# Non-Destructive Carabao Mango Sorter and Grader based on Physical Characteristics using Machine Learning

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

In Partial Fulfillment of the
Requirements for the Degree of
Bachelor of Science in Computer Engineering

by

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February, 2025

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# ORAL DEFENSE RECOMMENDATION SHEET

This thesis proposal, entitled **Non-Destructive Carabao Mango Sorter and Grader based on Physical Characteristics using Machine Learning**, prepared and submitted by thesis group, AISL-1-2425-C5, composed of:

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

**Dr. Reggie C. Gustillo**
*Adviser*

February 2, 2025

# ABSTRACT

*Index Terms*—Machine Learning, Carabao Mangoes, Sorting and Grading Mangoes, Machine Vision, Microcontroller.

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# ABBREVIATIONS

| | | |
|---|---|---|
| AC | Alternating Current | 78 |
| HTML | Hyper-text Markup Language | 78 |
| CSS | Cascading Style Sheet | 78 |
| XML | eXtensible Markup Language | 78 |

# NOTATION

| | | |
|---|---|---|
| $\mathcal{S}$ | a collection of distinct objects | 80 |
| $\mathcal{U}$ | the set containing everything | 80 |
| $\emptyset$ | the set with no elements | 80 |
| $\lvert\mathcal{S}\rvert$ | the number of elements in the set $\mathcal{S}$ | 80 |
| $h\left(t\right)$ | impulse response | 70 |
| $x\left(t\right)$ | input signal represented in the time domain | 70 |
| $y\left(t\right)$ | output signal represented in the time domain | 70 |

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., $\mathrm{SNR}$, which are printed in regular font. Constants are also set in regular font like $\mathrm{j}$. Standard functions and operators are also set in regular font, e.g., in $\sin\left(\cdot\right)$, $\max\{\cdot\}$. Commonly used notations are $t$, $f$, $\mathrm{j} = \sqrt{-1}$, $n$ and $\exp\left(\cdot\right)$, which refer to the time variable, frequency variable, imaginary unit, $n$th variable, and exponential function, respectively.

# GLOSSARY

| | |
|---|---|
| matrix | a concise and useful way of uniquely representing and working with linear transformations; a rectangular table of elements |
| Functional Analysis | the branch of mathematics concerned with the study of spaces of functions |

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# Chapter 1

# INTRODUCTION

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## 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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## 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[1] (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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[1]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.

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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.

## 1.3 Problem Statement

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

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

1. PS1: description of the ideal scenario for your intended audience
    - Describe the goals, desired state, or the values that your audience considers important and that are relevant to the problem.
2. PS2: reality of the situation
    - Describe a condition that prevents the goal, state, or value discussed in PS1 from being achieved or realized at the present time.
    - It is imperative to make the audience feel the pain point.
3. PS3: consequences for the audience
    - Using specific details, show how the situation contains a little promise of improvement unless something is done.

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

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## 1.4 Objectives and Deliverables

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

### 1.4.1 General Objective (GO)

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, consectetuer 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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### 1.5.1 Technical Benefit

1. First itemtext
2. Second itemtext
3. Last itemtext
4. First itemtext
5. Second itemtext

### 1.5.2 Social Impact

1. First itemtext
2. Second itemtext
3. Last itemtext
4. First itemtext

5. Second itemtext

### 1.5.3 Environmental Welfare

1. First itemtext
2. Second itemtext
3. Last itemtext
4. First itemtext
5. Second itemtext

## 1.6 Assumptions, Scope, and Delimitations

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

### 1.6.1 Assumptions

1. . . . ;
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.

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## 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 Breakdown Schedule and Bill of Materials will be included in this section and be removed in the final document.

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## 1.9 Overview of the Thesis Proposal

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

# Chapter 2

# LITERATURE REVIEW

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

## 2.1 Existing Work

Cite and summarize here relevant and significant literature (dissertations, theses, journals, patents, notable conference papers) through a table and descriptions to prove that no one has done your work yet and/or that your work is not a duplication of existing ones. Your 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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## 2.3 Summary

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

# Chapter 3

# THEORETICAL CONSIDERATIONS

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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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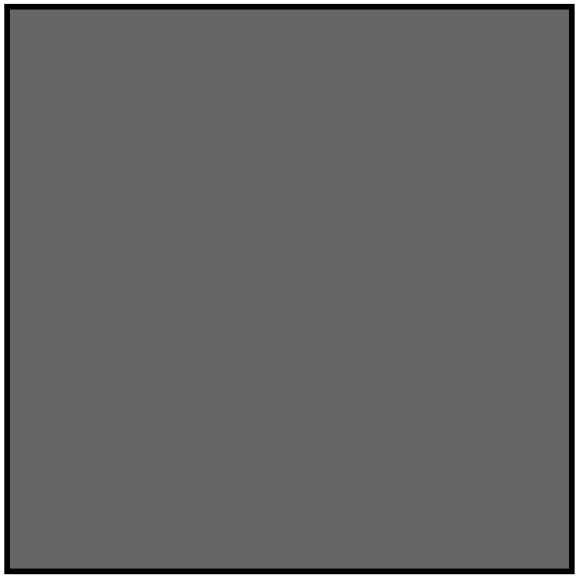

Fig. 3.1 A quadrilateral image example.

