.

Acknowledgements
> Say your piece.

NPSbody
> Thesis chapters follow.

2.2.3   The thesis postmatter

```
\def\showURL{}
\bibliographystyle{nps-plain-unsorted}
\bibliography{thesis}
\NPSappendix                    % Appendices follow
\chapter{[APPENDEX NAME]}
[APPENDEX BODY]
\NPSend
\chapter*{Initial Distribution List}
```

```
\addcontentsline{toc}{chapter}{Initial Distribution List}
\singlespace
\begin{enumerate}
\item Defense Technical Information Center\\Ft. Belvoir, Virginia
\item Dudly Knox Library\\Naval Postgraduate School\\Monterey, California
\item Marine Corps Representative\\Naval Postgraduate School\\Monterey, California
\item Directory, Training and Education, MCCDC, Code C46\\Quantico, Virginia
\item Marine Corps Tactical System Support Activity (Attn: Operations
  Officer)\\Camp Pendleton, California
\end{enumerate}
\end{document}
```

bibliographystyle
> Can be one of the provided styles (nps-plain, nps-plain-classified, nps-plain-classified-unsorted, nps-plain-unsorted) or others commonly used (acm, acmtrans, amsalpha, amsplain, apa-good, ieeetr, ieeetrans, TK)

bibliography
> Specifies your master `.bib` file, in this case, `thesis.bib`. All cited references should be kept in this file.

NPSappendix
> Treat all following `chapter` entries as appendicies.

NPSend
> Includes the authorindex, if the option was specified in the `documentclass`. Concludes the content of the thesis.

2.3   Labels

Labels are hidden markers in your `.tex` files created by `\label{name}`. These markers are never shown directly in the output files. However, correctly placing these in your file allows you to reference chapters, appendices, sections, figures, tables and equations. Label marker names can have a prefix such as `chap:`, `sec:`, `fig:`, `tab:` and `eqn:` to logically identify and sort labels.

- Chapters, Appendices and Sections should have the label directly after the curly braces of `\chapter{}` or `\section{}`.
- Figures should have the label inside the curly braces of the `\caption{}`.
- Tables and Equations should have the label inside of the `table` and `equation` environments.

The `vref` commands in Table 2.2 can also automatically swap "on page 4" for "on the preceeding page" and other phrases.

Built in to LaTeX:

`\ref{l}`	General reference of the label that places the label's number in the document.

Provided by `npsreport.cls`:

`\chapref{l}`	Chapter reference that formats as "Chapter 3"
`\chapvref{l}`	Chapter reference that formats as "Chapter 3 on page 4"
`\secref{l}`	Section reference that formats as "Section 3." You can use this for sections, subsections, and so on.
`\secvref{l}`	Section reference that formats as "Section 3 on page 4"
`\figref{l}`	Figure reference that formats as "Figure 3"
`\figvref{l}`	Figure reference that formats as "Figure 3 on page 4"
`\tabref{l}`	Table reference that formats as "Table 3"
`\tabvref{l}`	Table reference that formats as "Table 3 on page 4"
`\eqnref{l}`	Equation reference that formats as "Equation (3.1)"
`\eqnvref{l}`	Equation reference that formats as "Equation (3.1) on page 4"
`\eqnsref{l,m}`	Equation reference that formats as "Equations (3.1) and (3.5)"
`\eqnsvref{l,m}`	Equation reference that formats as "Equations (3.1) and (3.5) on page 4"
`\appref{l}`	Appendix reference that formats as "Appendix 3"
`\appvref{l}`	Appendix reference that formats as "Appendix 3 on page 4"

Table 2.2: Reference commands included in the `thesis.tex` demo file.

2.3.1 Tables and Figures

Tables and figures are floating objects that LaTeX moves around as necessary to make your thesis look better. Tables are inserted with the `\begin{table}` command while figures are inserted with `\begin{figure}`. Here are some rules to consider:

- Every table and figure should have a caption, created with the `\caption{text}` command.
- Every table and figure should have a unique label, created with the `\label{marker}` command.
- Every table and figure should be referred to in the main body of your text. LaTeX provides a command called `\ref{marker}`; this template provides additional commands `\tabref{marker}` and `\figref{marker}`. All of the reference commands are shown in Table 2.2.
- Do not assume that figures and tables will be on the same text as your page. Always refer to the figures and tables by their numbering.

