



PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE
SCHOOL OF ENGINEERING

THESIS PREPARATION PACKAGE USING

\mathcal{A}_M^S -L^AT_EX

MIGUEL TORRES TORRITI

Thesis submitted to the Office of Research and Graduate Studies
in partial fulfillment of the requirements for the degree of
Master of Science in Engineering

Advisor:

ADVISOR'S NAME

Santiago de Chile, April 2007

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Gratefully to my family

ACKNOWLEDGEMENTS

The `pucthesis` document class is possible thanks to Wendy McKay, from Université de Montréal who provided the original template and to Benoit Dubuc and Peter Whaite, from McGill's Centre for Intelligent Machines, who modified back in May 1993 the original template to create the `cimthesis` document class on which this template is based.

The merit of painting lies in the exactness of reproduction. Painting is a science and all sciences are based on mathematics. No human enquiry can be a science unless it pursues its path through mathematical exposition and demonstration.

No human investigation can be called real science if it cannot be demonstrated mathematically.

Nessuna humana investigazione si può dimandare vera scienza s'essa non passa per le matematiche dimostrazione.

—LEONARDO DA VINCI, Treatise on Painting

Seriousness, young man, is an accident of time. It consists, I don't mind telling you in confidence, in putting too high a value on time... In eternity, however, there is no time, you see. Eternity is a mere moment, just long enough for a joke.

—HERMANN HESSE, Steppenwolf (1928)

A man spoke with the Lord about heaven and hell. The Lord said to a man, 'Come I will show you hell'. They entered a room where a group of people sat around a huge pot of stew. Everyone was famished and desperate. Each held a spoon that reached the pot, but each spoon had a handle so long that it could not be used to reach each person's mouth. The suffering was terrible.

'Come, now I will show you heaven', the Lord said after a while. They entered another room, identical to the first—the pot of stew, the group of people, the same long spoons. But there everyone was happy and well-nourished.

'I don't understand,' said the man, 'why are they happy here when they were miserable in the other room and everything was the same?' The Lord smiled, 'Ah, but don't you see?' he said, 'Here they have learned to feed each other.'

AUTHOR UNKNOWN

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iv
LIST OF FIGURES	viii
LIST OF TABLES	ix
ABSTRACT	x
RESUMEN	xi
1. INTRODUCTION	1
1.1. Outline of the Thesis Document	1
1.2. Fonts	2
1.3. Margins	2
1.4. Line Spacing	2
2. THE PREAMBLE	4
2.1. Initialisations	4
2.2. Top Matter	4
2.3. Abstract	6
2.4. Acknowledgements	6
2.5. Table of Contents	6
2.6. Page Numbering	6
3. THE DOCUMENT	7
3.1. A Mathematical Extract	7
3.2. Theorems, Lemmas, and Other Proclamations	8
3.3. Regular Roman Font	8
3.4. Subsections and Subsubsections	9
3.4.1. A subsection in small caps	9

4. FIGURES	10
5. TABLES	14
6. ALGORITHMS AND PSEUDOCODE	19
7. REFERENCES	21
7.1. Reference Style	21
7.2. Producing References	24
7.3. BIB _T E _X Reference Examples	25
7.3.1. Book Reference Example	26
7.3.2. Paper-in-Book Reference Example	26
7.3.3. Journal Paper Reference Example	27
7.3.4. Conference Paper Reference Example	27
7.3.5. Thesis Reference Example	28
7.3.6. Technical Reports Reference Example	28
7.3.7. Technical Documentation/User's Guide Reference Example	28
7.3.8. An Example Using Abbreviations	29
8. GENERAL DOCUMENT PREPARATION TIPS	31
8.1. Tips for Figures and Tables	31
8.2. Tips on Abbreviations and Acronyms	31
8.3. Tips on Equations and Numbers	32
8.4. Other Recommendations	32
8.5. Tips on Units	33
8.6. Tips on Writing and the Use of Language	33
9. INSTALLING AND COMPILING	35
9.1. Installing L ^A T _E X	35
9.2. Compiling and Generating PDF Files	36
REFERENCES	37

APPENDIX A. THESIS PACKAGE DISTRIBUTION	40
APPENDIX B. RESOURCES ON THE INTERNET	63

LIST OF FIGURES

4.1	Leonardo da Vinci's Vitruvian Man (c. 1490).	11
4.2	Eigenvectors of the bilinear system Σ and its unstable subspace.	12
4.3	State trajectories versus time for the controlled bilinear system Σ	13

LIST OF TABLES

5.1	Simulation results.	15
5.2	Motronics Series M1 DC motor specifications.	17

ABSTRACT

This document is a sample prepared to illustrate the use of the $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX package version 2.2 and the \LaTeX `pucthesis` documentclass.

Authors should use the coding in the file `pucthesis_sample.tex` as a model. This file was used to prepare this sample.

The template file `pucthesis_template.tex` should be of help in getting started with the writing of a new thesis. A verbatim listing of the template file is provided in Appendix A of this document.

The style file, `pucthesis.sty`, and the document class `pucthesis.cls`, are based on style files from the *American Mathematical Society* (AMS). New documents should employ the `pucthesis.cls`, document class and be compiled using \LaTeX 2_ε. The current version of the `pucthesis.sty`, style file should not be used as it does not comply with the guidelines for thesis preparation. It is provided only as a reference and to support compilation in the unlikely situation that \LaTeX 2_ε is not available and only plain \LaTeX is. Most of the text in this sample document is the same as that usually provided by the AMS with their article and monograph style packages.

Keywords: thesis template, document writing, differential equations, aerodynamics, electromagnetic waves theory, shock analysis, elasticity, computer simulation, quantum mechanics, Campbell-Baker-Hausdorff formula.

RESUMEN

Este documento es un ejemplo preparado para ilustrar el uso de $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX versión 2.2 y la clase de documento `pucthesis` (*documentclass*) para \LaTeX .

Los autores deben usar la código en el archivo `pucthesis_sample.tex` como modelo. Este archivo fue utilizado para preparar este ejemplo.

El documento plantilla `pucthesis_template.tex` será de mucha ayuda para empezar con la escritura de una nueva tesis. Un listado *verbatim* del código del documento plantilla se presenta en el Apéndice A de este documento.

El archivo de estilo, `pucthesis.sty`, y la clase de documento `pucthesis.cls`, están basados en archivos de estilo de la *American Mathematical Society* (AMS). Los documentos nuevos deberían emplear la clase de documento `pucthesis.cls`, y ser compilados usando \LaTeX 2_ε. La versión actual del archivo de estilo `pucthesis.sty`, no debe ser utilizado, ya que no cumple con las instrucciones para la preparación de tesis. Este archivo se provee solamente como una referencia y para permitir la compilación en la improbable situación que \LaTeX 2_ε no esté disponible, pero si su versión anterior (*plain* \LaTeX). La mayor parte del texto de este ejemplo es la misma que usualmente es provista por la AMS en sus paquetes de estilo para artículos y monografías.

Palabras Claves: plantilla de tesis, escritura de documentos, ecuaciones diferenciales, aerodinámica, teoría electromagnética de ondas, análisis de impactos, elasticidad, simulación por computador, mecánica cuántica, fórmula de Campbell-Baker-Hausdorff.

1. INTRODUCTION

This sample thesis illustrates the use of the `pucthesis` document class, which is based on the `amsbook` document class of $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX version 2.2 and provides additional macros for writing theses according to the guidelines set in (Sistema de Bibliotecas, 2005).

In this sample thesis, brief instructions to authors will be interspersed with mathematical text extracted from (purposely unidentified) published papers. For instructions on preparing mathematical text, the author is referred to *The Joy of \TeX* , second edition, by Michael Spivak (Spivak, 1990) and *\LaTeX : A Document Preparation System* by Leslie Lamport (Lamport, 1994).

1.1. Outline of the Thesis Document

An $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX document consists of three main commands:

```
\documentclass[12pt,reqno,oneside]{pucthesis}
...                               %<-- the preamble section
\begin{document}
...                               %<-- the document text section
\end{document}
```

The preamble section will be described in Chapter 1 and the document text section in Chapter 2. Within these two sections any $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX preprint style commands may be used. In addition, new chapter commands do the following:

```
\NoChapterPageNo % suppresses numbering of chapter page
```

Several general purpose macros have also been added to the thesis package:

```
\draft           % switch on: add footer with [Draft: date and time]
\hhmm            % prints: the current hours and minutes as hh:mm
\today           % prints: day month year
\todayfr         % prints: jour mois an %french version of \today
\MoYr            % prints: month year
\MoYrfr          % prints: mois an %french version of \MoYr
```

```

\Month          % prints:  month
\Monthfr        % prints:  mois           %french version of \Month
\Year           % prints:  year
\verbatiminput{} % inputs a file verbatim; filename in the argument {}

```

1.2. Fonts

The fonts used in this paper are from the Times family; they should be available to all authors preparing papers with these macros using the package `times`.

N.B. *Good quality output can be obtained on 300dpi PostScript printers with the fonts produced in the proper size. To obtain the best quality of output, verify:*

- *that the printer being used is downloading the PostScript version of the fonts (and is not using bitmapped fonts, which produces very thin font outlines); and*
- *that the printer is printing black on white (and not the reverse).*

1.3. Margins

All page margins must be as follows:

Top: 40 mm

Left: 40 mm

Right: 20 mm

Bottom: 20 mm

1.4. Line Spacing

Line spacing must be 1.5, except in the following items:

- Quotes must be made at single line spacing. See for example the Acknowledgements chapter.
- The line following chapter or section titles must be a double line.