## 3.1 Summary

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

# Chapter 4

# 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

reasoning and evidence.

## 4.2 Summary

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

# Chapter 5

# METHODOLOGY

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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 Proposalreaches the objectives.

TABLE 5.1 SUMMARY OF METHODS FOR REACHING THE OBJECTIVES

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

*Continued on next page*

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*Continued from previous page*

| Objectives | Methods | Locations |
|---|---|---|
| SO1: To Quisque egestas wisi eget nunc. | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | Sec. 5.1 on p. 31 |
| SO2: To Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | Sec. 5.1 on p. 31 |
| SO3: To Nullam cursus pulvinar lectus. | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | Sec. 5.1 on p. 31 |
| SO4: To Morbi blandit ligula feugiat magna. | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | 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. | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | 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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## 5.2 Evaluation

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

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

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## 5.3 Summary

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

# Chapter 6

# RESULTS AND DISCUSSIONS

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

The next items below is not related to the description of this results and discussions chapter, but serves as an opener for the LaTeXportion of this template.

Here is an example of a citation for ISO 80000-2 standard [**?**]. Another one is [**?**] and [**?**].

In using this template, the user is expected to have a working knowledge of LaTeX. A good introduction is in [**?**]. Its latest version can be accessed at `http://www.ctan.org/tex-archive/info/lshort`. See the Appendix of `document_guide.pdf` for examples.

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

TABLE 6.1 SUMMARY OF RESULTS FOR ACHIEVING THE OBJECTIVES

| Objectives | Results | Locations |
|---|---|---|

*Continued on next page*

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*Continued from previous page*

| Objectives | Results | Locations |
|---|---|---|
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| SO1: To Quisque egestas wisi eget nunc. | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | Sec. 5.1 on p. 31 |
| SO2: To Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | Sec. 5.1 on p. 31 |
| SO3: To Nullam cursus pulvinar lectus. | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | Sec. 5.1 on p. 31 |

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| SO5: To Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | Sec. 5.1 on p. 31 |

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## 6.1 Summary

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

# Chapter 7

# CONCLUSIONS, RECOMMENDATIONS, AND FUTURE DIRECTIVES

## 7.1 Concluding Remarks

In this Thesis Proposal, . . .

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

## 7.2 Contributions

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

- the ;
- the ;
- the ;

## 7.3 Recommendations

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## 7.4 Future Prospects

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

1. the . . . .
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3. the . . . .

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

LaTeX-comment this and the following texts after you have implemented them. See the following references for helpful guides for the bibliography and script editing in general. Note that the links might be unavailable, but the names can be searched in the Web.

1. IEEE Citation Reference: www.ieee.org/documents/ieeecitationref.pdf
2. IEEE Editorial Style manual: www.ieee.org/documents/style_manual.pdf
3. IEEE Abbreviations for Transactions, Journals, Letters, and Magazines: www.ieee.org/documents/trans_journal_names.pdf

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

# Appendix A
# STUDENT RESEARCH ETHICS CLEARANCE

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**RESEARCH ETHICS CLEARANCE FORM**[1]
**For Thesis Proposals**

**Names of Student Researcher(s):**

**Dela Cruz, Juan Z.**

SAMPLE ONLY

**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.**

Baltasar

**Dr. Francisco D. Baltasar**

_____

**Name and Signature of Adviser/Mentor:**
**Date:** April 8, 2017

**Noted by:**

R Sison

**Dr. Rafael W. Sison**

_____

**Name and Signature of the Department Chairperson:**
**Date:** April 8, 2017

[1] The same form can be used for the reports of completed projects. The appropriate heading need only be used.

# Appendix B
# ANSWERS TO QUESTIONS TO THIS THESIS PROPOSAL

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## 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 busines 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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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.

### 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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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, consectetuer 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.

# Appendix C
# REVISIONS TO THE PROPOSAL

De La Salle University

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. Reggie C. Gustillo | Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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. | Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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.<br><br>**First** itemtext<br><br>**Second** itemtext<br><br>**Last** itemtext<br><br>**First** itemtext<br><br>**Second** itemtext | Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22 |

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| Examiner | Comment | Summary of how the comment was addressed | Locations |
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| Dr. Donable de Veas Abuan | Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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. | Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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.<br><br>**First** itemtext<br><br>**Second** itemtext<br><br>**Last** itemtext<br><br>**First** itemtext<br><br>**Second** itemtext | Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22 |

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| Examiner | Comment | Summary of how the comment was addressed | Locations |
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| Engr. Jose Martin Maningo | Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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. | Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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.<br>• First itemtext<br>• Second itemtext<br>• Last itemtext<br>• First itemtext<br>• Second itemtext | Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22 |

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| Examiner | Comment | Summary of how the comment was addressed | Locations |
|---|---|---|---|
| Dr. Alexander Co Abad | Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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. | Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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.<br>1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>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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| Examiner | Comment | Summary of how the comment was addressed | Locations |
|---|---|---|---|
| Dr. Rafael W. Sison | Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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. | Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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. | Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22 |

# Appendix D
# REVISIONS TO THE FINAL

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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.