2.4 Including Photos and Figures

This section shows how you can easily include photos.

Using the `\sgraphic{filename}{caption}` command you bring in a photo from a given file-

Figure 2.1: Banner from the top of the NPS web site.

Figure 2.2: A photo from the NPS web site.

Figure 2.3: A second photo from the NPS web site.

name and give it a caption. The filename is then automatically set up as LATEX cross-reference. Use the `\figref{tag}` command to get an in-paragraph reference. Figure 2.1 shows an example of this.

The `\twofigures{width1}{image1}{caption1}{width2}{image2}{caption2}` macro allows you to have two figures side-by-side, as shown in Figure 2.2 and Figure 2.3.

There are a large number of these layout macros at the end of `npsthesis.cls` — give them a look!

2.5 Changing the Template Font

Notional section to explain this. TK

2.6 Going Further

If you are interested, feel free to review the file `npsthesis.cls`. A great deal of effort has gone into making this file both readable and understandable. You will find additional commands in

this file and you may even have thoughts on changes to make. Please let us know what you come up with!

You may find the following packages useful:

`multirow` – Allows a single table cell to extend to multiple rows.

`ifthen` – Allows you to put conditions in your thesis. It is a bit easier than using the `if` that's built in to T_EX.

`acronym` – A great package for automatically generating acronym lists. It can track the usage of acronyms to correctly use the long name of the acronym on its first use.

`makeidx` – For creating an index of key words and phrases in your document.

`mcode` – Places a MATLAB® .m file contents directly into the output. The package performs syntax highlighting and line numbering if desired. This package is not in the CTAN and documentation may be obtained from the MATLAB® Central website at `http://tinyurl.com/3wgcufr`.

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CHAPTER 3:
Helpful Information for Your Report or Thesis

This chapter discusses elements of writing and style that are helpful when writing a report or thesis at NPS. This chapter is based on a publication that was distributed by the NPS Thesis Processor in 2009.

3.1   Style Information for Theses

3.1.1   English Grammar Tips

1. Punctuation (periods and commas) go inside quotation marks.
2. When using i.e., e.g., or etc. always put a comma before and after, *e.g.*, like this. You can also use the \ie, \eg and \etc macros that the thesis template provides.
3. Master's degree has an apostrophe and Postgraduate is one word.
4. If you use "however," make sure there's a comma before and after, unless you start a sentence with it. However, it's best not to start a sentence with "however." And while we are on the subject, you should try to avoid starting a sentence with "and" or "because."
5. When typing a date, do not use "st" or "th." Instead, just note the date: July 4, 1776, is Independence Day. Commas go after Month/date, year. No comma between month/yr.
6. Spell out numbers 1 through 9 as one to nine. Larger numbers remain as digits.
7. Capitalize C in Chapter, F in Figure and T in Table when referring to chapters, figures or tables in the text and use roman numerals vs numbers or spelling out, etc. for chapters. Even better, use the referencing commands described in Table 2.2 on page 31.
8. Footnote numbers go outside the punctuation.
9. Ibid cannot be the first footnote on the page.
10. When typing equations in text and use "where" or "if," etc. and it's not a new paragraph the word starts at the margin.
11. When inserting symbols, use the proper symbols commands. Avoid trying to include the character directly in the `.tex` file.
12. Avoid writing in the first person!
13. Avoid dangling participles. Wrong: Substituting (12) into (14) gives...; Correct: Substituting (12) into (14), we get...
14. Contractions are not used in formal writing. Cannot is one word.
15. Chapters, figures and tables do not show things. Instead, things are shown or illustrated in figures and tables. Things are discussed in chapters or sections.

3.2   Additional Writing Tips

1. Displayed equations must be numbered, part of a sentence and properly punctuated. This means your equation may have a period as the last character to indicate the sentence has ended.
2. In-line equations in paragraphs must be simple and use "/" to indicate division.

