



Electrical, Electromagnetic, and Optical Characterization of the InP/InGaAs Alloy System

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A Thesis Proposal  
Presented to the Faculty of the  
Department of Electronics and Computer Engineering  
Gokongwei College of Engineering  
De La Salle University

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In Partial Fulfillment of the  
Requirements for the Degree of  
Bachelor of Science in Electronics and Communications Engineering

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by  
DELA CRUZ Juan Z.  
FRANCO Nat Y.  
GARCIA Sebastian X.  
MARTINEZ Isabella W.  
RIANZARES Max V.

January, 2025



De La Salle University

## ORAL DEFENSE RECOMMENDATION SHEET

This thesis proposal, entitled **Electrical, Electromagnetic, and Optical Characterization of the InP/InGaAs Alloy System**, prepared and submitted by thesis group, ESG-04, composed of:

DELA CRUZ, Juan Z.  
FRANCO, Nat Y.  
GARCIA, Sebastian X.  
MARTINEZ, Isabella W.  
RIANZARES, Max V.

in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electronics and Communications Engineering (BS-ECE)** has been examined and is recommended for acceptance and approval for **ORAL DEFENSE**.

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**Dr. Francisco D. Baltasar**  
*Adviser*

January 22, 2025



## ABSTRACT

Keep your abstract short by giving the gist/nutshell of your thesis proposal. Use the following checklist questions to help you in crafting your abstract.

- ☐ Did you briefly state what you intend to do?
- ☐ Did you concisely discuss the problem statement?
- ☐ Did you tersely mention the objectives in general terms?
- ☐ Did you succinctly describe the methodology for the target audience?
- ☐ Did you strongly describe your significant results and your conclusions?

*Index Terms*—alloy system, characterization, InP, InGaAs (see IEEE Taxonomy and Thesaurus).



49

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## ABBREVIATIONS

152	AC	Alternating Current.....	86
153	HTML	Hyper-text Markup Language .....	86
154	CSS	Cascading Style Sheet .....	86
155	XML	eXtensible Markup Language .....	86



## NOTATION

157	$\mathcal{S}$	a collection of distinct objects . . . . .	88
158	$\mathcal{U}$	the set containing everything . . . . .	88
159	$\emptyset$	the set with no elements . . . . .	88
160	$ \mathcal{S} $	the number of elements in the set $\mathcal{S}$ . . . . .	88
161	$h(t)$	impulse response . . . . .	78
162	$x(t)$	input signal represented in the time domain . . . . .	78
163	$y(t)$	output signal represented in the time domain . . . . .	78

Throughout this thesis proposal, mathematical notations conform to ISO 80000-2 standard, e.g., variable names are printed in italics, the only exception being acronyms like, e.g., SNR, which are printed in regular font. Constants are also set in regular font like  $j$ . Standard functions and operators are also set in regular font, e.g., in  $\sin(\cdot)$ ,  $\max\{\cdot\}$ . Commonly used notations are  $t$ ,  $f$ ,  $j = \sqrt{-1}$ ,  $n$  and  $\exp(\cdot)$ , which refer to the time variable, frequency variable, imaginary unit,  $n$ th variable, and exponential function, respectively.



170

## GLOSSARY

171

matrix

a concise and useful way of uniquely representing and working with linear transformations; a rectangular table of elements

172

Functional Analysis

the branch of mathematics concerned with the study of spaces of functions



173

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## Chapter 1

191

## INTRODUCTION



## 1.1 Background of the Study

Aside from the usual text descriptions of the background, put here figures that will cast images to your audience about the context of your work.

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 216 placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor.  
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 219 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.  
 220 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit  
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222 Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem.  
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 227 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue  
 228 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.  
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 230 amet ipsum. Nunc quis urna dictum turpis accumsan semper.

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 232 Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec  
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 238 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit



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## 1.2 Prior Studies

Put here a narrative and a summary (not a duplicate) of your literature review chapter. In this section, summarize and highlight the gap(s) found in the literature review in Chapter 2. Preferably, a table showing the summary would be helpful.

Prior Studies or Literature Review<sup>1</sup> (expansion of the Prior Studies) is basically about competition. Competition.

So the suggested goals in writing the narrative of the Prior Studies in summative and highlighted forms are, in no particular order:

1. to mention the problem briefly;
2. to show the features of the existing literature in solving the problem
3. to show the weaknesses of the solutions of existing literature
4. to show how your solution is better (can be better (for proposals))

If the suggested table will be placed, please discuss it in light of the above-mentioned items.

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<sup>1</sup>The main difference between the Prior Studies and Literature Review is that the Prior Studies is done in a concise manner. By the way, this is also an example of a footnote usage.





258 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue  
 259 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.  
 260 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit  
 261 amet ipsum. Nunc quis urna dictum turpis accumsan semper.

## 262 1.3 Problem Statement

263 The problem statement needs to be very clear and to the point.

264 A persuasive problem statement from a contextualized and intended-audience-awareness  
 265 perspective consists of:

266 1. PS1: description of the ideal scenario for your intended audience

- 267 • Describe the goals, desired state, or the values that your audience considers  
 268 important and that are relevant to the problem.

269 2. PS2: reality of the situation

- 270 • Describe a condition that prevents the goal, state, or value discussed in PS1  
 271 from being achieved or realized at the present time.
- 272 • It is imperative to make the audience feel the pain point.

273 3. PS3: consequences for the audience

- 274 • Using specific details, show how the situation contains a little promise of  
 275 improvement unless something is done.



276 After the above-mentioned items, succinctly describe your solution. Please avoid describing  
 277 your entire solution here since you will articulate and elucidate it by showing what you want  
 278 to achieve through your objectives, and how you will make it through your methodology.  
 279 A well-constructed problem statement will convince your audience that the problem is real  
 280 and worth having you solve it.

281 Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem.  
 282 Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec  
 283 ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus  
 284 placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor.  
 285 Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla  
 286 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue  
 287 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.  
 288 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit  
 289 amet ipsum. Nunc quis urna dictum turpis accumsan semper.

## 290 1.4 Objectives and Deliverables

291 Your objectives are the states that you desire to achieve in solving the problem. The general  
 292 objective is the main state to be achieved whereas the specific ones are sub-states to be  
 293 achieved.

### 294 1.4.1 General Objective (GO)

295 GO: To Morbi quis dolor. ;



## 1.4.2 Specific Objectives (SOs)

- SO1: To Quisque egestas wisi eget nunc. ;
- SO2: To Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. ;
- SO3: To Nullam cursus pulvinar lectus. ;
- SO4: To Morbi blandit ligula feugiat magna. ;
- SO5: To Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. ;

## 1.4.3 Expected Deliverables

Table 1.1 shows the outputs, products, results, achievements, gains, realizations, and/or yields of the Thesis Proposal.

TABLE 1.1 EXPECTED DELIVERABLES PER OBJECTIVE

Objectives	Expected Deliverables
GO: To Morbi quis dolor.	⋮

## 1.5 Significance of the Study

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor.



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312 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue  
313 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.  
314 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit  
315 amet ipsum. Nunc quis urna dictum turpis accumsan semper.

## 316 1.5.1 Technical Benefit

317

- 318 1. First itemtext
- 319 2. Second itemtext
- 320 3. Last itemtext
- 321 4. First itemtext
- 322 5. Second itemtext

## 323 1.5.2 Social Impact

324

- 325 1. First itemtext
- 326 2. Second itemtext
- 327 3. Last itemtext
- 328 4. First itemtext



329 5. Second itemtext

### 330 1.5.3 Environmental Welfare

331

332 1. First itemtext

333 2. Second itemtext

334 3. Last itemtext

335 4. First itemtext

336 5. Second itemtext

## 337 1.6 Assumptions, Scope, and Delimitations

338 Bulletize your assumptions in one group, and then bulletize the scope in another, and do  
339 the same for your delimitations. The assumptions to put here are those major facts or  
340 statements that are *key* for your proposed solution to work. Scope refers to the space(s)  
341 for the operation of your proposed solution, whereas delimitations are the limits of the  
342 operation of your proposed solution.

### 343 1.6.1 Assumptions

344 1. ...;

345 2. ...;



3. ...;

### 1.6.2 Scope

1. ...;

2. ...;

3. ...;

### 1.6.3 Delimitations

1. ...;

2. ...;

3. ...;

## 1.7 Description and Methodology of the Thesis Proposal

A purpose of the description here is to re-steer/remind the panelist/reader again by tersely describing what your thesis is about (i.e. the problem and the main goal you want to achieve) in another way without sounding repetitive.

Your methodology is your means of achieving your stated objectives. What you put here is the summary of your methodology chapter.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec



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 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue  
 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.  
 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit  
 amet ipsum. Nunc quis urna dictum turpis accumsan semper.

## 1.8 Estimated Work Schedule and Budget

The estimated work schedule can be represented as a Gantt Chart or a combination of  
 Project Network Diagram, Work Breakdown Structure, and Critical Path. The budget can  
 be made into a Bill of Materials, financial plan, or if your Thesis Proposal is funded and  
 part of larger project, the cost, and date for reaching each milestone and/or deliverable for  
 your part of the project.

For ECE Department undergraduate theses, the individual Gantt Chart or Work Break-  
 down Schedule and Bill of Materials will be included in this section and be removed in the  
 final document.

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 Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec  
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 placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor.  
 Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla  
 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue



386 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.  
387 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit  
388 amet ipsum. Nunc quis urna dictum turpis accumsan semper.

389 **1.9 Overview of the Thesis Proposal**

390 Provide here a brief summary and what the reader should expect from each succeeding  
391 chapter. Show how each chapter is connected with each other.





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392

## Chapter 2

393

## LITERATURE REVIEW



394 It is to be noted that each subsection in this chapter should discuss in narrative form  
 395 each table that is presented in order to point out to the reader what the author(s) intend to  
 396 convey.

## 397 **2.1 Existing Work**

398 Cite and summarize here relevant and significant literature (dissertations, theses, journals,  
 399 patents, notable conference papers) through a table and descriptions to prove that no one  
 400 has done your work yet and/or that your work is not a duplication of existing ones. Your  
 401 focus here is what has *been done*.

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## 2.2 Lacking in the Approaches

You can summarize the weaknesses of existing approaches by a tabular comparison of the  
 literature. Your focus here is what has *not been done*, i.e. what features were missed, what  
 solutions were not considered, what the demerits are, etc. Through these items, you then  
 can introduce the necessity for doing your proposed solution.

It is to be noted that the degree of novelty for undergraduate thesis is lower than those  
 for graduate school. If a Ph.D. dissertation/thesis has a high degree of novelty and that for  
 an undergraduate is low, then a master's thesis is somewhere between the two.

Briefly include here the following in order to remind the reader why you are highlighting  
 the weaknesses of the solutions of existing literature.

- mentioning the problem
- showing how your solution is better (can be better (for proposals))

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## 504 **2.3 Summary**

505 Provide the gist of this chapter such that it reflects the contents and the message.



506

## **Chapter 3**

507

## **THEORETICAL CONSIDERATIONS**



Before starting the first section, provide an overview of the purpose of this chapter and its contents, and how they are relevant to your methodology. Discuss in this chapter the relevant theories and concepts that should support your proposed solutions.