- Double spaced lines must precede and end figures, as well as tables. Also a double spaced line must exist between the figure or table and its caption.

Note that line spacing can be changed using the command `baselinestretch` as shown in the next example (don't forget to include the braces around the section to which you want the new line spacing to apply, unless the line setting command is included within an environment declaration).

```
{
\renewcommand{\baselinestretch}{1.5}
...
}
```

2. THE PREAMBLE

2.1. Initialisations

All initialisations for theorems, new commands, numbering style, etc. should be made in the preamble before setting up the top matter for the preliminary pages. The commands included in this part are:

```
\newcommand\...\{...}    % for local definitions
\newtheorem{ }{ }[]
\numberwithin{ }{ }
```

2.2. Top Matter

The input format and content of the top matter can be best understood by examining the first part of the sample file `pucthesis_sample.tex`, up through the `\begin{document}` instruction.

The top matter includes both elements that must be input by the author and a few that are provided automatically. The authors' names and the title that are to appear in the running heads should be input between square brackets as an option to the `\author` and `\title` commands, respectively (currently this option has been disabled because it does not conform to the PUC thesis guidelines). The full names and title should be used unless they require too much space; in that event, abbreviated forms should be substituted. In the top matter, the title is input in caps and lowercase and will be set in all caps. The authors' names should be input in caps and lowercase.

Addresses are considered part of the top matter, but are set at the end of the document, following the references (currently this option has been disabled because it does not conform to the PUC thesis guidelines). For each author an address should be input. If the current address is different than the address where the research was carried out then both addresses are given with the current address second and coded as indicated in this sample file (currently this option has been disabled because it does not conform to the PUC thesis

guidelines). Following these addresses, an address for electronic mail should be given, if one exists. Note that no abbreviations are used in addresses, and complete addresses for each author should be entered in the order that names appear on the title page (this option is also disabled and only applies to the writing of papers).

In summary, the commands to be set up for the topmatter are the following:

```

\draft                % adds a footer with date of draft
\mdate{}             % date manuscript written/changed
\version{}           % manuscript version#
\title[] {}          % use \\ for a newline in title
\author[]{}
\address {Department\\
          University\\
          Street address, City (Province) Postal Code, Country\\
          {\it Tel.\!/} : (xxx) xxx-xxxx}

\email{aaaaaaaaa@@xxx.yyy.zz}
\university{}
\facultyto{}          % Faculty document presented to
\department{}
\faculty{}
\degree{}
\subject{}
\date{}               % month/year of presentation
\copyrightname{}
\copyrightyear{}
\president{}
\director{}
\codirector{}         % optional
\jurymember{}         % optional 1 name only
\manyjurymembers{}    % optional multiple names
\morejurymembers{}    % optional additional names
\examiner{}           % optional
\dateaccepted{}

```


The cover page is created after setting up the topmatter commands by using:

```
\pagenumbering{roman}  
\maketitle
```

2.3. Abstract

A short abstract should appear on page (ii) using the command:

```
\chapter*{ABSTRACT}
```

and should be followed by its Spanish version, the *resumen*:

```
\chapter*{RESUMEN}
```

2.4. Acknowledgements

Acknowledgements on page (iv) using the command:

```
\chapter*{ACKNOWLEDGEMENTS}
```

2.5. Table of Contents

The ‘Table of Contents’, ‘List of Figures’, and ‘List of Tables’ are the pages before the document and are created by the commands:

```
\tableofcontents  
\listoffigures  
\listoftables
```

2.6. Page Numbering

Preliminary pages must be numbered using roman numerals in lower case. Pages in the main body of the document must be numbered using arabic numbers.

3. THE DOCUMENT

In the following sections a sample of mathematical text is given using $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\text{L}\text{T}\text{E}\text{X}$, which incorporates the $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\text{T}\text{E}\text{X}$ commands inside $\text{L}\text{T}\text{E}\text{X}$. A comprehensive users guide may be found in a file called `{amslatex.tex}` in the local system TEX inputs directory.

3.1. A Mathematical Extract

The mathematical content of this sample paper has been extracted from published papers, with no effort made to retain any mathematical sense. It is intended only to illustrate the recommended manner of input.

Mathematical symbols in text should always be input in math mode as illustrated in the following paragraph.

A function is invertible in $C(X)$ if it is never zero, and in $C^*(X)$ if it is bounded away from zero. In an arbitrary $A(X)$, of course, there is no such description of invertibility which is independent of the structure of the algebra. Thus in §2 we associate to each noninvertible $f \in A(X)$ a z -filter $\mathcal{Z}(f)$ that is a measure of where f is “locally” invertible in $A(X)$. This correspondence extends to one between maximal ideals of $A(X)$ and z -ultrafilters on X . In §3 we use the filters $\mathcal{Z}(f)$ to describe the intersection of the free maximal ideals in any algebra $A(X)$. Finally, our main result allows us to introduce the notion of $A(X)$ -compactness of which compactness and realcompactness are special cases. In §4 we show how the Banach-Stone theorem extends to $A(X)$ -compact spaces.

The `\operatorname{ }` command is very useful in mathematical formula when abbreviations are used as operators, e.g. $\operatorname{grad}(x)$. If frequently used, `grad` may be predefined in the *preamble* using

```
\newcommand \opgrad{\operatorname{grad}}
```

A standard set of operators are provided in $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\text{L}\text{T}\text{E}\text{X}$, e.g.:

```
\max, \min, \det, \sin, \cos,
```

```
....
```

3.2. Theorems, Lemmas, and Other Proclamations

Theorems and lemmas are varieties of `theorem` environments. In this document, a `theorem` environment called `lemma` has been created, which is used below. Also, there is a `proof`, which is in the predefined `pf` environment. The lemma and proof below illustrate the use of the `enumerate` environment.

Lemma 3.1. *Let $f, g \in A(X)$ and let E, F be cozero sets in X .*

- (i) *If f is E -regular and $F \subseteq E$, then f is F -regular.*
- (ii) *If f is E -regular and F -regular, then f is $E \cup F$ -regular.*
- (iii) *If $f(x) \geq c > 0$ for all $x \in E$, then f is E -regular.*

PROOF 3.1. (i) *Obvious.*

- (ii) *Let $h, k \in A(X)$ satisfy $hf|_E = 1$ and $kf|_F = 1$. Let $w = h + k - fhk$. Then $fw|_{E \cup F} = 1$.*
- (iii) *Let $h = \max\{c, f\}$. Then $h|_E = f|_E$ and $h \geq c$. So $0 < h^{-1} \leq c^{-1}$. Hence $h^{-1} \in C^*(X) \subseteq A(X)$, and $h^{-1}f|_E = 1$. □*

Another `theorem`-type environment was defined at the beginning of this document, called `definition`. Here is an example of it:

Definition 3.1. *For $f \in A(X)$, we define*

$$\mathcal{Z}(f) = \{E \in Z[X] \mid f \text{ is } E^c\text{-regular}\}. \quad (3.1)$$

3.3. Regular Roman Font

Numbers, punctuation, (parentheses), [brackets], {braces}, and symbols used as tags should always be set in regular roman font (i.e. serif font such as Times not Italics). The following sample theorem illustrates how to code for roman type within the statement of a theorem.

Theorem 3.1. *Let \mathcal{G} be a free nilpotent-of-class-2 group of rank ≥ 2 with carrier G and let*

$$m : G \times G \rightarrow Z$$

satisfy (2.21), (2.22), and (2.24), and define κ by (2.23). Then this κ -group is κ -nilpotent of class 2 and κ -metabelian, that is to say, it satisfies S2 and S3, but it is κ -abelian if, and only if,

$$m(x, y) = -1 \quad \text{for all } x, y \notin G'. \quad (3.2)$$

(Thus (3.1) implies the trivial consequence (2.1).) Now I7', however, is equivalent to a condition similar to (2.25), namely

$$m(xz\sigma, yz\sigma) = m(x, y). \quad (3.3)$$

Letters used as abbreviations rather than as variables or constants are set in roman type. Use the control sequences (Spivak, 1990, p. 95) for common mathematical functions and operators like log and lim.

3.4. Subsections and Subsubsections

3.4.1. A subsection in small caps

We conclude by noting that another characterization of A -compactness follows from Mandelker. We call a family \mathcal{S} of closed sets in X A -stable if every $f \in A(X)$ is bounded on some member of \mathcal{S} . Then one can show that a space is A -compact if and only if every A -stable family of closed sets with the finite intersection property has nonempty intersection.

3.4.1.1. A second-level subheading

This paragraph is included only to illustrate the appearance of a sub-subsection.

4. FIGURES

Figures should be inserted within L^AT_EX's figure environment using the `graphicx` package instruction:

```
\includegraphics[scale=number]{path/file_name}
```

where `number` is the scaling factor of the figure (0.0– ∞) and `file_name` is the name of the figure in PostScript (.PS) or Encapsulated PostScript (.EPS) format. For further details see the documentation of the `graphicx` package.

REMARK 4.1. *Note that:*

- *A_MS-L_AT_EX recommends the use of the `graphicx` package. The A_MS-L_AT_EX documentation recommends to avoid the use of other packages to include figures, such as `epsfig`, because they may cause particular problems for A_MS production and because `graphicx` has superseded most other packages. The use of `epsfig`, has not shown however to produce any conflict with the pucthesis document class.*
- *The positioning of figures may need to be changed to obtain the best possible page layout. Thus it is important to label your figures and use the labels in the text when referring to figures. The figure caption should be positioned below the figure.*

This paragraph shows references to figures included in this chapter. Fig. 4.1 shows Leonardo da Vinci's Vitruvian Man, which was drawn circa 1490. Other figures, such as fig. 4.2 and fig. 4.3 show the kind of graphs typically found in scientific articles.

