

AN EVOLUTION OF CUBESAT SUBSYSTEM DESIGN METHODS FOR...

by

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A thesis submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Electrical Engineering

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DEDICATION

I dedicate this to my parents....

ACKNOWLEDGEMENTS

I would like acknowledge Acknowledgments must be double spaced and is limited to one page.

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ABSTRACT

The abstract must be single spaced and no more than 350 words, indent first line five spaces. The abstract must contain the following elements: (1) statement of the problem, (2) procedure or methods, (3) results, and (4) conclusions. Mathematical formulas, abbreviations, diagrams, and other illustrative materials should not be included. It should be written to be understood by a person who does not have expertise in the field.

INTRODUCTION

Welcome to the Montana State University electronic Thesis/Dissertation (ETD) L^AT_EX template. In this chapter various sections, subsections, and subsubsections are created and filled with random text). In Ch. 6 methods to write equations and how to include figures and tables are explored. Conclusions are drawn in Ch. 7.

Section

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Subsection With a Very Very Very Very
Very Very Very Very Very Very Long Title

For long subsection titles use the command `\longsubsection{#1}{#2}`, where `#1` is the first line of the long title, and `#2` is the second line of the long title. You can also pass an optional argument to this command that puts a shorter title in the table of contents as shown by the subsection below.

Another Subsection With a Very Very Very
Very Very Very Very Very Very Long Title

The are **not** similar commands for sections and subsubsections as these are not specified in the MSU style guide.

BACKGROUND

CubeSats are a growing industry and are becoming increasingly more capable and affordable space mission options. Off-the-shelf components can be used to develop complex missions....

DESIGN STUDY - SOLAR CELL EXPERIMENT

This design was for the FIREBIRD mission, and was an electronic load used to measure the IV response of solar cells in orbit.

DESIGN STUDY - ELECTRICAL POWER SUBSYSTEM

This is the Phoenix EPS design example.

DESIGN STUDY - ELECTRICAL GROUND SUPPORT EQUIPMENT

This is the VOID EGSE design example.

THEORY

Equations

Here is an example of an equation

$$a^2 + b^2 = c^2, \tag{6.1}$$

which states the square of the hypotenuse c of a triangle is equal to the sum of the square of the other two sides (a and b).

A collection of similar equations can be written using the `\align` environment, e.g.,

$$\sin(\theta) = \frac{1}{\csc(\theta)} \tag{6.2}$$

$$\cos(\theta) = \frac{1}{\sec(\theta)} \tag{6.3}$$

$$\tan(\theta) = \frac{1}{\cot(\theta)} \tag{6.4}$$

Cases can be added using

$$x = \begin{cases} y, & \text{if } t = 1; \\ z, & \text{otherwise.} \end{cases} \tag{6.5}$$

Symbols

Symbols, like greek letters, can be used in equations, e.g., θ , γ , and ζ . When variables are referenced in the text they should be written in mathmode and enclosed in dollar signs. For example, a and a , which are written in math and text modes, respectively.

Figures

Figures can easily be added to your latex document. Graphs and figures should be designed to be printed in black and white and clearly display information. Considering using vectorized graphics that will remain sharp even if viewed zoomed (try zooming on Fig 6.1). The text in your figure should be legible and preferably the same size as the text in the rest of your document.

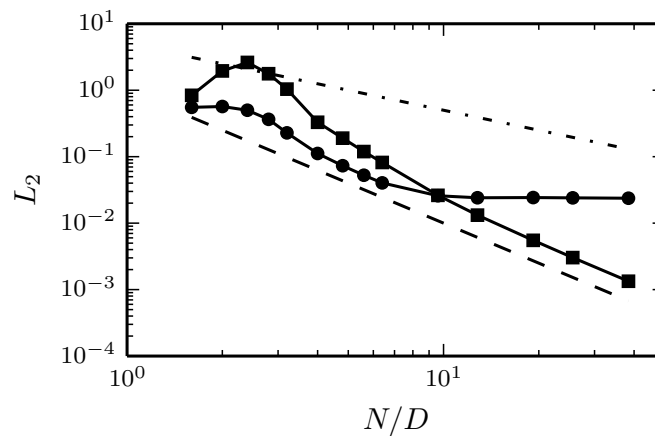


Figure 6.1: This is a figure of some data.