3. All figure captions should be complete sentences with a period at the end of the caption.
4. Figures and tables should display the units associated with quantities being displayed.
5. Axes in figures should be clearly labeled with quantities and units.
6. Discuss all figures and tables in your thesis.
7. Acronyms need to be defined in the acronyms list, in the abstract, in the executive summary, and the first time they are used in the thesis. They do not need to be defined for every chapter.
8. The introduction should provide the background that allows the reader to understand why he or she should be interested in the problem. Provide a discussion of related work with references. State clearly and explicitly the goal(s) or objective(s) of your work. Discuss how your work differs from the previous works.
9. Abstracts briefly summarize the work and helps the reader to ascertain the purpose of the thesis. It may include the problem at hand, the technique used to solve the problem, and the indicate the conclusion of the results.
10. Some departments require an an additional section called the Executive Summary. It is more comprehensive than the abstract and generally 2-10 pages in length. The Executive Summary must stand alone from the rest of the document. Figures and tables are numbered independently from the thesis content and do not appear in the List of Figures or List of Tables. Additionally, references in the Executive Summary are independent from the thesis and there is a separate list of references at the end of the Executive Summary.
11. Conclusions summarize the results obtained in your research and emphasize your original contributions. Recommended future work should include any new questions arising from your research.

3.2.1 LaTeX Tips

1. Do not use "*" or "x" to indicate multiplication. $X = YZ$ is sufficient.
2. If you must use multiplication, please do so using `\times` in math mode. That is, type `$X=Y\times Z$` to produce $X = Y \times Z$.
3. Use the LaTeX `\begin{figure}` and `\begin{table}` environment to create floating figures and tables. Use the `\caption` command to create your captions. Label your captions with the `\label{marker}` command inside the caption itself. Captions are shown in the paper as text. Labels are internal LaTeX identifiers that can be referenced with the `\ref{marker}` reference command.
4. Do not split text around a figure or table. Write complete paragraphs, since LaTeX will place figures in your document to efficiently use the paper.
5. When there is more than one reference, put them both into the `\cite` command: `\cite{john1,john2,john3}`. The additional `cite` package can improve the multiple citations result from [6,7,8] to [6-8].
6. Make sure there's at least one and a half lines of text at the top of the page—if LaTeX gives you a hard time, you may need to add or remove text so that everything works out properly.
7. Don't use math mode as a general italics—use `\emph{}`.

8. Do not make tables too wide in columns or they can be drawn off the right-side of the paper.
9. Use automatic numbering and lettering by using the appropriate environments, such as `enumerate`, `itemize` or `list`.
10. There can only be one `label` entry for a section, figure, etc.. Trying to have more than one will cause a problem in the automatic numbering. If you need to troubleshoot numbering, look in the generated `.toc` files.

3.3 Additional Software

3.3.1 Scripts Included with the NPS Thesis Template

There are several scripts included with the template that may be useful for your writing needs.

`make` – Included with the template is the `Makefile` that Mac and Linux users will readily enjoy. Typing `make` on the command prompt will perform all necessary commands to produce your document.

`build.py` – An alternate script to `make` that can be used for Windows users.

`authorindex.pl` – This perl script is used to generate the authorindex. You will need to use this script if you are generating your document with the authorindex option (see §2.2.1). An additional install of a perl interpreter is required for Microsoft® Windows (ActivePerl® is recommended).

`fixerrors.py` – This python script will correct `.bib` file entries for URLs that contain long URLs and also corrects errors in the authorindex `.ain` files.

`xls_extract.py` – This python script extracts all excel terms from an NPS budget spreadsheet and write LATEX variables. Although it is unlikely you will need to use the script exactly, it can be a reference of how to do something similar if needed for your document.

`xls_covert_to_pdf.py` – Converts the Excel workbook to PDF file format.

3.3.2 Citation Management Software

Organizing your thesis citations is critical to a successful thesis. Legacy techniques included using index cards. In modern times, software is available to help you accomplish this task. A complete list of the available options is at `http://en.wikipedia.org/wiki/Comparison_of_reference_management_software` . NPS has a site-license for Refworks. Other highly recommended options are Zotero and Mendeley. See `http://www.zotero.org/` and `http://www.mendeley.com/` for additional details.