Example 4.1. *The basic way to include a figure involves the following lines of code:*

```
\begin{figure}[htbp]
  \begin{center}
    \includegraphics*[scale=1.0]{path/filename.ps}
  \end{center}
  \caption[Short title for the Table of Figures]{Long title.}
  \label{fig:name}
\end{figure}
```

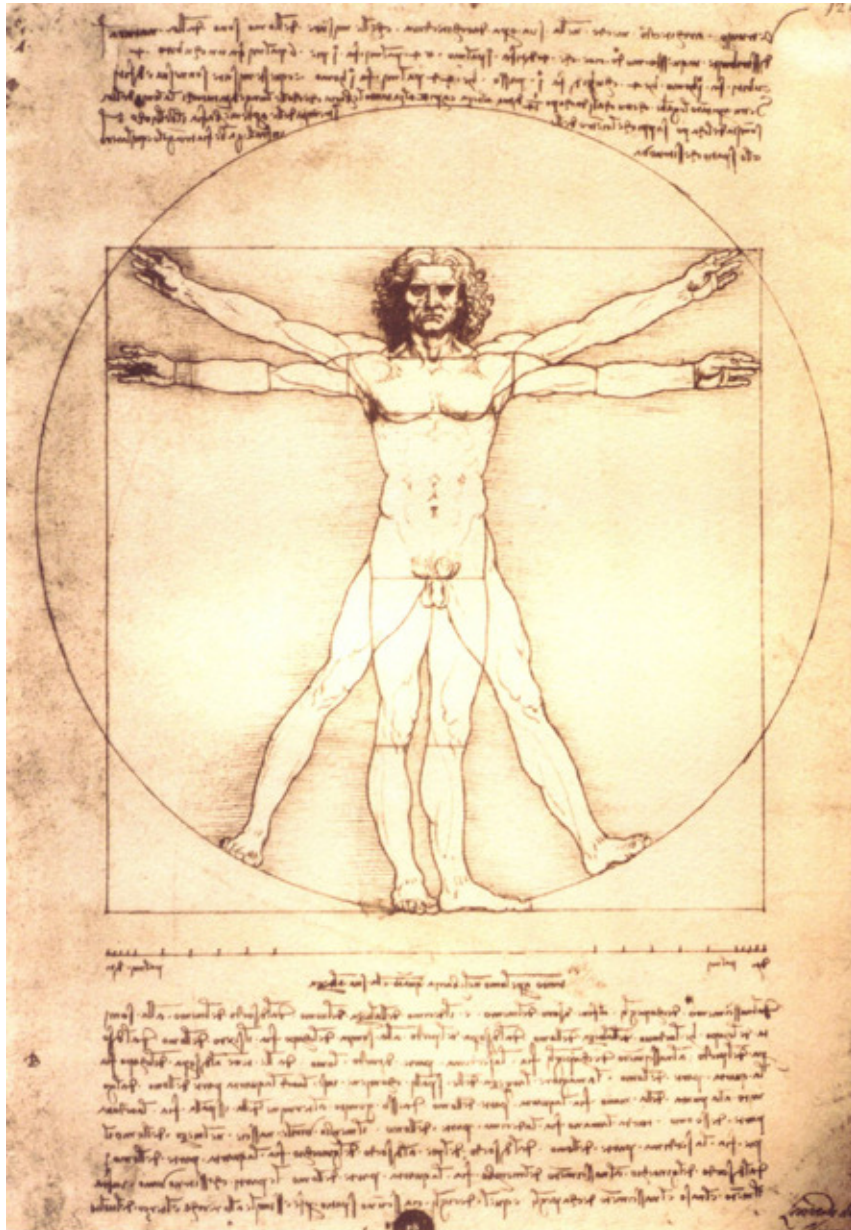
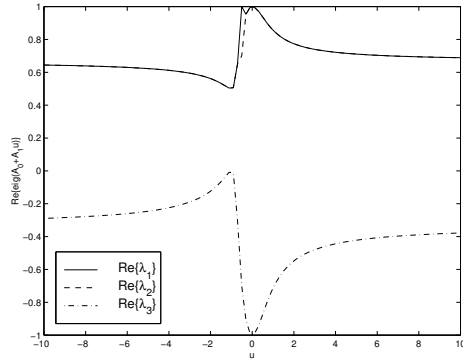
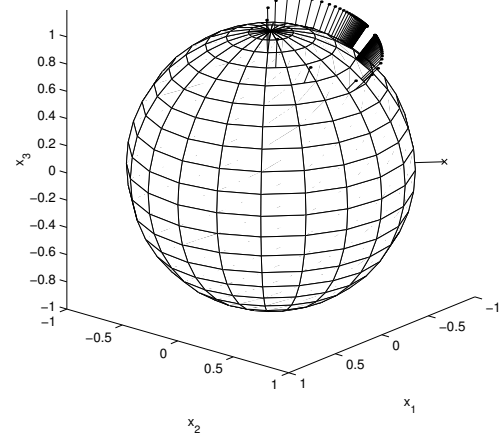


FIGURE 4.1. Leonardo da Vinci's Vitruvian Man (c. 1490).



(a) Eigenvalues of system Σ versus a constant control input $u \in \mathbb{R}$.



(b) Eigenvectors spanning the unstable subspace of system Σ as the control input $u \in \mathbb{R}$ varies.

FIGURE 4.2. Eigenvectors of the bilinear system Σ and its unstable subspace.

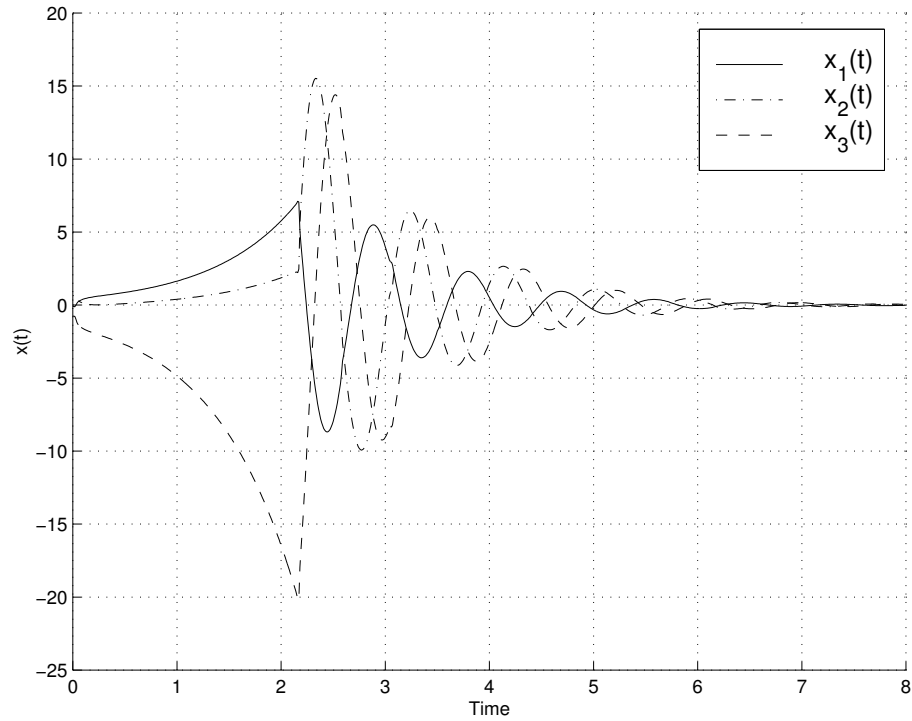


FIGURE 4.3. State trajectories versus time for the controlled bilinear system Σ . Note that a shorter version of this caption can be placed in the Table of Figures (TOF) by including an optional title using the command `\caption[Short title for TOF]{Long title}`.

5. TABLES

Including tables is much like including figures. However, it is important noting that, unlike figures, tables must be preceded by their captions. Tables are created using the `tabular` command within a `table` environment as shown by the following general code:

```
\begin{table*}[htbp]
\caption{Table title.}
\label{tab:simresults}
{\setstretch{1.5}
\begin{tabular}{|a|a|...|a|}\hline
Row/Column & Column 1 & ... & Column N\\\hline
Row 1      & 1, 1    & ... & 1, N    \\\hline
...        & ...     & ... & ...     \\\hline
Row M      & M, 1    & ... & M, N    \\\hline
\end{tabular}
}
\end{table*}
```

In the previous code, `|a|`, can be either of `|c|`, `|l|` or `|r|`, in order to define the alignment of the text in the column as centered, left-aligned or right-aligned, respectively. Another thing worth noting is the use of `\setstretch` to set the line spacing of the table. This command is part of the `setspace.sty` package, which is automatically included by the `pucthesis.cls` document class.

A simple table is shown in Table 5.1. As shown next in the code for this table, note that:

- Elements spanning multiple columns can be created using the command:

```
\multicolumn{n}{a}{Entry text}
```

Here `a` can be any of `c`, `l` or `r`, and may be followed by `|` to draw a vertical line at the end of the multicolumn.

- Horizontal lines spanning multiple column elements can be created with the command:

```
\cline{m-n}
```

where `m` and `n` correspond to the number of the starting and ending column, respectively.

TABLE 5.1. Simulation results.

