
AN INCREDIBLY INSIGHTFUL THESIS ABOUT SOMETHING EXTREMELY IMPORTANT

PRESTIGIOUS INSTITUTE OF SOMETHING IMPORTANT
DEPARTMENT OF VERY ADVANCED THEORETICAL STUFF



DOCTORAL THESIS

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Dedication

Acknowledgments

Abstract

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CHAPTER 1

Text and Structure

1.1 Paragraphs of Text

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

1.2 Text Styling

Bold, *Italic*, Underline, Monospaced, *Emphasized*

1.3 Quotations

This is an inline quote: “This is quoted.”

This is a block quote. It’s often used for long quoted passages, interviews, or highlighted text.

1.4 Footnotes

This is a footnote¹.

¹Footnote example...

1.5 Hyperlinks

We follow the steps provided in², but instead of choosing the **Desktop Install** option, we select the **ROS-Base Install**

1.6 Lists






1.6.1 Numbered List

1. The first item
2. The second item
 - (a) Sub-item one
 - (b) Sub-item two
 - i. Sub-sub-item A
 - ii. Sub-sub-item B
3. The third item

1.6.2 Bullet Points

- The first item
- The second item
 - Sub-item one
 - Sub-item two
 - * Sub-sub-item A
 - * Sub-sub-item B
- The third item

1.6.3 Fontawesome Lists

-  The first item
-  The second item
 -  Sub-item one
 -  Sub-item two
-  The third item

1.6.4 Descriptions and Definitions

Name Description

Word Definition

Comment Elaboration

1.7 Citation

This statement requires citation [1]; this one is more specific [2, page 122].

²  <https://docs.ros.org/en/jazzy/Installation/Ubuntu-Install-Debs.html>

CHAPTER 2

Equations and Symbols

2.1 Inline Math

The Pythagorean theorem is expressed as $a^2 + b^2 = c^2$.

2.2 Displayed Equations

$$E = mc^2 \quad (2.1)$$

2.3 Align Environment

$$f(x) = x^2 + 3x + 2 \quad (2.2)$$

$$= (x + 1)(x + 2) \quad (2.3)$$

2.4 Fractions, Roots, and Exponents

$$\frac{a+b}{c}, \quad \sqrt{2}, \quad x^{n+1}$$

2.5 Summations and Integrals

$$\sum_{i=1}^n i = \frac{n(n+1)}{2}, \quad \int_0^1 x^2 dx = \frac{1}{3}$$

2.6 Greek Symbols

2.6.1 Lowercase Greek Letters

$\alpha, \beta, \gamma, \delta, \varepsilon, \zeta, \eta, \theta, \iota, \kappa, \lambda, \mu, \nu, \xi, \pi, \rho, \sigma, \tau, \upsilon, \phi, \chi, \psi, \omega$

2.6.2 Uppercase Greek Letters

$\Gamma, \Delta, \Theta, \Lambda, \Xi, \Pi, \Sigma, \Upsilon, \Phi, \Psi, \Omega$

2.6.3 Variant Greek Symbols

$\varepsilon, \vartheta, \varpi, \rho, \varsigma, \varphi$

2.7 Matrices

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \quad (2.4)$$

2.8 Systems of Equations

$$\begin{cases} x + y = 1 \\ 2x - y = 3 \end{cases} \quad (2.5)$$

2.9 Numbered Equations with Labels

$$F = ma \quad (2.6)$$

As shown in Equation 2.6, force is proportional to mass and acceleration.

CHAPTER 3

Mathematical Environments

3.1 Theorems

This is an example of theorems.

3.1.1 Several equations

This is a theorem consisting of several equations.

Theorem 3.1.1 — Name of the theorem. In $E = \mathbb{R}^n$ all norms are equivalent. It has the properties:

$$||\mathbf{x}|| - ||\mathbf{y}|| \leq ||\mathbf{x} - \mathbf{y}|| \quad (3.1)$$

$$||\sum_{i=1}^n \mathbf{x}_i|| \leq \sum_{i=1}^n ||\mathbf{x}_i|| \quad \text{where } n \text{ is a finite integer} \quad (3.2)$$

3.1.2 Single Line

This is a theorem consisting of just one line.

