Writing a Thesis or Dissertation for University of Idaho with LaTeX

A Thesis
Presented in Partial Fulfillment of the Requirements for the
Degree of Master of Science
with a
Major in Nuclear Engineering
in the
College of Graduate Studies
University of Idaho
by
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Approved by:
Major Professor: Major Professor, Ph.D.
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Abstract

This is a template that will help you use LaTeX to write your thesis. The document will talk a lot about the functionality and conveniences of this template but is not a standalone tutorial. If you need to learn how to use LaTeX, check out Dr. Trefor Bassett. He has a great playlist on YouTube to teach you the basics and much more. If you happened across this document without the template, you can find more at https://github.com/sjroot97/UI-Thesis-Dissertation.

Acknowledgements

Dr. Borrelli made me learn LaTeX when I took his Nuclear Engineering basics class. I am glad to be free of the frustrations of Microsoft Word. When I started writing my thesis [1], the official template provided by CoGS was deprecated. It now longer exists. I brought it up to what I understand is modern standards. My thesis got accepted with minimal hacky fixes. Hopefully this will help you pass your formatting check too.

This work and my coursework was completed under a Graduate Fellowship funded by Nuclear Regulatory Commission (NRC).

Dedication

To my mother, <Mom>, who planted and nurtured my love of science. To my father, coach, foreman, tech support, and #1 fan, <Dad>, who kindled my engineering spirit. To my cats, <Name> and <Name>, who stayed up with me all those long nights. Thank you for your endless support.

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CoGS College of Graduate Studies.

NPP Nuclear Power Plant.

NRC Nuclear Regulatory Commission.

Statement of Contribution

Chapter 3 is a multi-authored article that was submitted to and accepted by <Journal> [2]. The author of this thesis was the primary author of the article, <writing the original draft manuscript and conceptualizing the methodology>. The co-authors offered the following valuable collaborative efforts in support of publication of the work:

- **Second Author** Revisions, support and guidance
- **Third Author** Writing, revisions, and response to reviewer comments, assistance in conceptualization, support in development and verification, case study selection
- **Last Author** Revisions, guidance and supervision, case study selection

I am grateful for their contributions.

Chapter 1: Introduction

This .pdf was rendered by the main .tex file, Thesis.tex. This file is formatted primarily by the document class 'UIdaho', which is provided by ./rcs/uidaho.cls. Thesis.tex contains very little of the text that makes up this template. Instead, it inputs files for each chapter. For a document as large as a thesis or dissertation usually ends up being, this makes keeping track of everything a lot easier. The text for the frontmatter (everything before this chapter) is contained in the folder ./Frontmatter/. Each of the chapters are contained in ./Chapters/, and the appendices are contained in ./Appendix/. This chapter, Chapter 1, can be found at ./Chapters/Introduction.tex, and will tell you how to change the template into your thesis.

1.1 Cover Page

The first thing you need to do is update your cover page. This is done in Thesis.tex, by updating the 'Thesis Information', as shown by Figure 1.1. This information is populated to form the cover page by the `\thesistitlepage` macro. If you are a Ph.D student, be sure to change the `\doctype` and `\thesisdegree`.

```
26  % Thesis Information
27  \title{Writing a Thesis or Dissertation\\for
    University of Idaho with LaTeX}
28  \author{Joe Vandal}
29  \doctype{Thesis}
30  %\doctype{Dissertation}
31  \thesisdegree{Master of Science}
32  %\thesisdegree{Doctor of Philosophy}
33  \major{Nuclear Engineering}
34  \advisor{Major Professor, Ph.D.}
35  \committee{Committee One, Ph.D.; Committee Two, Ph.D.}
36  \deptadmin{Department Chair, Ph.D.}
37  \graddate{May 2024}
38  %
```

Figure 1.1: Change the cover page info in this section of Thesis.tex. This information is automatically populated by the UIdaho document class.

1.2 MetaData

The next thing to do is to update your .pdf metadata. This is done by updating the fields displayed by Figure 1.2

```
49  % Configure the PDF output (Most of this is optional,
    it just adds metadata to the PDF)
50  \hypersetup{% pdftex
51  pdfauthor=Joe Vandal,
52  pdftitle=UI Thesis Template,
53  pdfsubject={Thesis LaTeX Template},
54  pdfkeywords={Idaho;Thesis;Dissertation;LaTeX Template}
55  pdfproducer={ShareLatex},  % e.g ShareLatex
56  pdfcreator={pdflatex},
57  pdfprintscaling={AppDefault}}
```

Figure 1.2: Change the information in this section of Thesis.tex. This information tells the pdf reader what to display as the document title, among other things.

1.3 Everything Else

Now, its as simple as writing your abstract, acknowledgements, dedication, statement of contribution (if applicable), your chapters, and any appendices you may choose to include. Good luck!

