

# Summer Research Program in Industrial and Applied Mathematics



SEOUL  
NATIONAL  
UNIVERSITY

Sponsor

⟨Sponsor Name⟩

**Final Report**

⟨Title of Project⟩

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# Abstract

This sample report serves two purposes. First, it introduces the RIPS “house style”—preferences for how copy is set and laid out on a page.\* Second, by comparing this document with the L<sup>A</sup>T<sub>E</sub>X source, it illustrates the effects of L<sup>A</sup>T<sub>E</sub>X code on the resulting typeset.<sup>†</sup>

(The Abstract should succinctly summarize the purpose and results of the RIPS project. Usually, it will be one paragraph of no more than half a page to one page in length. The Abstract is often the last major component to be written, since it is almost impossible to know what to say until you have essentially completed the project.

The Abstract is self-contained. For example, unfamiliar acronyms should be used sparingly, and if used, should also be spelled out. References to the literature should be specified completely, not cited for look-up in the Bibliography.)<sup>‡</sup>

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\*R. M. Ritter, *New Hart's Rules: The Handbook of Style for Writers and Editors*, Oxford University Press, 2005.

<sup>†</sup>Location of the source code is provided in Appendix B.

<sup>‡</sup>Note that in front matter the footnote reference can be a symbol, but in the body it is usually a number.



# Acknowledgments

It is appropriate in the Acknowledgments to thank individuals or organizations who made especially noteworthy contributions to your project. Elsewhere, within the body of the report, you can acknowledge more specific contributions where appropriate. These are matters of courtesy and professional ethics. As an example:

The RIPS L<sup>A</sup>T<sub>E</sub>X report template has been developed by Mike Raugh with advice and assistance from Oleg Alexandrov and Shawn Cokus in the early stage of development and general support of IPAM and the System Administration staff. The first RIPS template was based on an early version of the Math Clinic's report template at Harvey Mudd College; there the original template has been improved and is managed by Claire Connelly, the HMC Math Department's system administrator. Claire and her co-authors offer coding advice, a wealth of references, and a note about the origin of the template in their current edition, the `sample-clinic-report.pdf` accessible at <http://www.math.hmc.edu/computing/support/tex/sample-report>. Claire copyedited the third edition of Grätzer's *Math into LaTeX*, most of which work seems to have survived into the fourth edition: *More Math into LaTeX* [6].

When acknowledging individuals in this section, it is OK to use the names by which you know and speak to them. Here it is OK to write "Oleg Alexandrov." But you must be formal on the Title page and elsewhere within the report, where it is proper to specify honorifics, e.g., Dr. or Prof. On the Title page you would write "Dr. Oleg Alexandrov," and likewise within the body of the report if you were acknowledging him for a specific contribution, Claire Connelly uses no honorific, so you would use just her name on the title page. When in doubt, check the person's business card or follow usage on the person's web page.

As a result of suggestions from users, this Sample Report and its source are under continual improvement. Please contact the RIPS program director for your suggestions. An up-to-date list of changes is recorded in the "Revisions" folder for the Master Template Folder.



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# Chapter 1

## Introduction

The introduction should describe what the purpose of the project is/was and what you have accomplished. The introduction, as well as other parts of the report, can be developed incrementally and will evolve with the project. The introduction should contain the following items:

1. a brief description of the sponsoring organization (which often can be derived from the organization’s online boilerplate),
2. a suitably condensed statement of the problem posed by the sponsor,
3. some discussion of the relevance of the project to the sponsor’s business,
4. the team’s approach to the problem, gleaned from the team’s Work Statement (including a summary of background study, i.e., literature review, to explain how your work differs from or builds on previous efforts — this explanation should be reinforced by entries with annotation in the bibliography),
5. summary of the report: in separate paragraphs specify and summarize the major sections of your report (Ch 2, Ch 3, ... , Conclusion, Appendixes, Glossary, Bibliography).

The team as a whole is responsible for the development of a RIPS report, but various aspects will be divided among individuals, as your team will choose. A Report Coordinator (RC), selected from the team in the first week of the project, will be responsible for incorporating evolving components of your team’s report into the L<sup>A</sup>T<sub>E</sub>X template that was used to typeset this document, produced in a particular style we refer to as the *RIPS House Style*.

The template requires familiarity, and so a L<sup>A</sup>T<sub>E</sub>X tutorial explaining its use will be given during the second week of RIPS, and a special section for RCs is available in the “Templates-etc” folder on IPAM’s R-Drive. For more information, see also the README file. Prior familiarity with L<sup>A</sup>T<sub>E</sub>X would be advantageous for an RC, but expertise is not necessary because assistance will be provided by RIPS.



## Chapter 2

# A general outline of the body of the RIPS report

The basic structure of a RIPS report consists of *front matter*, the *text* (*main matter* or *body*), and *back matter*.<sup>1</sup>

Front matter includes a Cover Page, an Abstract, Acknowledgments, a Table of Contents, a List of Figures, a List of Tables.

The body of the report, text, consists of several chapters, including an Introduction, additional Chapters, and Conclusion.

Back matter may include appendixes, a glossary, a list of abbreviations and Bibliography.

This document, formatted to serve as a sample report, includes all of these components. In each component we provide some explanation to assist you in your initial writing. The remaining sections of this chapter describe the body of the report.

Two excellent resources for these and other considerations of report structure and style are the *Chicago Manual of Style* [13], now in its sixteenth edition, and its companion *A Manual for Writers of Research Papers, Theses, and Dissertations: Chicago Style for Students and Researchers* [12]. Perhaps the easiest yet authoritative reference to use because of its compact size and pithy language is *New Hart's Rules: The Handbook of Style for Writers and Editors* [11]. Other references are provided in the Bibliography and elsewhere in this Sample Report.

## 2.1 The Introduction

See Chapter 1 for a description of the content of the Introduction and the role of the Report Coordinator (RC). The RC should prepare a draft of the Introduction within the first couple of weeks, and the team should review it to make sure everyone is in agreement. The RC is in charge of coordinating development of the team's report, but the report is a team production and the RC need not (and probably should not) be the sole writer.

---

<sup>1</sup>New terms introduced in italics can be included in the Glossary, depending, if you like, on their importance and frequency of repetition in the text. Esoteric terms and abbreviations, when used throughout and are unlikely to be known or guessed by typical readers, should be included in a glossary.