In \LaTeX figures may float and move around to a location that is optimized using mathematics. The `htbp` in the definition of the figure environment means here, top, bottom, page and is the order of preference for where the figure goes.

Figure 6.2 shows you can also put pictures into \LaTeX documents. The size of the figure is controlled by adjusting width. If you find your figures are often floating to a page of their own consider changing their size and/or adding more text.

Figure 6.3 shows that you can create figures directly within your \LaTeX document using, for example, the `tikz` package.



Figure 6.2: Montana Hall on Montana State University's campus.

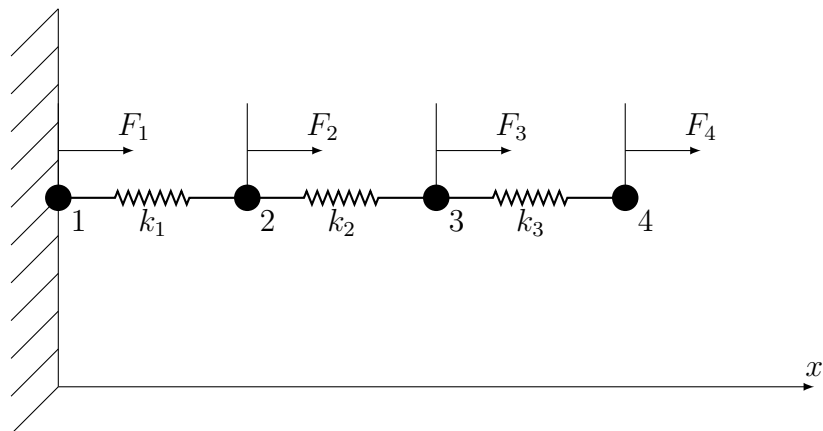


Figure 6.3: Figure created using the tikz package.

Tables

Tables can be created directly in your \LaTeX document. Table 6.1 shows how a short caption can be used in the table of contents and a long caption in the figure. In the table of contents “Area of ice sheet” is listed above the table “Area of ice sheet in millions of square miles with time.” is listed. This is done by adding an optional argument to the `\caption` command, i.e., `\caption[Short Caption]{Long Caption}`.

Table 6.1: Area of ice sheet in millions of square miles with time.

Year	1985	1990	1995	2000	2005	2010	2015
Area	16.2	15.5	15.2	15.5	14.6	15.4	14.5

References and Citations

Referencing other parts of the document

Equations, figures, tables, sections, and chapters can be references using the `\ref{label}` command. For example, `\ref{fig:plot}` references Fig. 6.1.

You can also use the `\vref` command to also get the page number. For example, `\vref{fig:plot}` references Fig. 6.1 on page 8.

The `label` used in the `\ref` command can be anything you want to use. It is helpful to use a convention. For example, all figures could have a label that starts with `fig:` and all table labels could start with `tab:`.

Citing others work

Citing others work is an important aspect of all scientific writing. All citations should be placed in the `.bib` file(s) listed in your `main.tex` document. Cite others

work using the `\cite` command, e.g., [?]. Multiple citations should be done within one cite command, e.g., [?,?,?].

CONCLUSION

\LaTeX produces documents that look great, automatically handles references and citations, and easily incorporates figures and tables. This is not a guide to \LaTeX but rather an introduction to the MSU style. If you want more information about \LaTeX many introductory guides can be found online.