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2. Comment
3. Summary of how the comment has been addressed
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| Examiner | Comment | Summary of how the comment has been addressed | Locations |
|---|---|---|---|
| Dr. Reggie C. Gustillo | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext<br>**First** itemtext<br>**Second** itemtext<br>**Last** itemtext<br>**First** itemtext<br>**Second** itemtext | Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22 |

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| Examiner | Comment | Summary of how the comment has been addressed | Locations |
|---|---|---|---|
| Dr. Donable de Veas Abuan | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext<br>**First** itemtext<br>**Second** itemtext<br>**Last** itemtext<br>**First** itemtext<br>**Second** itemtext | Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22 |
| Engr. Jose Martin Maningo | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext<br>• First itemtext<br>• Second itemtext<br>• Last itemtext<br>• First itemtext<br>• 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. Alexander Co Abad | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>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<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | 1. First itemtext<br>2. Second itemtext<br>3. Last itemtext<br>4. First itemtext<br>5. Second itemtext | Sec. 5.1 on p. 31, Sec. 5.2 on p. 33, Fig. 3.1 on p. 22 |

# Appendix E
# USAGE EXAMPLES

The user is expected to have a working knowledge of LaTeX. A good introduction is in [**?**]. 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 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 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 $y\left(t\right)$ is the result of the convolution of the input signal $x\left(t\right)$ and the impulse response $h\left(t\right)$ .

$$y\left(t\right) = h\left(t\right) * x\left(t\right) = \int_{-\infty}^{+\infty} h\left(t-\tau\right) x\left(\tau\right) \mathrm{d}\tau \tag{E.1}$$

Other example equations are as follows.

$$\begin{bmatrix} \frac{V_1}{I_1} \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} \frac{V_2}{I_2} \end{bmatrix} \tag{E.2}$$

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

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

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The verbatim LaTeX code of Sec. E1 is in List. E.1.

Listing E.1: Sample LaTeX code for equations and notations usage

```
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 |.

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}.

\begin{eqnarray}
     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
   \label{eq:conv}
\end{eqnarray}

Other example equations are as follows.

\begin{eqnarray}
   \left[ \dfrac{ V_{1} }{ I_{1} } \right] =
   \begin{bmatrix}
      A & B \\
      C & D
   \end{bmatrix}
   \left[ \dfrac{ V_{2} }{ I_{2} } \right]
   \label{eq:ABCD}
\end{eqnarray}

\begin{eqnarray}
\dfrac{1}{2} < \left\lfloor \mathrm{mod}\left(\left\lfloor \dfrac{y}{17}
     \right\rfloor 2^{-17 \lfloor x \rfloor - \mathrm{mod}(\lfloor y\
    rfloor, 17)},2\right)\right\rfloor,
\end{eqnarray}

\begin{eqnarray}
| \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
    }} \ge 1
\end{eqnarray}
```

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## E2 Notations

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

See https://en.wikipedia.org/wiki/Help:Displaying_a_formula and https://en.wikipedia.org/wiki/List_of_mathematical_symbols for LaTeX 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.

| | |
|---|---|
| mathnormal | $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9$ |
| mathit | $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, ff, fi, ß, \text{˚}, !, v, w, 0, 1, 9$ |
| mathrm | $\mathrm{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, ff, fi, ß, \text{˚}, !, v, w, 0, 1, 9}$ |
| mathbf | $\mathbf{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, ff, fi, ß, \text{˚}, !, v, w, 0, 1, 9}$ |
| mathsf | $\mathsf{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, ff, fi, ß, \text{˚}, !, v, w, 0, 1, 9}$ |
| mathtt | $\mathtt{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \uparrow, \downarrow, ß, \text{˚}, !, v, w, 0, 1, 9}$ |

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

| | |
|---|---|
| mathbfit | $\boldsymbol{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9}$ |
| mathsfit | $\mathit{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9}$ |
| mathsfbfit | $\boldsymbol{\mathit{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9}}$ |

Do the math alphabets match?

$ax\alpha\omega\boldsymbol{ax\alpha\omega}\mathit{ax\alpha\omega}\boldsymbol{\mathit{ax\alpha\omega}}$ $\mathit{TC\Theta\Gamma}\boldsymbol{\mathit{TC\Theta\Gamma}}TC\Theta\Gamma$

### E2.2 Vector symbols

Alphabetic symbols for vectors are boldface italic, $\boldsymbol{\lambda} = \boldsymbol{e}_1 \cdot \boldsymbol{a}$, while numeric ones (e.g. the zero vector) are bold upright, $\boldsymbol{a} + \mathbf{0} = \boldsymbol{a}$.

### E2.3 Matrix symbols

Symbols for matrices are boldface italic, too:[1] $\boldsymbol{\Lambda} = \boldsymbol{E} \cdot \boldsymbol{A}$.

[1] However, matrix symbols are usually capital letters whereas vectors are small ones. Exceptions are physical quantities like the force vector $\boldsymbol{F}$ or the electrical field $\boldsymbol{E}$.

## E2.4 Tensor symbols

Symbols for tensors are sans-serif bold italic,

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

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

$$\boldsymbol{D} = \epsilon_0 \boldsymbol{\epsilon}_\mathrm{r} \boldsymbol{E}$$

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## 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 | $A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, ff, fi, ß, \circ, !, v, w, 0, 1, 9$ |
| mathrm | $\mathrm{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, ff, fi, ß, \circ, !, v, w, 0, 1, 9}$ |
| mathbf | $\mathbf{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, ff, fi, ß, \circ, !, v, w, 0, 1, 9}$ |
| mathsf | $\mathsf{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, ff, fi, ß, \circ, !, v, w, 0, 1, 9}$ |
| mathtt | $\mathtt{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \uparrow, \downarrow, ß, \circ, !, v, w, 0, 1, 9}$ |

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

| | |
|---|---|
| mathbfit | $\boldsymbol{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9}$ |
| mathsfit | $\mathit{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9}$ |
| mathsfbfit | $\boldsymbol{\mathit{A, B, \Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Phi, \Psi, \Omega, \alpha, \beta, \pi, \nu, \omega, v, w, 0, 1, 9}}$ |

Do the math alphabets match?