## 2.2 Additional Chapters

The report should be a few chapters long and well-structured, making it easy for a reader to follow the line of your argument. The structure may, at least in the initial writing, reflect the layout of the work in the Work Statement. Here is an idea of what the structure of the report, spread over three chapters, might look like:

- FIRST, an outline of previous work on the problem (including references),
- SECOND, the mathematical basis for the project, and
- THIRD, a description of the computational aspects and results.

Intricate derivations, samples of code, extensive data, and other important but unwieldy text or figures may be placed in appendixes. These are just suggestions—ultimately, this is a matter of art and craftsmanship. You must decide what is reasonable for your project.

## 2.3 The Conclusion

In the concluding chapter you summarize what you have done, what issues and difficulties you encountered, and what you believe the value of this work should be for your sponsor. Since you now have experience and specialized knowledge, your sponsor will find it helpful for you to specify some directions for future work.

This ends a summary of the body of a report.

## 2.4 Parting Words about Back Matter: The Bibliography

Your bibliography should include all the works you cite in the body, but you should also include works that you investigated during your literature search. It's a good idea to annotate (in the bibliography) any work cited in the text that had special significance in your research that may not be apparent from the context in which it was cited. It's also a good idea to annotate any additional items in the bibliography that are not cited in the text, since otherwise their relevance to your own work and your literature search will be unknown to the reader — the annotations may be of use to your sponsor as well as demonstrate the scope of your exploration.

Your bibliography and annotations should coordinate with the comments made in Chapter 1 about how your approach builds on or is different from earlier work, supporting any claims you have made for originality.

A previous footnote offers advice about when to include a glossary.

In the following chapters of this sample report you will find some suggestions for various aspects of report writing.



## Chapter 3

# Mathematical typesetting

In L<sup>A</sup>T<sub>E</sub>X, formulas can be coded by enclosing them between dollar signs, so the expression  $x^2$  is coded as `$x^2$`. Also note that the circumflex (^) is used to express the power or a superscript. For another example,  $a^{23}$  can be coded as `$a^{23}$`, where curly brackets must be used. To write subscripts, one uses the underscore (\_), so  $x_2$  is coded as `$x_2$` and  $x_{23}$  is coded as `$x_{23}$`.

Here are a few more examples of mathematical typesetting:  $\int_{\alpha}^{2\beta} f(x) dx$  is coded as `$\int_{\alpha}^{2\beta} f(x)\, dx$`, and  $\sqrt{x+5}$  is coded as `$\sqrt{x+5}$`. Note that `\,` in the code for the preceding integral ensures that the proper space appears before  $dx$ ; in typography this (setting the space between symbols) is called *kerning*.

Often you will want to *display* a formula, that is, present the formula on a separate line—convenient for large formulas. For this you use the delimiters `\[` and `\]`. So, to write

$$\sum_{k=1}^n k^2 = \frac{1}{3}n^3 + \frac{1}{2}n^2 + \frac{1}{6}n$$

you can use `\[ \sum_{k=1}^n k^2 = \frac{1}{3}n^3 + \frac{1}{2}n^2 + \frac{1}{6}n \]`, in which some unnecessary spaces were included for clarity.

Displayed equations can be numbered, and they can be labeled for reference. The example is boxed for illustration:

This is an equation:

$$a^2 + b^2 = c^2. \tag{3.1}$$

Equation (3.1) is the Pythagorean theorem.

The above was coded as follows:

This is an equation:

```
\begin{equation}\label{eq:pythagora}
```

```
a^2+b^2=c^2.
```

```
\end{equation}
```

```
Equation \eqref{eq:pythagora} is the Pythagorean theorem.
```

You can find many more mathematical examples to use as templates on the In-

ternet. A good place to start is to see the files placed for your convenience in the “templates\_etc” folder on IPAM’s “R” (RIPS) drive.

When you have a theorem, you can set it in a *theorem environment*, which presents your theorem in a special font:

**Theorem 3.1 (Gauss-Bonnet)** *Here you state the theorem.*

When you have a lemma, you can set it in a *lemma environment*:

**Lemma 3.1 (Chebychef)** *Statement of lemma goes here.*

You may also have need of definitions. These can go in a *definition environment*:

**Definition 1 (Idempotent Operator)** *The definition goes here.*

Note that in the three preceding examples all the body text is set in italics. See the L<sup>A</sup>T<sub>E</sub>X source for this chapter to see how these examples are coded.

There exists a wealth of information on the Internet on how to use L<sup>A</sup>T<sub>E</sub>X—just type `latex tutorial` in any search engine. A good one is at the LaTeX Project site:

<http://latex-project.org/>

See also *More Math Into L<sup>A</sup>T<sub>E</sub>X* by Grätzer [6] and other books mentioned in the references.

# Chapter 4

## Sample figures and tables

### 4.1 Figures



Figure 4.1: A sample EPS figure with a caption.

#### Formats accepted by $\text{\LaTeX}$

This version of the RIPS  $\text{\LaTeX}$  template can be used to produce a pdf of your report using several different typesetters, including  $\text{pcTeX}$  and other options available on the IPAM network. All of these will accept figures in the encapsulated postscript (EPS) format providing you incorporate the appropriate *packages* in the *preamble* of your  $\text{\LaTeX}$  code.<sup>1</sup> The  $\text{\LaTeX}$  code for Figure 4.1 shows how to emplace, label and reference it. You may have to convert the format for your figure. But beware, incorporating graphics in  $\text{\LaTeX}$  can be quirky and require special attention and work-arounds.<sup>2</sup>

#### Creating figures with Matlab

Here's a sample code, describing how to create a figure in MATLAB and export it as EPS.

---

<sup>1</sup>The RIPS reports template devotes a section of the preamble to a method for ensuring that your chosen typesetter will be able to utilize eps files. This is one of several options for affecting formats that you will find explained by comments in the preamble. For a good source for general information on incorporating graphics in  $\text{\LaTeX}$ , see <http://amath.colorado.edu/documentation/LaTeX/reference/figures.html>.