This chapter is for providing the context to your panelist/reader. It is actually an expanded form of the Background of the Study that you have put in Chapter 1.

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Fig. 3.1 A quadrilateral image example.

558

## 3.1 Summary

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Provide the gist of this chapter such that it reflects the contents and the message.



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## Chapter 4

561

## DESIGN CONSIDERATIONS



Before starting the first section, provide an overview of the purpose of this chapter and its contents, and how they are relevant to your methodology.

Your primary goal in the Design Considerations chapter is to describe to your panelist/readers the key topics that fall further under Theoretical Considerations, but should be placed here instead since they are geared towards your Methodology. These key topics are those that you have directly adopted in making your solution/methodology. You can think of the connection of the Design Considerations chapter to the Theoretical Considerations chapter in this way: if your Theoretical Considerations chapter serves as the main foundation of a building, then the Design Considerations chapter functions as the columns.

The Design Considerations chapter is an avenue for explaining why you considered the topics here for your proposed methodology. This chapter is different from your methodology, because topics you discuss here are already accepted as part of the body of knowledge, and may have not been developed by you.

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## 4.1 Standards

Standards are essential for successful projects and impactful research. They provide a common framework and ensure consistency, quality, and safety across various disciplines. By adhering to established standards, your work becomes more reliable, interoperable, and valuable in real-world applications. Standards also demonstrate your understanding of industry best practices and enhance the credibility of your research.

To effectively integrate standards into your project, begin by identifying relevant standards related to your specific field. Thoroughly research and understand the requirements and guidelines outlined within these standards. Align your project objectives and methodologies to meet or exceed these standards. Document your use of standards in this section, including how and why specific standards were chosen. Finally, evaluate your results against the established standards, justifying any deviations from the norm with sound



632 reasoning and evidence.

633 **4.2 Summary**

634 Provide the gist of this chapter such that it reflects the contents and message.



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## Chapter 5

636

## METHODOLOGY





Put an overview of the contents of chapter. Mention here your methodology flow through a figure and provide an overview of it and how your methodology achieves your objectives. How your methodology achieves each of your specific objectives is what your panelists/examiners will be looking for. Specify how your methodology achieves your general objective and specific objectives. A point-by-point comparison how your methodology achieves each of your specific objectives is expected in the final Thesis Proposal.

Also make sure that you refer clearly to the chapters on the Literature Review, Theoretical Considerations, and Design Considerations showing how your methodology ties with those that you have discussed in those chapters.

Make an overview of the contents of the chapter. Put here your methodology flow through a figure and provide an overview of it.

In summative form, Table 5.1 indicates the approaches, designs, modes, processes, programs, techniques, and/or ways that the Thesis Proposal reaches the objectives.

TABLE 5.1 SUMMARY OF METHODS FOR REACHING THE OBJECTIVES

Objectives	Methods	Locations
GO: To Morbi quis dolor.	1. First itemtext 2. Second itemtext 3. Last itemtext 4. First itemtext 5. Second itemtext	Sec. 5.1 on p. 31

*Continued on next page*



*Continued from previous page*

Objectives	Methods	Locations
SO1: To Quisque egestas wisi eget nunc.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31
SO2: To Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31
SO3: To Nullam cursus pulvinar lectus.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31
SO4: To Morbi blandit ligula feugiat magna.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31

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Objectives	Methods	Locations
SO5: To Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31

## 5.1 Implementation

Summarize the process used to create/set-up the work with an explanation of such process, instruments, and materials that you used if any. If the description is lengthy, use condensed bullet points.

*Rule of thumb:* Implementation is how you made your work; (keywords: implemented, created, made, soldered, programmed, etc.).

If you wrote a program or made a simulation, you must state how the program or simulation functions in this section. An algorithm or a pseudocode as shown in Table E.2 is a good example.

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## 705 5.2 Evaluation

706 Describe the procedures for evaluating the correct behavior and outcome of your work,  
 707 including what information you need to gather and how you will obtain or measure it.

708 *Rule of thumb:* Evaluation is how you tested your work; (keywords: measured, tested,  
 709 compared, simulated, etc.).

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755 **5.3 Summary**

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757

## Chapter 6

758

## RESULTS AND DISCUSSIONS





759 Show in this chapter proofs why your proposed solution works. However, presenting  
 760 results ("It worked") without an appropriate explanation does not show thorough under-  
 761 standing. Aside from the data and results that you have obtained, and their explanation,  
 762 the discussion includes why components of your proposed solution work did or did not  
 763 work in accordance to what you described in the evaluation process, and how the proposed  
 764 solution performed and faired. Interpret the results and the reasons why they were obtained.  
 765 If your results are incorrect, apparent discrepancies from theory should be pointed out and  
 766 explained. In essence, what do the results mean? Citing existing publication can help you  
 767 compare your results and your explanations.

768 The next items below is not related to the description of this results and discussions  
 769 chapter, but serves as an opener for the  $\LaTeX$  portion of this template.

770 Here is an example of a citation for ISO 80000-2 standard [ISO, 2009]. Another one  
 771 is [Einstein, 1905] and [Croft, 1978].

772 In using this template, the user is expected to have a working knowledge of  $\LaTeX$ . A  
 773 good introduction is in [Oetiker et al., 2014]. Its latest version can be accessed at [http://](http://www.ctan.org/tex-archive/info/lshort)  
 774 [www.ctan.org/tex-archive/info/lshort](http://www.ctan.org/tex-archive/info/lshort). See the Appendix of `document_guide.pdf` for  
 775 examples.

776 In aggregate form, Table 6.1 shows the outcomes and completions in applying the  
 777 methodology of the Thesis Proposalper objective.

TABLE 6.1 SUMMARY OF RESULTS FOR ACHIEVING THE OBJECTIVES

Objectives	Results	Locations
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*Continued on next page*



*Continued from previous page*

Objectives	Results	Locations
GO: To Morbi quis dolor.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31
SO1: To Quisque eget wisi eget nunc.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31
SO2: To Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31
SO3: To Nullam cursus pulvinar lectus.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31

*Continued on next page*



*Continued from previous page*

Objectives	Results	Locations
SO4: To Morbi blandit ligula feugiat magna.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31
SO5: To Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam.	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	Sec. 5.1 on p. 31

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**6.1 Summary**

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## **Chapter 7**

826

## **CONCLUSIONS, RECOMMENDATIONS, AND**

827

## **FUTURE DIRECTIVES**



## 828 7.1 Concluding Remarks

829 In this Thesis Proposal, ...

830 Put here the main points that should be known and learned about the work topic.  
831 Summarize or give the gist of the essential principles and inferences drawn from your  
832 results.

## 833 7.2 Contributions

834 The interrelated contributions and supplements that have been developed by the author(s)  
835 in this Thesis Proposal are listed as follows. Only those that are unique to the authors' work  
836 are included.

- 837 • the ;
- 838 • the ;
- 839 • the ;

## 840 7.3 Recommendations

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## 7. Conclusions, Recommendations, and Future Directives



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## 886 7.4 Future Prospects

887 There are several prospects that may be extended for further studies. . . . So the suggested  
 888 topics are listed in the following.

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890 2. the . . . .

891 3. the . . . .

## 7. Conclusions, Recommendations, and Future Directives



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892 Note that for ECE undergraduate theses, as per the directions of the thesis adviser,  
893 Recommendations and Future Directives will be removed for the hardbound copy but will  
894 be retained for database storage.



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1189 following references for helpful guides for the bibliography and script editing in general.  
1190 Note that the links might be unavailable, but the names can be searched in the Web.

- 1191 1. IEEE Citation Reference: [www.ieee.org/documents/ieeecitationref.pdf](http://www.ieee.org/documents/ieeecitationref.pdf)
- 1192 2. IEEE Editorial Style manual: [www.ieee.org/documents/style\\_manual.pdf](http://www.ieee.org/documents/style_manual.pdf)
- 1193 3. IEEE Abbreviations for Transactions, Journals, Letters, and Magazines: [www.ieee.org/documents/trans\\_journal\\_names.pdf](http://www.ieee.org/documents/trans_journal_names.pdf)

1195 Also in your BibTeX file, enclose letters or words that should all be in uppercase in curly  
1196 brackets. Example: IBM, Philippines, eXtensible Markup Language.

1197 Produced: January 22, 2025, 17:23



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## **Appendix A**

1199

## **STUDENT RESEARCH ETHICS CLEARANCE**



1200

**RESEARCH ETHICS CLEARANCE FORM<sup>1</sup>**  
**For Thesis Proposals**

Names of Student Researcher(s):

Dela Cruz, Juan Z.

College: **Gokongwei College of Engineering**Department: **Electronics and Communications Engineering**Course: **PhD-ECE**Expected Duration of the Project: from: **April 2015**to: **April 2017**

Ethical considerations

None

*(The [Ethics Checklists](#) may be used as guides in determining areas for ethical concern/consideration)*

To the best of my knowledge, the ethical issues listed above have been addressed in the research.

**Dr. Francisco D. Baltasar**

Name and Signature of Adviser/Mentor:

Date: **April 8, 2017**

Noted by:

**Dr. Rafael W. Sison**

Name and Signature of the Department Chairperson:

Date: **April 8, 2017**

<sup>1</sup> The same form can be used for the reports of completed projects. The appropriate heading need only be used.



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## **Appendix B**

1202

# **ANSWERS TO QUESTIONS TO THIS THESIS**

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## **PROPOSAL**



## **B1 How important is the problem to practice?**

A possible answer to this question is the summary of your Significance of the Study, and that portion of the Problem Statement where you describe the ideal scenario for your intended audience.

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## **B2 How will you know if the solution/s that you will achieve would be better than existing ones?**

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### **B2.1 How will you measure the improvement/s?**

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### **B2.1.1 What is/are your basis/bases for the improvement/s?**

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### **B2.1.2 Why did you choose that/those basis/bases?**

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### **B2.1.3 How significant are your measure/s of the improvement/s?**

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### **B3 What is the difference of the solution/s from existing ones?**

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#### **B3.1 How is it different from previous and existing ones?**

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### **B4 What are the assumptions made (that are behind for your proposed solution to work)?**

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#### **B4.1 Will your proposed solution/s be sensitive to these assumptions?**

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#### **B4.2 Can your proposed solution/s be applied to more general cases when some assumptions are eliminated? If so, how?**

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#### **B5 What is the necessity of your approach / proposed solution/s?**

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**B5.1 What will be the limits of applicability of your proposed solution/s?**

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**B5.2 What will be the message of the proposed solution to technical people? How about to non-technical managers and business people?**

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**B6 How will you know if your proposed solution/s is/are correct?**

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### **B6.1 Will your results warrant the level of mathematics used (i.e., will the end justify the means)?**

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### **B7 Is/are there an/\_ alternative way/s to get to the same solution/s?**

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### **B7.1 Can you come up with illustrating examples, or even better, counterexamples to your proposed solution/s?**

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## **B7.2 Is there an approximation that can arrive at essentially the same proposed solution/s more easily?**

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## **B8 If you were the examiner of your Thesis Proposal, how would you present the Thesis Proposal in another way? Give your remarks, especially for your methodology and the results and discussions.**

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## **B8.1 What are the weaknesses of your Thesis Proposal, specifically your methodology and the results and discussions?**

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## **Appendix C**

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## **REVISIONS TO THE PROPOSAL**



Make a table with the following columns for showing the summary of revisions to the proposal based on the comments of the panel of examiners.