$\boldsymbol{ax\alpha\omega ax\alpha\omega ax\alpha\omega} \quad \boldsymbol{TC\Theta\Gamma TC\Theta\Gamma TC\Theta\Gamma}$

### E2.5.1 Vector symbols

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

### E2.5.2 Matrix symbols

Symbols for matrices are boldface italic, too:[2] $\boldsymbol{\Lambda = E \cdot A}$.

### E2.5.3 Tensor symbols

Symbols for tensors are sans-serif bold italic,

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

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

$$\boldsymbol{D = \epsilon_0 \epsilon_\mathrm{r} E}$$

[2] However, matrix symbols are usually capital letters whereas vectors are small ones. Exceptions are physical quantities like the force vector $\boldsymbol{F}$ or the electrical field $\boldsymbol{E}$.

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The verbatim LaTeX code of Sec. E2 is in List. E.2.

Listing E.2: Sample LaTeX code for notations usage

```
% A teststring with Latin and Greek letters::
\newcommand{\teststring}{%
% capital Latin letters
% A,B,C,
A,B,
% capital Greek letters
%\Gamma,\Delta,\Theta,\Lambda,\Xi,\Pi,\Sigma,\Upsilon,\Phi,\Psi,
\Gamma,\Delta,\Theta,\Lambda,\Xi,\Pi,\Sigma,\Phi,\Psi,\Omega,
% small Greek letters
\alpha,\beta,\pi,\nu,\omega,
% small Latin letters:
% compare \nu, \omega, v, and w
v,w,
% digits
0,1,9
}


\subsection{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.

\begin{eqnarray*}
\mbox{mathnormal} &  & \teststring \\
\mbox{mathit} &  & \mathit{\teststring}\\
\mbox{mathrm} &  & \mathrm{\teststring}\\
\mbox{mathbf} &  & \mathbf{\teststring}\\
\mbox{mathsf} &  & \mathsf{\teststring}\\
\mbox{mathtt} &  & \mathtt{\teststring}
\end{eqnarray*}
 New alphabets bold-italic, sans-serif-italic, and sans-serif-bold-
    italic.
\begin{eqnarray*}
\mbox{mathbfit}     &  & \mathbfit{\teststring}\\
\mbox{mathsfit}     &  & \mathsfit{\teststring}\\
\mbox{mathsfbfit} &  & \mathsfbfit{\teststring}
\end{eqnarray*}
%
Do the math alphabets match?

$
\mathnormal  {a x \alpha \omega}
\mathbfit    {a x \alpha \omega}
\mathsfbfit{a x \alpha \omega}
\quad
\mathsfbfit{T C \Theta \Gamma}
\mathbfit    {T C \Theta \Gamma}
\mathnormal  {T C \Theta \Gamma}
$

\subsection{Vector symbols}
```

```
Alphabetic symbols for vectors are boldface italic,
$\vec{\lambda}=\vec{e}_{1}\cdot\vec{a}$,
while numeric ones (e.g. the zero vector) are bold upright,
$\vec{a} + \vec{0} = \vec{a}$.

\subsection{Matrix symbols}

Symbols for matrices are boldface italic, too:%
\footnote{However, matrix symbols are usually capital letters whereas
    vectors
are small ones. Exceptions are physical quantities like the force
vector $\vec{F}$ or the electrical field $\vec{E}$.%
}
$\matrixsym{\Lambda}=\matrixsym{E}\cdot\matrixsym{A}.$


\subsection{Tensor symbols}

Symbols for tensors are sans-serif bold italic,

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


The permittivity tensor describes the coupling of electric field and
displacement: \[
\vec{D}=\epsilon_{0}\tensorsym{\epsilon}_{\mathrm{r}}\vec{E}\]



\newpage
\subsection{Bold math version}

The ``bold'' math version is selected with the commands
\verb+\boldmath+ or \verb+\mathversion{bold}+

{\boldmath
   \begin{eqnarray*}
   \mbox{mathnormal} &  & \teststring \\
   \mbox{mathit} &  & \mathit{\teststring}\\
   \mbox{mathrm} &  & \mathrm{\teststring}\\
   \mbox{mathbf} &  & \mathbf{\teststring}\\
   \mbox{mathsf} &  & \mathsf{\teststring}\\
   \mbox{mathtt} &  & \mathtt{\teststring}
   \end{eqnarray*}
    New alphabets bold-italic, sans-serif-italic, and sans-serif-bold-
        italic.
   \begin{eqnarray*}
   \mbox{mathbfit}     &  & \mathbfit{\teststring}\\
   \mbox{mathsfit}     &  & \mathsfit{\teststring}\\
   \mbox{mathsfbfit} &  & \mathsfbfit{\teststring}
   \end{eqnarray*}
   %
   Do the math alphabets match?
```

```
    $
    \mathnormal  {a x \alpha \omega}
    \mathbfit    {a x \alpha \omega}
    \mathsfbfit{a x \alpha \omega}
    \quad
    \mathsfbfit{T C \Theta \Gamma}
    \mathbfit    {T C \Theta \Gamma}
    \mathnormal  {T C \Theta \Gamma}
    $

    \subsection{Vector symbols}

    Alphabetic symbols for vectors are boldface italic,
    $\vec{\lambda}=\vec{e}_{1}\cdot\vec{a}$,
    while numeric ones (e.g. the zero vector) are bold upright,
    $\vec{a} + \vec{0} = \vec{a}$.




    \subsection{Matrix symbols}

    Symbols for matrices are boldface italic, too:%
    \footnote{However, matrix symbols are usually capital letters whereas
        vectors
    are small ones. Exceptions are physical quantities like the force
    vector $\vec{F}$ or the electrical field $\vec{E}$.%
    }
    $\matrixsym{\Lambda}=\matrixsym{E}\cdot\matrixsym{A}.$


    \subsection{Tensor symbols}

    Symbols for tensors are sans-serif bold italic,

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

    The permittivity tensor describes the coupling of electric field and
    displacement: \[
    \vec{D}=\epsilon_{0}\tensorsym{\epsilon}_{\mathrm{r}}\vec{E}\]
}
```