<sup>2</sup>There is a simple way to make format conversions that works in some cases. Click on the file in its current format, then when the graphic appears on your screen use “save as” to write the graphic in a format you select from the given options. See Chapter 7 for more suggestions.

```
% Shows how to make a MATLAB figure

% create a vector of N points between a and b
a=-1.2; b = -a; N = 100; X=linspace(a, b, N);

Y = X.^3 - X; % a function of X

figure(1); clf; % pop up a figure, clean it

H = axes; set(H, 'fontsize', 20); % set the font

plot(X, Y, 'color', 'blue', 'linewidth', 2); % plot

axis([a, b, -0.6, 0.6]); % the viewable box

saveas(gcf, 'MyPicture.eps', 'psc2'); % save the picture in color
```

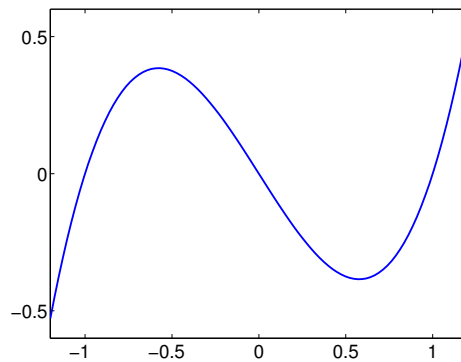


Figure 4.2: A sample figure created as an `eps` file by MATLAB. To see an example of quirky treatment, compare this figure when you typeset the report template with PCTEX and pdfL<sup>A</sup>T<sub>E</sub>X.

The source code for Figure 4.4 is available in the sample RIPS report directory. The L<sup>A</sup>T<sub>E</sub>X code for incorporating this figure in the report template is:

```
\begin{figure}[h]
\begin{center}
\includegraphics[clip, width=0.4\textwidth]{Graphics/MatlabPicture.eps}
\caption{A sample figure created with \textsc{Matlab}.}\label<name
of label
\end{center}
\end{figure}
```

Beware: your label identifier should always follow the caption statement. You can place it higher up without crashing the L<sup>A</sup>T<sub>E</sub>X compiler, but doing so can result in an erroneous enumeration for the label in your text.

## Software for drawing diagrams

There exist many programs for drawing figures and diagrams. If you have a preferred system, please let the RIPS director know about it. Maybe it should be referenced here. The following two were recommended by Academic Mentors:

PSTRICKS is a powerful system for designing and incorporating fine mathematical graphics into T<sub>E</sub>X and L<sup>A</sup>T<sub>E</sub>X documents. Be aware that it works directly with inline code for some L<sup>A</sup>T<sub>E</sub>X typesetters but requires special handling for pdfL<sup>A</sup>T<sub>E</sub>X. See Figure 4.3.

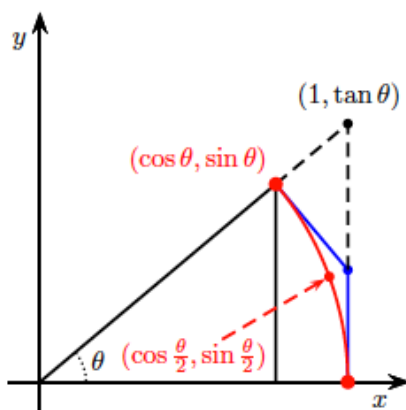


Figure 4.3: PSTricks code for this figure is in the “Graphics” folder for the L<sup>A</sup>T<sub>E</sub>X template. The code was run using XeL<sup>A</sup>T<sub>E</sub>X and the resulting pdf file was converted to an eps file.

*Inkscape* is free and of high quality; with this program, you should always keep the figures in Inkscape’s native SVG format, and save them as EPS only in order to view them in L<sup>A</sup>T<sub>E</sub>X.

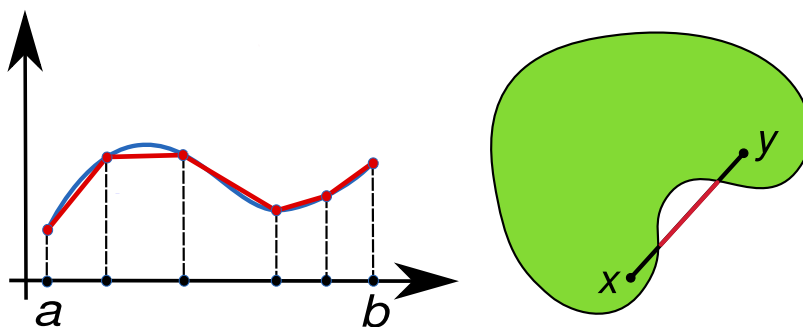


Figure 4.4: A couple of figures drawn with Inkscape.

The two adjacent graphics in Figure 4.4 were created with Inkscape and exported to EPS. The figures in the original SVG format are available in the report directory. Note that the convention for punctuating a figure caption or table caption is pretty loose. If an initial phrase is followed by a complete sentence, the phrase as well as any complete sentence should be ended with a period. For consistency, it is OK to end

all captions with a period even if a caption is just a phrase, as are all three captions illustrated here.

## 4.2 Tables

The next example is a simple table: Table 4.1. The  $\text{\LaTeX}$  code for it is presented after the table.

Date	High	Low
1-Jul	40	12
2-Jul	37	14
3-Jul	35	20

Table 4.1: A simple table showing fictional data.

Look at the following source code for Table 4.1, and note particularly how it is labeled. The references to it in the two preceding sentences were created by incorporating the label in the  $\text{\LaTeX}$  code (“`Table \ref{TABLE:Simple}`”) used for creating this chapter. Tables are labeled and referenced in a way similar to figures.

```
Note that the label follows the caption.
\begin{table}[h]
\begin{center}
\begin{tabular}{|lcc|}
\hline
Date & High & Low\\ \hline
1-Jul & 40 & 12\\
2-Jul & 37 & 14\\
3-Jul & 35 & 20\\ \hline
\end{tabular}
\end{center}
\caption{A sample table showing fictional data.}\label{TABLE:Simple}
\end{table}
```

The next example, Table 4.2, illustrates a table in which column widths are specified by parameters in order to force long text to be spread over more than one line:

Betty	Betty has a story to tell.
Bob	Bob has a longer story to tell.
Bill	Bill has a very much longer and far more dramatic story to tell.

Table 4.2: A sample table with split lines of text.

Here’s the code for Table 4.2:

```

\begin{table}[h]
\begin{center}
\begin{tabular}{|p{1in}|p{2in}|} \hline
Betty & Betty has a story to tell. \\ \hline
Bob   & Bob has a longer story to tell. \\ \hline
Bill  & Bill has a very much longer and far more dramatic story to tell. \\ \hline
\end{tabular}
\caption{A sample table with split lines of text.}\label{TABLE:SplitText}
\end{center}
\end{table}

```

## Style tips about figures and tables

You should always make sure that your figures are easy to see, so for example, make sure that any curves are not too thin or text is not too small. And don't forget to include axis labels with units specified.

