



1

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

3

4

A Thesis Proposal

5

Presented to the Faculty of the

6

Department of Electronics and Communications Engineering

7

Gokongwei College of Engineering

8

De La Salle University

9

10

In Partial Fulfillment of the

11

Requirements for the Degree of

12

Bachelor of Science in Electronics and Communications Engineering

13

14

by

15

DELA CRUZ, Juan A.

16

FRANCO, Nat B.

17

RIANZARES, Max C.

18

May, 2016



De La Salle University

ORAL DEFENSE RECOMMENDATION SHEET

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

DELA CRUZ, Juan A.

FRANCO, Nat B.

RIANZARES, Max C.

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

Dr. Francisco D. Baltasar

Adviser

May 27, 2016



De La Salle University

THESIS PROPOSAL APPROVAL SHEET

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

DELA CRUZ, Juan A.

FRANCO, Nat B.

RIANZARES, Max C.

with group number ESG-04 in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electronics and Communications Engineering (BS-ECE)** has been examined and is recommended for acceptance and approval.

PANEL OF EXAMINERS

Dr. Amado Z. Hernandez

Chair

Dr. Jose Y. Alonzo

Member

Dr. Mariana X. Mercado

Member

Dr. Francisco D. Baltasar

Adviser

Date: May 27, 2016



De La Salle University

55
56
57
58

2016

All Rights Reserved. No part of this publication may be reproduced, stored in an information retrieval system, or transmitted, in any form or by any means, electronic, mechanical, by photocopying, scanning, recording, or otherwise, except under the terms of the applicable law.



De La Salle University

59

ACKNOWLEDGMENT

60

61

Write this prior to hard binding if you have submitted all requirements and are told by your adviser that you have passed.



62

ABSTRACT

63

Keep your abstract short by giving the gist/nutshell of your thesis proposal.

64

Index Terms—alloy system, characterization, InP, InGaAs.



65

TABLE OF CONTENTS

66

Oral Defense Recommendation Sheet **ii**

67

Thesis Proposal Approval Sheet **iii**

68

Acknowledgment **v**

69

Abstract **vi**

70

Table of Contents **vii**

71

List of Figures **x**

72

List of Tables **xi**

73

Abbreviations **xii**

74

Notation **xiii**

75

Glossary **xiv**

76

Listings **xv**

77

Chapter 1 INTRODUCTION **1**

78

1.1 Background of the Study 2

79

1.2 Prior Studies 4

80

1.3 Problem Statement 4

81

1.4 Objectives 5

82

1.4.1 General Objective(s) 5

83

1.4.2 Specific Objectives 5

84

1.5 Significance of the Study 5

85

1.6 Assumptions, Scope and Delimitations 6

86

1.7 Description and Methodology 6

87

1.8 Overview 6

88

Chapter 2 LITERATURE REVIEW **7**

89

2.1 Summary 10



90	References	11
91	Appendix A ANSWERS TO QUESTIONS TO THIS THESIS PROPOSAL	12
92	A1 How important is the problem to practice?	13
93	A2 How will you know if the solution/s that you will achieve would be better	
94	than existing ones?	13
95	A2.1 How will you measure the improvement/s?	13
96	A2.1.1 What is/are your basis/bases for the improvement/s? . .	14
97	A2.1.2 Why did you choose that/those basis/bases?	14
98	A2.1.3 How significant are your measure/s of the improvement/s? .	14
99	A3 What is the difference of the solution/s from existing ones?	15
100	A3.1 How is it different from previous and existing ones?	15
101	A4 What are the assumptions made (that are behind for your proposed solution	
102	to work)?	15
103	A4.1 Will your proposed solution/s be sensitive to these assumptions? .	16
104	A4.2 Can your proposed solution/s be applied to more general cases	
105	when some of the assumptions are eliminated? If so, how?	16
106	A5 What is the necessity of your approach / proposed solution/s?	16
107	A5.1 What will be the limits of applicability of your proposed solution/s? .	17
108	A5.2 What will be the message of the proposed solution to technical	
109	people? How about to non-technical managers and business men? .	17
110	A6 How will you know if your proposed solution/s is/are correct?	17
111	A6.1 Will your results warrant the level of mathematics used (i.e., will	
112	the end justify the means)?	18
113	A7 Is/are there an/_ alternative way/s to get to the same solution/s?	18
114	A7.1 Can you come up with illustrating examples, or even better, counter	
115	examples to your proposed solution/s?	18
116	A7.2 Is there an approximation that can arrive at the essentially the same	
117	proposed solution/s more easily?	19
118	A8 If you were the examiner of your proposal, how would you present the	
119	proposal in another way?	19
120	A8.1 What are the weaknesses of your proposal?	19
121	Appendix B USAGE EXAMPLES	21
122	B1 Equations	22
123	B2 Notations	24
124	B3 Abbreviation	30
125	B4 Glossary	32
126	B5 Figure	33
127	B6 Table	39