## E3 Abbreviation

This section shows examples of the use of LaTeXcommands 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).

- Provide your own link text: style sheet.

The verbatim LaTeX code of Sec. E3 is in List. E.3.

Listing E.3: Sample LaTeX code for abbreviations usage

```
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:

\begin{itemize}

   \item \acr{xml} and \acr{css}.

   \item Next use: \acr{xml} and \acr{css}.

   \item Full form: \gls{xml} and \gls{css}.

   \item Reset again. \glsresetall{abbreviation}

   \item Start with a capital. \Acr{html}.

   \item Next: \Acr{html}. Full: \Gls{html}.

   \item Prefer capitals? \renewcommand{\acronymfont}[1]{\
      MakeTextUppercase{#1}} \Acr{xml}. Next: \acr{xml}. Full: \gls{xml
      }.

   \item Prefer small-caps? \renewcommand{\acronymfont}[1]{\textsc{#1}}
      \Acr{css}. Next: \acr{css}. Full: \gls{css}.

   \item Resetting all acronyms.\glsresetall{abbreviation}

   \item Here are the acronyms again:

   \item \Acr{html}, \acr{xml} and \acr{css}.

   \item Next use: \Acr{html}, \acr{xml} and \acr{css}.

   \item Full form: \Gls{html}, \gls{xml} and \gls{css}.

   \item Provide your own link text: \glslink{[textbf]css}{style}

\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 $\boldsymbol{A}$. 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

```
\begin{itemize}

   \item \Glspl{matrix} are usually denoted by a bold capital letter,
       such as $\mathbfit{A}$. The \gls{matrix}'s $(i,j)$th element is
       usually denoted $a_{ij}$. \Gls{matrix} $\mathbf{I}$ is the
       identity \gls{matrix}.

   \item A set, denoted as \gls{not:set}, is a collection of objects.

   \item The universal set,  denoted as \gls{not:universalSet}, is the
       set of everything.

   \item The empty set, denoted as \gls{not:emptySet}, contains no
       elements.

   \item \Gls{Functional Analysis} is seen as the study of complete
       normed vector spaces, i.e., Banach spaces.

   \item The cardinality of a set, denoted as \gls{not:cardinality}, is
       the number of elements in the set.