Your figures should look good both in color and as black-and-white, since for presentations you will most likely want figures in color, while in a printed report all the figures will usually be printed in black-and-white (and then, what looks very clear and pretty on your screen may appear as a dark region on paper).

Good captions greatly improve the usefulness of figures and tables.

But no matter how well a caption describes a figure or table, you should always reference it and explain it in your text. You may feel you are being redundant, but your readers won't think so: a picture with a good description is worth a thousand words, and a picture without a description in the text is left dangling.

## 4.3 Picking nits

Notice that in this sample report, all of the captions for figures and tables are placed below the object, and their labels end with a numbered identifier—e.g., Figure 4.1, Table 4.2—terminated with a colon (":") inserted automatically by the  $\text{\LaTeX}$  compiler. *The Chicago Manual of Style* specifies the use of a period (".") to follow the figure number and a blank space to follow the table number, and *New Hart's Rules* follows both figure and table numbers with a blank space. Moreover, *New Hart's Rules* places table captions above the table, rather than beneath. But here we bow to usage in Grätzer's *More Math Into  $\text{\LaTeX}$*  (See Bibliography for references). In such minutiae it's your choice, but remember, consistency (perhaps a hobgoblin of lesser minds but certainly a ruling passion in typography) is standard practice.

Another place to be on guard is in referencing, e.g., sections, equations, and lemmas. Do you capitalize or leave it in lower case: Chapter 1 or chapter 1, Theorem 1 or theorem 1, Lemma 1 or lemma 1? Of course at sentence heads you have no choice but to capitalize. When you refer to a figure or a table, you may write, for example, "Fig. 1", "Figure 1", with or without an initial capital, and write "Table 1" or "table 1". Recommended usage for this report is to use proper nouns: whether abbreviated or spelled out in full, capitalize the labels. It's up to you, but be consistent.

You'll think of other things as you go along. Just consider how it looks on the page, and *be consistent throughout your report.*



## Chapter 5

# Dealing with bibliographic references

L<sup>A</sup>T<sub>E</sub>X uses a tool called BIB<sub>T</sub>E<sub>X</sub> to help you manage bibliographic references. The references are maintained in a separate file, with a `.bib` extension. For example, in this sample RIPS report the references are in the `Biblio.bib` file, which is then included from the main document.

BIB<sub>T</sub>E<sub>X</sub> affords a variety of *entry types* (also known as *record types*) for bibliographic records of books, articles, proceedings, theses, and many others. A good discussion of these and of the *field entries* used for each type, find the WIKIPEDIA article for BIB<sub>T</sub>E<sub>X</sub>. You can use any editor to create your own bibliographic records, but you might find useful open-source tools available on the web.<sup>1</sup>

If you would like to include a reference to a book or an article in the BIB<sub>T</sub>E<sub>X</sub> file, you can either create its BIB<sub>T</sub>E<sub>X</sub> entry by hand, or get it ready-made as a Bib<sub>T</sub>E<sub>X</sub> entry from a web source. *Google Scholar*, which you can find on the internet, is free and easy to use after you have set up preferences to include citations in a BIB<sub>T</sub>E<sub>X</sub> format. Ask your Academic Mentor for other suggestions.

After you update your report's references file, to see the updated references displayed in the report you need to run L<sup>A</sup>T<sub>E</sub>X on the report, then run BIB<sub>T</sub>E<sub>X</sub> (on the report, not on the references file), and then run L<sup>A</sup>T<sub>E</sub>X on the report again, once or a couple of times.<sup>2</sup> Don't be surprised if it takes you awhile to get used to this routine—you won't be the first. Look for the BIB<sub>T</sub>E<sub>X</sub> icon or *Bibliography* tab somewhere in your editor's toolbar.

For example, to cite the book *More Math Into L<sup>A</sup>T<sub>E</sub>X* by Grätzer [6], first look in the `Biblio.bib` file to find that the entry for that reference is labeled `gratzer`. Then enter the code `\cite{gratzer}` in your text. After

- running L<sup>A</sup>T<sub>E</sub>X on your document once,
- then running BIB<sub>T</sub>E<sub>X</sub> on your document once,
- then running L<sup>A</sup>T<sub>E</sub>X on your document twice,

---

<sup>1</sup>Appendix A lists some examples of record types and fields used for BIB<sub>T</sub>E<sub>X</sub> entries.

<sup>2</sup>Some typesetters can operate in a mode that performs all these operations in the correct sequence automatically.

you will find the citation “[6]” obtained in the preceding paragraph, which is the correct number the reference for Grätzer’s book winds up as in the Bibliography of this report. Note that you do not run  $\text{\LaTeX}$  on the `.bib` file.

$\text{\BibTeX}$  does take getting used to. You may need some help from an experienced  $\text{\LaTeX}$ er when getting started.

## Chapter 6

# Giving credit where credit is due

The point was made in the Acknowledgments section of this Sample Report that it is important to credit others whose work you use—it is a matter of professional ethics and courtesy. In addition to acknowledgment of broad assistance or contributions that you put into the Acknowledgments, you may also need to reference more specific contributions elsewhere in your text. Wherever a distinction is needed, make it clear which part of your work you have borrowed or adapted from others, and provide a reference to the source.



# Chapter 7

## Some extra advice for starting up with L<sup>A</sup>T<sub>E</sub>X

The following is a small collection of answers to questions RIPS students have asked.

### 1. How do I open and modify L<sup>A</sup>T<sub>E</sub>X files, as well as view the results?

Several L<sup>A</sup>T<sub>E</sub>X typesetters are available on the IPAM network. The default options are activated by clicking on the main page for the report template,

`z-Report-Master-2015.tex`

The present version of the template is being maintained using the TeXworks typesetter “pdfLaTeX.” For more information about other options, see the README file listed among the files used in construction this report.

The template is divided into several chapters, appendixes and other files with functions identifiable by their names coded in L<sup>A</sup>T<sub>E</sub>X (files ending in “.tex”) along with some graphics files coded as Encapsulate Postscript (“.eps”). If you modify any one of these source files, you will need to run the typesetter on the main `z-Report-Master-2015.tex` file. See Chapter 5 for tips handling bibliographic references. And see Appendix B for location of the L<sup>A</sup>T<sub>E</sub>X sources relating to this sample report.

