Title of Thesis

by

Name of Author

Degree Title

2025

Name of Academic Unit
University of Macau

Title of Thesis

by

Name of Author

A thesis submitted in partial fulfillment of the
requirements for the degree of

Degree Title

Name of Academic Unit
University of Macau

2025

Approved by_____
Supervisor

_____

_____

_____

_____

Date_____

In presenting this thesis in partial fulfillment of the requirements for a Master's degree at the University of Macau, I agree that the Library and the Faculty of Science and Technology shall make its copies freely available for inspection. However, reproduction of this thesis for any purposes or by any means shall not be allowed without my written permission. Authorization is sought by contacting the author at

Address:

Telephone:
Fax:
E-mail:

Signature: _____

Date: _____

University of Macau

Abstract

TITLE OF THESIS

by Name of Author

Thesis Supervisor: Name of Supervisor
Degree Title

The Faculty requires an Abstract for a master's or doctoral thesis. It must be in both submitted copies and must follow the format given in the sample. The title of the thesis must appear exactly as it does on the Title Page. The name of your Supervisor must appear in full with his or her appropriate academic title (no professional titles may be used) and the name of the program authorized to offer the degree.

The text of the Abstract must be one-and-one-half or double-spaced and must conform to margin requirements.

All abstracts must not exceed 350 words or 35 lines (this requirement is inline with the requirement of Dissertation Abstracts International so that your abstract could be published in full there if necessary).

It is requested by the publisher that the Abstract not include formulas, diagrams, or symbols. Should a formula, diagram, or symbol be essential to the text in the Abstract, it may not be handwritten. If Greek letters of the alphabet are to be used, they must be clearly inscribed.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

This is a sample document of the University of Macau (UM) Typst thesis template.

1.1. Second level heading

1.1.1. Third level heading

1.1.1.1. Fourth level heading

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguique possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et collaudata est, cum id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et.

1.2. Footnotes

Footnotes contain additional textual material or references to specific citations in the text.[1]

1.3. Font

The University of Macau (UM) is a comprehensive research-oriented public university of international standing. Since her establishment in 1981, UM has been dedicated to providing a multifaceted education through our unique educational model and residential college system and in accordance with the university motto: Humanity, Integrity, Propriety, Wisdom and Sincerity.

In recent years, UM has been taking initiatives for a comprehensive and structural reform and entered a new era of unprecedented growth. We are pleased to see that our progress is being recognised globally as listed in the Times Higher Educa-

[1] When citing literature, give as much information on the page where the citation is made as is consistent with publication practice in the field of research. Footnotes, Chapter Notes, or End Notes do not take the place of a Bibliography or List of References.

tion World University Rankings and through our growing partnership with top academic institutions both at home and abroad. Locally, UM is the first institution to be awarded the Medal of Merit-Education by the Macao SAR government in recognition of the efforts and contributions of the university's staff and students. We are confident that the rising reputation of UM will enable us to scale new heights in the international academic circles.

On behalf of UM, I would like to invite you to browse our website to get a better sense of our academic programmes and latest development. Also, I would like to welcome you to visit our gorgeous campus where you can see our strengths and advantages, interact with us, and experience the uniqueness of the UM community.

CHAPTER 2: MATH AND CITATIONS

2.1. Math

2.1.1. Numbers and Units

Numbers and units support are provided by `unify`:
- $12\,345.678\,90$
- $0.3 \cdot 10^{45}$
- $\mathrm{kg\,m\,s^{-1}}$
- $\mu\mathrm{m}$ $\mu\mathrm{m}$
- Ω Ω
- $0.13\,\mathrm{mm}$
- $10 - 20$
- $(10 - 20)\,^{\circ}\mathrm{C}$

Typst also has special syntax and library functions to typeset mathematical formulas.
- $1 \pm 2\mathrm{i}$
- $1.654 \times 2.34 \times 3.430$

2.1.2. Mathematical Symbols And Formulas

According to (International Organization for Standardization, 2019), an explicitly defined function not depending on the context is printed in upright type, e.g. $\sin$, $\exp$, $\ln$, Γ.