128	B7 Algorithm or Pseudocode Listing	43
129	B8 Program/Code Listing	45
130	B9 Referencing	47
131	B9.1 A subsection	48
132	B9.1.1 A sub-subsection	49
133	B10 Index	50
134	B11 Adding Relevant PDF Pages (e.g. Standards, Datasheets, Specification	
135	Sheets, Application Notes, etc.)	51
136	Appendix C PUBLICATION LIST AND AWARD	55
137	Appendix D VITA	57
138	Index	59



139

LIST OF FIGURES

140

B.1 A quadrilateral image example. 33

141

B.2 Figures on top of each other. See List. B.6 for the corresponding \LaTeX code. 35

142

B.3 Four figures in each corner. See List. B.7 for the corresponding \LaTeX code. . 37



143

LIST OF TABLES

144

B.1 Feasible triples for highly variable grid 39

145

B.2 Calculation of $y = x^n$ 43



146

ABBREVIATIONS

147	AC	Alternating Current.....	30
148	CSS	Cascading Style Sheet	30
149	HTML	Hyper-text Markup Language	30
150	XML	eXtensible Markup Language	30



NOTATION

151

152	$ \mathcal{S} $	the number of elements in the set \mathcal{S}	32
153	\emptyset	the set with no elements	32
154	$h(t)$	impulse response	22
155	\mathcal{S}	a collection of distinct objects	32
156	\mathcal{U}	the set containing everything	32
157	$x(t)$	input signal represented in the time domain	22
158	$y(t)$	output signal represented in the time domain	22

159 Throughout this thesis proposal, mathematical notations conform to ISO 80000-2 standard,
160 e.g. variable names are printed in italics, the only exception being acronyms like e.g. SNR,
161 which are printed in regular font. Constants are also set in regular font like j . Functions are
162 also set in regular font, e.g. in $\sin(\cdot)$. Commonly used notations are t , f , $j = \sqrt{-1}$, n and
163 $\exp(\cdot)$, which refer to the time variable, frequency variable, imaginary unit, n th variable,
164 and exponential function, respectively.



165

GLOSSARY

166

matrix a concise and useful way of uniquely representing and working with linear transformations; a rectangular table of elements 32



167

LISTINGS

168	B.1 Sample \LaTeX code for equations and notations usage	23
169	B.2 Sample \LaTeX code for notations usage	27
170	B.3 Sample \LaTeX code for abbreviations usage	31
171	B.4 Sample \LaTeX code for glossary and notations usage	32
172	B.5 Sample \LaTeX code for a single figure	34
173	B.6 Sample \LaTeX code for three figures on top of each other	36
174	B.7 Sample \LaTeX code for the four figures	38
175	B.8 Sample \LaTeX code for making typical table environment	41
176	B.9 Sample \LaTeX code for algorithm or pseudocode listing usage	44
177	B.10 Computing Fibonacci numbers	45
178	B.11 Sample \LaTeX code for program listing	46
179	B.12 Sample \LaTeX code for referencing sections	47
180	B.13 Sample \LaTeX code for referencing subsections	48
181	B.14 Sample \LaTeX code for referencing sub-subsections	49
182	B.15 Sample \LaTeX code for Index usage	50
183	B.16 Sample \LaTeX code for including PDF pages	51



Chapter 1

INTRODUCTION

Contents

1.1	Background of the Study	2
1.2	Prior Studies	4
1.3	Problem Statement	4
1.4	Objectives	5
1.4.1	General Objective(s)	5
1.4.2	Specific Objectives	5
1.5	Significance of the Study	5
1.6	Assumptions, Scope and Delimitations	6
1.7	Description and Methodology	6
1.8	Overview	6



199

1.1 Background of the Study

200

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem.

201

Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec

202

ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus

203

placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor.

204

Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla

205

tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue

206

a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.

207

Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit

208

amet ipsum. Nunc quis urna dictum turpis accumsan semper.

209

 Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem.

210

Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec

211

ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus

212

placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor.

213

Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla

214

tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue

215

a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.

216

Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit

217

amet ipsum. Nunc quis urna dictum turpis accumsan semper.

218

 Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem.

219

Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec

220

ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus

221

placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor.



222 Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla
 223 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue
 224 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.
 225 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit
 226 amet ipsum. Nunc quis urna dictum turpis accumsan semper.