### 2. Should I use a single-sided or double-sided format for my report?

Clearly, double-sided printing saves paper. But this is not as simple as it seems. Best to explain this in vocabulary used by publishers: *opening*, *recto*, and *verso*: An *opening* is the pair of pages you see when you open a book at random; the *recto* is the page on the right-hand side, and the *verso* is the page on the left-hand side — or, on a single leaf, *recto* is the front side and *verso* is the opposite side. When you open almost any book at the start of a new chapter, the first page of the chapter will appear on the right-hand page—*recto*. This is true whether or not the left-hand page of the opening—*verso*—is blank. That’s the way it should be in your report. Each major section of your report, not just chapters, should begin on a *recto*.

Rectos are always odd-numbered. Very likely, you will not get these results if you submit your single-sided report for double-sided copying on a printer. There are some L<sup>A</sup>T<sub>E</sub>X acrobatics you must specify to make your double-sided report turn out with proper recto-verso pagination, the code for which is built into `z-Report-Master-2014.tex`; you will see which document class to use—and which to comment out—at the top of the file.

**3. What format should I use for my report for the editing process, and for the final copies?**

See Chapter 8.

**4. How do I convert images (for example, in JPG, GIF, BMP, or PNG formats) to EPS?**

There is a simple procedure using a “Terminal” on an iMac: just invoke the “convert” command and specify the source and target file and coding. Other methods can be complicated.

Another possibility is to read them in MATLAB and export them to EPS from there. Here’s a sample code:

```
A=imread('MyFigure.jpg');           % read the image
imshow(A);                          % show it on the screen
saveas(gcf, 'MyFigure.eps', 'psc2'); % export to color eps
```

Note that this can create large EPS files. Simple diagrams are better recreated in INKSCAPE or MATLAB and then exported to EPS.

**5. What if a figure caption is too long to fit nicely in the list of figures?**

Chapter 4 discusses figures in general; there you can see an example of how a figure caption is created. Ordinarily, the figure caption provides the text for the title for the figure in the report’s List of Figures.

But what if the figure caption is too long or otherwise inappropriate for using in the List of Figures? The solution is to include an alternative title in square brackets (before the curly brackets—braces) in the caption declaration:

```
\caption[Alternative title for List of Figures]{The caption
that appears under your figure; it can be more complex than
is appropriate for a title in the List of Figures.}
```

The same technique is used for providing alternative titles for tables—and for running heads as well, although these are not used in your RIPS report.

**6. A useful little thing to know about fractions:** When you compose an inline fraction, sometimes it looks too small:  $\frac{x}{y}$ . Instead of using the L<sup>A</sup>T<sub>E</sub>X “frac” function, try “dfrac” to increase the size:  $\frac{x}{y}$ .

## 7. Where can I find more information on L<sup>A</sup>T<sub>E</sub>X?

The internet is a great resource. Search and ye shall find! See, for example,

<http://latex-project.org/>

Or you may want to get one of the books listed in the Bibliography, for example, *More Math Into L<sup>A</sup>T<sub>E</sub>X* [6], or the *L<sup>A</sup>T<sub>E</sub>X Companion* [10]. Your mentor most likely knows a lot of L<sup>A</sup>T<sub>E</sub>X too, so don't hesitate to ask for help.

## 8. Where can I find standard references to resolve finer points of style?

There are many good references, but the RIPS director uses the 16<sup>th</sup> edition of *The Chicago Manual of Style* [13] and its companion *A Manual for Writers of Research Papers, Theses, and Dissertations: Chicago Style for Students and Researchers* [12] as references of first resort, followed by the handy compact reference *Hart's New Rules* [11]. Other highly developed style guides are the *MLA Handbook for Writers of Research Papers* [4] and the *Publication Manual of the American Psychological Association* [2].

The examples in Grätzer's *More Math into LaTeX* [6] can also be used to resolve some style questions as well as questions about L<sup>A</sup>T<sub>E</sub>X coding. See the bibliography pages for other good resources.

## 9. How should I punctuate itemized and enumerated lists?

Here's a rule that gets broken easily because the items in a list are sometimes not just a single phrase or sentence. Usually you will introduce your list with a sentence or phrase that ends with a colon. In that case:

- begin each item with a lower-case initial letter;
- terminate all but the last sentence with a semicolon or a phrase with a comma;
- end the last sentence or phrase with a period.

Here's an example that shows how any rule starts to get tricky:

- begin each item with a lower-case initial letter;
- terminate the last sentence with a semicolon or a phrase with a comma,
- but end the last sentence or phrase with a period.

I think the comma at the end of the second item is correct, but you may be tempted to place a semicolon there to be consistent. And in case you have more than one sentence, or a mixture of a sentence and a phrase on a single line, What then? I'd prefer to avoid the latter complication if possible by make each item a simple sentence or phrase, and use only sentences or only phrases in a single list.

10. **Are there standard fonts for representing filenames, file extensions, URLs?**

In this document we have used `teletype` for filenames and `SMALL CAPS` for file extensions, program names, and the names of software packages. For URLs, we use `teletype`.

11. **How do I write the tilde symbol?**

Just hitting the tilde key on the keyboard won't work, as that character is special to  $\text{\LaTeX}$ . Instead, use the `\sim` command, which gives  $\sim$ . The reason the plain keyboard tilde character is special is that it is used for a non-breaking space, e.g., by writing

`Dr.~Jones`

instead of simply

`Dr. Jones`

This is how to tell  $\text{\LaTeX}$  never to break a line after 'Dr.' with 'Jones' starting at the beginning of the next line.

12.  **$\text{\LaTeX}$  and Bib $\text{\TeX}$  reserved characters**

These characters are interpreted in special ways by  $\text{\LaTeX}$  typesetters:

`# $ % ^ & _ { } ~ \`

You may print them in your text by "escaping" them with the backslash (`\`), e.g., use `\#` in your  $\text{\LaTeX}$  code. If not properly escaped, these characters can cause mysterious errors, especially in Bib $\text{\TeX}$  files because the source of the error can be inadequately-referenced by  $\text{\LaTeX}$ .

13. **Why do Bib $\text{\TeX}$  bib files so often fail to compile?**

If you have not used Bib $\text{\TeX}$  before, you may find it a bit difficult getting used to it. It's not a part of  $\text{\LaTeX}$ , so it requires some special handling. Most  $\text{\LaTeX}$  users find it to be worth the effort, since it allows them to keep their references in a separate file (or files) that can easily be re-used. Bib $\text{\TeX}$  makes it easy to reference items and to present them in a consistent format.