Algorithm	Error		Efficiency
	Pos. [m]	Ang. [°]	
KF	0.21	2.3	1.0
EKF	0.15	1.1	1.2
PF	0.12	0.9	9.8

```

\begin{table*}[htbp]
\caption{Simulation results.}
\label{tab:simresults}
{\setstretch{1.5}
\begin{tabular}{|c|c|c|c|}\hline
Algorithm &\multicolumn{2}{c|}{Error} & Efficiency\\\cline{2-3}
& Pos. [m] & Ang. [^\circ] & \\
KF & 0.21 & 2.3 & 1.0 \\
EKF & 0.15 & 1.1 & 1.2 \\
PF & 0.12 & 0.9 & 9.8 \\
\end{tabular}
}
\end{table*}

```

More complicated tables can also be created as illustrated in Table 5.2. In addition to entries spanning multiple columns and the use of `c`, `l`, `r` alignment commands note the following:

- The `@` allows to:
 - Suppress the space before or after a column (`@{ }`).
 - Insert special column separators, e.g. `@{ . }`.
 - Modify the space between columns using `@{ \hspace{width} }`.
- Instead of the `c`, `l`, `r`, it is also possible to use any of the following paragraph making commands:
 - `p{width}`: paragraph column with text vertically aligned at the top.

REMARK 5.1.

- A package useful for creating table elements spanning several rows is the `multirow` package.

- *Table elements can be constrained and arbitrarily positioned using the `parbox` environment.*

TABLE 5.2. Motronics Series M1 DC motor specifications.

Parameter		Symbol	Units	Model		Comments
				M1-6V	M1-9V	
1.10	Nominal Voltage	V_a	V	6.00	9.00	This is a design parameter.
1.100	Current	Nom. I_{anom}	A	0.035	0.025	This parameter depends on the superconducting properties of the material.
		Max. I_{amax}	A	1.90	1.30	This parameter is limited by the heating constraints of the insulation.
2.10	Armature Resistance	R_a	Ω	0.85	2.15	—
2.20	Armature Inductance	L_a	μH	45	90	—
3.700	Speed	Nom. ω_{nom}	RPM	7000	7500	—
		Max. ω_{max}	RPM	8000	8000	—
4.500	Angular Acceleration	Max. α_{max}	rad/s^2	120×10^3		—
4.800	Torque	Max. T_{mmax}	Nm	0.01		Guaranteed.
50.200	Temperature	Nom. T_{op}	C	-30—+85		Experimentally determined.
		Max. T_{max}	C	+125		Limited by insulation properties.

```

\begin{table*}[htbp]
\caption{Motronics Series M1 DC motor specifications.}
\label{tab:motorspecs}
{\setstretch{1.5}
\small
\begin{tabular}{r@{}llccrrp{25mm}}\hline
& & Parameter & & Symbol & & Units & & \multicolumn{2}{c}{Model} \\
& & & & & & & & & Comments\\
& & & & & & & & \multicolumn{1}{c}{M1-6V} \\
& & & & & & & & \multicolumn{1}{c}{M1-9V} \\
& & & & & & & & & \\
1.&10 & Nominal Voltage & &  $V_a$  & & V & & 6.00 & 9.00 \\
& & & & & & & & & This is a design parameter. \\
1.&100 & Current & Nom. &  $I_a$  & (nom) & A & & 0.035 & 0.025 \\
& & & & & & & & & This parameter depends on \\
& & & & & & & & & the superconducting \\
& & & & & & & & & properties of the material. \\
& & & Max. &  $I_a$  & (max) & A & & 1.90 & 1.30 \\
& & & & & & & & & This parameter is limited \\
& & & & & & & & & by the heating constraints \\
& & & & & & & & & of the insulation. \\
2.&10 & Armature Resistance & &  $R_a$  & &  $\Omega$  & & 0.85 & 2.15 & --- \\
2.&20 & Armature Inductance & &  $L_a$  & &  $\mu$  H & & 45 & 90 & --- \\
3.&700 & Speed & Nom. &  $\omega$  & (nom) & RPM & & 7000 & 7500 & --- \\
& & & Max. &  $\omega$  & (max) & RPM & & 8000 & 8000 & --- \\
4.&500 & Angular Acceleration & & & &  $\text{rad/s}^2$  & & & & \\
& & & Max. &  $\alpha$  & (max) & & & & &  $120 \times 10^3$  \\
& & & & & & & & & & --- \\
4.&800 & Torque & Max. &  $T_m$  & (max) & Nm & & & & 0.01 \\
& & & & & & & & & & Guaranteed. \\
50.&200 & Temperature & Nom. &  $T_{op}$  & & C & & & & -30--+85 \\
& & & & & & & & & & Experimentally determined. \\
& & & Max. &  $T_{max}$  & & C & & & & +125 \\
& & & & & & & & & & Limited by insulation \\
& & & & & & & & & & properties. \\
\end{tabular}
}
\end{table*}

```

6. ALGORITHMS AND PSEUDOCODE

This section presents some examples of algorithms and pseudocode written with the `algorithm2e` package. This package requires the `float` and `xspace` packages. The `fancybox` package may additionally be required if fancier frame boxes are desired. Algorithm 1 shows the standard `ruled` style. Algorithm 2 shows an algorithm style based on the `shadowbox` command of the `fancybox` package and a modification of the `ruled` algorithm style that has been added to the `algorithm2e` package under the name of `norule`. For further information on this and other algorithm typesetting packages see:

<http://www.tex.ac.uk/cgi-bin/texfaq2html?label=algorithms>.

Algorithm 1: Euk's algorithm

Data: this text

Result: how to write algorithms with L^AT_EX 2_ε

initialization;

while *not at end of this document* **do**

 read current section;

if *understand* **then**

 go to next section;

 current section becomes this one;

else

 go back to the beginning of current section;

end

end

Use this ruler to check the width of the frame boxes

relative to the page width.

Algorithm 2: Euk's algorithm

Data: this text

Result: how to write algorithm with L^AT_EX 2_ε

initialization;

while *not at end of this document* **do**

 read current section;

if *understand* **then**

 go to next section;

 current section becomes this one;

else

 go back to the beginning of current section;

end

end

7. REFERENCES

7.1. Reference Style

References must employ the American Psychological Association (APA) citation convention; see the following SIBUC's URL address:

http://www.puc.cl/sw_educ/gnosis/citas/citas.htm

To this end, the `BIBTEX` bibliography tool is used together with the `apacite` bibliography style, which requires the following files:

- `apacite.sty`: must be placed where `TEX` can find it, such as the directory which contains your `.tex` document.
- `apacite.bst`: must be placed where `BIBTEX` can find it, such as the directory which contains your `.tex` document.
- `apacitex.bst`: must be placed where `BIBTEX` can find it, such as the directory which contains your `.tex` document.

These files are included with the distribution of the `pucthesis` document class. The latest version of the `apacite` files can be obtained from the CTAN's site:

<http://texcatalogue.sarovar.org/entries/apacite.html>

There are two primary forms of citation in the `apacite` style dependent upon whether the reference is used as a noun or parenthetically. Additionally, those references with more than two authors are cited with all authors the first the citation occurs in the text and only with the first author's name followed by 'et al.' in subsequent occurrences. The following example illustrates this point:

`LATEX` is a system for typesetting documents developed in 1985 by a computer scientist named Leslie Lamport (1994). `LATEX` is based on another piece of software called `TEX`, written between the late 1970s and early 1980s by Donald E. Knuth (1986), a well-known computer scientist and mathematician at Stanford University. `LATEX` is based on

the principle that authors should concentrate on logical design rather than visual design when writing their documents.

There are many handbooks that cover technical writing aspects involving style, structure and layout (Higham, 1998; Knuth, Larrabee, & Roberts, 1988; Strunk, White, & Angell, 1999). Higham's 1998 book is to the technical writer what the work by Strunk et al. (1999) is to the liberal arts writer. Portions of the book by Knuth et al. (1988) are also available in his technical report STAN-CS-88-1193.

The following aspects shown in the previous example are worth noting:

- The command `\fullciteA` (also `\citeA`, `\shortciteA`) is employed when the citation is used as a noun in the sentence, e.g. citations 1, 2, 7 and 8. This command is similar to the `\citeasnoun` command of the `harvard` citation style package. However, the latter does not allow multiple citations.
- The commands `\cite`, `\fullcite` and `\shortcite` are employed to produce parenthetical references and allow creating lists of citations, e.g. citations 3, 4 and 5.
- The command `\citeyear` produces the document's year within parenthesis. Use `\citeyearNP` to cite the year without the parenthesis, e.g. citation 6. The latter is equivalent to `\citeyear*` of the `harvard` package.
- The first occurrence of a reference must include the last name of all authors separated by commas, except for the last one, which must be connected by an `&`, e.g. citations 4 and 5.
- In the case of references with two authors, the second and following occurrences must include the lastname of the first author and second author separated by an `&`.
- In the case of references with three or more authors, the second and following occurrences must include the lastname of the first author followed by 'et al.', which is an abbreviation of the latin expression 'et alii' (masculine) 'et aliae' (femenine) meaning 'and others'. See, for example, the last two citations (7, 8).

- Possessive citations can be made using the family of citation commands ending in NP, such as `\citeNP`, `\citeyearNP`, as shown in citation 6. These versions of the standard citation commands are useful for constructing complex citations within parenthetical material. The `harvard` package handles this using the `\possessivecite` command.

In some situations it may be necessary to refer to certain pages within a book. This can be done as in standard L^AT_EX bibliographies using `\cite[pp. 32--35]{Label}`. For example, `\cite[pp. 43--54]{KNU88}` produces: (Knuth et al., 1988, pp. 43–54).