Theorem 3.1.2 A set $\mathcal{D}(G)$ is dense in $L^2(G)$, $|\cdot|_0$.

3.2 Definitions

This is an example of a definition. A definition could be mathematical or it could define a concept.

Definition 3.2.1 — Definition name. Given a vector space E , a norm on E is an application, denoted $||\cdot||$, E in $\mathbb{R}^+ = [0, +\infty[$ such that:

$$||\mathbf{x}|| = 0 \Rightarrow \mathbf{x} = \mathbf{0} \quad (3.3)$$

$$||\lambda \mathbf{x}|| = |\lambda| \cdot ||\mathbf{x}|| \quad (3.4)$$

$$||\mathbf{x} + \mathbf{y}|| \leq ||\mathbf{x}|| + ||\mathbf{y}|| \quad (3.5)$$

3.3 Notations

Notation 3.1. Given an open subset G of \mathbb{R}^n , the set of functions φ are:

1. Bounded support G ;
2. Infinitely differentiable;

a vector space is denoted by $\mathcal{D}(G)$.

3.4 Remarks

This is an example of a remark.



The concepts presented here are now in conventional employment in mathematics. Vector spaces are taken over the field $\mathbb{K} = \mathbb{R}$, however, established properties are easily extended to $\mathbb{K} = \mathbb{C}$.

3.5 Corollaries

This is an example of a corollary.

Corollary 3.5.1 — Corollary name. The concepts presented here are now in conventional employment in mathematics. Vector spaces are taken over the field $\mathbb{K} = \mathbb{R}$, however, established properties are easily extended to $\mathbb{K} = \mathbb{C}$.

3.6 Propositions

This is an example of propositions.

3.6.1 Several equations

Proposition 3.6.1 — Proposition name. It has the properties:

$$||\mathbf{x}|| - ||\mathbf{y}|| \leq ||\mathbf{x} - \mathbf{y}|| \quad (3.6)$$

$$||\sum_{i=1}^n \mathbf{x}_i|| \leq \sum_{i=1}^n ||\mathbf{x}_i|| \quad \text{where } n \text{ is a finite integer} \quad (3.7)$$

3.6.2 Single Line

Proposition 3.6.2 Let $f, g \in L^2(G)$; if $\forall \varphi \in \mathcal{D}(G)$, $(f, \varphi)_0 = (g, \varphi)_0$ then $f = g$.

3.7 Examples

This is an example of examples.

3.7.1 Equation and Text

■ **Example 3.1** Let $G = \{x \in \mathbb{R}^2 : |x| < 3\}$ and denoted by: $x^0 = (1, 1)$; consider the function:

$$f(x) = \begin{cases} e^{|x|} & \text{si } |x - x^0| \leq 1/2 \\ 0 & \text{si } |x - x^0| > 1/2 \end{cases} \quad (3.8)$$

The function f has bounded support, we can take $A = \{x \in \mathbb{R}^2 : |x - x^0| \leq 1/2 + \varepsilon\}$ for all $\varepsilon \in]0; 5/2 - \sqrt{2}[$. ■

3.7.2 Paragraph of Text

■ **Example 3.2 — Example name.** Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris. ■

3.8 Exercises

This is an example of an exercise.

■ **Exercise 3.1** This is a good place to ask a question to test learning progress or further cement ideas into students' minds. ■

3.9 Problems

Problem 3.1 What is the average airspeed velocity of an unladen swallow?

3.10 Vocabulary

Define a word to improve a students' vocabulary.

Vocabulary 3.1 — Word. Definition of word.