No doubt about it, Bib $\text{\TeX}$  does have some fussy features. For example, your reference list will crash if it contains reserved characters, e.g., in URLs. The point of confusion is that some characters reserved by Bib $\text{\TeX}$  are not reserved elsewhere or the normal methods of escape don't work, so these characters can be pesky and catch you unawares. Here are some character encodings that are useful as alternatives in your bib file:

- use `\&` for *ampersand*;
- use `\_` for *underbar*;
- use `\sim` for *tilde*.



The curly brackets are not strictly necessary, but they are used to avoid needing a space before a character that follows the symbol.

### Which bibliographic style should I use?

There are many options. For example, the *siam* and *ieeetr* styles produce good results for RIPS reports.

Your bibliography should distinguish book titles by printing them in *italic* font. But titles of written materials that appear within a collection such as journal articles are distinguished by surrounding them with double quote and are preferably printed in *roman* font, and preferably the title of the *collection* is italicized.

Both the “siam” and “ieeetr” italicize book titles. However they treat article and collection titles, and multiple entries by the same author, differently.

The advantage of the “siam” style is that it aggregates books or articles by the same author in reverse-chronological order under a single author entry. A disadvantage is that it also italicizes article titles and does not quote them, and it prints collection titles in roman font. The quotation problem is easily solved by your supplying them in your `bib` file by surrounding the title with two back quotes on the left and two apostrophes on the right, but you cannot switch the italic and roman fonts, which is unfortunate but acceptable.

An article is cited here as an example using the “siam” bibliographic style: “A Set of Postulates for Plane Geometry (Based on Scale and Protractors)” by G. D. Birkhoff [3]. Take a look at the `bib` file to see how it was necessary to surround the title of the article with quotes; moreover, curly braces were used to prevent `LATEX` from reducing the capital letters in the title to lowercase.

The “ieeetr” style differentiates book and article titles, and titles for articles in collections, correctly. However, if there are multiple books or articles by an author, “ieeetr” awkwardly tosses additional entries to the end.

Check the available options to make sure you can get a good result.

#### 14. Where do inline citations go within the “body text”?

The *body text* or *running text* is the main text in a book or report; it excludes chapter and section heads, front matter, back matter and sometimes, depending on context, footnotes and captions. Generally, it’s what the author wrote and not the text supplied by the publisher. For the purpose here, I include footnotes and captions.

*The Chicago Manual of Style* [13] is silent on where to place inline citations, whether within a sentence or after the period, but Turabian gives examples of citations within sentences and none after the period [12]. According to *The Chicago Manual of Style* you can do something like this for a block quotation — note that there are no quotation marks, and authorship (or citation) is dropped in parentheses below the quotation:

O for a Muse of fire, that would ascend  
The brightest heaven of invention,

A kingdom for a stage, princes to act  
And monarchs to behold the swelling scene!  
(Prologue to “Henry V” by William Shakespeare)

#### 15. How do I control the page placement of figures and tables?

The placement algorithms in L<sup>A</sup>T<sub>E</sub>X are complicated. The GRAPHICX package used by the RIPS Master Template is discussed in extensive detail in the authoritative “Using Imported Graphics in L<sup>A</sup>T<sub>E</sub>X and pdfL<sup>A</sup>T<sub>E</sub>X” by Keith Reckdahl at

<http://ctan.math.washington.edu/tex-archive/info/epslatex/english/epslatex.pdf>

For a start, see Sections 18 and 19: “Customizing Float Placement” and “Customizing the Figure Environment.” Note especially Section 21, “Non-Floating Figures:”

Since non-floating figures can produce large sections of vertical white-space, non-floating figures are generally considered poor typesetting style. Instead, users are strongly encouraged to use the figure environments `[!ht]` optional argument which moves the figure only if there is not enough room for it on the current page.

See the internet for other solutions, e.g., for fixing gross placement errors using commands like: `\raggedbottom`, `\baselinestretch`, `\parskip`.

#### 16. How long should my report be?

Depending on how formal you choose to make your midterm report, it can evolve into the final report, so the latter will usually be longer than the midterm report but not necessarily. The dissertation of at least one Nobel Laureate was under thirty pages in length, so it is possible to report winning results succinctly. Here’s a rule of thumb:

Just decide what points you want to make, and then make all your points in clear language, using figures and tables wherever they facilitate understanding. It’s hard to be succinct when you don’t have a lot of time to prune your text. But try to be as brief as possible without injuring clarity.

After you have done that, check to see whether your report has all the major ingredients described in this Sample Report, especially in Chapters 1 & 2. Considered as a draft on its way to becoming the final report, the midterm report may be written a little more loosely and contain things that you may decide to prune later.

If everything is there, including the extra pages created by LaTex, such as table of contents, list of figures, list of tables, as necessitated by your text, then that’s how long your report should be.

## Chapter 8

# Final comments about polishing your report for publication

Writing a good report is a serious challenge, requiring time and attention to details that are easily and often greatly underestimated by inexperienced writers. So how does a good report acquire its final polish?

Your academic mentor will help guide your writing throughout your project. He or she will be the first to review your report draft and edit it not only for style but also for technical correctness. After you have satisfied your academic mentor with your draft, you will submit it to the RIPS program director for *copy editing*, who will attend to matters of readability, grammar, and style. After you submit your drafts for their review, it is likely they will return it to you with corrections, crossed out text, and possibly even suggestions for overhauling whole parts of it. That is normal editing practice, and it is an expected part of the process of writing a professional-quality document.

Since your report is sponsored work, your sponsoring liaison should be given an opportunity to review it before its release. But here's an important caution: Don't submit a draft to your sponsor until *after* it has been revised in compliance with suggestions from your academic mentor and the RIPS director. It's good practice to give sponsors your most professional efforts—not your first drafts. After you have satisfied the editing requirements of your academic mentor and the RIPS director, you should send your sponsor a **pdf** of a copy by email for review. Your sponsor may suggest further changes.

You will facilitate the process of editing your report by submitting a single-sided printed copy for editing. Double-sided is too hard to work with. Although it is typical for copy editing to use double spacing of a manuscript to allow for editorial comments between lines, it is unnecessary for a RIPS report. A table of *proofreader's marks* used by copy editors for mark-up, and used sometimes here at IPAM, is referenced in Appendix B.

After you have completed all the edits required by your academic mentor and the RIPS director, you can prepare final copies in two formats, respectively: (1) a single-sided **pdf** as an electronic copy, which you can email to your sponsor, and (2) a slim double-sided copy for the final print version — you can print this in the fatter

single-sided format if your figures or text bleed through to the flip side of the page. See Chapter 7 for a discussion of the special pagination requirements for double-sided copying.