The following list demonstrates some of the main commands to produce citations:

- First occurrence of `\cite{TAY03}`:
(Taylor, Johnson, & Faulkner, 2003)
- Second occurrence of `\cite{TAY03}`:
(Taylor et al., 2003)
- Forcing all authors in the third occurrence using `\fullcite{TAY03}`:
(Taylor, Johnson, & Faulkner, 2003)
- Forcing a short citation is achieved using `\shortcite{TAY03}`:
(Taylor et al., 2003)
- Standard citation of the authors' names without parentheses using `\citeA{TAY03}`:
Taylor et al. (2003)
- Full citation of the authors' names without parentheses using `\fullciteA{TAY03}`:
Taylor, Johnson, and Faulkner (2003)
- Short citation of the authors' names without parentheses using `\shortciteA{TAY03}`:
Taylor et al. (2003)

- Standard citation of the authors' names only (without publication year) using `\citeauthor{TAY03}`:
Taylor et al.
- Full citation of the authors' names only (without publication year) using `\fullciteauthor{TAY03}`:
Taylor, Johnson, and Faulkner
- Full citation of the authors' names only (without publication year) using `\shortciteauthor{TAY03}`:
Taylor et al.
- Citation of the publication year within parentheses using `\citeyear{TAY03}`:
(2003)
- Citation of the publication year without parentheses using `\citeyearNP{TAY03}`:
2003
- Full citation without parentheses using `\fullciteNP{TAY03}`:
Taylor, Johnson, & Faulkner, 2003
- First occurrence of a reference with two authors, such as `\cite{TAL93}`:
(Talluri & Aggarwal, 1993)
- Second occurrence of the previous reference with two authors, `\cite{TAL93}`.
It is to be noted that the ampersand (&) is used instead of the 'et al.', unlike citations with three or more authors:
(Talluri & Aggarwal, 1993)

For a full explanation of the many options supported by the `apacite` bibliography style package see (Meijer, 2005).

7.2. Producing References

Producing the bibliography involves the following steps:

- (i) Creating one or more `.bib` files with the `BIBTEX` entries for each reference.
See the examples below, the `BIBTEX` documentation or the references in:

`http://en.wikipedia.org/wiki/BibTeX`

- (ii) Including the following lines in the `.tex` document to insert the references contained in the `.bib` files, e.g. `refs1.bib`, `refs2.bib`, `refs3.bib`, ...:

```
\bibliographystyle{apacite}
\bibliography{refs1,refs2,refs3,...}
```

- (iii) Compiling the `.tex` document using the command:

```
latex filename
```

- (iv) Compiling with the `bibtex` command the `.aux` file generated by the `latex` compiler. The `.aux` file contains, among other information, the data about the `BIBTEX` references collections stored in the `.bib` files. To carry out this step, execute the following command:

```
bibtex filename
```

The `bibtex` compiler will produce a `.bbl` and `.blg` file that will be included in the final document, after compiling the `.tex` document twice in the next step.

- (v) Execute:

```
latex filename
```

```
latex filename
```

- (vi) If the document has an index of terms or authors, execute:

```
makeindex filename
```

```
latex filename
```

```
latex filename
```

7.3. `BIBTEX` Reference Examples

One or more `.bib` files containing the references must be created following the `BIBTEX` package documentation. The references in a `BIBTEX` file do not need to be alphabetical order because `BIBTEX` will take care of arranging them for you depending on the bibliography style employed. The following references have been chosen to illustrate the coding of the

most common types of references. It is to be noted that not all of the possible fields for the different types of references are employed. If you wish to use the optional fields, you must remove the text ALT or OPT preceding the field identifier. Use the abbreviations for journal names that are given in annual indexes of *Mathematical Reviews*:

<http://www.ams.org/msnhtml/serials.pdf>

7.3.1. Book Reference Example

See reference (Strunk et al., 1999):

```
@Book{STR99,
  author =      {W. Strunk and E. B. White and R. Angell},
  ALTeditor =   {},
  title =       {The Elements of Style},
  publisher =    {Allyn \& Bacon},
  year =        {1999},
  OPTkey =      {},
  OPTvolume =   {},
  OPTnumber =   {},
  OPTseries =    {},
  OPTaddress =   {},
  edition =      {$4^{th}$},
  OPTmonth =     {},
  OPTnote =      {},
  OPTannote =    {}
}
```

7.3.2. Paper-in-Book Reference Example

See reference (Talluri & Aggarwal, 1993):

```
@InBook{TAL93,
  author =      {R. Talluri and J. Aggarwal},
  editor =      {C. H. Chen, L. F. Pau, P. S. P. Wang},
  title =       {Handbook of Pattern Recognition and Computer
                  Vision},
  chapter =     {Positional estimation techniques for an
                  autonomous mobile robot -- a review},
  publisher =    {World Scientific Publishing Co.},
  year =        {1993},
  OPTkey =      {},
  OPTvolume =   {},
  OPTnumber =   {},
  OPTseries =    {},
  OPTtype =     {}
}
```

```

OPTaddress = {},
OPTedition = {},
OPTmonth = {},
OPTpages = {769--801},
OPTnote = {},
OPTannote = {}
}

```

7.3.3. Journal Paper Reference Example

See reference (Manski, 1977):

```

@Article{MAN77,
  author = {C. F. Manski},
  title = {The structure of random utility models},
  journal = {Theory and Decisions},
  year = {1977},
  OPTkey = {},
  volume = {v. 8},
  number = {n. 3},
  pages = {229--254},
  OPTmonth = {},
  OPTnote = {},
  OPTannote = {}
}

```

7.3.4. Conference Paper Reference Example

See reference (Taylor et al., 2003):

```

@InProceedings{TAY03,
  author = {D. W. Taylor and P. N. Johnson and W. T. Faulkner},
  title = {Local area radio navigation: a tool for GPS-denied
    geolocation},
  OPTcrossref = {},
  OPTkey = {},
  booktitle = {Proc. of the SPIE-Aerosense Conference, Orlando,
    Florida, 24 April 2003},
  pages = {125--136},
  year = {2003},
  OPTeditor = {},
  volume = {v. 5084 - Location Services and Navigation
    Technologies},
  OPTnumber = {},
  OPTseries = {},
  OPTaddress = {},
  OPTmonth = {},
  OPTorganization = {},
}

```

```

OPTpublisher = {},
OPTnote =      {},
OPTannote =     {}
}

```

7.3.5. Thesis Reference Example

See reference (Cecil, 1970):

```

@PhdThesis{CEC70,
  author =      {S. O. Cecil},
  title =       {Correlations of Rock Bolt Shotcrete Support and
                  Rock Quality Parameters in Scandinavian Tunnels},
  school =      {Departament of Civil Engineering, University of
                  Illinois at Urbana Champaign},
  year =        {1970},
  OPTkey =      {},
  OPTtype =     {},
  address =     {U.S.A.},
  OPTmonth =    {},
  OPTnote =     {},
  OPTannote =   {}
}

```

7.3.6. Technical Reports Reference Example

See reference (Godhavn, Balluchi, Crawford, & Sastry, 1997):

```

@TechReport{GOD97,
  author =       {J.-M. Godhavn and A. Balluchi and L. S. Crawford
                  and S. S. Sastry},
  title =        {Control of Nonholonomic Systems with Drift Terms},
  institution =  {UC Berkeley-ERL},
  year =         {1997},
  OPTkey =      {},
  type =         {Memorandum M97/01},
  OPTnumber =   {},
  OPTaddress =   {},
  OPTmonth =     {},
  OPTnote =     {},
  OPTannote =   {}
}

```

7.3.7. Technical Documentation/User's Guide Reference Example

See reference (Char et al., 1991):

```

@Manual{CHAR91,

```

```

title =          {Maple {V} Language Reference Manual},
OPTkey =         {},
author =         {B. W. Char and K. O. Geddes and G. H. Gonnet
                  and B. Leong and M. B. Monagan and S. M. Watt},
OPTorganization = {},
OPTaddress =     {},
edition =        {Springer-Verlag},
OPTmonth =       {},
year =           {1991},
OPTnote =        {},
OPTannote =      {}
}

```

7.3.8. An Example Using Abbreviations

The `@String` BIB_{TEX} entry provides an easy way to refer to text strings that are used frequently in references, such as the name of journals, conferences, publishers, among other.

Consider for example a `.bib` file with the following entries:

```

@String{ PROCL = {{Proceedings of the}}}
@String{ CDC = {{IEEE Conf. on Decision and Control}}}
@String{ IEEEP = {{Proc. of the IEEE}}}

```

It is to be noted that an extra pair of braces is used whenever the capital letters in the string must be preserved. It is also worth pointing out that `@String` BIB_{TEX} entries are useful for creating comments within a `.bib` file since BIB_{TEX} does not provide a command to create references like the `%` command in L_{ATEX} .

The following reference (Cyborg, 3000) shows the use of the above abbreviations:

```

@InProceedings{CYB00,
  author =      {Alfa Cyborg},
  title =       {The Life in {U}nimatrix {O}ne},
  OPTcrossref = {},
  OPTkey =      {},
  booktitle =   PROCL # { } # CDC,
  pages =       {1001--1005},
  year =        {3000},
  OPTeditor =   {},
  volume =      {III},
  OPTnumber =   {}
}

```



```

OPTseries =    {},
address =      {Delta Quadrant},
month =        {December},
OPTorganization = {},
publisher = IEEP,
OPTnote =      {},
OPTannote =    {}
}

```

Notice that the abbreviations *are not enclosed by parentheses*. Use the # sign to concatenate strings. Often a blank space must be inserted between abbreviations. This can be achieved by inserting # { } # between abbreviations.