CHAPTER 4

Figures and Tables

4.1 Figures

Supported formats include: ‘.png’, ‘.jpg’, ‘.jpeg’, ‘.pdf’, and ‘.eps’ (depending on the compiler). It is recommended to use ‘.pdf’ for vector images and ‘.png’ for raster graphics.

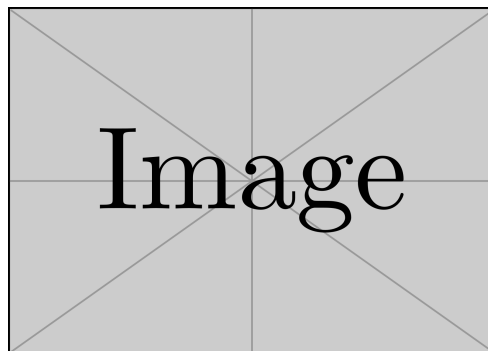


Figure 4.1: A sample figure with a caption.

Refer to Figure 4.1 to cite a full figure in your text.

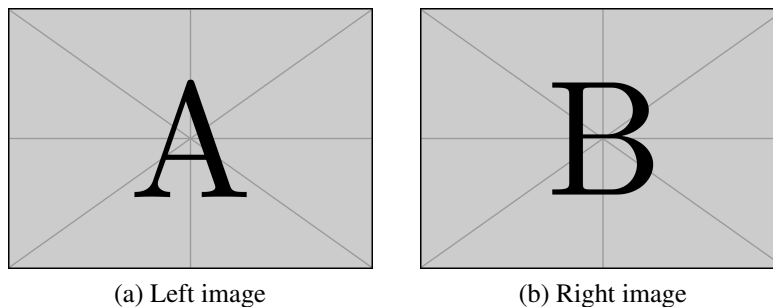


Figure 4.2: Two images displayed side by side.

Refer to subfigures individually as Figures 4.2a and 4.2b, or collectively as Figure 4.2.

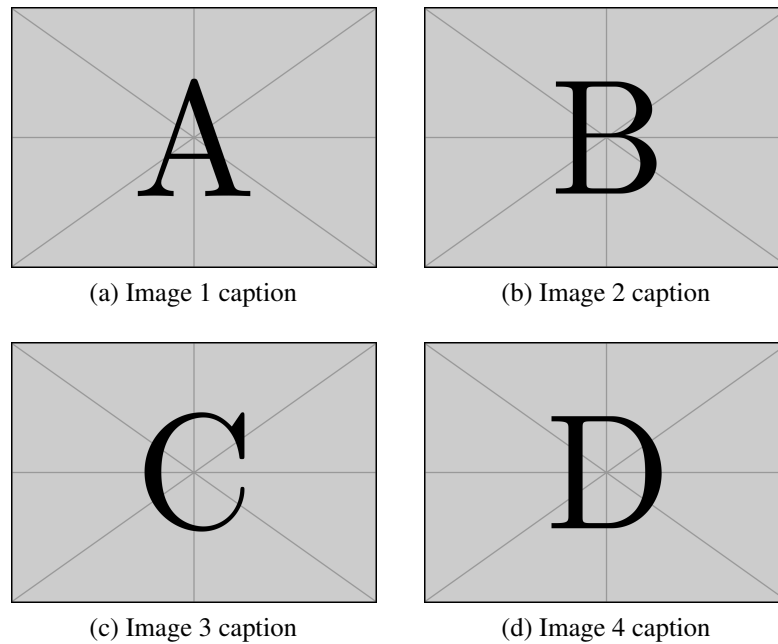


Figure 4.3: Comparison of four different images.

You can reference subfigures individually, such as Figure 4.3b, or the full group using Figure 4.3.

4.2 Tables

Table 4.1: Experimental results for each treatment.

Treatment	Response 1	Response 2
Treatment 1	0.000 326 2	0.562
Treatment 2	0.001 568 1	0.910
Treatment 3	0.000 927 1	0.296

Table 4.2: Sample parameters with corresponding physical units.