1. Examiner

2. Comment

3. Summary of how the comment was addressed

4. Locations in the document where the changes have been reflected

TABLE C.1 SUMMARY OF REVISIONS TO THE PROPOSAL

Examiner	Comment	Summary of how the comment was addressed	Locations
Dr. Francisco D. Baltasar	Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.	<p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.</p> <p><b>First</b> itemtext</p> <p><b>Second</b> itemtext</p> <p><b>Last</b> itemtext</p> <p><b>First</b> itemtext</p> <p><b>Second</b> itemtext</p>	<p>Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22</p>

*Continued on next page*





Continued from previous page

Examiner	Comment	Summary of how the comment was addressed	Locations
Dr. Amado Z. Hernandez	<p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.</p>	<p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.</p> <p><b>First</b> itemtext</p> <p><b>Second</b> itemtext</p> <p><b>Last</b> itemtext</p> <p><b>First</b> itemtext</p> <p><b>Second</b> itemtext</p>	<p>Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22</p>

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Examiner	Comment	Summary of how the comment was addressed	Locations
Dr. Jose Y. Alonzo	<p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.</p>	<p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.</p> <ul style="list-style-type: none"> <li>• First itemtext</li> <li>• Second itemtext</li> <li>• Last itemtext</li> <li>• First itemtext</li> <li>• Second itemtext</li> </ul>	<p>Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22</p>

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Examiner	Comment	Summary of how the comment was addressed	Locations
Dr. Mariana X. Mercado	<p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.</p>	<p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.</p> <ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	<p>Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22</p>

Continued on next page



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Examiner	Comment	Summary of how the comment was addressed	Locations
Dr. Rafael W. Sison	<p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.</p>	<p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.</p>	<p>Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22</p>



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## **Appendix D**

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## **REVISIONS TO THE FINAL**



Make a table with the following columns for showing the summary of revisions to the proposal based on the comments of the panel of examiners.

1. Examiner
2. Comment
3. Summary of how the comment has been addressed
4. Locations in the document where the changes have been reflected

TABLE D.1 SUMMARY OF REVISIONS TO THE THESIS PROPOSAL

Examiner	Comment	Summary of how the comment has been addressed	Locations
Dr. Francisco D. Baltasar	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol>	<ol style="list-style-type: none"> <li>1. First itemtext</li> <li>2. Second itemtext</li> <li>3. Last itemtext</li> <li>4. First itemtext</li> <li>5. Second itemtext</li> </ol> <p><b>First</b> itemtext</p> <p><b>Second</b> itemtext</p> <p><b>Last</b> itemtext</p> <p><b>First</b> itemtext</p> <p><b>Second</b> itemtext</p>	<p>Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22</p>

*Continued on next page*



*Continued from previous page*

Examiner	Comment	Summary of how the comment has been addressed	Locations
Dr. Amado Z. Hernandez	1. First itemtext 2. Second itemtext 3. Last itemtext 4. First itemtext 5. Second itemtext	1. First itemtext 2. Second itemtext 3. Last itemtext 4. First itemtext 5. Second itemtext  <b>First</b> itemtext  <b>Second</b> itemtext  <b>Last</b> itemtext  <b>First</b> itemtext  <b>Second</b> itemtext	Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22
Dr. Jose Y. Alonzo	1. First itemtext 2. Second itemtext 3. Last itemtext 4. First itemtext 5. Second itemtext	1. First itemtext 2. Second itemtext 3. Last itemtext 4. First itemtext 5. Second itemtext  • First itemtext  • Second itemtext  • Last itemtext  • First itemtext  • Second itemtext	Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22

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*Continued from previous page*

Examiner	Comment	Summary of how the comment has been addressed	Locations
Dr. Mariana X. Mercado	1. First itemtext 2. Second itemtext 3. Last itemtext 4. First itemtext 5. Second itemtext	1. First itemtext 2. Second itemtext 3. Last itemtext 4. First itemtext 5. Second itemtext	Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22
Dr. Rafael W. Sison	1. First itemtext 2. Second itemtext 3. Last itemtext 4. First itemtext 5. Second itemtext	1. First itemtext 2. Second itemtext 3. Last itemtext 4. First itemtext 5. Second itemtext	Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22





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## **Appendix E**

### **USAGE EXAMPLES**

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The user is expected to have a working knowledge of  $\text{\LaTeX}$ . A good introduction is in [Oetiker et al., 2014]. Its latest version can be accessed at <http://www.ctan.org/tex-archive/info/lshort>.

## E1 Equations

The following examples show how to typeset equations in  $\text{\LaTeX}$ . This section also shows examples of the use of `\gls{ }` commands in conjunction with the items that are in the `notation.tex` file. **Please make sure that the entries in `notation.tex` are those that are referenced in the  $\text{\LaTeX}$  document files used by this Thesis Proposal. Please comment out unused notations and be careful with the commas and brackets in `notation.tex`.**

In (E.1), the output signal  $y(t)$  is the result of the convolution of the input signal  $x(t)$  and the impulse response  $h(t)$ .

$$y(t) = h(t) * x(t) = \int_{-\infty}^{+\infty} h(t - \tau) x(\tau) d\tau \quad (\text{E.1})$$

Other example equations are as follows.

$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_2 \\ I_2 \end{bmatrix} \quad (\text{E.2})$$

$$\frac{1}{2} < \left[ \text{mod} \left( \left\lfloor \frac{y}{17} \right\rfloor 2^{-17\lfloor x \rfloor - \text{mod}(\lfloor y \rfloor, 17)}, 2 \right) \right], \quad (\text{E.3})$$

$$|\zeta(x)^3 \zeta(x + iy)^4 \zeta(x + 2iy)| = \exp \sum_{n,p} \frac{3 + 4 \cos(ny \log p) + \cos(2ny \log p)}{np^{nx}} \geq 1 \quad (\text{E.4})$$



1466

The verbatim  $\text{\LaTeX}$  code of Sec. E1 is in List. E.1.Listing E.1: Sample  $\text{\LaTeX}$  code for equations and notations usage

```

1 The following examples show how to typeset equations in \LaTeX. This
  section also shows examples of the use of \verb| \gls{ } | commands
  in conjunction with the items that are in the \verb| notation.tex |
  file. \textbf{Please make sure that the entries in} \verb| notation.
  tex |\textbf{ are those that are referenced in the \LaTeX \
  document files used by this \documentType. Please comment out
  unused notations and be careful with the commas and brackets in} \
  \verb| notation.tex |.

2
3 In~\eqref{eq:conv}, the output signal \gls{not:output_sigt} is the
  result of the convolution of the input signal \gls{not:input_sigt}
  and the impulse response \gls{not:ir}.

4
5 \begin{eqnarray}
6   y\left( t \right) = h\left( t \right) * x\left( t \right)=\int_{-\infty}^{+\infty}h\left( t-\tau \right)x\left( \tau \right) \mathrm{d}\tau
7   \label{eq:conv}
8 \end{eqnarray}
9
10 Other example equations are as follows.
11
12 \begin{eqnarray}
13   \left[ \begin{matrix} V_{1} \\ I_{1} \end{matrix} \right] =
14   \begin{matrix} A & B \\ C & D \end{matrix}
15   \begin{matrix} V_{2} \\ I_{2} \end{matrix}
16   \label{eq:ABCD}
17 \end{eqnarray}
18
19 \begin{eqnarray}
20   \left[ \begin{matrix} V_{1} \\ I_{1} \end{matrix} \right] =
21   \left[ \begin{matrix} A & B \\ C & D \end{matrix} \right]
22   \left[ \begin{matrix} V_{2} \\ I_{2} \end{matrix} \right]
23   \label{eq:ABCD}
24 \end{eqnarray}
25
26 \begin{eqnarray}
27   \left| \zeta(x)^3 \zeta(x + iy)^4 \zeta(x + 2iy) \right| =
28   \exp\sum_{n,p} \frac{3 + 4 \cos( ny \log p) + \cos(2ny \log p)}{np^{nx}}
29   \geq 1
30 \end{eqnarray}

```



## E2 Notations

In order to use the standardized notation, the user is highly suggested to see the ISO 80000-2 standard [ISO, 2009].

See [https://en.wikipedia.org/wiki/Help:Displaying\\_a\\_formula](https://en.wikipedia.org/wiki/Help:Displaying_a_formula) and [https://en.wikipedia.org/wiki/List\\_of\\_mathematical\\_symbols](https://en.wikipedia.org/wiki/List_of_mathematical_symbols) for L<sup>A</sup>T<sub>E</sub>X maths and other notations, respectively.

The following were taken from `isomath-test.tex`.

### E2.1 Math alphabets

If there are other symbols in place of Greek letters in a math alphabet, it uses T1 or OT1 font encoding instead of OML.

<code>mathnormal</code>	$A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9$
<code>mathit</code>	$A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \mathfrak{f}, \mathfrak{f}, \beta, ^\circ, !, v, w, 0, 1, 9$
<code>mathrm</code>	$A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \mathfrak{f}, \mathfrak{f}, \beta, ^\circ, !, v, w, 0, 1, 9$
<code>mathbf</code>	$\mathbf{A}, \mathbf{B}, \mathbf{\Gamma}, \mathbf{\Delta}, \mathbf{\Theta}, \mathbf{\Lambda}, \mathbf{\Xi}, \mathbf{\Pi}, \mathbf{\Sigma}, \mathbf{\Phi}, \mathbf{\Psi}, \mathbf{\Omega}, \mathbf{f}, \mathbf{f}, \mathbf{\beta}, ^\circ, !, v, w, 0, 1, 9$
<code>mathsf</code>	$A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \mathfrak{f}, \mathfrak{f}, \beta, ^\circ, !, v, w, 0, 1, 9$
<code>mathtt</code>	$A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \uparrow, \downarrow, \beta, ^\circ, !, v, w, 0, 1, 9$

New alphabets bold-italic, sans-serif-italic, and sans-serif-bold-italic.

<code>mathbfit</code>	$\mathbf{A}, \mathbf{B}, \mathbf{\Gamma}, \mathbf{\Delta}, \mathbf{\Theta}, \mathbf{\Lambda}, \mathbf{\Xi}, \mathbf{\Pi}, \mathbf{\Sigma}, \mathbf{\Phi}, \mathbf{\Psi}, \mathbf{\Omega}, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9$
<code>mathsf</code>	$A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9$
<code>mathsfbit</code>	$\mathbf{A}, \mathbf{B}, \mathbf{\Gamma}, \mathbf{\Delta}, \mathbf{\Theta}, \mathbf{\Lambda}, \mathbf{\Xi}, \mathbf{\Pi}, \mathbf{\Sigma}, \mathbf{\Phi}, \mathbf{\Psi}, \mathbf{\Omega}, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9$

Do the math alphabets match?