See Appendix A in page 40 for details about the coding of the references and citations.

8. GENERAL DOCUMENT PREPARATION TIPS

Some helpful hints on how to prepare a better document are briefly explained in this section.

8.1. Tips for Figures and Tables

- Try to position figures and tables at the top or bottom of pages. Avoid placing them in the middle a page.
- Remember figure captions should be centered below the figures.
- Remember table captions should be centered above the tables.
- Avoid placing figures and tables before their first mention in the text.
- In some papers you may use the abbreviation “Fig. #”, even at the beginning of a sentence.
- Figure axis labels are often a source of confusion. Use words rather than symbols. For example, write “Magnetization”, or “Magnetization (M)”, not just “M”.
- Put units in parentheses. Do not label axes only with units. For example, write “Magnetization [A/m]” or “Magnetization [A m⁻¹]”, not just “[A/m]” o “[A m⁻¹]”.
- Do not label axes with a ratio of quantities and units. For example, write “Temperature [K]”, not “Temperature/K”.
- Multipliers can be very confusing. Write “Magnetization (kA/m)” or “Magnetization (10³ A/m)”.
- Figure labels should be legible at 8-point type.

8.2. Tips on Abbreviations and Acronyms

- Define abbreviations and acronyms the first time they are used in the text, even if they have been defined in the abstract.
- Abbreviations such as IEEE, SI, MKS, CGS, ac, dc, and rms do not have to be defined. Do not use abbreviations in the title unless they are unavoidable.

8.3. Tips on Equations and Numbers

- Number equations consecutively with equation numbers in parentheses flushed with the right margin, as in (8.1).
- To make your equations more compact, you may use the solidus (/) and the exp function, etc.
- Italicize Roman symbols for quantities and variables, but not Greek symbols.
- Use an en dash “–” rather than a hyphen “-” for a minus sign.
- Use parentheses to avoid ambiguities in denominators.
- Punctuate equations with commas or periods when they are part of a sentence, as in

$$\frac{e^{ix}}{2} = \frac{\cos x + i \sin x}{2} \Rightarrow \exp(ix)/2 = (\cos x + i \sin x)/2. \quad (8.1)$$

- Symbols in your equation should be defined before the equation appears or immediately following.
- Cite equations using “(8.1),” not “Eq. (8.1)” or “equation (8.1)”, except at the beginning of a sentence, e.g. “Equation (8.1) is ...”.

8.4. Other Recommendations

- Do not number Acknowledgement and References chapters.
- Use two spaces after periods (full stops). Use one space after abbreviation periods, commas, colons and semi-colons.
- Hyphenate complex modifiers: “zero-field-cooled magnetization”.
- Avoid dangling participles, such as, “Using (8.1), the potential was calculated”. Write instead, “The potential was calculated using (8.1)” or “Using (8.1), we calculated the potential”.
- Use a zero before decimal points: “0.25”, not “.25”.
- Use cm³, not “cc”.
- Do not mix complete spellings and abbreviations of units: “Wb/m²” or “Webers per square meter”, not “Webers/m²”.

- Spell units when they appear in text: “a few Henries”, not “a few H”.
- If your native language is not English, try to get a native English-speaking colleague to proofread your work.

8.5. Tips on Units

- Use either SI (MKS) or CGS as primary units. (SI units are encouraged).
- English units may be used as secondary units in parentheses. An exception would be the use of English units as identifiers in trade, such as “3.5-inch disk drive”.
- Avoid combining SI and CGS units, such as current in Amperes and magnetic field in Oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.

8.6. Tips on Writing and the Use of Language

- The word “data” is plural, not singular.
- In British English, periods and commas are outside quotation marks, like “this comma”, while in American English, periods and commas are within quotation marks, like “this period.”
- A parenthetical statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.) A graph within a graph is an “inset”, not an insert.
- The word “alternatively” is preferred to the word “alternately” (unless you mean something that alternates).
- Do not use the word “essentially” to mean “approximately” or “effectively”.
- Be aware of the different meanings of the homophones “affect” and “effect”, “complement” and “compliment”, “discreet” and “discrete”, “principal” and “principle”.
- Do not confuse “imply” and “infer”.

- The prefix “non” is not a word; it should be joined to the word it modifies, usually without a hyphen.
- There is no period after the “et” in the Latin abbreviation “et al.”.
- The abbreviation “i.e.” means “that is”, and the abbreviation “e.g.” means “for example”.
- In the acknowledgements try to avoid the stilted expression, “One of us (R. B. G.) thanks...”. Instead, try “R.B.G. thanks...”.
- An excellent style manual for science writers is the book by M. Young, *The Technical Writers Handbook*, Mill Valley, CA., University Science, 1989. Check also the style manuals cited in the References.

9. INSTALLING AND COMPILING

9.1. Installing L^AT_EX

Obtain a L^AT_EX compiler, such as MiK_TE_X for Windows, available at:

<http://www.miktex.org/>

All installations steps can be found at the developers' site. It is also possible to find several places on the Internet with good summaries of all the steps needed to get your system up and running, see for example:

<http://www.math.aau.dk/~dethlef/Tips/introduction.html>

Once the L^AT_EX system is installed, you should install a text editor, such as:

- Emacs-Auc_TE_X

<http://www.gnu.org/software/emacs/windows/ntemacs.html>,

<http://www.gnu.org/software/auctex/>

- L_Ed

<http://www.latexeditor.org/>

- Ly_X

<http://www.lyx.org/>

- EditPlus

<http://www.editplus.com/>

- WinEdt

<http://www.winedt.com/>

- Kile

<http://kile.sourceforge.net/>

- Vi/Vim

<http://www.vim.org/>

Front-end editors for L^AT_EX come in many different flavours and is hard to recommend a particular one. Some might have not very friendly command interfaces, some other have

more intuitive user interfaces, but may be slower or less flexible. Of all the previous editors, perhaps Emacs-AucTeX is the most powerful combination. Emacs is a truly versatile system. It can be a bit nasty to learn, but is very efficient, highly-costumizable, and light. Learning to use it will pay-off in time if writings documents and coding is part of your daily life.

9.2. Compiling and Generating PDF Files

The basic steps for compiling any L^AT_EX files and generating PDF files are:

- (i) Generating a DVI file from a L^AT_EX file (`.tex`→`.dvi`):

```
latex filename.tex
```

- (ii) Generating a PS file from a DVI file (`.dvi`→`.ps`):

```
dvips -t letter filename.dvi
```

- (iii) Generating a PDF file from a PS file (`.ps`→`.pdf`):

Install Ghostscript/Ghostview and select the `File/Convert` option from the menu bar. Then select the device `pdfwrite` and the output resolution. Press `Ok` and give the file a name with extension `.pdf`. Alternatively, you can use Acrobat Distiller to convert PostScript files to PDF files.

There are other PDF generators, such as `dvipdfm`, `pdflatex`, `tex2pdf`. However, some features are not fully supported by these converters, which may not produce adequate results.

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- Strunk, W., White, E. B., & Angell, R. (1999). *The elements of style* (4th ed.). Allyn & Bacon.
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University of Chicago Press Staff. (2003). *The chicago manual of style* (15th ed.). University of Chicago Press.

van Leunen, M.-C. (1992). *A handbook for scholars* (revised ed.). Oxford University Press.

Williams, P., & Schnier, T. (1996). The Harvard family of bibliography styles. *the harvard package documentation* [Computer software manual].

APPENDIX A. THESIS PACKAGE DISTRIBUTION

The thesis package distribution, {pucthesis.zip}, consists of the following files:

```
pucthesis Package v. 1.3 2007.06.22 MTT
```

```
This distribution of pucthesis includes:
```

```
--- Auxiliary Packages ---
```

```
apacite.bst
```

```
apacite.sty
```

```
algorithm2e.sty
```

```
fancybox.sty
```

```
setspace.sty
```

```
--- pucthesis Document Class Files ---
```

```
pucthesis.cls
```

```
pucthesis.sty % * obsolete *
```

```
logouc_23x30p38mm.ps
```

```
logouc_23x30p38mm.pdf
```

```
--- pucthesis Template Files ---
```

```
pucthesis_template.tex
```

```
pucthesis_template.pdf
```

```
--- pucthesis Sample Files ---
```

```
pucthesis_sample.tex
```

```
pucthesis_sample.pdf
```

```
/figs/bsr3b2c_eig.ps
```

```
/figs/bsr3b2cfan.ps
```

```
/figs/bsr3x.ps
```

```
/figs/vitruvian.ps
```

```
README.txt
```

```
-----
```

1. Introduction

The PUC Thesis document style for LaTeX requires the

following files:

- pucthesis.cls
- apacite.sty

Additionally, if you need to include algorithms and special boxes or frames in your manuscript, it is suggested that you use:

- algorithm2e.sty
- fancybox.sty packages

Using these packages is not compulsory, but may prove useful. These packages are included here because they are required by the examples.

2. Installing:

It is assumed that you have a working standard installation of:

- The TeX/LaTeX system
- Ghostscript/Ghostview
- Some editor such as Emacs+AUCTeX, WinEdit, etc.

The installed TeX/LaTeX system must include the following packages in addition to those included with this distribution:

Minimum pre-requisites of the pucthesis class:

=====

- class: amsbook
- packages: setspace.sty, graphicx.sty, apacite.sty

Package pre-requisites of the pucthesis_template:

=====

- amsmath, amsfons, amssymb, times

Package pre-requisites of the pucthesis_sample:

=====

- amsmath, amsfons, amssymb, times
- algorithm2e, fancybox

- float, xspace (required by algorithm2e)

* Required packages not included with this distribution are usually part of the standard TeX/LaTeX installation. If your system does not include them, you must add them before compiling this distribution.