\end{enumerate}
```

## E5 Figure

This section shows several ways of placing figures. PDFLaTeX compatible files are PDF, PNG, and JPG. Please see the `figure` subdirectory.

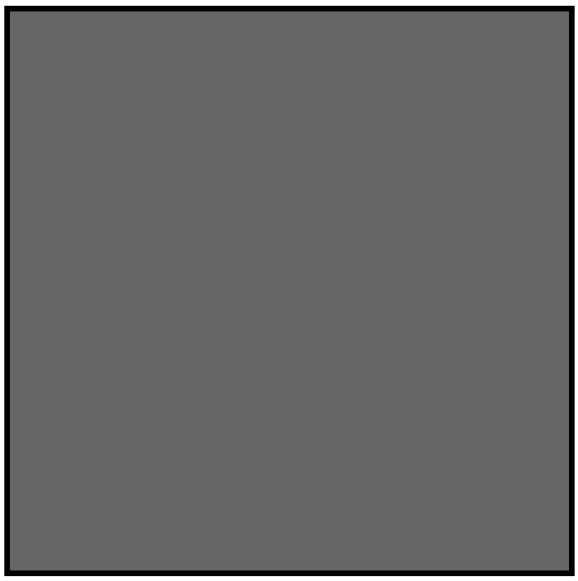
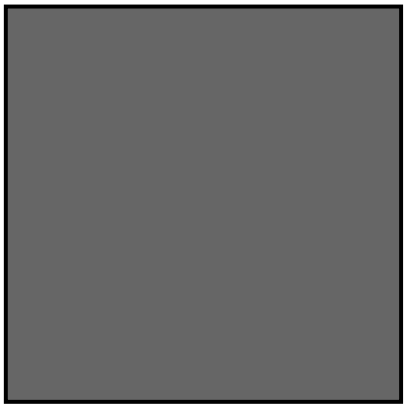


Fig. E.1 A quadrilateral image example.

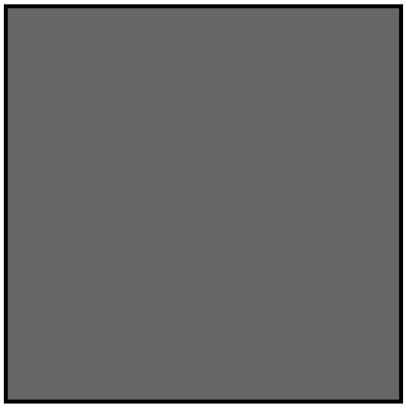
Fig. E.1 is a gray box enclosed by a dark border. List. E.5 shows the corresponding LaTeX code.

Listing E.5: Sample LaTeX code for a single figure

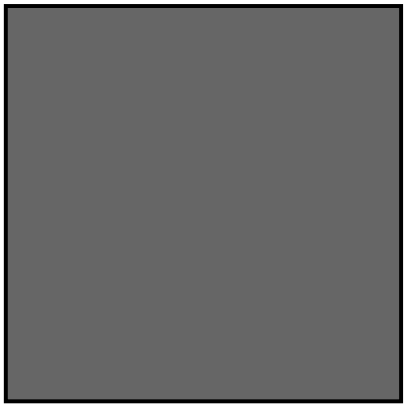
```
\begin{figure}[!htbp]
   \centering
      \includegraphics[width=0.5\textwidth]{example}
   \caption{A quadrilateral image example.}
   \label{fig:example}
\end{figure}
\cleardoublepage

Fig.~\ref{fig:example} is a gray box enclosed by a dark border. List.~\
   ref{lst:onefig} shows the corresponding \LaTeX \ code.
\end{figure}
```



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



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

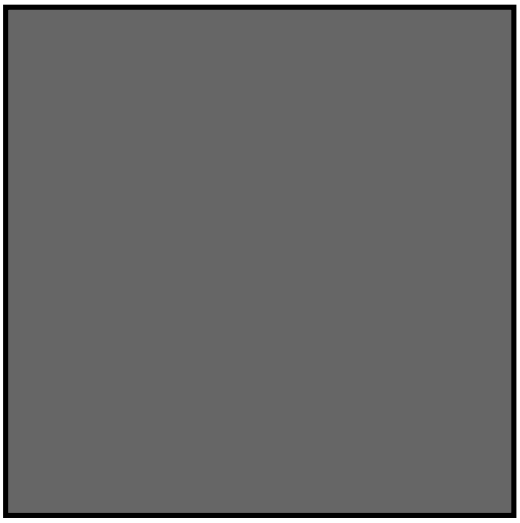


(c) A sub-figure in the bottom row.

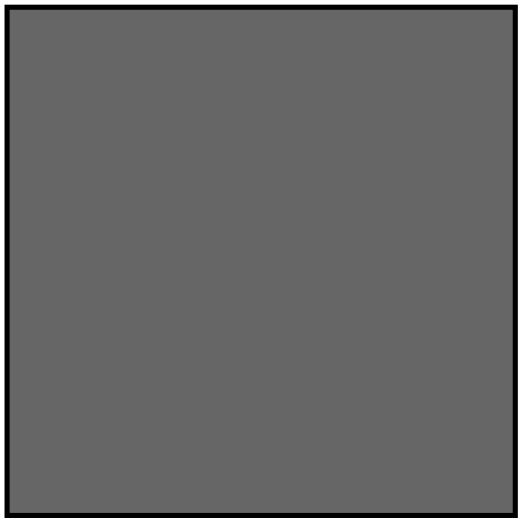
Fig. E.2 Figures on top of each other. See List. E.6 for the corresponding LaTeX code.

Listing E.6: Sample LaTeX code for three figures on top of each other

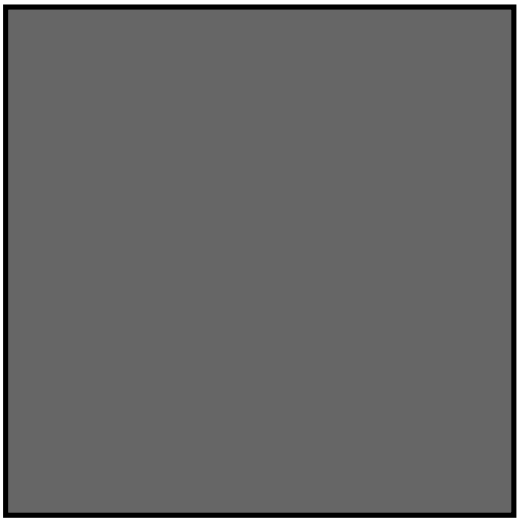
```
\begin{figure}[!htbp]
\centering
\subbottom[A sub-figure in the top row.]{
\includegraphics[width=0.35\textwidth]{example_gray_box}
\label{fig:top}
}
\vfill
\subbottom[A sub-figure in the middle row.]{
\includegraphics[width=0.35\textwidth]{example_gray_box}
\label{fig:mid}
}
\vfill
\subbottom[A sub-figure in the bottom row.]{
\includegraphics[width=0.35\textwidth]{example_gray_box}
\label{fig:botm}
}
\caption{Figures on top of each other}
\label{fig:tmb}
\end{figure}
```



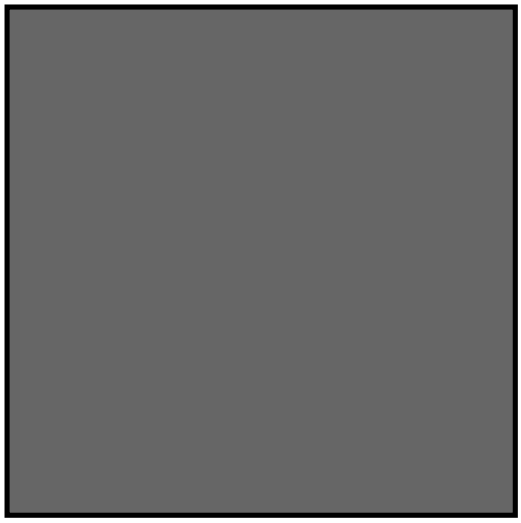
(a) A sub-figure in the upper-left corner.



(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 LaTeX code.

Listing E.7: Sample LaTeX code for the four figures