APPENDICES

APPENDIX A

EXAMPLE CODE

% MATLAB code to say 'hello world'

disp('Hello world')

APPENDIX B

EXAMPLE SCHEMATIC

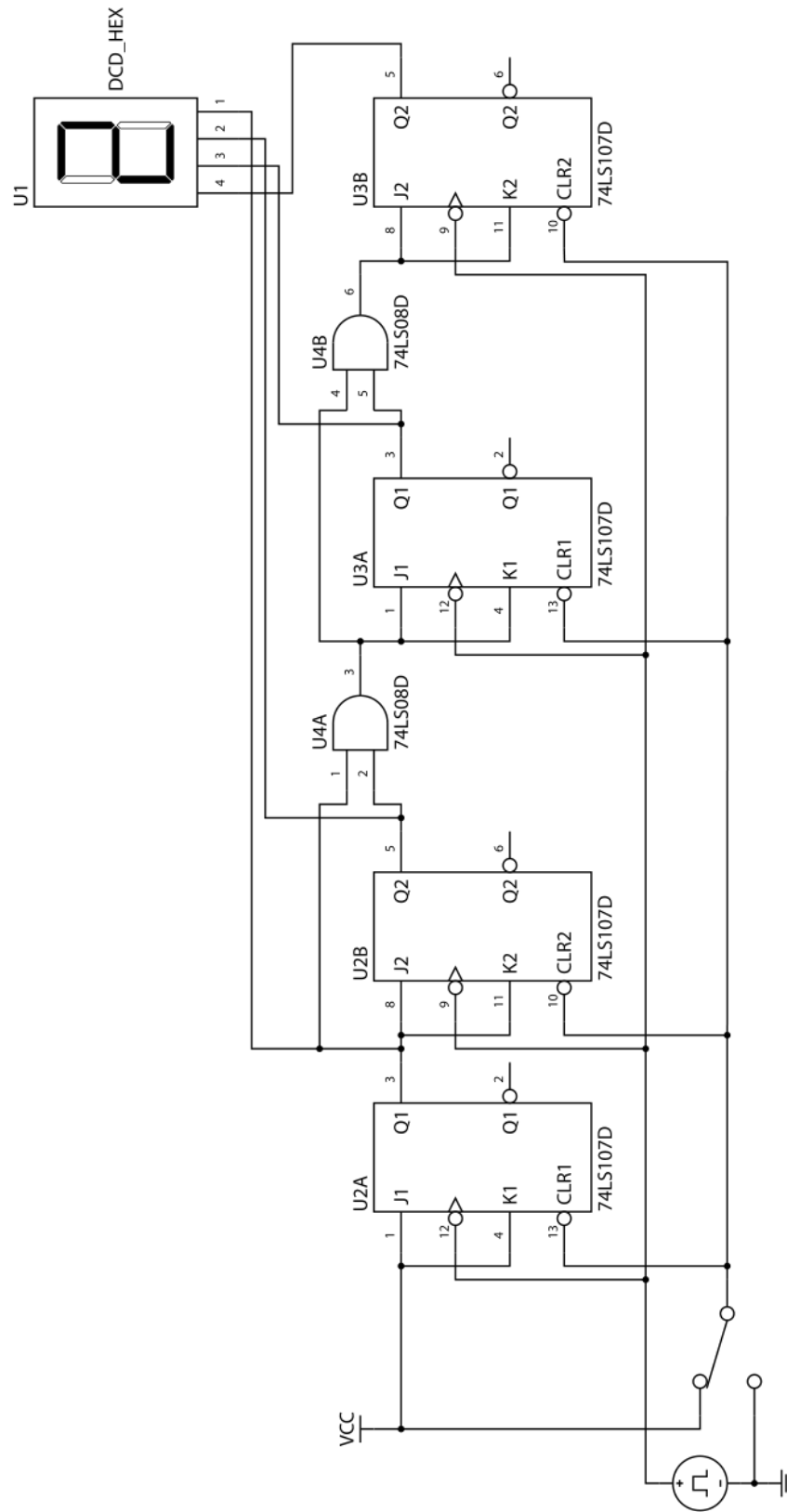


Figure B.1: Large schematic on landscape page