$\alpha x \alpha \omega \mathbf{a} x \alpha \omega \mathbf{a} x \alpha \omega \quad T C \Theta \Gamma T C \Theta \Gamma T C \Theta \Gamma$

### E2.2 Vector symbols

Alphabetic symbols for vectors are boldface italic,  $\lambda = e_1 \cdot \mathbf{a}$ , while numeric ones (e.g. the zero vector) are bold upright,  $\mathbf{a} + \mathbf{0} = \mathbf{a}$ .

### E2.3 Matrix symbols

Symbols for matrices are boldface italic, too:<sup>1</sup>  $\mathbf{A} = \mathbf{E} \cdot \mathbf{A}$ .

<sup>1</sup>However, matrix symbols are usually capital letters whereas vectors are small ones. Exceptions are physical quantities like the force vector  $\mathbf{F}$  or the electrical field  $\mathbf{E}$ .



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**E2.4 Tensor symbols**

1485

Symbols for tensors are sans-serif bold italic,

$$\boldsymbol{\alpha} = \boldsymbol{e} \cdot \boldsymbol{a} \quad \Longleftrightarrow \quad \alpha_{ijl} = e_{ijk} \cdot a_{kl}.$$

1486

The permittivity tensor describes the coupling of electric field and displacement:

$$\boldsymbol{D} = \epsilon_0 \boldsymbol{\epsilon}_r \boldsymbol{E}$$



## E2.5 Bold math version

The “bold” math version is selected with the commands `\boldmath` or `\mathversion{bold}`

`mathnormal`     $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9$

`mathit`     $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \mathfrak{f}, \mathfrak{fi}, \mathfrak{B}, ^\circ, !, v, w, 0, 1, 9$

`mathrm`     $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \mathfrak{f}, \mathfrak{fi}, \mathfrak{B}, ^\circ, !, v, w, 0, 1, 9$

`mathbf`     $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \mathfrak{f}, \mathfrak{fi}, \mathfrak{B}, ^\circ, !, v, w, 0, 1, 9$

`mathsf`     $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \mathfrak{f}, \mathfrak{fi}, \mathfrak{B}, ^\circ, !, v, w, 0, 1, 9$

`mathtt`     $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \uparrow, \downarrow, \mathfrak{B}, ^\circ, !, v, w, 0, 1, 9$

New alphabets bold-italic, sans-serif-italic, and sans-serif-bold-italic.

`mathbf`     $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9$

`mathsf`     $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9$

`mathsf`     $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9$

Do the math alphabets match?

$\alpha x \alpha \omega \alpha x \alpha \omega \alpha x \alpha \omega \quad TC\Theta\Gamma TC\Theta\Gamma TC\Theta\Gamma$

### E2.5.1 Vector symbols

Alphabetic symbols for vectors are boldface italic,  $\lambda = e_1 \cdot a$ , while numeric ones (e.g. the zero vector) are bold upright,  $a + 0 = a$ .

### E2.5.2 Matrix symbols

Symbols for matrices are boldface italic, too:<sup>2</sup>  $\Lambda = E \cdot A$ .

### E2.5.3 Tensor symbols

Symbols for tensors are sans-serif bold italic,

$$\alpha = e \cdot a \quad \Longleftrightarrow \quad \alpha_{ijl} = e_{ijk} \cdot a_{kl}.$$

The permittivity tensor describes the coupling of electric field and displacement:

$$D = \epsilon_0 \epsilon_r E$$

<sup>2</sup>However, matrix symbols are usually capital letters whereas vectors are small ones. Exceptions are physical quantities like the force vector  $F$  or the electrical field  $E$ .



1500 The verbatim L<sup>A</sup>T<sub>E</sub>X code of Sec. E2 is in List. E.2.

Listing E.2: Sample L<sup>A</sup>T<sub>E</sub>X code for notations usage

```

1501 1 % A teststring with Latin and Greek letters::
1502 2 \newcommand{\teststring}{%
1503 3 % capital Latin letters
1504 4 % A,B,C,
1505 5 A,B,
1506 6 % capital Greek letters
1507 7 %\Gamma,\Delta,\Theta,\Lambda,\Xi,\Pi,\Sigma,\Upsilon,\Phi,\Psi,
1508 8 \Gamma,\Delta,\Theta,\Lambda,\Xi,\Pi,\Sigma,\Phi,\Psi,\Omega,
1509 9 % small Greek letters
1510 10 \alpha,\beta,\pi,\nu,\omega,
1511 11 % small Latin letters:
1512 12 % compare \nu, \omega, v, and w
1513 13 v,w,
1514 14 % digits
1515 15 0,1,9
1516 16 }
1517 17
1518 18
1519 19 \subsection{Math alphabets}
1520 20
1521 21 If there are other symbols in place of Greek letters in a math
1522 22 alphabet, it uses T1 or OT1 font encoding instead of OML.
1523 23
1524 24 \begin{eqnarray*}
1525 25 \mbox{\mathnormal} & & \mbox{\teststring} \\
1526 26 \mbox{\mathit} & & \mbox{\mathit{\teststring}} \\
1527 27 \mbox{\mathrm} & & \mbox{\mathrm{\teststring}} \\
1528 28 \mbox{\mathbf} & & \mbox{\mathbf{\teststring}} \\
1529 29 \mbox{\mathsf} & & \mbox{\mathsf{\teststring}} \\
1530 30 \mbox{\mathtt} & & \mbox{\mathtt{\teststring}} \\
1531 31 \end{eqnarray*}
1532 32 New alphabets bold-italic, sans-serif-italic, and sans-serif-bold-
1533 33 italic.
1534 34 \begin{eqnarray*}
1535 35 \mbox{\mathbfit} & & \mbox{\mathbfit{\teststring}} \\
1536 36 \mbox{\mathsfit} & & \mbox{\mathsfit{\teststring}} \\
1537 37 \mbox{\mathsfbfit} & & \mbox{\mathsfbfit{\teststring}} \\
1538 38 \end{eqnarray*}
1539 39 %
1540 40 Do the math alphabets match?
1541 41 $
1542 42 \mathnormal {a x \alpha \omega}
1543 43 \mathbfit {a x \alpha \omega}
1544 44 \mathsfbfit{a x \alpha \omega}
1545 45 \quad
1546 46 \mathsfbfit{T C \Theta \Gamma}
1547 47 \mathbfit {T C \Theta \Gamma}
1548 48 \mathnormal {T C \Theta \Gamma}
1549 49 $
1550 50
1551 51 \subsection{Vector symbols}
1552 52

```



```

1555 53 Alphabetic symbols for vectors are boldface italic,
1556 54  $\vec{\lambda} = \vec{e}_1 \cdot \vec{a}$ ,
1557 55 while numeric ones (e.g. the zero vector) are bold upright,
1558 56  $\vec{a} + \vec{0} = \vec{a}$ .
1559 57
1560 58 \subsection{Matrix symbols}
1561 59
1562 60 Symbols for matrices are boldface italic, too:%
1563 61 \footnote{However, matrix symbols are usually capital letters whereas
1564 62 vectors
1565 62 are small ones. Exceptions are physical quantities like the force
1566 63 vector  $\vec{F}$  or the electrical field  $\vec{E}$ .%
1567 64 }
1568 65  $\Lambda = E \cdot A$ .
1569 66
1570 67
1571 68 \subsection{Tensor symbols}
1572 69
1573 70 Symbols for tensors are sans-serif bold italic,
1574 71
1575 72 \[
1576 73 \quad \text{\texttt{\textbf{tensorsym}\{alpha\}}} = \text{\texttt{\textbf{tensorsym}\{e\}}} \cdot \text{\texttt{\textbf{tensorsym}\{a\}}}
1577 74 \quad \quad \quad \text{\texttt{\textbf{quad}}} \quad \text{\texttt{\textbf{Longleftarrow}}} \quad \text{\texttt{\textbf{quad}}}
1578 75 \quad \text{\texttt{\textbf{alpha}\{ijl\}}} = \text{\texttt{\textbf{e}\{ijk\}}} \cdot \text{\texttt{\textbf{a}\{kl\}}}.
1579 76 \]
1580 77
1581 78
1582 79 The permittivity tensor describes the coupling of electric field and
1583 80 displacement: \[
1584 81 \vec{D} = \epsilon_0 \text{\texttt{\textbf{tensorsym}\{\epsilon\}\{\mathrm{r}\}}} \vec{E} \]
1585 82
1586 83
1587 84
1588 85 \newpage
1589 86 \subsection{Bold math version}
1590 87
1591 88 The ‘‘bold’’ math version is selected with the commands
1592 89 \verb+\boldmath+ or \verb+\mathversion{bold}+
1593 90
1594 91 {\boldmath
1595 92 \begin{eqnarray*}
1596 93 \quad \text{\texttt{\textbf{mbox}\{mathnormal\}}} & & \text{\texttt{\textbf{teststring}}} \\
1597 94 \quad \text{\texttt{\textbf{mbox}\{mathit\}}} & & \text{\texttt{\textbf{mathit}\{teststring\}}} \\
1598 95 \quad \text{\texttt{\textbf{mbox}\{mathrm\}}} & & \text{\texttt{\textbf{mathrm}\{teststring\}}} \\
1599 96 \quad \text{\texttt{\textbf{mbox}\{mathbf\}}} & & \text{\texttt{\textbf{mathbf}\{teststring\}}} \\
1600 97 \quad \text{\texttt{\textbf{mbox}\{mathsf\}}} & & \text{\texttt{\textbf{mathsf}\{teststring\}}} \\
1601 98 \quad \text{\texttt{\textbf{mbox}\{mathtt\}}} & & \text{\texttt{\textbf{mathtt}\{teststring\}}} \\
1602 99 \end{eqnarray*}
1603 100 \quad New alphabets bold-italic, sans-serif-italic, and sans-serif-bold-
1604 101 italic.
1605 102 \begin{eqnarray*}
1606 102 \quad \text{\texttt{\textbf{mbox}\{mathbfit\}}} & & \text{\texttt{\textbf{mathbfit}\{teststring\}}} \\
1607 103 \quad \text{\texttt{\textbf{mbox}\{mathsf fit\}}} & & \text{\texttt{\textbf{mathsf fit}\{teststring\}}} \\
1608 104 \quad \text{\texttt{\textbf{mbox}\{mathsf bfit\}}} & & \text{\texttt{\textbf{mathsf bfit}\{teststring\}}} \\
1609 105 \end{eqnarray*}
1610 106 \%
1611 107 Do the math alphabets match?