```
\begin{figure}[!htbp]
\centering
\subbottom[A sub-figure in the upper-left corner.]{
\includegraphics[width=0.45\textwidth]{example_gray_box}
\label{fig:upprleft}
}
\hfill
\subbottom[A sub-figure in the upper-right corner.]{
\includegraphics[width=0.45\textwidth]{example_gray_box}
\label{fig:uppright}
}
\vfill
\subbottom[A sub-figure in the lower-left corner.]{
\includegraphics[width=0.45\textwidth]{example_gray_box}
\label{fig:lowerleft}
}
\hfill
\subbottom[A sub-figure in the lower-right corner]{
\includegraphics[width=0.45\textwidth]{example_gray_box}
\label{fig:lowright}
}
\caption{Four figures in each corner. See List.~\ref{lst:fourfigs} for
    the corresponding \LaTeX \ code.}
\label{fig:fourfig}
\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) |

List. E.8 shows the corresponding LaTeX code.

Listing E.8: Sample LaTeX code for making typical table environment

```
\begin{center}
{\scriptsize
\begin{tabularx}{\textwidth}{p{0.1\textwidth}|p{0.2\textwidth}|p{0.5\textwidth}}
\caption{Feasible triples for highly variable grid} \label{tab:triple_grid} \\
\hline
\hline
\textbf{Time (s)} &
\textbf{Triple chosen} &
\textbf{Other feasible triples} \\
\hline
\endfirsthead
\multicolumn{3}{c}%
{\textit{Continued from previous page}} \\
\hline
\hline
\textbf{Time (s)} &
\textbf{Triple chosen} &
\textbf{Other feasible triples} \\
\hline
\endhead
\hline
\multicolumn{3}{r}{\textit{Continued on next page}} \\
\endfoot
\hline
\endlastfoot
\hline

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) \\
```

```
43 41175 & (1, 12, 13725) & (1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1,
       0) \\
44 43920 & (1, 13, 10980) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
45 46665 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
46 49410 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
47 52155 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1,
       0) \\
48 54900 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
49 57645 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
50 60390 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
51 63135 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
52 65880 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
53 68625 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
54 71370 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
55 74115 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
56 76860 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
57 79605 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
58 82350 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
59 85095 & (1, 12, 13725) & (1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1,
       0) \\
60 87840 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
61 90585 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
62 93330 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
63 96075 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
64 98820 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
65 101565 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
66 104310 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
67 107055 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
68 109800 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
69 112545 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3,
       1, 0) \\
70 115290 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
71 118035 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
72 120780 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
73 123525 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
74 126270 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3,
       1, 0) \\
75 129015 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
76 131760 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
77 134505 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
78 137250 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
79 139995 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
80 142740 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
81 145485 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3,
       1, 0) \\
82 148230 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
83 150975 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
84 153720 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
85 156465 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
86 159210 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
87 161955 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
88 164700 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
89 \end{tabularx}
90 }
91 \end{center}
```

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## E7 Algorithm or Pseudocode Listing

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 LaTeX code.

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

| | | |
|---|---|---|
| **Input(s):** | | |
| $n$ | : | $n$th power; $n \in \mathbb{Z}^+$ |
| $x$ | : | base value; $x \in \mathbb{R}^+$ |
| **Output(s):** | | |
| $y$ | : | 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 LaTeX code for algorithm or pseudocode listing usage

```
\begin{table}[!htbp]
   \caption{Calculation of $y = x^n$}
   \label{tab:calcxn}
   {\footnotesize
   \begin{tabular}{lll}
   \hline
   \hline
   {\bfseries Input(s):} & & \\
   $n$ & : & $n$th power; $n \in \mathbb{Z}^{+}$ \\
   $x$ & : & base value; $x \in \mathbb{R}^{+}$ \\
   \hline
   {\bfseries Output(s):} & & \\
   $y$ & : & result; $y \in \mathbb{R}^{+}$  \\
   \hline
   \hline
   \\
   \end{tabular}
   }
   \begin{algorithmic}[1]
   {\footnotesize
      \REQUIRE $n \geq 0 \vee x \neq 0$
      \ENSURE $y = x^n$
      \STATE $y \Leftarrow 1$
      \IF{$n < 0$}
            \STATE $X \Leftarrow 1 / x$
            \STATE $N \Leftarrow -n$
      \ELSE
            \STATE $X \Leftarrow x$
            \STATE $N \Leftarrow n$
      \ENDIF
      \WHILE{$N \neq 0$}
            \IF{$N$ is even}
                  \STATE $X \Leftarrow X \times X$
                  \STATE $N \Leftarrow N / 2$
            \ELSE[$N$ is odd]
                  \STATE $y \Leftarrow y \times X$
                  \STATE $N \Leftarrow N - 1$
            \ENDIF
      \ENDWHILE
   }
   \end{algorithmic}
\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)