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

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



1.2 Prior Studies

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

1.3 Problem Statement

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



266

1.4 Objectives

267

1.4.1 General Objective(s)

268

To ...;

269

1.4.2 Specific Objectives

270

1. To ...;

271

2. To ...;

272

3. To ...;

273

4. To ...;

274

5. To ...;

275

1.5 Significance of the Study

276

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem.

277

Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec

278

ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus

279

placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor.

280

Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla

281

tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue

282

a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.

283

Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit

284

amet ipsum. Nunc quis urna dictum turpis accumsan semper.



1.6 Assumptions, Scope and Delimitations

Bulletize your scope in one group, and then bulletize the delimitations in another. Bulletize your assumptions as well.

1.7 Description and Methodology

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

1.8 Overview

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



301

Chapter 2

302

LITERATURE REVIEW

303

Contents

304

305

306

2.1	Summary	10
-----	-------------------	----



307 Cite and summarize here relevant and significant literature (dissertations, theses, jour-
308 nals, patents, notable conference papers) to prove that no one has done your work yet.

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

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

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



331 Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla
 332 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue
 333 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.
 334 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit
 335 amet ipsum. Nunc quis urna dictum turpis accumsan semper.

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

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



354

2.1 Summary



355

REFERENCES

356

[ISO, 2009] ISO (2009). 80000-2. *Quantities and units–Part 2: Mathematical signs and symbols to be used in the natural sciences and technology*.

357

358

[Oetiker et al., 2014] Oetiker, T., Partl, H., Hyna, I., and Schlegl, E. (2014). *The Not So Short Introduction to L^AT_EX 2_ε Or L^AT_EX 2_ε in 157 minutes*. n.a.

359

360

Produced: May 27, 2016, 08:21



Appendix A ANSWERS TO QUESTIONS TO THIS THESIS PROPOSAL

Contents

A1	How important is the problem to practice?	13
A2	How will you know if the solution/s that you will achieve would be better than existing ones?	13
A2.1	How will you measure the improvement/s?	13
A2.1.1	What is/are your basis/bases for the improvement/s?	14
A2.1.2	Why did you choose that/those basis/bases?	14
A2.1.3	How significant are your measure/s of the improvement/s?	14
A3	What is the difference of the solution/s from existing ones?	15
A3.1	How is it different from previous and existing ones?	15
A4	What are the assumptions made (that are behind for your proposed solution to work)?	15
A4.1	Will your proposed solution/s be sensitive to these assumptions?	16
A4.2	Can your proposed solution/s be applied to more general cases when some of the assumptions are eliminated? If so, how?	16
A5	What is the necessity of your approach / proposed solution/s?	16
A5.1	What will be the limits of applicability of your proposed solution/s?	17
A5.2	What will be the message of the proposed solution to technical people? How about to non-technical managers and business men?	17
A6	How will you know if your proposed solution/s is/are correct?	17
A6.1	Will your results warrant the level of mathematics used (i.e., will the end justify the means)?	18
A7	Is/are there an/_ alternative way/s to get to the same solution/s?	18
A7.1	Can you come up with illustrating examples, or even better, counter examples to your proposed solution/s?	18
A7.2	Is there an approximation that can arrive at the essentially the same proposed solution/s more easily?	19
A8	If you were the examiner of your proposal, how would you present the proposal in another way?	19
A8.1	What are the weaknesses of your proposal?	19



396

A1 How important is the problem to practice?

397

398

399

400

401

402

403

404

405

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

406

A2 How will you know if the solution/s that you will achieve would be better than existing ones?

407

408

409

410

411

412

413

414

415

416

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

417

A2.1 How will you measure the improvement/s?

418

419

420

421

422

423

424

425

426

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



427 **A2.1.1 What is/are your basis/bases for the improvement/s?**

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

437 **A2.1.2 Why did you choose that/those basis/bases?**

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

447 **A2.1.3 How significant are your measure/s of the improvement/s?**

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



457 **A3 What is the difference of the solution/s from ex-** 458 **isting ones?**

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

468 **A3.1 How is it different from previous and existing ones?**

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

478 **A4 What are the assumptions made (that are be-** 479 **hind for your proposed solution to work)?**

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



489 **A4.1 Will your proposed solution/s be sensitive to these as-**
 490 **sumptions?**

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

500 **A4.2 Can your proposed solution/s be applied to more general**
 501 **cases when some of the assumptions are eliminated? If**
 502 **so, how?**

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

512 **A5 What is the necessity of your approach / pro-**
 513 **posed solution/s?**

514 Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem.
 515 Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec
 516 ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus
 517 placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor.
 518 Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla
 519 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue
 520 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.