3.3.3 Revision Control Systems and Subversion

Revision control software such as subversion (`svn`), mercurial (`hg`), `git`, and others are excellent modern choices. Consult their websites to determine which one best suits your needs.

You will note that LATEX creates many temporary files. These files should *not* be included in your subversion repository. Because they are generated on a per-machine basis, you can get conflicts if different files are created and then committed on different machines.

If you are using subversion to manage your thesis, you should instruct it to ignore these files. This can be done with the `make ignore` target in the Makefile.

```
ignore:
        svn propget svn:ignore . > /tmp/ignore
        echo thesis.pdf >> /tmp/ignore
        echo '*.ain' >> /tmp/ignore
        echo '*.aux' >> /tmp/ignore
        echo '*.asy' >> /tmp/ignore
        echo '*.bbl' >> /tmp/ignore
        echo '*.blg' >> /tmp/ignore
        echo '*.lof' >> /tmp/ignore
        echo '*.log' >> /tmp/ignore
        echo '*.lot' >> /tmp/ignore
        echo '*.sow' >> /tmp/ignore
        echo '*.toc' >> /tmp/ignore
        echo '*.zip' >> /tmp/ignore
        sort /tmp/ignore | uniq | grep . | svn propset svn:ignore -F -
        .
        @echo "
        @echo Will ignore:
        svn propget svn:ignore .
        @/bin/rm -f /tmp/ignore
```

3.4   NPS Thesis Guidance

3.4.1   Section Order of Appearance
1. Table of Contents
2. List of Figures*
3. List of Tables*
4. List of Acronyms*
5. Executive Summary*
6. Acknowledgements*
7. Chapters
8. Appendices
9. Index*
10. References
11. Initial Distribution List

In the above list, the starred items do not appear in Table of contents. Not all theses will have an index, but that can be generated automatically with LaTeX. If your thesis only has one appendix, then it is not lettered, but just referred as the appendix (even in the table of contents). If you have multiple, then they are lettered. If you do not have any tables, then the list of tables is not included. This also applies to list of figures and acronyms.

3.4.2 Initial Distribution List Recipients

Each thesis contains a list at the end of the original recipients of the thesis. You may add additional names to this list for professional or personal reasons. When you submit your thesis, you will provide an email address for the individuals on the list, and they will receive an email when the thesis has been posted.

1. Defense Technical Information Center
   Ft. Belvoir, Virginia
2. Dudly Knox Library
   Naval Postgraduate School
   Monterey, California
3. Your department chair
   Naval Postgraduate School
   Monterey, California
4. Your advisor
   Naval Postgraduate School
   Monterey, California
5. Your 2nd reader/coadvisor
   Naval Postgraduate School
   Monterey, California
6. Each author
   Naval Postgraduate School
   Monterey, California

   Marine officer students are required to show:
7. Marine Corps Representative
   Naval Postgraduate School
   Monterey, California
8. Directory, Training and Education, MCCDC, Code C46
   Quantico, Virginia
9. Marine Corps Tactical System Support Activity (Attn: Operations Officer)
   Camp Pendleton, California

   Officer students in the Operations Research Program are also required to show:
10. Director, Studies and Analysis Division, MCCDC, Code C45
    Quantico, Virginia

Officer students in the Space Ops/Space Engineering Program or in the Information War-fare/Information Systems and Operations are also required to show:

11. Head, Information Operations and Space Integration Branch, PLI/PP&O/HQMC, Washington, DC

3.4.3 Documentation submitted with thesis

The Thesis processors will require some additional forms to accept your thesis and give you a green card. These forms are available on their website at `http://www.nps.edu/research/research1.html`.

- Thesis release form
- Thesis color page request form
- Special Abstract
- Completed Signature Page

APPENDIX A:
Using the NPS LyX Template

The NPS LyX Dissertation Template was developed by CDR Michael Bilzor is available for use with LyX. The template can be obtained from `http://simson.net/npsthesis/lyxthesis.zip`. The remainder of this section was written by CDR Bilzor and describes using the template.