Note that when you use ADOBE READER for printing your **pdf**, you are presented with options for *page scaling*. You may have to play with this to get the margins right.

# Appendix A

## BibT<sub>E</sub>X Sample Records, Record Types and Fields

```
@BOOK{gm68,  
  author = "George A. Menuhin",  
  title = "Universal Algebra",  
  publisher = "D. van Nostrand",  
  address = "Princeton",  
  year = 1968,  
}  
  
@BOOK{fr82,  
  author = "Ferenc R. Richardson",  
  title = "General Lattice Theory",  
  edition = "Expanded and Revised",  
  language = "Russian",  
  publisher = "Mir",  
  address = "Moscow",  
  year = 1982,  
}  
  
@ARTICLE{em57,  
  author = "Ernest T. Moynahan",  
  title = "On a Problem of {M. Stone}",  
  journal = "Acta Math. Acad. Sci. Hungar.",  
  pages = "455--460",  
  volume = 8,  
  year = 1957,  
}  
  
@ARTICLE{em57a,  
  author = "Ernest T. Moynahan",  
  title = "Ideals and Congruence Relations in  
    Lattices.\textup{II}",  
  journal = "Magyar Tud. Akad. Mat. Fiz. Oszt. K{\o}zl.",  
  language = "Hungarian",  
  pages = "417--434",  
  volume = 7,  
  year = 1957,  
}  
  
@PHDTHESIS{sF90,  
  author = "Soo-Key Foo",  
  title = "Lattice Constructions",  
  school = "University of Winnebago",  
  address = "Winnebago, MN",  
  year = 1990,  
  month = dec,  
}
```

Figure A.1: Examples of BibT<sub>E</sub>X records for a .bib file (*The LaTeX Companion*, 2<sup>nd</sup> ed, 2004, 384–385)

article	An article from a journal or magazine. <i>Required:</i> author, title, journal, year. <i>Optional:</i> volume, number, pages, month, note.
book	A book with an explicit publisher. <i>Required:</i> author or editor, title, publisher, year. <i>Optional:</i> volume or number, series, address, edition, month, note.
booklet	A work that is printed and bound, but without a named publisher or sponsoring institution. <i>Required:</i> title. <i>Optional:</i> author, howpublished, address, month, year, note.
inbook	A part of a book, e.g., a chapter, section, or whatever and/or a range of pages. <i>Required:</i> author or editor, title, chapter and/or pages, publisher, year. <i>Optional:</i> volume or number, series, type, address, edition, month, note.
incollection	A part of a book having its own title. <i>Required:</i> author, title, booktitle, publisher, year. <i>Optional:</i> editor, volume or number, series, type, chapter, pages, address, edition, month, note.
inproceedings	An article in a conference proceedings. <i>Required:</i> author, title, booktitle, year. <i>Optional:</i> editor, volume or number, series, pages, address, month, organization, publisher, note.
manual	Technical documentation. <i>Required:</i> title. <i>Optional:</i> author, organization, address, edition, month, year, note.
mastersthesis	A master's thesis. <i>Required:</i> author, title, school, year. <i>Optional:</i> type, address, month, note.
misc	Use this type when nothing else fits. A warning will be issued if all optional fields are empty (i.e., the entire entry is empty or has only ignored fields). <i>Required:</i> none. <i>Optional:</i> author, title, howpublished, month, year, note.
phdthesis	A Ph.D. thesis. <i>Required:</i> author, title, school, year. <i>Optional:</i> type, address, month, note.
proceedings	Conference proceedings. <i>Required:</i> title, year. <i>Optional:</i> editor, volume or number, series, address, publisher, note, month, organization.
techreport	A report published by a school or other institution, usually numbered within a series. <i>Required:</i> author, title, institution, year. <i>Optional:</i> type, number, address, month, note.
unpublished	A document having an author and title, but not formally published. <i>Required:</i> author, title, note. <i>Optional:</i> month, year.

Table 13.1: BibTeX's entry types as defined in most styles

Figure A.2: BibTeX entry types, entered on the first line of a BibTeX record (*The LaTeX Companion*, 2<sup>nd</sup> ed, 2004, 375)

address	Usually the address of the publisher or other institution. For major publishing houses, just give the city. For small publishers, specifying the complete address might help the reader.
annote	An annotation. Not used by the standard bibliography styles, but used by others that produce an annotated bibliography (e.g., <code>annote</code> ). The field starts a new sentence and hence the first word should be capitalized.
author	The name(s) of the author(s), in BibTeX name format (Section 13.2.2).
booktitle	Title of a book, part of which is being cited (Section 13.2.2). For book entries use the <code>title</code> field.
chapter	A chapter (or section or whatever) number.
crossref	The database key of the entry being cross-referenced (Section 13.2.5).
edition	The edition of a book (e.g., "Second"). This should be an ordinal, and should have the first letter capitalized, as shown above; the standard styles convert to lowercase when necessary.
editor	Name(s) of editor(s), in BibTeX name format. If there is also an <code>author</code> field, then the <code>editor</code> field gives the editor of the book or collection in which the reference appears.
howpublished	How something strange has been published.
institution	Institution sponsoring a technical report.
journal	Journal name. Abbreviations are provided for many journals (Section 13.2.3).
key	Used for alphabetizing and creating a label when the <code>author</code> and <code>editor</code> information is missing. This field should not be confused with the key that appears in the <code>\cite</code> command and at the beginning of the database entry.
month	The month in which the work was published or, for an unpublished work, in which it was written. For reasons of consistency the standard three-letter abbreviations ( <code>jan</code> , <code>feb</code> , <code>mar</code> , etc.) should be used (Section 13.2.3).
note	Any additional information that can help the reader.
number	The number of a journal, magazine, technical report, or work in a series. An issue of a journal or magazine is usually identified by its volume and number; a technical report normally has a number; and sometimes books in a named series carry numbers.
organization	The organization that sponsors a conference or that publishes a manual.
pages	One or more page numbers or range of numbers (e.g., 42-111 or 7,41,73-97 or 43+, where the '+' indicates pages that do not form a simple range).
publisher	The publisher's name.
school	The name of the school where the thesis was written.
series	The name of a series or set of books. When citing an entire book, the <code>title</code> field gives its title and an optional <code>series</code> field gives the name of a series or multivolume set in which the book is published.
title	The work's title, typed as explained in Section 13.2.2.
type	The type of a technical report (e.g., "Research Note"). This name is used instead of the default "Technical Report". For the entry type <code>phdthesis</code> you could use the term "Ph.D. dissertation" by specifying: <code>type = "{Ph.D.} dissertation"</code> . Similarly, for the <code>inbook</code> and <code>incollection</code> entry types you can get "section 1.2" instead of the default "chapter 1.2" with <code>chapter = "1.2"</code> and <code>type = "Section"</code> .
volume	The volume of a journal or multivolume book.
year	The year of publication or, for an unpublished work, the year it was written. Generally, it should consist of four numerals, such as 1984, although the standard styles can handle any year whose last four nonpunctuation characters are numerals, such as "about 1984".