521 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit
522 amet ipsum. Nunc quis urna dictum turpis accumsan semper.

523 **A5.1 What will be the limits of applicability of your proposed so-**
524 **lution/s?**

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

534 **A5.2 What will be the message of the proposed solution to**
535 **technical people? How about to non-technical managers**
536 **and business men?**

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

546 **A6 How will you know if your proposed solution/s**
547 **is/are correct?**

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



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

557 **A6.1 Will your results warrant the level of mathematics used**
558 **(i.e., will the end justify the means)?**

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

568 **A7 Is/are there an/_ alternative way/s to get to the**
569 **same solution/s?**

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

579 **A7.1 Can you come up with illustrating examples, or even bet-**
580 **ter, counter examples to your proposed solution/s?**

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



585 Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla
586 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue
587 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.
588 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit
589 amet ipsum. Nunc quis urna dictum turpis accumsan semper.

590 **A7.2 Is there an approximation that can arrive at the essen-** 591 **tially the same proposed solution/s more easily?**

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

601 **A8 If you were the examiner of your proposal, how** 602 **would you present the proposal in another way?**

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

612 **A8.1 What are the weaknesses of your proposal?**

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



De La Salle University

617 Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla
618 tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue
619 a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris.
620 Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit
621 amet ipsum. Nunc quis urna dictum turpis accumsan semper.



De La Salle University

622

623

Appendix B

USAGE EXAMPLES



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

B1 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 (B.1), the output signal $y(t)$ is the result of the convolution of the input signal $x(t)$ and the impulse response $h(t)$.

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

Other example equations are as follows.

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

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

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



637

The verbatim L^AT_EX code of Sec. B1 is in List. B.1.Listing B.1: Sample L^AT_EX code for equations and notations usage

```

1 The following examples show how to typeset equations in \LaTeX.
2
3 In~\eqref{eq:conv}, the output signal \gls{not:output_sigt} is the
  result of the convolution of the input signal \gls{not:input_sigt}
  and the impulse response \gls{not:ir}.
4
5 \begin{eqnarray}
6   y\left( t \right) = h\left( t \right) * x\left( t \right)=\int_{-\infty}^{+\infty}h\left( t-\tau \right)x\left( \tau \right) \mathrm{d}\tau
7   \label{eq:conv}
8 \end{eqnarray}
9
10 Other example equations are as follows.
11
12 \begin{eqnarray}
13   \left[ \dfrac{V_{1}}{I_{1}} \right] =
14   \begin{bmatrix}
15     A & B \\
16     C & D
17   \end{bmatrix}
18   \left[ \dfrac{V_{2}}{I_{2}} \right]
19   \label{eq:ABCD}
20 \end{eqnarray}
21
22 \begin{eqnarray}
23   \{1\over 2\} < \left\lfloor \mathrm{mod}\right\left(\left\lfloor y \over 17\right\right\right\rfloor 2^{\{-17\lfloor x \rfloor - \mathrm{mod}(\lfloor y \rfloor, 17)\},2\right)\right\rfloor,
24 \end{eqnarray}
25
26 \begin{eqnarray}
27   \left| \zeta(x)^3\zeta(x+iy)^4\zeta(x+2iy) \right| =
28   \exp\sum_{n,p}\frac{3+4\cos(ny\log p) +\cos(2ny\log p)}{n^p}\geq 1
29 \end{eqnarray}

```



B2 Notations

In order to use the standardized notation, the user is highly suggested to see the ISO 80000-2 standard [ISO, 2009]. The following were taken from `isomath-test.tex`.

Math alphabets

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

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

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

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

Do the math alphabets match?

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

Vector symbols

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

Matrix symbols

Symbols for matrices are boldface italic, too:¹ $A = E \cdot A$.

¹However, matrix symbols are usually capital letters whereas vectors are small ones. Exceptions are physical quantities like the force vector F or the electrical field E .

652 **Tensor symbols**

653 Symbols for tensors are sans-serif bold italic,

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

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

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



Bold math version

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

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

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

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

Do the math alphabets match?