While mathematical constants, the values of which never change, are printed in upright type, e.g. $\mathrm{e} = 2.718\,281\,828...$; $\pi = 3.141\,592...$; $\mathrm{i}^2 = -1$.

Well-defined operators are also printed in upright type, e.g. $\div$, ∂ in ∂x and each d in $\frac{\mathrm{d}f}{\mathrm{d}x}$.

Formulas should be centered on a new line. Each formula should be numbered sequentially by chapter, with the number aligned to the right.

$$\mathrm{e}^{\mathrm{i}\pi} + 1 = 0 \tag{2.1}$$

$$\frac{\mathrm{d}^2 u}{\mathrm{d}t^2} = \int f(x)\,\mathrm{d}x \tag{2.2}$$

The end of the formula needs punctuation, whether a comma or a period, depending on the following sentence.

$$\frac{2h}{\pi}\int_0^\infty \frac{\sin(\omega\delta)}{\omega}\cos(\omega x)\,\mathrm{d}\omega = \begin{cases} h, & |x|<\delta, \\ \frac{h}{2}, & x=\pm\delta, \\ 0, & |x|>\delta. \end{cases} \tag{2.3}$$

When the formula is long, it is best to break the line at the equal sign "=".

$$\begin{aligned} &I(X_3;X_4) - I(X_3;X_4 \mid X_1) - I(X_3;X_4 \mid X_2) \\ &= \left[I(X_3;X_4) - I(X_3;X_4 \mid X_1)\right] - I\big(X_3;X_4 \mid \tilde{X}_2\big) \\ &= I(X_1;X_3;X_4) - I\big(X_3;X_4 \mid \tilde{X}_2\big). \end{aligned} \tag{2.4}$$

If breaking the line at the equal sign is difficult to achieve, you can also break the line at the $+$, $-$, $\times$, $\div$ operators. When breaking the line, the operator should only be written in front of the broken line and not repeated.

$$\begin{aligned} \frac{1}{2}\Delta\big(f_{ij}f^{ij}\big) = 2\Bigg(&\sum_{i<j}\chi_{ij}\big(\sigma_i-\sigma_j\big)^2 + f^{ij}\nabla_j\nabla_i(\Delta f) \\ &+\nabla_k f_{ij}\nabla^k f^{ij} + f^{ij}f^k\left[2\nabla_i R_{jk} - \nabla_k R_{ij}\right]\Bigg). \end{aligned} \tag{2.5}$$

2.1.3. Theorems

`Theorion` is used in this template to set up environments for theorems, lemmas, and propositions.

Theorem 2.1 is an example for a theorem:

Theorem 2.1 (Residue theorem). *Let U be a simply connected open subset of the complex plane containing a finite list of points $a_1, ..., a_n$, $U_0 = U \setminus \{a_1, ..., a_n\}$ and a function f holomorphic on U_0. Letting γ be a closed rectifiable curve in U_0, and denoting the residue of f at each point a_k by $\operatorname{Res}(f, a_k)$ and the winding number of γ around a_k by $*\,\mathrm{I}*(\gamma, a_k)$, the line integral of f around γ is equal to $2\pi\mathrm{i}$ times the sum of residues, each counted as many times as γ winds around the respective point:*

$$\oint_\gamma f(z)\,\mathrm{d}z = 2\pi\mathrm{i}\sum_{k=1}^{n} \mathrm{I}(\gamma, a_k)\ \operatorname{Res}(f, a_k). \tag{2.6}$$

If γ is a positively oriented simple closed curve, $\mathrm{I}(\gamma, a_k)$ is 1 if a_k is in the interior of γ and 0 if not, therefore

$$\oint_\gamma f(z)\,\mathrm{d}z = 2\pi\mathrm{i}\sum \operatorname{Res}(f, a_k). \tag{2.7}$$

with the sum over those a_k inside γ.