Unzip the distribution to any directory. No additional steps are required.

3. Compiling the Examples:

Change the directory to where the source files are located.

From a DOS command window execute:

make.bat

From a Unix shell execute:

make

The file, {pucthesis_sample.tex}, gives some samples of typical mathematics formatting in $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$. The template file, {pucthesis_template.tex}, provides the basic commands to help prepare new thesis documents in the correct format. The latter file may be duplicated and customized as needed. A listing of the template file is given in the section below.

```

%=====
%      pucthesis_template.tex      04-Apr-2007, modif.  04-Apr-2007
%_____
%.....10.....20.....30.....40.....50.....60.....70.%
%_____|_____|_____|_____|_____|_____|_____|_
%=====
% $Id:  pucthesis_template.tex,v 1.5 2007/04/04 20:46:03 mtorrest Exp $
\documentclass[12pt,reqno,oneside]{pucthesis}      % For dvips
%\documentclass[12pt,reqno,oneside,pdftex]{pucthesis} % For pdflatex
%\documentclass[10pt,reqno,twoside]{pucthesis}
%\draft
%\doublespacing
%\usepackage{verbatim}
%\usepackage{setspace}
\usepackage{graphicx}
\usepackage{amsmath}
\usepackage{amsfonts}
\usepackage{amssymb}
\usepackage{algorithm2e}
\usepackage{fancybox}
\usepackage{float}
\usepackage{times}

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%      Preamble      %
%-----
%      \newcommand\...\{...\}      %
%      \newtheorem{}{}[]      %
%      \numberwithin{}{}      %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%----- NEW ENVIRONMENTS -----
\newtheorem{definition}{\bf Definition}[chapter]
\newtheorem{property}{Property}[chapter]
\newtheorem{claim}{Claim}[chapter]
\newtheorem{lemma}{\bf Lemma}[chapter]

```

```

\newtheorem{proposition}{Proposition}[chapter]
\newtheorem{theorem}{\noindent \bf Theorem}[chapter]
\newtheorem{corollary}{\bf Corollary}[chapter]
\newtheorem{pf}{Proof}[chapter]
\newtheorem{example}{\bf Example}[chapter]
\newtheorem{remark}{Remark}[chapter]

%----- PLACE ADDITIONAL ENVIRONMENTS/DEFINITIONS HERE -----

% ...

%-----%

\begin{document}

      %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
      %
      %  INITIALISATIONS : Top Matter
      %
      %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%\draft                      %adds a footer with date of draft
\mdate{April 17, 2007}      %date manuscript changed
\version{1}                %manuscript version#

\title[Short Title]{Long title of the thesis}
\author{Author's Full Name}
%
\address{Escuela de Ingenier\'ia\\
         Pontificia Universidad Cat\'olica de Chile\\
         Vicu\~na Mackenna 4860\\
         Santiago, Chile\\
         {\it Tel.\!/} : 56 (2) 354-2000}
\email{mailname@address}
%
\facultyto      {the School of Engineering}
%\department    {Departement of ...}
\faculty        {Faculty of Engineering}
\degree          {Master of Science in Engineering}

```

```

% or {Doctor in Engineering Sciences}
\advisor      {Advisor's Name}
\committeememberA {Committee Member A}
\committeememberB {Committee Member B (Optional)}
\guestmemberA {Guest Committee Member A}
\guestmemberB {Guest Committee Member B (Optional)}
\ogrsmember    {ORGS Representative}
\subject       {Engineering}
\date          {April 2007}
\copyrightname{Author's Full Name}
\copyrightyear{MMVII}
\dedication    {Gratefully to my family}

```

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   PRELIMINARIES                                                    %
%-----%
%       page i & ii:  cover page                                     %
%       page iii:   dedication                                       %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

```

```

\NoChapterPageNumber          % no header - footer on first page of chapter
\pagenumbering{roman}
\maketitle

```

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   EXTRA PAGES                                                      %
%-----%
%       page --:   not used                                           %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

```

```

%\newpage
%\thispagestyle{empty}

```

```

%-----%

```

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

```



```

%           page iv:  ACKNOWLEDGEMENTS                                     %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\chapter*{ACKNOWLEDGEMENTS}

%.....

%.....

Write in a sober style your acknowledgements to those persons that contributed
to the development and preparation of your thesis.

% Do not use the following lines.
% These do not comply with the PUC Thesis guidelines.
%~\vspace{1cm}
%\hfill\parbox[t]{6cm}{\raggedleft
%
%           \em Author's Full Name\}[lex]
%
%           Santiago, Chile, dd mmmm yyyy}

\cleardoublepage % In double-sided printing style makes the next page
% a right-hand page, (i.e.  a truly odd-numbered page
% with respect to absolut counting), producing a blank
% page if necessary.  Added by MTT 20.AUG.2002

%-----%

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%           page v & up ---                                                %
%           Table of Contents                                                %
%           List of Figures                                                  %
%           List of Tables                                                  %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\tableofcontents
\listoffigures
\listoftables

\cleardoublepage % In double-sided printing style makes the next page
% a right-hand page, (i.e.  a truly odd-numbered page
% with respect to absolut counting), producing a blank
% page if necessary.  Added by MTT 20.AUG.2002

```

%-----%

%%%

% page x & xi: ABSTRACT - RESUMEN

%%%

\chapter*{ABSTRACT}

%.....

%.....

The abstract must contain between 100 and 300 words. The abstract must be written in English and Spanish. In the case of doctoral theses, the layout of the abstract page is different, so please check the template provided by the OGRS.

%%%

% KEYWORDS %

%-----%

% at the end of the abstract page %

%%%

~\vfill

{\bf Keywords:} \parbox[t]{.8\textwidth}{

thesis template, document writing, {\bf (Write here the keywords relevant and strictly related to the topic of the thesis)}.}

\chapter*{RESUMEN}

%.....

%.....

El resumen debe contener entre 100 y 300 palabras. El resumen debe ser escrito en ingl\`es y espa~nol. En el caso de tesis de doctorado, el formato de la p\`agina del resumen es distinta, por favor verifique la plantilla entregada por la Direcci\`on de Postgrado.

%%%

% PALABRAS CLAVES %

```

%-----%
%      al final de la pagina de resumen      %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

~\vfill
{\bf Palabras Claves:} \parbox[t]{.75\textwidth}{
  plantilla de tesis, escritura de documentos, {\bf (Colocar aqu\'i las
  palabras claves relevantes y estr\'ictamente relacionadas al tema de la
  tesis)}.

\cleardoublepage % In double-sided printing style makes the next page
% a right-hand page, (i.e. a truly odd-numbered page
% with respect to absolut counting), producing a blank
% page if necessary. Added by MTT 20.AUG.2002

%=====

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%      TEXT OF THESIS
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\pagenumbering{arabic}

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%      CHAPTER 1
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\chapter[INTRODUCTION]{INTRODUCTION}
%.....
%.....
\section{Problem Definition/Problem Description}
\section{Motivation}
\subsection{Some examples}
\subsection{Some features}
\section{Existing Techniques/Existing Approaches}
\subsection{General methods}
\subsection{Drawbacks of existing approaches}

```

```

\section{Summary of Contributions/Original Contributions}
\section{Thesis Outline/Document Organization}

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   CHAPTER 2
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\chapter[BASIC ASSUMPTIONS, FACTS AND PRELIMINARY RESULTS]{BASIC ASSUMPTIONS,
FACTS AND PRELIMINARY RESULTS}
%A\mbox{}\parbox{0.8\textwidth}{
%BASIC ASSUMPTIONS, FACTS AND PRELIMINARY RESULTS}}
%.....
%.....
This section introduces some preliminary notions and mathematical background.
The following is a citation~\cite{CYB00}.

\section{Basic Assumptions}
\section{Basic Facts and Preliminary Results}
\section{Mathematical Models}

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   CHAPTER 3
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\chapter[ANALYSIS AND SIMULATIONS]{ANALYSIS AND SIMULATIONS}
%.....
%.....

\section{Analysis}
\section{Simulations}

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   CHAPTER 4
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\chapter[IMPLEMENTATION AND TESTING]{IMPLEMENTATION AND TESTING METHODOLOGY}
%.....

```

```

%.....

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   CHAPTER 5
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\chapter[EXPERIMENTAL RESULTS]{EXPERIMENTAL RESULTS}
%.....
%.....

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   CHAPTER 6
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\chapter{CONCLUSION AND FUTURE RESEARCH}
%.....
%.....