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

Vector symbols

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

Matrix symbols

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

Tensor symbols

Symbols for tensors are sans-serif bold italic,

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

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

$$D = \epsilon_0 \epsilon_r E$$

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



669 The verbatim \LaTeX code of Sec. B2 is in List. B.2.

Listing B.2: Sample \LaTeX code for notations usage

```

670 1 % A teststring with Latin and Greek letters::
671 2 \newcommand{\teststring}{%
672 3 % capital Latin letters
673 4 % A,B,C,
674 5 A,B,
675 6 % capital Greek letters
676 7 %\Gamma,\Delta,\Theta,\Lambda,\Xi,\Pi,\Sigma,\Upsilon,\Phi,\Psi,
677 8 \Gamma,\Delta,\Theta,\Lambda,\Xi,\Pi,\Sigma,\Phi,\Psi,\Omega,
678 9 % small Greek letters
679 10 \alpha,\beta,\pi,\nu,\omega,
680 11 % small Latin letters:
681 12 % compare \nu, \omega, v, and w
682 13 v,w,
683 14 % digits
684 15 0,1,9
685 16 }
686 17
687 18
688 19 \subsection*{Math alphabets}
689 20
690 21 If there are other symbols in place of Greek letters in a math
691 22 alphabet, it uses T1 or OT1 font encoding instead of OML.
692 23
693 24 \begin{eqnarray*}
694 25 \mbox{\mathnormal} & & \mbox{\teststring} \\
695 26 \mbox{\mathit} & & \mbox{\mathit{\teststring}} \\
696 27 \mbox{\mathrm} & & \mbox{\mathrm{\teststring}} \\
697 28 \mbox{\mathbf} & & \mbox{\mathbf{\teststring}} \\
698 29 \mbox{\mathsf} & & \mbox{\mathsf{\teststring}} \\
699 30 \mbox{\mathtt} & & \mbox{\mathtt{\teststring}} \\
700 31 \end{eqnarray*}
701 32 New alphabets bold-italic, sans-serif-italic, and sans-serif-bold-
702 33 italic.
703 34 \begin{eqnarray*}
704 35 \mbox{\mathbfit} & & \mbox{\mathbfit{\teststring}} \\
705 36 \mbox{\mathsf fit} & & \mbox{\mathsf fit{\teststring}} \\
706 37 \mbox{\mathsf bfit} & & \mbox{\mathsf bfit{\teststring}} \\
707 38 \end{eqnarray*}
708 39 %
709 40 Do the math alphabets match?
710 41 $
711 42 \mathnormal {a x \alpha \omega}
712 43 \mathbfit {a x \alpha \omega}
713 44 \mathsf bfit {a x \alpha \omega}
714 45 \quad
715 46 \mathsf bfit {T C \Theta \Gamma}
716 47 \mathbfit {T C \Theta \Gamma}
717 48 \mathnormal {T C \Theta \Gamma}
718 49 $
719 50
720 51 \subsection*{Vector symbols}
721 52

```



```

724 53 Alphabetic symbols for vectors are boldface italic,
725 54  $\vec{\lambda} = \vec{e}_1 \cdot \vec{a}$ ,
726 55 while numeric ones (e.g. the zero vector) are bold upright,
727 56  $\vec{a} + \vec{0} = \vec{a}$ .
728 57
729 58 \subsection*{Matrix symbols}
730 59
731 60 Symbols for matrices are boldface italic, too:%
732 61 \footnote{However, matrix symbols are usually capital letters whereas
733 62 vectors
734 62 are small ones. Exceptions are physical quantities like the force
735 63 vector  $\vec{F}$  or the electrical field  $\vec{E}$ .%
736 64 }
737 65  $\Lambda = E \cdot A$ .
738 66
739 67
740 68 \subsection*{Tensor symbols}
741 69
742 70 Symbols for tensors are sans-serif bold italic,
743 71
744 72 \[
745 73 \quad \quad \quad \text{\textit{\textbf{\textit{\alpha}}}}} = \text{\textit{\textbf{\textit{e}}}} \cdot \text{\textit{\textbf{\textit{a}}}}
746 74 \quad \quad \quad \Longleftrightarrow
747 75 \quad \quad \quad \alpha_{ijl} = e_{ijk} \cdot a_{kl}.
748 76 \]
749 77
750 78
751 79 The permittivity tensor describes the coupling of electric field and
752 80 displacement: \[
753 81 \vec{D} = \epsilon_0 \text{\textit{\textbf{\textit{\epsilon}}}}}(\text{\textit{\textbf{\textit{r}}}}) \vec{E} \]
754 82
755 83
756 84
757 85 \newpage
758 86 \subsection*{Bold math version}
759 87
760 88 The ‘‘bold’’ math version is selected with the commands
761 89 \verb+\boldmath+ or \verb+\mathversion{bold}+
762 90
763 91 {\boldmath
764 92 \begin{eqnarray*}
765 93 \quad \text{\textnormal} & \& \& \text{\teststring} \\
766 94 \quad \text{\textit} & \& \& \text{\textit{\teststring}} \\
767 95 \quad \text{\textit{\textbf}}} & \& \& \text{\textit{\textbf{\teststring}}} \\
768 96 \quad \text{\textit{\textbf{\textit}}}}} & \& \& \text{\textit{\textbf{\textit{\teststring}}}}} \\
769 97 \quad \text{\textsf} & \& \& \text{\textsf{\teststring}} \\
770 98 \quad \text{\texttt} & \& \& \text{\texttt{\teststring}} \\
771 99 \end{eqnarray*}
772 100 \quad New alphabets bold-italic, sans-serif-italic, and sans-serif-bold-
773 101 \quad italic.
774 102 \begin{eqnarray*}
775 103 \quad \text{\textbf{\textit}}} & \& \& \text{\textbf{\textit{\teststring}}} \\
776 104 \quad \text{\textsf{\textit}}} & \& \& \text{\textsf{\textit{\teststring}}} \\
777 105 \quad \text{\textsf{\textbf{\textit}}}}} & \& \& \text{\textsf{\textbf{\textit{\teststring}}}}} \\
778 106 \end{eqnarray*}
779 107 %
780 108 Do the math alphabets match?