Table 13.2: BibTeX's standard entry fields

Figure A.3: BibTeX fields, the "catalog" fields for a BibTeX record. ("The LaTeX Companion", 2<sup>nd</sup> ed, 2004)





## Appendix B

### Where to find this sample RIPS report?

Read-only L<sup>A</sup>T<sub>E</sub>X source code for the RIPS Report Template, sample BEAMER slide presentations, and other L<sup>A</sup>T<sub>E</sub>X supporting materials are available at,

Computer -> IPAM RIPS FOLDER -> on the R Drive under under "Templates-etc"

Your report will be “copyedited”, i.e., edited for conformance to the RIPS *House Style*. For reference, a table of proofreader’s marks that may be used for markup of your draft is included. It was copied from *The Chicago Manual of Style, 16th ed.* (See original source at: [www.chicagomanualofstyle.org/tools\\_proof.html](http://www.chicagomanualofstyle.org/tools_proof.html).)



# Appendix C

## Glossary

<b>Page vs Leaf:</b>	In bookbinding, a trimmed sheet of paper bound in a book; each side of a leaf is a <b>page</b> .
<b>Opening:</b>	The two pages you see when you open a book. The right-hand <b>page</b> is the <b>recto</b> —and the left-hand page is the <b>verso</b> .
<b>Recto:</b>	The front side of a <b>leaf</b> ; in a book or journal, a right-hand page. To <b>start recto</b> is to begin on a recto page, as any major section—e.g., title page, table of contents, preface, chapter, appendix, bibliography—normally does. Contrast <b>verso</b> .
<b>Verso:</b>	The back side of a <b>leaf</b> ; the <b>page</b> on the left-hand side of an <b>opening</b> .
<b>Front matter:</b>	As applied to this report, the material that appears in the front of the document, including title page, the abstract, acknowledgments, table of contents, list of figures, list of tables, usually numbered with lowercase roman numerals. RIPS reports initiate pagination with 1 in the front matter and proceed throughout with arabic numerals. This variation of usage is allowed because modern typesetting permits easy re-pagination after pages have been added to the front matter, something not easily done—after completion of the main matter—when typesetting was done by hand.
<b>Main matter:</b>	The main part of the document, including the appendixes. <b>Page</b> numbers start from 1 using arabic numerals if front matter is enumerated using roman numerals.
<b>Back matter:</b>	Material that appears at the back of the document, which in our report includes only the Bibliography.



# Appendix D

## Abbreviations

IPAM. Institute for Pure and Applied Mathematics. An institute of the National Science Foundation, located at UCLA.

RIPS. Research in Industrial Projects for Students. A regular summer program at IPAM, in which teams of undergraduate (or fresh graduate) students participate in sponsored team research projects.

UCLA. The University of California at Los Angeles.



# Selected Bibliography Including Cited Works

- [1] AMERICAN MATHEMATICAL SOCIETY, MathSciNet: Mathematical Reviews on the Web. (<http://www.ams.org/mathscinet/>). Accessed June 17, 2009.

Because an online reference may be changed at any time, it is conventional to tie the reference to the date when the resource was accessed.

- [2] AMERICAN PSYCHOLOGICAL ASSOCIATION, *Publication Manual of the American Psychological Association*, American Psychological Association, Washington, DC, fifth ed., 2001.

A standard reference, focused on scientific publication.

- [3] BIRKHOFF, GEORGE DAVID, “*A Set of Postulates for Plane Geometry (Based on Scale and Protractors)*”, *Annals of Mathematics*, 33 (1932).
- [4] J. GIBALDI, *MLA Handbook for Writers of Research Papers*, The Modern Language Association, New York, sixth ed., 2003.

One of the standard style manuals for scholarly writing.

- [5] G. GRÄTZER, *Math Into L<sup>A</sup>T<sub>E</sub>X*, Birkhäuser, Boston, MA, third ed., 2000.
- [6] ———, *More Math Into L<sup>A</sup>T<sub>E</sub>X*, Birkhäuser, Boston, MA, fourth ed., 2007.
- [7] N. J. HIGHAM, *Handbook of writing for the mathematical sciences*, Society for Industrial and Applied Mathematics (SIAM), Philadelphia, PA, second ed., 1998.
- [8] S. G. KRANTZ, *Mathematical publishing*, American Mathematical Society, Providence, RI, 2005.

Sage advice from a widely published mathematician.

- [9] L. LAMPORT, *L<sup>A</sup>T<sub>E</sub>X: A Document Preparation System*, Addison-Wesley, Boston, MA, USA, second ed., 1994.

It is conventional for an online resource to specify the date on which the resource was most recently accessed.

- [10] F. MITTELBACH AND M. GOOSSENS, *The L<sup>A</sup>T<sub>E</sub>X Companion*, Addison-Wesley Longman Publishing Co., Inc., Boston, MA, USA, second ed., 2004.
- [11] R. M. RITTER, *New Hart's Rules: The Handbook of Style for Writers and Editors*, Oxford University Press, Oxford, 2005.

A succinct and authoritative style manual for British authors, with pointers for American English, adapted from the *Oxford Guide to Style*.

- [12] K. L. TURABIAN, *A Manual for Writers of Research Papers, Theses, and Dissertations: Chicago Style for Students and Researchers*, University of Chicago Press, Chicago, seventh ed., 2007.
- [13] UNIVERSITY OF CHICAGO PRESS, *Chicago Manual of Style*, University of Chicago Press, Chicago, 16th ed., 2010.

An encyclopedic reference on style for print media, a widely used standard. For RIPS reports, it is used as the authority of first resort.

- [14] H. VOSS, *PSTricks: Graphics and PostScript for T<sub>E</sub>X and L<sup>A</sup>T<sub>E</sub>X*, UIT, Cambridge, England, 2011.
- [15] J. R. WALKER AND T. TAYLOR, *The Columbia Guide to Online Style*, Columbia University Press, Chicago, second ed., 2006.