\section{Review of the Results and General Remarks}
\section{Comparison of Solutions}
\section{Future Research Topics}

%-----%

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   REFERENCES
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%\nocite{*} % To make all the uncited references to appear in the bibliography.
\bibliographystyle{apacite}
\bibliography{abbrev,pucthesis_refs}

%-----%

%-----%

```

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   APPENDICES
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

\appendix
\chapter[ADDITIONAL RESOURCES]{ADDITIONAL RESOURCES}

%.....
%.....

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   INDEX
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%% Uncomment the following lines to include an index.

%% INSERT INDEX PAGE # IN TOC
%%\addtocounter{chapter}{1}
%%\addcontentsline{toc}{chapter}{\protect\numberline{\thechapter}{Index}}
%%\addcontentsline{toc}{chapter}{\protect\numberline{}{Index}}
%% NOTE: Insert "\label{IDX}" in '.ind' file after compiling the index
%% with makeindex.
%%\index{ @\label{IDX}}
%% The above NOTE is not really needed as can be achieved by
%% the trick below.
%\addtocounter{page}{1}
%\label{IDX}
%\addtocounter{page}{-1}
%\printindex

%-----%

\end{document}

%=====
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

```

The files {abbrev.bib} and {pucthesis_refs.bib} listed next provide an example of how to build .bib files.

```
@String{ comment1 = {
% Mathematical Reviews - AMS Abbreviations
% http://www.ams.org/msnhtml/serials.pdf
% http://www.ams.org/tools

% List of Serials
%
%Applied Mathematics and Optimization.  An International Journal with Applications to Stochastics.
Springer, New York.  ISSN 0095-4616.
%
%Automatica.  A Journal of IFAC, the International Federation of Automatic Control.  Pergamon,
Oxford.  ISSN 0005-1098.
% * Communications on Pure and Applied Mathematics
%Computer Physics Communications.  An International Journal and Program Library for Computational
Physics and Physical Chemistry.  North-Holland, Amsterdam.  ISSN 0010-4655.
%
%Doklady Akademii Nauk.  Rossi\u{i}skaya Akademiya Nauk.  Doklady Akademii Nauk.
%MAIK ``Nauka/Interperiodika'', Moscow.  (Physics section translated in Dokl.  Phys.)  ISSN
0869-5652.
%
%European Journal of Control.  Hermes Sci.  Publ., Paris.  ISSN 0947-3580.
%
%IEEE -- Institute of Electrical and Electronics Engineers --
%IEEE Transactions on Automatic Control.  IEEE, Piscataway, NJ.  ISSN 0018-9286.
%IEEE Transactions on Image Processing.  IEEE, Piscataway, NJ.  ISSN 1057-7149.
%IEEE Transactions on Information Theory.  IEEE, Piscataway, NJ.  ISSN 0018-9448.
%IEEE Transactions on Signal Processing.  IEEE, Piscataway, NJ.  ISSN 1053-587X.
%
%IMHOTEP.  Journal Africain de Mathematiques Pures et Appliquees.  African Journal of Pure and
Applied Mathematics.  IMHOTEP Afr.  J. Pure Appl.  Math., Orleans.
%
%International Journal of Control.  Taylor & Francis, London.  ISSN 0020-7179.
%
%Journal of Mathematical Analysis and Applications.  Academic Press, Orlando, FL.  ISSN 0022-247X.
%
%Journal of Differential Equations.  Academic Press, Orlando, FL.  ISSN 0022-0396.
%
%Journal of Functional Analysis.  Academic Press, Orlando, FL.  ISSN 0022-1236.
%
%Journal of Mathematical Physics.  Amer.  Inst.  Phys., Melville, NY.  ISSN 0022-2488.
%
%Mathematics of Control, Signals, and Systems.  Springer, Godalming.  ISSN 0932-4194.
%
%Memoirs of the American Mathematical Society.  Amer.  Math.  Soc., Providence, RI.  ISSN 0065-9266.
%
%
%SIAM Journal on Control.  (Later became SIAM Journal on Control and Optimization).
%SIAM Journal on Control and Optimization.  SIAM, Philadelphia, PA.  ISSN 1095-7138.
%SIAM Review.  SIAM, Philadelphia, PA.  ISSN 1095-7200.
%
%Systems & Control Letters.  North-Holland, Amsterdam.  ISSN 0167-6911.
```

```

%
%Translations of Mathematical Monographs. Amer. Math. Soc., Providence, RI.
%
%* Zeitschrift f\"{u}r Wahrscheinlichkeits-Theorie und verwandte Gebiete.
%
%List of Proceedings
%IFAC Proc. Ser. IFAC Proceedings Series. IFAC, Laxenburg.
%Proceedings of the American Mathematical Society. Amer. Math. Soc., Providence, RI. ISSN
0002-9939.
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% Abbreviations
% <ABBREV>NMR Denotes not in Mathematical Reviews - AMS Abbreviations.
% ----- JOURNALS -----
}}

@String{ AMO = {{Appl. Math. Optim.}}}
@String{ AUTOM = {{Automatica J. IFAC}}}

@String{ COMMPAMNMR = {{Commun. Pure Appl. Math.}}}
@String{ COMPPHYS = {{Comput. Phys. Comm.}}}

@String{ DAN = {{Dokl. Akad. Nauk}}}
@String{ EJC = {{Eur. J. Control}}}

@String{ IEEEAC = {{IEEE Trans. Automat. Control}}}
@String{ IEEECTNMR = {{IEEE Trans. Circuit Theory}}}
@String{ IEEECSNMR = {{IEEE Trans. Control Systems Tech.}}}
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@String{ IEEEIT = {{IEEE Trans. Inform. Theory}}}
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@String{ ZWVNMR = {{Z. Wahrsch. Verw. Gebiete}}}

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% Abbreviations
% <ABBREV>NMR Denotes not in Mathematical Reviews - AMS Abbreviations.

```



```

% ----- PROCEEDINGS -----
}}

@String{ PROCL = {{Proceedings of the}}}

@String{ ACC = {{American Control Conf.}}}
@String{ CDC = {{IEEE Conf. on Decision and Control}}}
@String{ ICIP = {{IEEE Int. Conf. on Image Process.}}}
@String{ IFAC = {{IFAC Proc. Ser.}}}
@String{ AMSP = {{Proc. Amer. Math. Soc.}}}
@String{ IEEEP = {{Proc. of the IEEE}}}

@String{ comment4 = {
% Abbreviations
% <ABBREV>NMR Denotes not in Mathematical Reviews - AMS Abbreviations.
% ----- PUBLISHERS ---
}}

@String{ AMSP = {{American Mathematical Society}}}
@String{ ADIP = {{Addison-Wesley}}}
@String{ ARTP = {{Artech House}}}
@String{ BIRP = {{Birkh\"auser}}}
@String{ CAMP = {{Cambridge University Press}}}
@String{ CHIP = {{University of Chicago Press}}}
@String{ CRCP = {{CRC Press}}}
@String{ ELSP = {{Elsevier Science}}}
@String{ IEEP = {{IEEE Press}}}
@String{ MCGP = {{McGraw-Hill}}}
@String{ MITP = {{MIT University Press}}}
@String{ OXFP = {{Oxford University Press}}}
@String{ SPRP = {{Springer-Verlag}}}
@String{ WILP = {{John Wiley and Sons}}}

```

```

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  publisher = {Nauka},
  year = {1982},
  OPTkey = {},
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  OPTnumber = {},
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  address = {Moscow},
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             Birkh\"auser, 1985},
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  year = {1984},
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  school = {Departament of Civil Engineering, University of Illinois
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  year = {1970},
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  OPTmonth = {},
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  OPTnote = {},
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            and S. S. Sastry},
  title = {Control of Nonholonomic Systems with Drift Terms},
  institution = {UC Berkeley-ERL},
  year = {1997},
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  OPTmonth = {},
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year = {1994},
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OPTvolume = {},
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OPTseries = {},
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OPTnote = {},
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  journal = {Theory and Decisions},
  year = {1977},
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  number = {n. 3},
  pages = {229--254},
  OPTmonth = {},
  OPTnote = {},
  OPTannote = {}
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  OPTkey = {},
  author = {E[rik] Meijer},
  organization = {Department of Econometrics, University of Groningen},
  address = {9700 {AV} {G}roningen, {T}he {N}etherlands, {PO} Box 800},
  OPTedition = {},
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  year = {2005},
  OPTnote = {},
  OPTannote = {}
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  year = {2004},
  OPTkey = {},
  OPTvolume = {},
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  OPTmonth = {},
  OPTnote = {},
  OPTannote = {}
}

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  organization = {Pontificia Universidad Cat\'olica de Chile},
  address = {Pontificia Universidad Cat\'olica de Chile},
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publisher = {World Scientific Publishing Co.},
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APPENDIX B. RESOURCES ON THE INTERNET

Many resources about writing technical documents and L^AT_EX can be found on the Internet. Some recommended sites are:

- T_EX Resources on the Web - T_EX Users Group
<http://www.tug.org/interest.html>
- L^AT_EX Tutorial
Introducing L^AT_EX, by Denise Moore, Department of Computer Science,
Cornell University.
[http://www.cs.cornell.edu/Info/Misc/LaTeX-Tutorial/
Introduction.html](http://www.cs.cornell.edu/Info/Misc/LaTeX-Tutorial/Introduction.html)
- L^AT_EX Guides and Links to Writing Style Tips
Getting to grips with L^AT_EX, by Andrew Roberts, School of Computing,
University of Leeds
<http://www.andy-roberts.net/misc/latex/index.html>
<http://www.andy-roberts.net/misc/index.html>
- L^AT_EX Packages
The Comprehensive T_EXArchive Network
<http://www.ctan.org/>
- L^AT_EX Packages
The T_EX Catalogue OnLine, by Graham Williams
<http://texcatalogue.sarovar.org/>
- T_EX/L^AT_EX Compiler for Windows
The MiK_TE_X Project, by Christian Schenk
<http://www.miktex.org/>
- The American Mathematical Society $\mathcal{A}\mathcal{M}\mathcal{S}$ -L^AT_EX Package and Resources
<http://www.ams.org/authors/>
- T_EX Frequently Asked Questions
<http://www.dillgroup.ucsf.edu/latex/index.html>

- **Help on L^AT_EX**

<http://www-hermes.desy.de/latex/LaTeX.html>

- **Tips on Structuring Thoughts and Communication by Jean-Luc Doumont**

<http://www.jlconsulting.be/>

<http://www.principiae.be/>