Chapter 2: Body

This section demonstrates some of the features of this template, including:

1) Equations;

2) Short-cuts;

3) Notes; and

4) Objects;

These will allow you to:

- Automatically refer to numbered objects without having to manually cross-reference; and
- Save keystrokes for commonly used sequences;

The template uses the `inline` option on the `enumitem` package which allows inline lists. This can be useful to: 1) save space in the document; 2) improve the flow of the text; and 3) prevent run-on sentences;

2.1 Equations

By default, LaTeX has equations which can be referred to using the `\label` and `\activeref` macros. For example, Eqn. 2.1.

$$e(t) = PV(t) - SP(t) \tag{Eqn. 2.1}$$

It is common to have both equations and reactions in your work. Thesis.tex provides functionality to distinguish reactions and mathematical equations. See Rxn. 2.1.

$$^{87}Br \xrightarrow[56sec]{\beta^-} {}^{87}Kr^* \rightarrow {}^{86}Kr + n \tag{Rxn. 2.1}$$

If you would prefer to not differentiate equations and reactions, you can remove that functionality by removing the lines using `\renewcommand{\theequation}` and `\renewcommand{\thechemequation}`.

2.2 Short-cuts

2.2.1 Acronyms

You will likely use acronyms in your thesis. Define your acronyms in uidaho.cls using `\newacronym{tag}{abbreviatio`
The first time you use an acronym, use `\acf{tag}` to render the full acronym, as such: Nuclear Power Plant (NPP). Afterwards, you can use `\acs{tag}` to only render the abbreviation (NPP), or `\acl{tag}` to only render the full text (Nuclear Power Plant). For the plural cases, use `\acsp{tag}` or `\aclp{tag}`. Any acronyms that you use will automatically be defined in the List of Acronyms.

2.2.2 Custom Commands

If you have repeated text objects that are tedious to type in, *e.g.* ^{135}Xe, you can use the `\newcommand` command to define a short-cut. uidaho.cls contains quite a few nuclides, as well as some latin phrases, *e.g.* , *i.e.* , *et al.* , and even scientific notation.

Generally, nuclides take one optional argument. For example, `\Xe` renders ^{135}Xe , but `\Xe[136]` renders ^{136}Xe . `6.02\sci[23]` will render 6.02$\times$ 10^{23} .

2.3 Notes

There are two types of notes supported by this template. Footnotes[1] and margin notes. Margin notes are set-up in Thesis.tex using `\newcommandx`. You can customize the appearance of the notes and have different types of notes if you wish.

margin notes remind you to come back and do something

2.4 Objects

By use of the 'cleveref' package, you don't need to type out 'Figure' or 'Table' when referring to your objects. It automatically adds the label if you use `\cref` instead of `\ref` (see Figure 2.1).

Figure 2.1: Long version of caption. The short version, which is input in square brackets, is displayed in the List of Figures. LaTeX knows to look for graphics in the ./img/ directory because it is specified using the graphicspath command in Thesis.tex.

This template also has support for tikz drawings (Figure 2.2) and pgf plots (Figure 2.3).

Tables require you to use `\Cref` instead of `\cref` (see Table 2.1)

The template also has support for Python and Serpent code blocks using the custom './rcs/slither.sty' package. Codes are included in Appendix A.

Finally, LaTeX handles citations for you. Include the data about your citations in ./rcs/References.bib, and cite them here using `\cite`. For example, [1]. If you are citing textbooks and want to include a chapter, put any such information in square brackets [3, Ch. 6].

[1] Footnotes provide additional context to the reader.

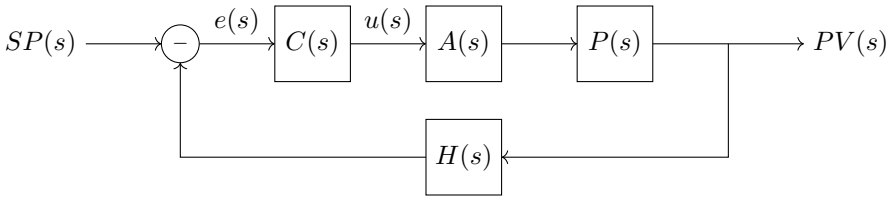
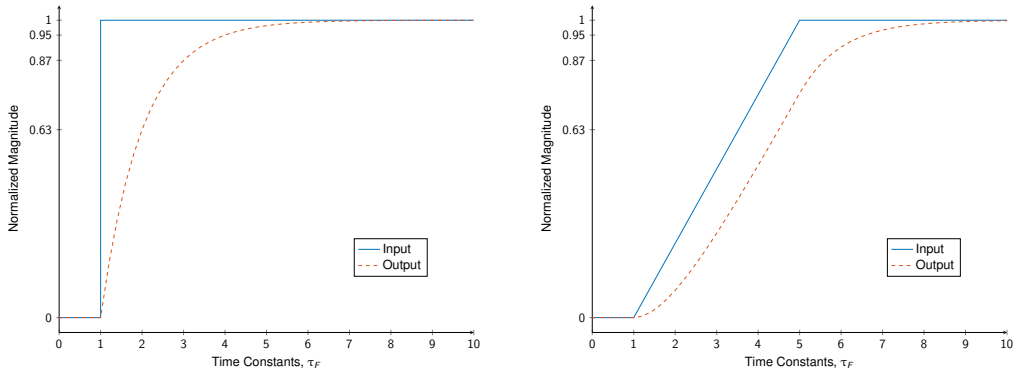


Figure 2.2: Feedback control loop. The process-variable (PV) is measured by the transducer (H) and compared to the set-point (SP). The controller (C) uses the actuator (A) to control the process (P) based on the error (e).