```
/* fibo.c -- It prints out the first N Fibonacci
 *           numbers.
 */

#include <stdio.h>

int main(void) {
    int n;         /* Number of fibonacci numbers we will print */
    int i;         /* Index of fibonacci number to be printed next */
    int current;   /* Value of the (i)th fibonacci number */
    int next;      /* Value of the (i+1)th fibonacci number */
    int twoaway;   /* Value of the (i+2)th fibonacci number */

    printf("How many Fibonacci numbers do you want to compute? ");
    scanf("%d", &n);
    if (n<=0)
       printf("The number should be positive.\n");
    else {
      printf("\n\n\tI \t Fibonacci(I) \n\t=====================\n");
      next = current = 1;
      for (i=1; i<=n; i++) {
   printf("\t%d \t\t\t%d\n", i, current);
   twoaway = current+next;
   current = next;
   next    = twoaway;
      }
    }
}

/* The output from a run of this program was:

How many Fibonacci numbers do you want to compute? 9

   I   Fibonacci(I)
   =====================
   1      1
   2      1
   3      2
   4      3
   5      5
   6      8
   7      13
   8      21
   9      34

*/
```

List. E.11 shows the corresponding LaTeX code.

Listing E.11: Sample LaTeX code for program listing

```
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.
```

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## 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.
```

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## 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 LaTeX code.

Listing E.13: Sample LaTeX code for referencing subsections

```
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.
```

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### 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 LaTeX code.

Listing E.14: Sample LaTeX code for referencing sub-subsections

```
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.
```

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# 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).

The following subsections are examples of citations.

## E10.1 Books

- [?]
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## E10.2 Booklets

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## E10.3 Proceedings

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## E10.4 In books

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## E10.5 In proceedings

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## E10.6 Journals

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## E10.7 Theses/dissertations

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## E10.8 Technical Reports and Others

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## E10.9 Miscellaneous

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## E11 Index

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.

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 LaTeX code for Index usage

```
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.
```

## E12 Adding Relevant PDF Pages

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 `pdfpages` for other options.

Listing E.16: Sample LaTeX code for including PDF pages

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

# 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(1) | 468 | 780 | 780 | 780 | 650 | 650 | 1,404 |
| Maximum HR I/Os(2) | 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.

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

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

| Package[1][2][3] | 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.

# 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(1) | 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(4) | | | | | | 832, 52 |
| FLVB2104 | 47.5x47.5 | | 702, 76 | 702, 76 | 702, 76 | 624, 76 | |
| FHVB2104 | 52.5x52.5(4) | | | | | | 702, 76 |
| FLVC2104 | 47.5x47.5 | | 416, 80 | 416, 80 | 416, 104 | 416, 96 | |
| FHVC2104 | 52.5x52.5(4) | | | | | | 416, 104 |
| FLVA2577 | 52.5x52.5 | | | | 448, 120 | 448, 96 | 448, 128 |

**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 devices with the same sequence. The footprint compatible devices within this family are outlined.
4. 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

Kenan A. Banal 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. Computer 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.

Francis Robert Miguel F. BAUTISTA 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. Computer 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.

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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.

Daniel G. SALAZAR 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. Computer 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.

# Appendix G
# ARTICLE PAPER(S)

# Article/Forum Paper Format (IEEE LaTeX format)

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

1781

***Abstract*—The abstract goes here.** Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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, consectetuer 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, consectetuer 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.

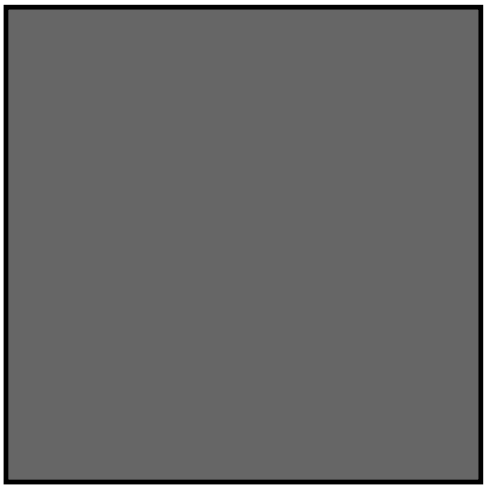

Fig. 1. Simulation results for the network.

TABLE I
AN EXAMPLE OF A TABLE

| One | Two |
|---|---|
| Three | Four |

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*1) Subsubsection Heading Here:* Subsubsection text here. Lorem ipsum dolor sit amet, consectetuer 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, consectetuer 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.

## II. Conclusion

The conclusion goes here.

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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

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## REFERENCES

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