Proof of Theorem 2.1.

Proof. *First, according to …*
Next, we have …
Finally, … □

2.2. Notation Of References

When citing literature, give as much information on the page where the citation is made as is consistent with publication practice in the field of research.

A Bibliography or List of References is a comprehensive list of all sources used by the author and is required at the end of each thesis, appearing immediately after the text. For master's thesis, the Faculty will accept any recognized format. Whereas for doctoral thesis, either the MLA(Modern Language Association of America, 2021) or APA(American Psychological Association, 2019) style should be used.

CHAPTER 3: ILLUSTRATIONS

The term *illustrations* refers to informational material that illustrates and enhances the text. Figures, Maps, and tables are all examples of illustrations and are either inserted throughout the text, appearing as soon as possible after the references to them have been made, or grouped at the end of each chapter. Whichever method you choose, you must use it consistently for all the figures, tables, or other illustrations included.

3.1. Figures

Figures may include photographs (original or photocopied), charts, diagrams, graphs, and drawings. If original photographs are used, they must be included in both copies. They must all be listed in the preliminary pages in a List of Figures. Figure numbers and captions appear below the figure.

Typst has a built-in `figure` function for inserting figures, which supports various image formats, including PNG, JPEG, PDF, and SVG.

3.1.1. Single Figure

A simple example of inserting a single figure is shown in Fig. 3.1.

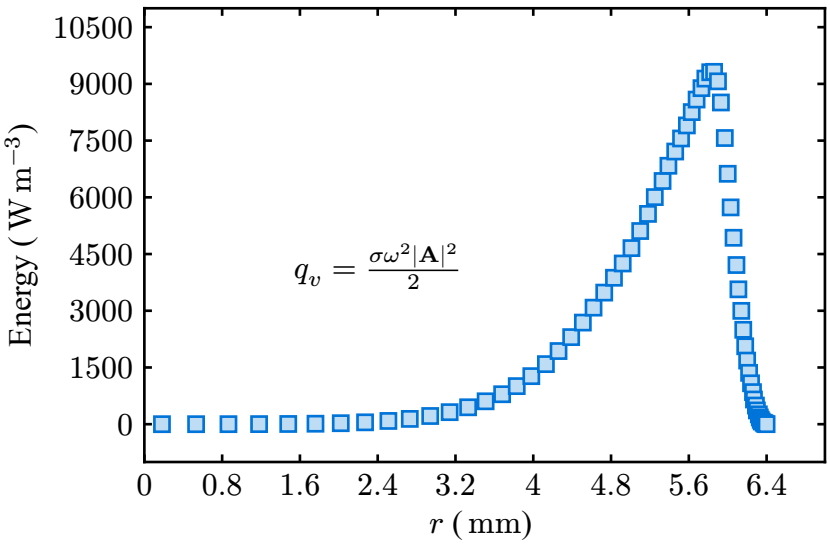


Fig. 3.1. Energy distribution as a function of radial distance.

3.1.2. Multiple Figures

A simple example of inserting multiple figures is shown in Fig. 3.2. These two horizontally aligned subfigures share a single figure counter and do not have individual subfigure titles.

Fig. 3.2. Caption

If the figures are independent and do not share a common figure counter, then you can use the `grid` function, as shown in Fig. 3.3 and Fig. 3.4.

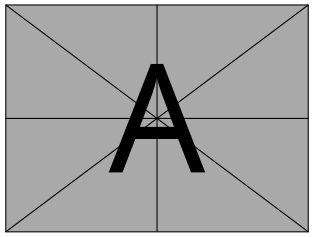


Fig. 3.3. Caption for figure A

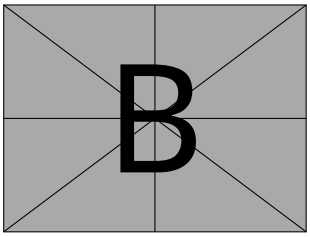
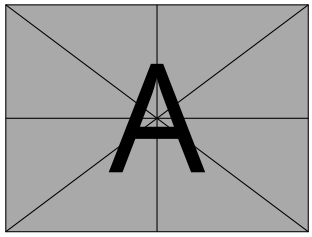
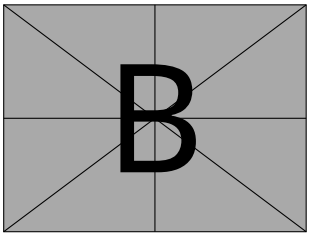