```



```

781 108
782 109 $
783 110 \mathnormal {a x \alpha \omega}
784 111 \mathbfit {a x \alpha \omega}
785 112 \mathsfbfit{a x \alpha \omega}
786 113 \quad
787 114 \mathsfbfit{T C \Theta \Gamma}
788 115 \mathbfit {T C \Theta \Gamma}
789 116 \mathnormal {T C \Theta \Gamma}
790 117 $
791 118
792 119 \subsection*{Vector symbols}
793 120
794 121 Alphabetic symbols for vectors are boldface italic,
795 122 $\vec{\lambda}=\vec{e}_{1}\cdot\vec{a}$,
796 123 while numeric ones (e.g. the zero vector) are bold upright,
797 124 $\vec{a} + \vec{0} = \vec{a}$.
798 125
799 126
800 127
801 128
802 129 \subsection*{Matrix symbols}
803 130
804 131 Symbols for matrices are boldface italic, too:%
805 132 \footnote{However, matrix symbols are usually capital letters whereas
806 133 vectors
807 133 are small ones. Exceptions are physical quantities like the force
808 134 vector $\vec{F}$ or the electrical field $\vec{E}$.%
809 135 }
810 136 $\matrixsym{\Lambda}=\matrixsym{E}\cdot\matrixsym{A}$.
811 137
812 138
813 139 \subsection*{Tensor symbols}
814 140
815 141 Symbols for tensors are sans-serif bold italic,
816 142
817 143 \[
818 144 \tensorsym{\alpha} = \tensorsym{e}\cdot\tensorsym{a}
819 145 \quad \Longleftarrow \quad
820 146 \alpha_{ijl} = e_{ijk}\cdot a_{kl}.
821 147 \]
822 148
823 149 The permittivity tensor describes the coupling of electric field and
824 150 displacement: \[
825 151 \vec{D}=\epsilon_{0}\tensorsym{\epsilon}_{\mathrm{r}}\vec{E}\]
826 152 }

```



B3 Abbreviation

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

Again please see List. B.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). 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).



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

858 The verbatim \LaTeX code of Sec. B3 is in List. B.3.

Listing B.3: Sample \LaTeX code for abbreviations usage

```

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

```



B4 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. B.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 A . The matrix’s (i, j) th element is usually denoted a_{ij} . Matrix I is the identity matrix.
- A set, denoted as 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.
- The cardinality of a set, denoted as $|S|$, is the number of elements in the set.

The verbatim \LaTeX code for the part of Sec. B4 is in List. B.4.

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

```

1 \begin{itemize}
2
3   \item \Glspl{matrix} are usually denoted by a bold capital letter,
      such as  $\mathbf{A}$ . The  $\gls{matrix}$ ’s  $(i, j)$ th element is
      usually denoted  $a_{ij}$ .  $\gls{matrix}$   $\mathbf{I}$  is the
      identity  $\gls{matrix}$ .
4
5   \item A set, denoted as  $\gls{not:set}$ , is a collection of objects.
6
7   \item The universal set, denoted as  $\gls{not:universalSet}$ , is the
      set of everything.
8
9   \item The empty set, denoted as  $\gls{not:emptySet}$ , contains no
      elements.
10
11   \item The cardinality of a set, denoted as  $\gls{not:cardinality}$ , is
      the number of elements in the set.
12
13 \end{itemize}