```





```

1612 108
1613 109 $
1614 110 \mathnormal {a x \alpha \omega}
1615 111 \mathbf{f}it {a x \alpha \omega}
1616 112 \mathsf{f}it{a x \alpha \omega}
1617 113 \quad
1618 114 \mathsf{f}it{T C \Theta \Gamma}
1619 115 \mathbf{f}it {T C \Theta \Gamma}
1620 116 \mathnormal {T C \Theta \Gamma}
1621 117 $
1622 118
1623 119 \subsection{Vector symbols}
1624 120
1625 121 Alphabetic symbols for vectors are boldface italic,
1626 122 $\vec{\lambda}=\vec{e}_1\cdot\vec{a}$,
1627 123 while numeric ones (e.g. the zero vector) are bold upright,
1628 124 $\vec{a} + \vec{0} = \vec{a}$.
1629 125
1630 126
1631 127
1632 128
1633 129 \subsection{Matrix symbols}
1634 130
1635 131 Symbols for matrices are boldface italic, too:%
1636 132 \footnote{However, matrix symbols are usually capital letters whereas
1637 133 vectors
1638 134 are small ones. Exceptions are physical quantities like the force
1639 135 vector $\vec{F}$ or the electrical field $\vec{E}$.%
1640 136 }
1641 137 $\matrixsym{\Lambda}=\matrixsym{E}\cdot\matrixsym{A}$.
1642 138
1643 139 \subsection{Tensor symbols}
1644 140
1645 141 Symbols for tensors are sans-serif bold italic,
1646 142
1647 143 \[
1648 144 \tensorsym{\alpha} = \tensorsym{e}\cdot\tensorsym{a}
1649 145 \quad \Longleftrightarrow \quad
1650 146 \alpha_{ijl} = e_{ijk}\cdot a_{kl}.
1651 147 \]
1652 148
1653 149 The permittivity tensor describes the coupling of electric field and
1654 150 displacement: \[
1655 151 \vec{D}=\epsilon_0\tensorsym{\epsilon}_{\mathrm{r}}\vec{E}\]
1656 152 }

```



## E3 Abbreviation

This section shows examples of the use of  $\LaTeX$  commands in conjunction with the items that are in the `abbreviation.tex` and in the `glossary.tex` files. Please see List. E.3. **To lessen the  $\LaTeX$  parsing time, it is suggested that you use `\acr{ }` only for the first occurrence of the word to be abbreviated.**

Again please see List. E.3. Here is an example of first use: alternating current (ac). Next use: ac. Full: alternating current (ac). Here's an acronym referenced using `\acr` : hyper-text markup language (html). And here it is again: html. If you are used to the glossaries package, note the difference in using `\gls` : hyper-text markup language (html). And again (no difference): hyper-text markup language (html). For plural use `\glspl` . Here are some more entries:

- extensible markup language (xml) and cascading style sheet (css).
- Next use: xml and css.
- Full form: extensible markup language (xml) and cascading style sheet (css).
- Reset again.
- Start with a capital. Hyper-text markup language (html).
- Next: Html. Full: Hyper-text markup language (html).
- Prefer capitals? Extensible markup language (XML). Next: XML. Full: extensible markup language (XML).
- Prefer small-caps? Cascading style sheet (CSS). Next: CSS. Full: cascading style sheet (CSS).
- Resetting all acronyms.
- Here are the acronyms again:
- Hyper-text markup language (HTML), extensible markup language (XML) and cascading style sheet (CSS).
- Next use: HTML, XML and CSS.
- Full form: Hyper-text markup language (HTML), extensible markup language (XML) and cascading style sheet (CSS).



- 1688 • Provide your own link text: style sheet.

1689 The verbatim  $\text{\LaTeX}$  code of Sec. E3 is in List. E.3.

### Listing E.3: Sample $\text{\LaTeX}$ code for abbreviations usage

```

1 Again please see List.~\ref{lst:abbrv}. Here is an example of first use:
   \acr{ac}. Next use: \acr{ac}. Full: \gls{ac}. Here's an acronym
   referenced using \verb| \acr |: \acr{html}. And here it is again: \
   acr{html}. If you are used to the \texttt{glossaries} package, note
   the difference in using \verb| \gls |: \gls{html}. And again (no
   difference): \gls{html}. Here are some more entries:
2
3 \begin{itemize}
4
5   \item \acr{xml} and \acr{css}.
6
7   \item Next use: \acr{xml} and \acr{css}.
8
9   \item Full form: \gls{xml} and \gls{css}.
10
11  \item Reset again. \glsresetall{abbreviation}
12
13  \item Start with a capital. \Acr{html}.
14
15  \item Next: \Acr{html}. Full: \Gls{html}.
16
17  \item Prefer capitals? \renewcommand{\acronymfont}[1]{\
   MakeTextUppercase{#1}} \Acr{xml}. Next: \acr{xml}. Full: \gls{xml}
   }.
18
19  \item Prefer small-caps? \renewcommand{\acronymfont}[1]{\textsc{#1}}
   \Acr{css}. Next: \acr{css}. Full: \gls{css}.
20
21  \item Resetting all acronyms.\glsresetall{abbreviation}
22
23  \item Here are the acronyms again:
24
25  \item \Acr{html}, \acr{xml} and \acr{css}.
26
27  \item Next use: \Acr{html}, \acr{xml} and \acr{css}.
28
29  \item Full form: \Gls{html}, \gls{xml} and \gls{css}.
30
31  \item Provide your own link text: \glslink{[textbf]css}{style}
32
33 \end{itemize}

```



## E4 Glossary

This section shows examples of the use of `\gls{ }` commands in conjunction with the items that are in the `glossary.tex` and `notation.tex` files. Note that entries in `notation.tex` are prefixed with “not:” label (see List. E.4).

**Please make sure that the entries in `notation.tex` are those that are referenced in the  $\LaTeX$  document files used by this Thesis Proposal. Please comment out unused notations and be careful with the commas and brackets in `notation.tex`.**

- Matrices are usually denoted by a bold capital letter, such as  $\mathbf{A}$ . The matrix's  $(i, j)$ th element is usually denoted  $a_{ij}$ . Matrix  $\mathbf{I}$  is the identity matrix.
- A set, denoted as  $\mathcal{S}$ , is a collection of objects.
- The universal set, denoted as  $\mathcal{U}$ , is the set of everything.
- The empty set, denoted as  $\emptyset$ , contains no elements.
- Functional Analysis is seen as the study of complete normed vector spaces, i.e., Banach spaces.
- The cardinality of a set, denoted as  $|\mathcal{S}|$ , is the number of elements in the set.

The verbatim  $\LaTeX$  code for the part of Sec. E4 is in List. E.4.

Listing E.4: Sample  $\LaTeX$  code for glossary and notations usage

```

1 \begin{itemize}
2
3   \item \Glspl{matrix} are usually denoted by a bold capital letter,
      such as  $\mathbf{A}$ . The  $\mathbf{A}$ 's  $(i,j)$ th element is
      usually denoted  $a_{ij}$ .  $\mathbf{I}$  is the
      identity  $\mathbf{I}$ .
4
5   \item A set, denoted as  $\mathbf{S}$ , is a collection of objects.
6
7   \item The universal set, denoted as  $\mathbf{U}$ , is the
      set of everything.
8
9   \item The empty set, denoted as  $\emptyset$ , contains no
      elements.
10
11  \item  $\mathbf{FA}$  is seen as the study of complete
      normed vector spaces, i.e., Banach spaces.
12
13  \item The cardinality of a set, denoted as  $\mathbf{card(S)}$ , is
      the number of elements in the set.
14
15 \end{itemize}

```



## E5 Figure

This section shows several ways of placing figures. PDFL<sup>A</sup>T<sub>E</sub>X compatible files are PDF, PNG, and JPG. Please see the `figure` subdirectory.



Fig. E.1 A quadrilateral image example.



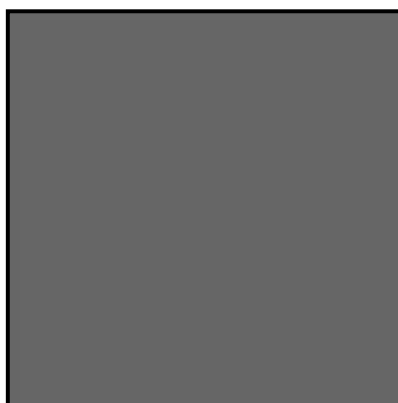
1709 Fig. E.1 is a gray box enclosed by a dark border. List. E.5 shows the corresponding  
1710  $\text{\LaTeX}$  code.

Listing E.5: Sample  $\text{\LaTeX}$  code for a single figure

```
1 \begin{figure}[!htbp]
2   \centering
3   \includegraphics[width=0.5\textwidth]{example}
4   \caption{A quadrilateral image example.}
5   \label{fig:example}
6 \end{figure}
7 \cleardoublepage
8
9 Fig.~\ref{fig:example} is a gray box enclosed by a dark border. List.~\
  ref{lst:onefig} shows the corresponding  $\text{\LaTeX}$  \ code.
10 \end{figure}
```



(a) A sub-figure in the top row.



(b) A sub-figure in the middle row.



(c) A sub-figure in the bottom row.

Fig. E.2 Figures on top of each other. See List. E.6 for the corresponding  $\text{\LaTeX}$  code.

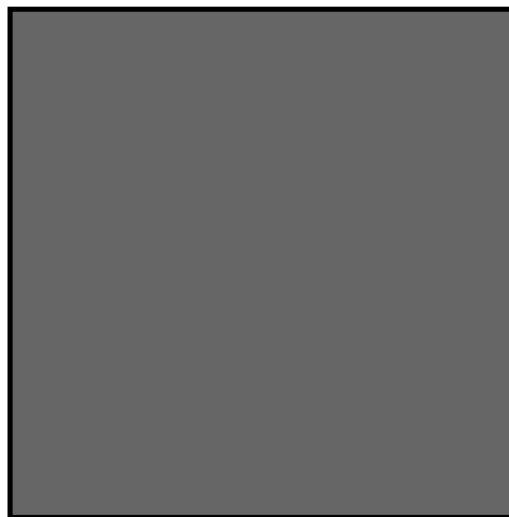


Listing E.6: Sample L<sup>A</sup>T<sub>E</sub>X code for three figures on top of each other

```
1 \begin{figure}[!htbp]
2 \centering
3 \subbottom[A sub-figure in the top row.]{
4 \includegraphics[width=0.35\textwidth]{example_gray_box}
5 \label{fig:top}
6 }
7 \vfill
8 \subbottom[A sub-figure in the middle row.]{
9 \includegraphics[width=0.35\textwidth]{example_gray_box}
10 \label{fig:mid}
11 }
12 \vfill
13 \subbottom[A sub-figure in the bottom row.]{
14 \includegraphics[width=0.35\textwidth]{example_gray_box}
15 \label{fig:botm}
16 }
17 \caption{Figures on top of each other}
18 \label{fig:tmb}
19 \end{figure}
```



(a) A sub-figure in the upper-left corner.



(b) A sub-figure in the upper-right corner.



(c) A sub-figure in the lower-left corner.



(d) A sub-figure in the lower-right corner

Fig. E.3 Four figures in each corner. See List. E.7 for the corresponding  $\text{\LaTeX}$  code.