Fig. 3.4. Caption for figure B

If you want to create a single figure with multiple subfigures, you can use the `subfigure` function, as shown in Fig. 3.5a and Fig. 3.5b.



(a) Caption for figure A



(b) Caption for figure B

Fig. 3.5. Caption for subfigures A and B

3.2. Tables

3.2.1. Basic Tables

Tables contain information placed in a columnar arrangement and are the only illustrations numbered and captioned above.

An example of a simple three line table is shown in Table 3.1.

Table 3.1: An elegant three-line table

Item		
Animal	Description	Price ($)
Gnat	per gram	13.65

Item		
Animal	Description	Price ($)
	each	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33
Armadillo	frozen	8.99

3.2.2. Complex Tables

To be implemented

3.3. Algorithms

To be implemented

3.4. Code Blocks

Though Typst has built-in support for code blocks, it is recommended not to put large blocks of code directly in the thesis document. If necessary, you can use the `codly` package to insert code blocks with syntax highlighting.

```c
#include <stdio.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/wait.h>
int main() {
  pid_t pid;
  switch ((pid = fork())) {
    case -1:
      printf("fork failed\n");
      break;
    case 0:
      /* child calls exec */
      execl("/bin/ls", "ls", "-l", (char*)0);
      printf("execl failed\n");
      break;
    default:
      /* parent uses wait to suspend execution until child
      finishes */
```

```
18        wait((int*)0);
19        printf("is completed\n");
20      break;
21    }
22    return 0;
23  }
```

CHAPTER 4: CONCLUSION

This chapter concludes the thesis.

BIBLIOGRAPHY

American Psychological Association. (2019). *Publication Manual of the American Psychological Association* (7th ed.). American Psychological Association. https://apastyle.apa.org/products/publication-manual-7th-edition

International Organization for Standardization. (2019). *Quantities and units — Part 2: Mathematics* (Issues ISO80000–2:2019). https://www.iso.org/standard/64973.html

Modern Language Association of America. (2021). *MLA Handbook* (9th ed.). MLA Handbook Plus. https://mlahandbookplus.org/

APPENDIX A: MAXWELL EQUATIONS

For the two-dimensional case, the polarization vectors are as follows:

$$\mathbf{E} = E_{z(r,\theta)}\hat{\mathbf{z}}, \tag{A.1}$$

$$\mathbf{H} = H_{r(r,\theta)}\hat{\mathbf{r}} + H_{\theta(r,\theta)}\hat{\boldsymbol{\theta}}. \tag{A.2}$$

Taking the curl of (A.2):

$$\nabla \times \mathbf{E} = \frac{1}{r}\frac{\partial E_z}{\partial \theta}\hat{\mathbf{r}} - \frac{\partial E_z}{\partial r}\hat{\boldsymbol{\theta}}, \tag{A.3}$$

$$\nabla \times \mathbf{H} = \left[\frac{1}{r}\frac{\partial}{\partial r}(rH_\theta) - \frac{1}{r}\frac{\partial H_r}{\partial \theta}\right]\hat{\mathbf{z}}. \tag{A.4}$$