Using the NPS LyX Dissertation Template

A.1 Get LaTeX

Download and install, if necessary, a LaTeX installation package. For Mac, I recommend using MacTeX - it includes some extras like BibDesk and gives you a good basic LaTeX editor. (`http://www.tug.org/mactex/2009/`)

A.2 Get LyX

Download it, install it, and tell it about your LaTeX installation. (If the lack of a spell-checker is bugging you, an easy way to add one is via MacPorts (http://www.macports.org/) - once a package like aspell has been ported in, you can point LyX to it and it'll use it).

A.3 Editing your SF298

Edit the standard sf298 style file, or use a modified version.

A.3.1 Option 1 - modify the standard sf298 file (permanent fix)

I don't have Windows-specific directions for this task, but it has been tested on MacOS and Ubuntu.

Find the copy of your LaTeX distro's `sf298.sty` file:

MacOS `/usr/local/texlive/2010/texmf-dist/tex/latex/sf298/sf298.sty`
Ubuntu `/usr/share/texmf-texlive/tex/latex/sf298/sf298.sty`

These files are read-only, and may be hidden. To make the file read-write, do a chmod at the command line (Unix gurus), or use Get Info (Command-I) from the Finder and click the lock icon; you'll be prompted for the admin password and can then make canges to the permissions.

(The template includes a modified copy of the `sf298.sty` file in the `/styles` folder, in case you just want to set permissions, delete the old one, and replace it with this one).

Open `sf298.sty` in a text editor (I recommend TextWrangler for Mac; I had issues with standard text editor in saving the file, but TextWrangler was obedient).

Locate and comment out the following line (as shown below, now with a % at the beginning):

```
%\ExecuteOptions{config,nofloatlongboxes}
```

Skip the next line, then comment out the following three lines as shown:

```
%\if Y\sf@config
%  \InputIfFileExists{sf298.cfg}{}{}
%\fi
```

Save the file and exit. Lyx will default to using the LATEX distribution copy of `sf298.sty` unless you explicitly point it to the location of a different copy of `sf298.sty` in your `\usepackage` statement. Unmodified, you will get at least two errors compiling the NPS dissertation file. With `sf298.sty` modified, it will now compile the NPS LATEX dissertation format without the errors.

A.3.2   Option 2 - use the custom-named nps_sf298 style file and keep a copy of it in your dissertation's working directory (easy fix).

Open up the LATEX Preamble in LyX, using Document/Settings. Once there, change the statement `\usepackage{sf298}` to `\usepackage{nps_sf298}`, and be sure there is always a copy of `nps_sf298.sty` in your dissertation's working directory.

Open up the Template. The file is called `Sample_nps_phd.lyx`. It uses the files in the `/images` directory, as well as the bibliography file `Sample.bib`. Typeset a PDF file to check it out. If everything works, you can use this as a template and edit your dissertation using the LyX editor.

Notes:

- This template takes most of the formatting from the `npsphd.cls` file (from Prof. Simson Garfinkel and MAJ Rob Harder), and ads the necessary parts into a LyX field called "LATEX Preamble," which is accessible under document settings. The basic class is "report", and the master fonts are set to Times New Roman. To add more style files, add `\usepackage` statements to the ones already in the Preamble.
- Be sure that the fields you use for Title, Name, etc. exactly match between where they're entered in the document in multiple places (i.e., in the sf298 fields).
- Sections like the Abstract, Acknowledgments, etc. are implemented as unnumbered chapters (chapter* in the pulldown).
- `hyperref` support is available throug the native LyX GUI interface.
- The document class in LyX is just "report," and all the customization comes from the LATEX preamble. LyX has a way to create what it calls a "layout" which is LyX-speak for a locally-defined custom LATEX document class. I haven't done this, but it's probably a good "future work" project.

REFERENCES

[1] Apache Software Foundation. Apache subversion. `http://subversion.apache.org/`, August 2011.

[2] Michel Goossens. *The LaTeX graphics companion: illustrating documents with TeX and PostScript*. Addison-Wesley, Reading Ma., 1997.

[3] Klaus Höppner. Strategies for including graphics in latex documents. *TUGboat*, 26(1), 2005.

Initial Distribution List

1. Defense Technical Information Center
   Ft. Belvoir, Virginia
2. Dudly Knox Library
   Naval Postgraduate School
   Monterey, California