```



873

B5 Figure

874

875

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

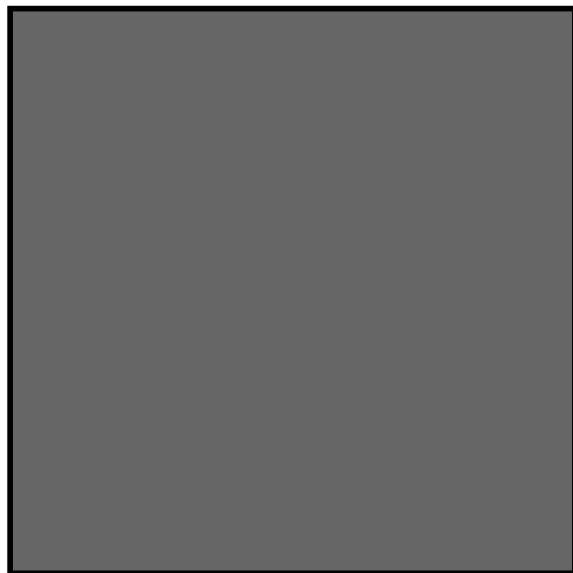


Fig. B.1 A quadrilateral image example.



876

877

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

Listing B.5: Sample \LaTeX code for a single figure

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



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



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



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

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

Listing B.6: Sample L^AT_EX code for three figures on top of each other

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



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



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



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



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

Fig. B.3 Four figures in each corner. See List. B.7 for the corresponding \LaTeX code.

Listing B.7: Sample \LaTeX code for the four figures

```

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

```



878

B6 Table

879

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

TABLE B.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)



881 List. B.8 shows the corresponding \LaTeX code.

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

```

882 1 \begin{center}
883 2 {\scriptsize
884 3 \begin{tabularx}{\textwidth}{p{0.1\textwidth}|p{0.2\textwidth}|p{0.5\textwidth}}
885 4 \caption{Feasible triples for highly variable grid} \label{tab:triple_
886 5 grid} \\
887 6 \hline
888 7 \textbf{Time (s)} &
889 8 \textbf{Triple chosen} &
890 9 \textbf{Other feasible triples} \\
891 10 \hline
892 11 \endfirsthead
893 12 \multicolumn{3}{c}{\textit{Continued from previous page}} \\
894 13 \hline
895 14 \hline
896 15 \textbf{Time (s)} &
897 16 \textbf{Triple chosen} &
898 17 \textbf{Other feasible triples} \\
899 18 \hline
900 19 \endhead
901 20 \hline
902 21 \hline
903 22 \multicolumn{3}{r}{\textit{Continued on next page}} \\
904 23 \endfoot
905 24 \hline
906 25 \endlastfoot
907 26 \hline
908 27
909 28 0 & (1, 11, 13725) & (1, 12, 10980), (1, 13, 8235), (2, 2, 0), (3, 1, 0) \\
910 29 & 2745 & (1, 12, 10980) & (1, 13, 8235), (2, 2, 0), (2, 3, 0), (3, 1, 0) \\
911 30 & 5490 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
912 31 & 8235 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
913 32 & 10980 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
914 33 & 13725 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
915 34 & 16470 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
916 35 & 19215 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
917 36 & 21960 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
918 37 & 24705 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
919 38 & 27450 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
920 39 & 30195 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
921 40 & 32940 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
922 41 & 35685 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
923 42 & 38430 & (1, 13, 10980) & (2, 2, 2745), (2, 3, 0), (3, 1, 0)

```




```

936 43 41175 & (1, 12, 13725) & (1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1,
937 0) \\
938 44 43920 & (1, 13, 10980) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
939 45 46665 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
940 46 49410 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
941 47 52155 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1,
942 0) \\
943 48 54900 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
944 49 57645 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
945 50 60390 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
946 51 63135 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
947 52 65880 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
948 53 68625 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
949 54 71370 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
950 55 74115 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
951 56 76860 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
952 57 79605 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
953 58 82350 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
954 59 85095 & (1, 12, 13725) & (1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1,
955 0) \\
956 60 87840 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
957 61 90585 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
958 62 93330 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
959 63 96075 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
960 64 98820 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
961 65 101565 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
962 66 104310 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
963 67 107055 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
964 68 109800 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
965 69 112545 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3,
966 1, 0) \\
967 70 115290 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
968 71 118035 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
969 72 120780 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
970 73 123525 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
971 74 126270 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3,
972 1, 0) \\
973 75 129015 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
974 76 131760 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
975 77 134505 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
976 78 137250 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
977 79 139995 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
978 80 142740 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
979 81 145485 & (1, 12, 16470) & (1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3,
980 1, 0) \\
981 82 148230 & (2, 2, 2745) & (2, 3, 0), (3, 1, 0) \\
982 83 150975 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
983 84 153720 & (1, 12, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
984 85 156465 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
985 86 159210 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
986 87 161955 & (1, 13, 16470) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
987 88 164700 & (1, 13, 13725) & (2, 2, 2745), (2, 3, 0), (3, 1, 0) \\
988 89 \end{tabularx}
989 90 }
990 91 \end{center}

```



992

B7 Algorithm or Pseudocode Listing

993

Table B.2 shows an example pseudocode. Note that if the pseudocode exceeds one page, it can mean that its implementation is not modular. List. B.9 shows the corresponding L^AT_EX code.