Listing E.7: Sample  $\text{\LaTeX}$  code for the four figures

```

1 \begin{figure}[!htbp]
2 \centering
3 \subbottom[A sub-figure in the upper-left corner.]{
4 \includegraphics[width=0.45\textwidth]{example_gray_box}
5 \label{fig:upprleft}
6 }
7 \hfill
8 \subbottom[A sub-figure in the upper-right corner.]{
9 \includegraphics[width=0.45\textwidth]{example_gray_box}
10 \label{fig:uppright}
11 }
12 \vfill
13 \subbottom[A sub-figure in the lower-left corner.]{
14 \includegraphics[width=0.45\textwidth]{example_gray_box}
15 \label{fig:lowerleft}
16 }
17 \hfill
18 \subbottom[A sub-figure in the lower-right corner]{
19 \includegraphics[width=0.45\textwidth]{example_gray_box}
20 \label{fig:lowright}
21 }
22 \caption{Four figures in each corner. See List.\ref{lst:fourfigs} for
23 the corresponding \LaTeX \ code.}
24 \label{fig:fourfig}
25 \end{figure}

```



## E6 Table

This section shows an example of placing a table (a long one). Table E.1 are the triples.

TABLE E.1 FEASIBLE TRIPLES FOR HIGHLY VARIABLE GRID

Time (s)	Triple chosen	Other feasible triples
0	(1, 11, 13725)	(1, 12, 10980), (1, 13, 8235), (2, 2, 0), (3, 1, 0)
2745	(1, 12, 10980)	(1, 13, 8235), (2, 2, 0), (2, 3, 0), (3, 1, 0)
5490	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
8235	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
10980	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
13725	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
16470	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
19215	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
21960	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
24705	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
27450	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
30195	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
32940	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
35685	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
38430	(1, 13, 10980)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
41175	(1, 12, 13725)	(1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
43920	(1, 13, 10980)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
46665	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
49410	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
52155	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
54900	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
57645	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
60390	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
63135	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
65880	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
68625	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
71370	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
74115	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
76860	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
79605	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
82350	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
85095	(1, 12, 13725)	(1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
87840	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
90585	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
93330	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
96075	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
98820	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
101565	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
104310	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
107055	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
109800	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
112545	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
115290	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
118035	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
120780	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
123525	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)

*Continued on next page*



*Continued from previous page*

Time (s)	Triple chosen	Other feasible triples
126270	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
129015	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
131760	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
134505	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
137250	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
139995	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
142740	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
145485	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
148230	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
150975	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
153720	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
156465	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
159210	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
161955	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
164700	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)



1714

List. E.8 shows the corresponding  $\text{\LaTeX}$  code.Listing E.8: Sample  $\text{\LaTeX}$  code for making typical table environment

```

1715 1 \begin{center}
1716 2 {\scriptsize
1717 3 \begin{tabularx}{\textwidth}{p{0.1\textwidth}|p{0.2\textwidth}|p{0.5\textwidth}}
1718 4 \caption{Feasible triples for highly variable grid} \label{tab:triple_
1719 5 grid} \\
1720 6 \hline
1721 7 \textbf{Time (s)} &
1722 8 \textbf{Triple chosen} &
1723 9 \textbf{Other feasible triples} \\
1724 10 \hline
1725 11 \endfirsthead
1726 12 \multicolumn{3}{c}{\textit{Continued from previous page}} \\
1727 13 \hline
1728 14 \hline
1729 15 \textbf{Time (s)} &
1730 16 \textbf{Triple chosen} &
1731 17 \textbf{Other feasible triples} \\
1732 18 \hline
1733 19 \endhead
1734 20 \hline
1735 21 \multicolumn{3}{r}{\textit{Continued on next page}} \\
1736 22 \endfoot
1737 23 \hline
1738 24 \endlastfoot
1739 25 \hline
1740 26
1741 27
1742 28 0 & (1, 11, 13725) & (1, 12, 10980), (1, 13, 8235), (2, 2, 0), (3, 1, 0) \\
1743 29 & & \\
1744 30 2745 & (1, 12, 10980) & (1, 13, 8235), (2, 2, 0), (2, 3, 0), (3, 1, 0) \\
1745 31 & & \\
1746 32 5490 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1747 33 8235 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1748 34 10980 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1749 35 13725 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1750 36 16470 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1751 37 19215 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1752 38 21960 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1753 39 24705 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1754 40 27450 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1755 41 30195 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
1756 42 32940 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1757 43 35685 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1758 44 38430 & (1, 13, 10980) & (2, 2, 2745), (2, 3, 0), (3, 1, 0)

```



```

1769 43 41175 & (1, 12, 13725) & (1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1,
1770      0) \\
1771 44 43920 & (1, 13, 10980) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1772 45 46665 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
1773 46 49410 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
1774 47 52155 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1,
1775      0) \\
1776 48 54900 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1777 49 57645 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1778 50 60390 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1779 51 63135 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1780 52 65880 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1781 53 68625 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
1782 54 71370 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1783 55 74115 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1784 56 76860 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1785 57 79605 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1786 58 82350 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1787 59 85095 & (1, 12, 13725) & (1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1,
1788      0) \\
1789 60 87840 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1790 61 90585 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1791 62 93330 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1792 63 96075 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1793 64 98820 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1794 65 101565 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1795 66 104310 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1796 67 107055 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1797 68 109800 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1798 69 112545 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3,
1799      1, 0) \\
1800 70 115290 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1801 71 118035 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1802 72 120780 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1803 73 123525 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1804 74 126270 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3,
1805      1, 0) \\
1806 75 129015 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
1807 76 131760 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
1808 77 134505 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1809 78 137250 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1810 79 139995 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
1811 80 142740 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
1812 81 145485 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3,
1813      1, 0) \\
1814 82 148230 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
1815 83 150975 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1816 84 153720 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1817 85 156465 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1818 86 159210 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1819 87 161955 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1820 88 164700 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
1821 89 \end{tabularx}
1822 90 }
1823 91 \end{center}
1824

```



1825

E7 Algorithm or Pseudocode Listing

1826

1827

1828

Table E.2 shows an example pseudocode. Note that if the pseudocode exceeds one page, it can mean that its implementation is not modular. List. E.9 shows the corresponding L<sup>A</sup>T<sub>E</sub>X code.

TABLE E.2 CALCULATION OF  $y = x^n$

<b>Input(s):</b>	
$n$	: $n$ th power; $n \in \mathbb{Z}^+$
$x$	: base value; $x \in \mathbb{R}^+$
<b>Output(s):</b>	
$y$	: result; $y \in \mathbb{R}^+$

```
Require:  $n \geq 0 \vee x \neq 0$ 
Ensure:  $y = x^n$ 
1:  $y \leftarrow 1$ 
2: if  $n < 0$  then
3:    $X \leftarrow 1/x$ 
4:    $N \leftarrow -n$ 
5: else
6:    $X \leftarrow x$ 
7:    $N \leftarrow n$ 
8: end if
9: while  $N \neq 0$  do
10:  if  $N$  is even then
11:     $X \leftarrow X \times X$ 
12:     $N \leftarrow N/2$ 
13:  else  $\{N$  is odd $\}$ 
14:     $y \leftarrow y \times X$ 
15:     $N \leftarrow N - 1$ 
16:  end if
17: end while
```



Listing E.9: Sample L<sup>A</sup>T<sub>E</sub>X code for algorithm or pseudocode listing usage

```

1 \begin{table}[!htbp]
2   \caption{Calculation of  $y = x^n$ }
3   \label{tab:calcxn}
4   {\footnotesize
5     \begin{tabular}{lll}
6       \hline
7       \hline
8       {\bfseries Input(s):} & & \\
9       $n$ & : & $n$th power; $n$ \in \mathbb{Z}^{+}$ \\
10      $x$ & : & base value; $x$ \in \mathbb{R}^{+}$ \\
11      \hline
12      {\bfseries Output(s):} & & \\
13      $y$ & : & result; $y$ \in \mathbb{R}^{+}$ \\
14      \hline
15      \hline
16      \\
17    \end{tabular}
18  }
19  \begin{algorithmic}[1]
20    {\footnotesize
21      \REQUIRE $n \geq 0$ \vee $x \neq 0$
22      \ENSURE $y = x^n$
23      \STATE $y \leftarrow 1$
24      \IF{$n < 0$}
25        \STATE $X \leftarrow 1 / x$
26        \STATE $N \leftarrow -n$
27      \ELSE
28        \STATE $X \leftarrow x$
29        \STATE $N \leftarrow n$
30      \ENDIF
31      \WHILE{$N \neq 0$}
32        \IF{$N$ is even}
33          \STATE $X \leftarrow X \times X$
34          \STATE $N \leftarrow N / 2$
35        \ELSE[$N$ is odd]
36          \STATE $y \leftarrow y \times X$
37          \STATE $N \leftarrow N - 1$
38        \ENDIF
39      \ENDWHILE
40    }
41  \end{algorithmic}
42 \end{table}

```



## E8 Program/Code Listing

List. E.10 is a program listing of a C code for computing Fibonacci numbers by calling the actual code. Please see the `code` subdirectory.

Listing E.10: Computing Fibonacci numbers in C (./code/fibo.c)

```

1  /* fibo.c -- It prints out the first N Fibonacci
2  *              numbers.
3  */
4
5  #include <stdio.h>
6
7  int main(void) {
8      int n;          /* Number of fibonacci numbers we will print */
9      int i;          /* Index of fibonacci number to be printed next */
10     int current;     /* Value of the (i)th fibonacci number */
11     int next;        /* Value of the (i+1)th fibonacci number */
12     int twoaway;     /* Value of the (i+2)th fibonacci number */
13
14     printf("How many Fibonacci numbers do you want to compute? ");
15     scanf("%d", &n);
16     if (n<=0)
17         printf("The number should be positive.\n");
18     else {
19         printf("\n\n\tI\t\t\tFibonacci(I)\t\t\t\n\n\t=====\\n");
20         next = current = 1;
21         for (i=1; i<=n; i++) {
22             printf("\t%d\t\t\t\t%d\\n", i, current);
23             twoaway = current+next;
24             current = next;
25             next = twoaway;
26         }
27     }
28 }
29
30 /* The output from a run of this program was:
31
32 How many Fibonacci numbers do you want to compute? 9
33
34     I      Fibonacci(I)
35     =====
36     1      1
37     2      1
38     3      2
39     4      3
40     5      5
41     6      8
42     7     13
43     8     21
44     9     34
45
46 */

```



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List. E.11 shows the corresponding  $\text{\LaTeX}$  code.

Listing E.11: Sample  $\text{\LaTeX}$  code for program listing

```
1 List.~\ref{lst:fib_c} is a program listing of a C code for computing  
Fibonacci numbers by calling the actual code. Please see the \verb|  
code | subdirectory.
```



## E9 Referencing

Referencing chapters: This appendix is in Appendix E, which is about examples in using various  $\LaTeX$  commands.

Referencing sections: This section is Sec. E9, which shows how to refer to the locations of various labels that have been placed in the  $\LaTeX$  files. List. E.12 shows the corresponding  $\LaTeX$  code.

Listing E.12: Sample  $\LaTeX$  code for referencing sections

```
1 Referencing sections: This section is Sec.~\ref{sec:ref}, which shows
   how to refer to the locations of various labels that have been
   placed in the \LaTeX \ files. List.~\ref{lst:refsec} shows the
   corresponding \LaTeX \ code.
```

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.