(a) Step-function

(b) Ramp-function

Figure 2.3: Pre-filter on step-function and ramp-function. When the pre-filter acts on a step-function, it follows an exponential curve, reaching 63.2% of the magnitude of the step in 1 time constant, 86.5% in 2 time constants, 95.0% in 3 time constants and so on. The ramp-function exhibits similar but more complicated dynamics due to the changing input.

Table 2.1: Relevant nuclear constants [3]. The ^{135}I fission yield (γ) is the sum of direct and indirect fission. The ^{135}I microscopic neutron capture cross-section (σ) is neglected as it is so small that it is insignificant compared to its own decay rate and the ^{135}Xe cross-section.

	γ (%)	λ (hr^{-1})	σ_a (Mb)
^{135}I	6.39	0.1035	-
^{135}Xe	0.237	0.0753	2.65*

*At 0.025 eV

Chapter 3: A Paper that is Also a Thesis Chapter

If any of your chapters are also multi-authored publications, be sure to fill out the Statement of Contribution in the frontmatter. If all of your chapters are standalone, remove the Statement of Contribution by commenting out the `\include{Frontmatter/Contribution}` command in Thesis.tex. If you have multiple chapters which have been published, modify the statement of contribution to reflect this.

If your chapter has been submitted but the publishing process is not complete, you can add a 'note' to the bibtex info in References.bib to state that the work is under review, under revision, in press, etc.

Chapter 4: Conclusions

As you finish your thesis, you will want to prepare it for the formatting check. One useful feature is the 'show frame' option. This will draw lines to show the margins, headspace, footspace, etc. You can toggle it on and off by going under uidaho.cls and uncommenting `%\RequirePackage[showframe]{geometry}` and commenting out `\RequirePackage{geometry}`. You need to be sure that nothing at all prints in the margin or CoGS will make you change it. Once you ensure this, you can submit your thesis for a formatting check. Doing this before you defend will allow you more time to address any formatting issues you are made aware of.

If you wish to make your slides in LaTeX, there is a template called Defense.tex in this repository that uses the 'beamer' class. This is convenient as it allows you to reuse code from your thesis, and any updates to things like figures will automatically be implemented in both places. Good luck on your presentation.

References

[1] Root, Sam J., 2024 5. Dynamic System Modeling and PID Controller Design for a Molten Salt Microreactor. Master's thesis, University of Idaho.

[2] Vandal, Joe, Author, Second, Author, Third, Author, Last, 2023. A paper that is also a thesis chapter. Journal of Idaho 100, 123456. ISSN 0029-9876. doi:10.1016/j.nucengdes.2023.123456.

[3] Lamarsh, John R., Baratta, Anthony J., 2001. Introduction to Nuclear Engineering. Pretice Hall, Upper Sadle River, New Jersey, 3rd edition.

Appendix A: Codes

The package ‘slither’ in the ./rcs folder provides code blocks for python or serpent. If you need to include other languages I am sure you can find a package to do that. Slither could probably be modified with some level of difficulty to include MCNP code as well. The documentation may help. https://github.com/sjroot97/Slither-LaTeX-package

A.1 Python

Code 1: Hello!

```
1    print("Hello World") #comment
2    try:
3       a=2/x
4    except ZeroDivisionError:
5       print('undefined')
```

Inline codes like `import numpy` or `x =1`

Or, include code in the best way, by inputing it from a file.

Code 2: F strings

```
1 x =4
2 print(f"The numeral four: {x}")
3 #comment
```

A.2 Serpent

Code 3: Fuel

```
    /*
    Enriched (4%) Uranium Metal
    */
    mat fuel     -10.1
    92235.03c    -0.04
    92238.03c    -0.96
    'string'
```

Inline codes like `surf s1 sqc 0.0 0.0 100.0.`

Or input from a file.

Code 4: Physics Cards

```
%./cards/physics.txt
% _____________________Physics cards_____
set power 1e7 %10MWth
set pop 1000000 500 100 1
%dep daystep 1 1 1 1 1
%set mcvol 10000000
%set nbuf 10
%set printm 1 1e-10
%set inventory "all"
%set pcc leli 10 10
set acelib "endfb71r1_p2" "endfb71r1" "jeff31u"
%set declib "sss_jeff31.dec"
%set nfylib "sss_jeff31.nfy"
det EnergyDetector dm Salt4 de EnergyGrid
ene EnergyGrid 3 500 1e-11 2e1
```