994

995

TABLE B.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 B.9: Sample L^AT_EX code for algorithm or pseudocode listing usage

```

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

```



B8 Program/Code Listing

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

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

```

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

```



999

List. B.11 shows the corresponding \LaTeX code.

Listing B.11: Sample \LaTeX code for program listing

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



B9 Referencing

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

Referencing sections: This section is Sec. B9, which shows how to refer to the locations of various labels that have been placed in the \LaTeX files. List. B.12 shows the corresponding \LaTeX code.

Listing B.12: Sample \LaTeX code for referencing sections

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

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



B9.1 A subsection

Referencing subsections: This section is Sec. B9.1, which shows how to refer to a subsection. List. B.13 shows the corresponding \LaTeX code.

Listing B.13: Sample \LaTeX code for referencing subsections

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

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



B9.1.1 A sub-subsection

Referencing sub-subsections: This section is Sec. B9.1.1, which shows how to refer to a sub-subsection. List. B.14 shows the corresponding \LaTeX code.

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

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

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



B10 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. B.15 is a program listing of the above-mentioned paragraph.

Listing B.15: Sample \LaTeX code for Index usage

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



B11 Adding Relevant PDF Pages (e.g. Standards, Datasheets, Specification Sheets, Application Notes, etc.)

Selected PDF pages can be added (see List. B.16), but note that the options must be tweaked. See the manual of `pdfpages` for other options.

Listing B.16: Sample \LaTeX code for including PDF pages

```
1 \includepdf[pages={8-10},%
2 offset=3.5mm -10mm,%
3 scale=0.73,%
4 frame]
5 {./reference/Xilinx2015-UltraScaleArchitectureOverview.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 C

PUBLICATION LIST AND AWARD

Journal

1. ...

2. ...

Conference

1. ...

2. ...



De La Salle University

1064

Others

1065

1. ...

1066

2. ...

1067

Award

1068

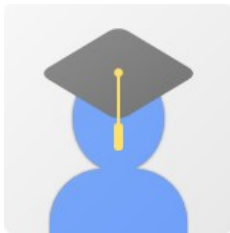
1. ...

1069

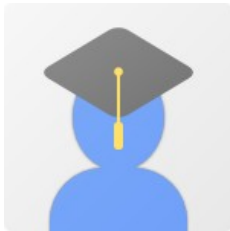
2. ...



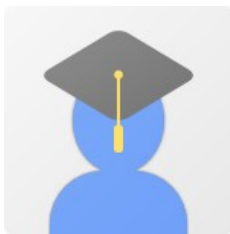
Appendix D VITA



Juan A. dela Cruz received the B.Sc., M.Sc., and Ph.D. degrees in chemistry all from the Pamantasan ng Pilipinas, San Juan, Metro Manila, Philippines, in 2011, 2013 and 2016 respectively. He is currently taking up his B.Sc. Electronics and Communications Engineering studies. He has developed several high-speed packet-switched network systems and node modules. His research interests include high-speed packet-switched networks, high speed radio interface design, discrete simulation and statistical models for packet switches.



Nat B. Franco received the B.Sc., M.Sc., and Ph.D. degrees in chemistry all from the Pamantasan ng Pilipinas, San Juan, Metro Manila, Philippines, in 2011, 2013 and 2016 respectively. He is currently taking up his B.Sc. Electronics and Communications Engineering studies. He has developed several high-speed packet-switched network systems and node modules. His research interests include high-speed packet-switched networks, high speed radio interface design, discrete simulation and statistical models for packet switches.



Max C. Rianzares received the B.Sc., M.Sc., and Ph.D. degrees in chemistry all from the Pamantasan ng Pilipinas, San Juan, Metro Manila, Philippines, in 2011, 2013 and 2016 respectively. He is currently taking up his B.Sc. Electronics and Communications Engineering studies. He has developed several high-speed



1090 packet-switched network systems and node modules. His research interests include
1091 high-speed packet-switched networks, high speed radio interface design, discrete
1092 simulation and statistical models for packet switches.



INDEX

1093	contributions, 28
1094	Fourier operator, 70
1095	Fredholm integral, 70
1096	summary, 4