Since $\bar{\bar{\mu}}$ is diagonal in cylindrical coordinates, the curl of the electric field $\mathbf{E}$ in Maxwell's equations is:

$$\nabla \times \mathbf{E} = \mathrm{i}\omega\mathbf{B}, \tag{A.5}$$

$$\frac{1}{r}\frac{\partial E_z}{\partial \theta}\hat{\mathbf{r}} - \frac{\partial E_z}{\partial r}\hat{\boldsymbol{\theta}} = \mathrm{i}\omega\mu_r H_r\hat{\mathbf{r}} + \mathrm{i}\omega\mu_\theta H_\theta\hat{\boldsymbol{\theta}}. \tag{A.6}$$

Therefore, the components of $\mathbf{H}$ can be written as:

$$H_r = \frac{1}{\mathrm{i}\omega\mu_r}\frac{1}{r}\frac{\partial E_z}{\partial \theta}, \tag{A.7}$$

$$H_\theta = \frac{1}{\mathrm{i}\omega\mu_\theta}\frac{1}{r}\frac{\partial E_z}{\partial r}. \tag{A.8}$$

Similarly, since $\bar{\bar{\epsilon}}$ is diagonal in cylindrical coordinates, the curl of the magnetic field $\mathbf{H}$ in Maxwell's equations is:

$$\nabla \times \mathbf{H} = -\mathrm{i}\omega\mathbf{D}, \tag{A.9}$$

$$\left[\frac{1}{r}\frac{\partial}{\partial r}(rH_\theta) - \frac{1}{r}\frac{\partial H_r}{\partial \theta}\right]\hat{\mathbf{z}} = -\mathrm{i}\omega\bar{\bar{\epsilon}}\mathbf{E} = -\mathrm{i}\omega\epsilon_z E_z\hat{\mathbf{z}}, \tag{A.10}$$

$$\frac{1}{r}\frac{\partial}{\partial r}(rH_\theta) - \frac{1}{r}\frac{\partial H_r}{\partial \theta} = -\mathrm{i}\omega\epsilon_z E_z. \tag{A.11}$$

From this, we obtain the wave equation for E_z:

$$\frac{1}{\mu_\theta \epsilon_z}\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial E_z}{\partial r}\right)+\frac{1}{\mu_r \epsilon_z}\frac{1}{r^2}\frac{\partial^2 E_z}{\partial \theta^2}+\omega^2 E_z=0. \tag{A.12}$$

APPENDIX B: FLOW CHARTS

The `fletcher` package provides support for creating diagrams with arrows, including flow charts shown in Fig. B.1[2] and state diagrams shown in Fig. B.2[3].

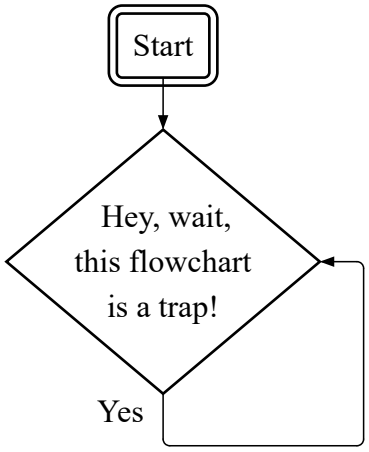


Fig. B.1. Flow chart

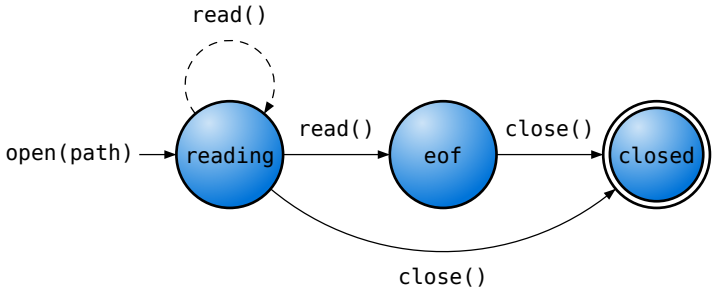


Fig. B.2. State diagram

[2]https://github.com/Jollywatt/typst-fletcher/blob/main/docs/readme-examples/2-flowchart-trap.typ

[3]https://github.com/Jollywatt/typst-fletcher/blob/main/docs/readme-examples/3-state-machine.typ