## E9.1 A subsection

Referencing subsections: This section is Sec. E9.1, which shows how to refer to a subsection. List. E.13 shows the corresponding  $\text{\LaTeX}$  code.

### Listing E.13: Sample $\text{\LaTeX}$ code for referencing subsections

```
1 Referencing subsections: This section is Sec.~\ref{sec:subsec}, which
  shows how to refer to a subsection. List.~\ref{lst:refsub} shows the
  corresponding \LaTeX \ code.
```

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.



### E9.1.1 A sub-subsection

Referencing sub-subsections: This section is Sec. E9.1.1, which shows how to refer to a sub-subsection. List. E.14 shows the corresponding  $\text{\LaTeX}$  code.

#### Listing E.14: Sample $\text{\LaTeX}$ code for referencing sub-subsections

```
1 Referencing sub-subsections: This section is Sec.\ref{sec:subsubsec},
   which shows how to refer to a sub-subsection. List.\ref{lst:
   refsubsub} shows the corresponding \LaTeX \ code.
```

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.



## E10 Citing

Citing bibliography content is done using BibTeX. It requires the creation of a BibTeX file (.bib extension name), and then added in the argument of `\bibliography{ }`. For each .bib file, separate them by a comma in the argument of `\bibliography{ }` without the extension name. Building your BibTeX file (references.bib) can be done easily with a tool called JabRef ([www.jabref.org](http://www.jabref.org)).

The following subsections are examples of citations.

### E10.1 Books

- ['Chicago', 1982]
- [Aristotle, 1877]
- [Aristotle, 1907]
- [Aristotle, 1968]
- [Aristotle, 1929]
- [ABCM, 1959]
- [Augustine, 1995]
- [Averroes, 1982]
- [Butcher, 1981]
- [Chapman, 1975]
- [Cicero, 1995]
- [Coleridge, 1983]
- [Cotton et al., 1999]
- [van Gennep, 1909a]
- [van Gennep, 1909b]
- [van Gennep, 1960]
- [Gerhardt, 2000]
- [Gonzalez, 2001]



- 1898 • [Goossens et al., 1994]
- 1899 • [Hammond, 1997]
- 1900 • [HersHKovitz, 1962]
- 1901 • [Hoel, 1971a]
- 1902 • [Homer, 2004]
- 1903 • [Knuth, 1981a]
- 1904 • [Knuth, 1981b]
- 1905 • [Knuth, 1973a]
- 1906 • [Kullback, 1997a]
- 1907 • [Kullback, 1997b]
- 1908 • [Kullback, 1959]
- 1909 • [Malinowski, 1972]
- 1910 • [Maron, 2000]
- 1911 • [Massa, 2004]
- 1912 • [McColvin, 2004]
- 1913 • [Nietzsche, 1988b]
- 1914 • [Nietzsche, 1988a]
- 1915 • [Oetiker et al., 2014]
- 1916 • [Piccato, 2001]
- 1917 • [Smart, 1976]
- 1918 • [Vázquez de Parga et al., 1993]
- 1919 • [Wilde, 1899]
- 1920 • [Wood, 1961]
- 1921 • [Worman, 2002]
- 1922 • [Wright, 1978a]
- 1923 • [Lipcoll et al., 1977]





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**E10.2 Booklets**

1925

- [Knvth, 1988]

1926

**E10.3 Proceedings**

1927

- [Oz and Yannakakis, 1983]

1928

**E10.4 In books**

1929

- [von Brandt and Hoffmann, 1987]

1930

- [BSI, 1973a]

1931

- [Eckstein and Zuckermann, 1960]

1932

- [Feigl, 1958]

1933

- [Gordon, 1975]

1934

- [Hanson, 1967]

1935

- [Hoel, 1971b]

1936

- [Hyman, 1981]

1937

- [Kant, 1968a]

1938

- [Kant, 1968b]

1939

- [Knuth, 1973b]

1940

- [Knuth, 1973c]

1941

- [Lincoll, 1977a]

1942

- [Lincoll, 2004]

1943

- [Lincoll, 1977b]

1944

- [McNeill, 1963]

1945

- [Milton, 1924]

1946

- [Nietzsche, 1988c]



- 1947 • [Ogilvy, 1965]
- 1948 • [Pines, 1979]
- 1949 • [Ramsbottom, 1931]
- 1950 • [Ranganthan, 1951]
- 1951 • [Thomson, 1971]
- 1952 • [Westfahl, 2004]
- 1953 • [Wright, 1963]
- 1954 • [Wright, 1978b]

### E10.5 In proceedings

- 1955 • [Chave, 1964]
- 1956 • [Chomsky, 1973]
- 1957 • [Morau, 1979]
- 1958 • [Oaho et al., 1983a]
- 1959 • [Oaho et al., 2004]
- 1960 • [Oaho et al., 1983b]
- 1961 • [Salam, 1968]

### E10.6 Journals

- 1963 • [Aamport, 2004]
- 1964 • [Aamport, 1986a]
- 1965 • [Aamport, 1986b]
- 1966 • [Aksin et al., 2006]
- 1967 • [Angenendt, 2002]
- 1968 • [Aslin, 1949]



- |      |                                 |
|------|---------------------------------|
| 1970 | • [Baez and Lauda, 2004a]       |
| 1971 | • [Bertram and Wentworth, 1996] |
| 1972 | • [Bry and Afflerbach, 1968]    |
| 1973 | • [Doody, 1974]                 |
| 1974 | • [Einstein, 1905]              |
| 1975 | • [Fletcher and Hopkins, 1907]  |
| 1976 | • [Gillies, 1933]               |
| 1977 | • [Glashow, 1961]               |
| 1978 | • [Godfrey, 1959]               |
| 1979 | • [Hanlon, 1972]                |
| 1980 | • [Heller and Lederis, 1958]    |
| 1981 | • [Herrmann et al., 2006]       |
| 1982 | • [Hostetler et al., 1998]      |
| 1983 | • [Howells, 1966a]              |
| 1984 | • [Howells, 1966b]              |
| 1985 | • [Howells, 1951]               |
| 1986 | • [ISO, 2009]                   |
| 1987 | • [Jackson, 1979]               |
| 1988 | • [Johnson, 1974]               |
| 1989 | • [Moore, 1998]                 |
| 1990 | • [Moore, 1965]                 |
| 1991 | • [Prufer, 1964]                |
| 1992 | • [Reese, 1958]                 |
| 1993 | • [Sarfraz and Razzak, 2002]    |



- 1994 • [Shore, 1991]
- 1995 • [Sigfridsson and Ryde, 1998]
- 1996 • [Weinberg, 1967]
- 1997 • [Yoon et al., 2006]
- 1998 • [GAJ, 1986]

### E10.7 Theses/dissertations

- 1999
- 2000 • [Croft, 1978]
- 2001 • [Maguire, 1976]
- 2002 • [Mann, 1968]
- 2003 • [Masterly, 1988a]
- 2004 • [Masterly, 1988b]
- 2005 • [Phony-Baloney, 1988a]
- 2006 • [Phony-Baloney, 1988b]

### E10.8 Technical Reports and Others

- 2007
- 2008 • ['Brunswick', 1985]
- 2009 • [BSI, 1983]
- 2010 • [BSI, 1978]
- 2011 • [BSI, 1976]
- 2012 • [BSI, 1973b]
- 2013 • [Ellis and Walton, 1971]
- 2014 • [Terrific, 1988]
- 2015 • [Terrific, 1988]
- 2016 • [Winget Ltd., 1967]



2017 • [Ünderwood et al., 2004]

2018 • [Ünderwood et al., 1988]

2019 • [Downes, 1974]

2020 • [Exchequer, 1639]

2021 • [Pym, 1624]

2022 • [Traquair, 1638]

## 2023 **E10.9 Miscellaneous**

2024 • [Almendro et al., 1998]

2025 • [Baez and Lauda, 2004b]

2026 • [Chiu and Chow, 1978]

2027 • [Itzhaki, 1996]

2028 • [Kowalik and Isard, 1995]

2029 • [Laufenberg et al., 2006]

2030 • [Loh, 1992]

2031 • [Markey, 2005]

2032 • [Missilany, 1984]

2033 • [Padhye et al., 1999]

2034 • [Sorace et al., 1997]

2035 • [Wassenberg and Sanders, 2010]

2036 • [Missilany, 2004]



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## E11 Index

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For key words or topics that are expected (or the user would like) to appear in the Index, use `\index{key}`, where `key` is an example keyword to appear in the Index. For example, Fredholm integral and Fourier operator of the following paragraph are in the Index.

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If we make a very large matrix with complex exponentials in the rows (i.e., cosine real parts and sine imaginary parts), and increase the resolution without bound, we approach the kernel of the Fredholm integral equation of the 2nd kind, namely the Fourier operator that defines the continuous Fourier transform.

List. E.15 is a program listing of the above-mentioned paragraph.

### Listing E.15: Sample $\text{\LaTeX}$ code for Index usage

```
1 If we make a very large matrix with complex exponentials in the rows (i.
  e., cosine real parts and sine imaginary parts), and increase the
  resolution without bound, we approach the kernel of the \index{
  Fredholm integral} Fredholm integral equation of the 2nd kind,
  namely the \index{Fourier} Fourier operator that defines the
  continuous Fourier transform.
```



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## E12 Adding Relevant PDF Pages

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Examples of such PDF pages are Standards, Datasheets, Specification Sheets, Application Notes, etc. Selected PDF pages can be added (see List. E.16), but note that the options must be tweaked. See the manual of `pdftpages` for other options.

Listing E.16: Sample  $\text{\LaTeX}$  code for including PDF pages

```
1 \includepdf[pages={8-10},%  
2 offset=3.5mm -10mm,%  
3 scale=0.73,%  
4 frame,%  
5 pagecommand={},]  
6 {./reference/Xilinx2015-UltraScale-Architecture-Overview.pdf}
```



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UltraScale Architecture and Product Overview

## Virtex UltraScale FPGA Feature Summary

Table 6: Virtex UltraScale FPGA Feature Summary

	VU065	VU080	VU095	VU125	VU160	VU190	VU440
Logic Cells	626,640	780,000	940,800	1,253,280	1,621,200	1,879,920	4,432,680
CLB Flip-Flops	716,160	891,424	1,075,200	1,432,320	1,852,800	2,148,480	5,065,920
CLB LUTs	358,080	445,712	537,600	716,160	926,400	1,074,240	2,532,960
Maximum Distributed RAM (Mb)	4.8	3.9	4.8	9.7	12.7	14.5	28.7
Block RAM/FIFO w/ECC (36Kb each)	1,260	1,421	1,728	2,520	3,276	3,780	2,520
Total Block RAM (Mb)	44.3	50.0	60.8	88.6	115.2	132.9	88.6
CMT (1 MMCM, 2 PLLs)	10	16	16	20	30	30	30
I/O DLLs	40	64	64	80	120	120	120
Fractional PLLs	5	8	8	10	15	15	0
Maximum HP I/Os <sup>(1)</sup>	468	780	780	780	650	650	1,404
Maximum HR I/Os <sup>(2)</sup>	52	52	52	104	52	52	52
DSP Slices	600	672	768	1,200	1,560	1,800	2,880
System Monitor	1	1	1	2	3	3	3
PCIe Gen3 x8	2	4	4	4	5	6	6
150G Interlaken	3	6	6	6	8	9	0
100G Ethernet	3	4	4	6	9	9	3
GTH 16.3Gb/s Transceivers	20	32	32	40	52	60	48
GTY 30.5Gb/s Transceivers	20	32	32	40	52	60	0

**Notes:**

1. HP = High-performance I/O with support for I/O voltage from 1.0V to 1.8V.
2. HR = High-range I/O with support for I/O voltage from 1.2V to 3.3V.