Symbol	Description	Value	Units
<i>A</i>	Sample parameter A	12.50	m
<i>B</i>	Sample parameter B	3.14	kg
<i>C</i>	Sample parameter C	−0.98	s

This is an example of referencing a table using its assigned label. As shown in Table 4.2.

CHAPTER 5

Code Environments

5.1 C++ Code environment

C++ Program Listing 1: Code example

```
1  // Unless required by applicable law or agreed to in writing, software
2  // distributed under the License is distributed on an "AS IS" BASIS,
3  // WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
4  // See the License for the specific language governing permissions and
5  // limitations under the License.
6
7  #include <chrono>
8  #include <memory>
9  #include <string>
10
11 #include "rclcpp/rclcpp.hpp"
12 #include "std_msgs/msg/string.hpp"
13
14 using namespace std::chrono_literals;
15
16 /* This example creates a subclass of Node and uses a fancy C++11 lambda
17  * function to shorten the callback syntax, at the expense of making the
18  * code somewhat more difficult to understand at first glance. */
19
20 class MinimalPublisher : public rclcpp::Node
21 {
22 public:
23     MinimalPublisher()
24     : Node("minimal_publisher"), count_(0)
25     {
26         publisher_ = this->create_publisher<std_msgs::msg::String>("topic", 10);
27         auto timer_callback =
28             [this]() -> void {
29                 auto message = std_msgs::msg::String();
30                 message.data = "Hello, world! " + std::to_string(this->count_++);
31                 RCLCPP_INFO(this->get_logger(), "Publishing: '%s'", message.data.c_str());
32                 this->publisher_->publish(message);
33             };
34         timer_ = this->create_wall_timer(500ms, timer_callback);
35     }
36
37 private:
38     rclcpp::TimerBase::SharedPtr timer_;
39     rclcpp::Publisher<std_msgs::msg::String>::SharedPtr publisher_;
40     size_t count_;
41 };
```

```

42
43 int main(int argc, char * argv[])
44 {
45     rclcpp::init(argc, argv);
46     rclcpp::spin(std::make_shared<MinimalPublisher>());
47     rclcpp::shutdown();
48     return 0;
49 }

```

5.2 Arduino Code environment

Program Listing 1: Arduino code example

```

1  /* -----
2     Arduino Style Test (Minimal Directives)
3     Contains:
4     - Basic Arduino functions
5     - A couple of #defines
6     - One #include
7     - LED toggle + analog read
8  ----- */
9
10 #include <Arduino.h>          // Basic Arduino library
11
12 #define LED_PIN 9             // LED output pin
13 #define POT_PIN A0           // Potentiometer analog input pin
14
15 unsigned long lastTime = 0;
16 const unsigned long interval = 500; // LED toggle interval in ms
17
18 void setup() {
19     Serial.begin(9600);
20     pinMode(LED_PIN, OUTPUT);
21     pinMode(POT_PIN, INPUT);
22
23     Serial.println("Arduino minimal directive test started.");
24 }
25
26 void loop() {
27     // Toggle LED every 500 ms
28     if (millis() - lastTime >= interval) {
29         toggleLED();
30         lastTime = millis();
31     }
32
33     // Read analog value
34     int value = analogRead(POT_PIN);
35     Serial.print("Analog: ");
36     Serial.println(value);
37
38     delay(50);
39 }
40
41 // Toggle LED state
42 void toggleLED() {
43     static bool state = LOW;
44     state = !state;
45     digitalWrite(LED_PIN, state ? HIGH : LOW);
46 }

```

CHAPTER 6

Miscellaneous

6.1 Boxes



Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris.



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References

Books

- [Smi12] John Smith. *Book title*. 1st edition. Volume 3. 2. City: Publisher, Jan. 2012, pages 123–200 (cited on page 2).

Articles

- [Smi13] James Smith. “Article title”. In: 14.6 (Mar. 2013), pages 1–8 (cited on page 2).