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## UltraScale Architecture and Product Overview

## Virtex UltraScale Device-Package Combinations and Maximum I/Os

Table 7: Virtex UltraScale Device-Package Combinations and Maximum I/Os

Package <sup>(1)(2)(3)</sup>	Package Dimensions (mm)	VU065	VU080	VU095	VU125	VU160	VU190	VU440
		HR, HP GTH, GTY	HR, HP GTH, GTY	HR, HP GTH, GTY	HR, HP GTH, GTY	HR, HP GTH, GTY	HR, HP GTH, GTY	HR, HP GTH, GTY
FFVC1517	40x40	52, 468 20, 20	52, 468 20, 20	52, 468 20, 20				
FFVD1517	40x40		52, 286 32, 32	52, 286 32, 32				
FLVD1517	40x40				52, 286 40, 32			
FFVB1760	42.5x42.5		52, 650 32, 16	52, 650 32, 16				
FLVB1760	42.5x42.5				52, 650 36, 16			
FFVA2104	47.5x47.5		52, 780 28, 24	52, 780 28, 24				
FLVA2104	47.5x47.5				52, 780 28, 24			
FFVB2104	47.5x47.5		52, 650 32, 32	52, 650 32, 32				
FLVB2104	47.5x47.5				52, 650 40, 36			
FLGB2104	47.5x47.5					52, 650 40, 36	52, 650 40, 36	
FFVC2104	47.5x47.5			52, 364 32, 32				
FLVC2104	47.5x47.5				52, 364 40, 40			
FLGC2104	47.5x47.5					52, 364 52, 52	52, 364 52, 52	
FLGB2377	50x50							52, 1248 36, 0
FLGA2577	52.5x52.5						0, 448 60, 60	
FLGA2892	55x55							52, 1404 48, 0

## Notes:

1. Go to [Ordering Information](#) for package designation details.
2. All packages have 1.0mm ball pitch.
3. Packages with the same last letter and number sequence, e.g., A2104, are footprint compatible with all other UltraScale architecture-based devices with the same sequence. The footprint compatible devices within this family are outlined. See the [UltraScale Architecture Product Selection Guide](#) for details on inter-family migration.



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## Virtex UltraScale+ FPGA Feature Summary

Table 8: Virtex UltraScale+ FPGA Feature Summary

	VU3P	VU5P	VU7P	VU9P	VU11P	VU13P
Logic Cells	689,640	1,051,010	1,379,280	2,068,920	2,147,040	2,862,720
CLB Flip-Flops	788,160	1,201,154	1,576,320	2,364,480	2,453,760	3,271,680
CLB LUTs	394,080	600,577	788,160	1,182,240	1,226,880	1,635,840
Max. Distributed RAM (Mb)	12.0	18.3	24.1	36.1	34.8	46.4
Block RAM/FIFO w/ECC (36Kb each)	720	1,024	1,440	2,160	2,016	2,688
Block RAM (Mb)	25.3	36.0	50.6	75.9	70.9	94.5
UltraRAM Blocks	320	470	640	960	1,152	1,536
UltraRAM (Mb)	90.0	132.2	180.0	270.0	324.0	432.0
CMTs (1 MMCM and 2 PLLs)	10	20	20	30	12	16
Max. HP I/O <sup>(1)</sup>	520	832	832	832	624	832
DSP Slices	2,280	3,474	4,560	6,840	8,928	11,904
System Monitor	1	2	2	3	3	4
GTY Transceivers 32.75Gb/s	40	80	80	120	96	128
PCIe Gen3 x16 and Gen4 x8	2	4	4	6	3	4
150G Interlaken	3	4	6	9	9	12
100G Ethernet w/RS-FEC	3	4	6	9	6	8

**Notes:**

1. HP = High-performance I/O with support for I/O voltage from 1.0V to 1.8V.

## Virtex UltraScale+ Device-Package Combinations and Maximum I/Os

Table 9: Virtex UltraScale+ Device-Package Combinations and Maximum I/Os

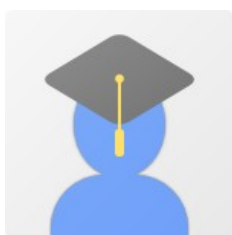
Package (1)(2)(3)	Package Dimensions (mm)	VU3P	VU5P	VU7P	VU9P	VU11P	VU13P
		HP, GTY	HP, GTY	HP, GTY	HP, GTY	HP, GTY	HP, GTY
FFVC1517	40x40	520, 40					
FLVF1924	45x45					624, 64	
FLVA2104	47.5x47.5		832, 52	832, 52	832, 52		
FHVA2104	52.5x52.5 <sup>(4)</sup>						832, 52
FLVB2104	47.5x47.5		702, 76	702, 76	702, 76	624, 76	
FHVB2104	52.5x52.5 <sup>(4)</sup>						702, 76
FLVC2104	47.5x47.5		416, 80	416, 80	416, 104	416, 96	
FHVC2104	52.5x52.5 <sup>(4)</sup>						416, 104
FLVA2577	52.5x52.5				448, 120	448, 96	448, 128

**Notes:**

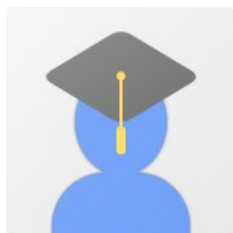
- Go to [Ordering Information](#) for package designation details.
- All packages have 1.0mm ball pitch.
- Packages with the same last letter and number sequence, e.g., A2104, are footprint compatible with all other UltraScale devices with the same sequence. The footprint compatible devices within this family are outlined.
- These 52.5x52.5mm overhang packages have the same PCB ball footprint as the corresponding 47.5x47.5mm packages (i.e., the same last letter and number sequence) and are footprint compatible.



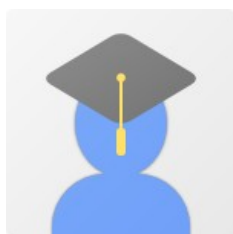
## Appendix F VITA



Juan Z. dela Cruz received the B.Sc., M.Sc., and Ph.D. degrees in chemistry all from the Pamantasan ng Pilipinas, San Juan, Metro Manila, Philippines, in 2020, 2022 and 2025 respectively. He is currently taking up his B.Sc. Electronics and Communications Engineering studies. He has developed several high-speed packet-switched network systems and node modules. His research interests include high-speed packet-switched networks, high speed radio interface design, discrete simulation and statistical models for packet switches.



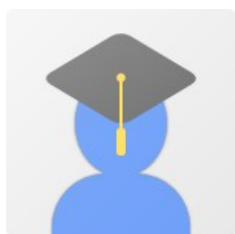
Nat Y. Franco received the B.Sc., M.Sc., and Ph.D. degrees in chemistry all from the Pamantasan ng Pilipinas, San Juan, Metro Manila, Philippines, in 2020, 2022 and 2025 respectively. He is currently taking up his B.Sc. Electronics and Communications Engineering studies. He has developed several high-speed packet-switched network systems and node modules. His research interests include high-speed packet-switched networks, high speed radio interface design, discrete simulation and statistical models for packet switches.



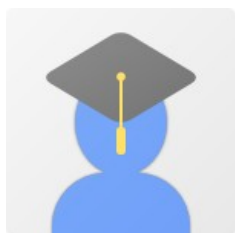
Sebastian X. Garcia received the B.Sc., M.Sc., and Ph.D. degrees in chemistry all from the Pamantasan ng Pilipinas, San Juan, Metro Manila, Philippines, in 2020, 2022 and 2025 respectively. He is currently taking up his B.Sc. Electronics



2072 and Communications Engineering studies. He has developed several high-speed packet-  
 2073 switched network systems and node modules. His research interests include high-speed  
 2074 packet-switched networks, high speed radio interface design, discrete simulation and  
 2075 statistical models for packet switches.



2076 Isabella W. Martinez received the B.Sc., M.Sc., and Ph.D. degrees  
 2077 in chemistry all from the Pamantasan ng Pilipinas, San Juan, Metro Manila, Philippines,  
 2078 in 2020, 2022 and 2025 respectively. He is currently taking up his B.Sc. Electronics  
 2079 and Communications Engineering studies. He has developed several high-speed packet-  
 2080 switched network systems and node modules. His research interests include high-speed  
 2081 packet-switched networks, high speed radio interface design, discrete simulation and  
 2082 statistical models for packet switches.



2083 Max V. Rianzares received the B.Sc., M.Sc., and Ph.D. degrees  
 2084 in chemistry all from the Pamantasan ng Pilipinas, San Juan, Metro Manila, Philippines,  
 2085 in 2020, 2022 and 2025 respectively. He is currently taking up his B.Sc. Electronics  
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 2087 switched network systems and node modules. His research interests include high-speed  
 2088 packet-switched networks, high speed radio interface design, discrete simulation and  
 2089 statistical models for packet switches.



De La Salle University

2090

## Appendix G

2091

## ARTICLE PAPER(S)

# Article/Forum Paper Format (IEEE LaTeX format)

Michael Shell, *Member, IEEE*, John Doe, *Fellow, OSA*, and Jane Doe, *Life Fellow, IEEE*

2092

**Abstract**—The abstract goes here. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

**Index Terms**—Computer Society, IEEE, IEEEtran, journal, LaTeX, paper, template.

## I. INTRODUCTION

THIS demo file is intended to serve as a “starter file” for IEEE article papers produced under LaTeX using IEEEtran.cls version 1.8b and later. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

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M. Shell was with the Department of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA, 30332.

E-mail: see <http://www.michaelshell.org/contact.html>

J. Doe and J. Doe are with Anonymous University.



Fig. 1. Simulation results for the network.

TABLE I  
AN EXAMPLE OF A TABLE

One	Two
Three	Four

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## II. CONCLUSION

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(a) Case I



(b) Case II

Fig. 2. Simulation results for the network.

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#### APPENDIX A

##### PROOF OF THE FIRST ZONKLAR EQUATION

Appendix one text goes here.

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#### APPENDIX B

Appendix two text goes here. [1].

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#### ACKNOWLEDGMENT

The authors would like to thank...

#### REFERENCES

- [1] T. Oetiker, H. Partl, I. Hyna, and E. Schlegl, *The Not So Short Introduction to L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub> Or L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub> in 157 minutes.* n.a., 2014.