

CITY UNIVERSITY OF HONG KONG  
香港城市大學

A Title Sample  
一個標題  
示例

Submitted to  
Department of Biomedical Engineering  
生物醫學工程學系  
in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy  
哲學博士學位

by

Pan Fei  
潘飛

January 2021  
二零二一年一月



To



# Abstract

AAA

# CITY UNIVERSITY OF HONG KONG

## Qualifying Panel and Examination Panel

Surname: Pan  
First name: Fei  
Degree: PhD  
Department: Department of Biomedical Engineering

The Qualifying Panel of the above student is composed of:

*Supervisor(s)*

Professor Department of Biomedical Engineering,  
City University of Hong Kong

*Qualifying Panel Member(s)*

Professor Department of Biomedical Engineering,  
City University of Hong Kong

Professor Department of Biomedical Engineering,  
City University of Hong Kong

The thesis has been examined and approved by the following examiners:

Professor Department of Biomedical Engineering,  
City University of Hong Kong

Professor Department of Biomedical Engineering,  
City University of Hong Kong

Professor Department of Biomedical Engineering,  
City University of Hong Kong

Professor Department of Mechanical and Automation Engineering,  
The Chinese University of Hong Kong

## **Acknowledgements**

It has been a long and thrilling journey, with unimaginable challenges, both academic and social, since I came to CityU in the peaceful summer of 2016.





# Table of Contents

<b>List of Figures</b>	<b>xi</b>
<b>List of Tables</b>	<b>xiii</b>
<b>List of Algorithms</b>	<b>xv</b>
<b>List of Listings</b>	<b>xvii</b>
<b>Symbols</b>	<b>xix</b>
<b>Acronyms</b>	<b>xxi</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Background . . . . .	1
1.2 Statement of Problems . . . . .	3
1.3 Research Objectives . . . . .	3
1.4 Methodologies and Significance . . . . .	3
1.5 Summary . . . . .	4
<b>2 Literature Review</b>	<b>5</b>
2.1 Introduction . . . . .	5
2.2 Summary . . . . .	5
<b>3 Your Main Work</b>	<b>9</b>
3.1 Introduction . . . . .	9
3.2 Conclusions . . . . .	10

## Table of Contents

---

<b>4</b>	<b>Experiments</b>	<b>15</b>
4.1	Introduction . . . . .	17
4.2	Experimental Results . . . . .	17
4.2.1	Some Results . . . . .	17
4.2.2	Discussion . . . . .	18
4.3	Conclusions . . . . .	18
<b>5</b>	<b>Conclusions</b>	<b>19</b>
5.1	Summary . . . . .	19
5.2	Future Work . . . . .	19
	<b>References</b>	<b>21</b>
	<b>Index</b>	<b>23</b>
	<b>Appendix A Research Output</b>	<b>25</b>
	<b>Appendix B Curriculum Vitae</b>	<b>27</b>

# List of Figures

2.1	caption . . . . .	6
2.2	caption. . . . .	7
2.3	caption . . . . .	8
3.1	caption. . . . .	9
3.2	caption. . . . .	9
4.1	這是一個測試 . . . . .	15



# List of Tables

3.1	表格 . . . . .	10
3.2	The Skewing Angles ( $\beta$ ) for $\text{Mu}(\text{H}) + \text{X}_2$ and $\text{Mu}(\text{H}) + \text{HX}$ . . . . .	10
3.3	Alphabet . . . . .	10
3.4	一個跨頁的表格 . . . . .	11



# List of Algorithms

4.1 The Bellman-Kalaba algorithm . . . . . 18





# List of Listings

4.1 My C-Code . . . . . 17



# Symbols

$\overrightarrow{OP}$	Displacement of the micropipette tip $P$ to the origin $O$
$(a, b, c)$	Coordinates of $\overrightarrow{OP}$ in the world coordinate frame $(O, x, y, z)$



# Acronyms

<b>PBS</b>	phosphate buffered saline
<b>NCBI</b>	National Center for Biotechnology Information
<b>RNA</b>	ribonucleic acid
<b>DNA</b>	deoxyribonucleic acid
<b>mRNA</b>	messenger RNA
<b>cDNA</b>	complementary DNA
<b>CRISPR</b>	clustered regularly interspaced short palindromic repeats
<b>TGV</b>	train à grande vitesse



# Chapter 1

## Introduction

English. Русский<sup>1</sup>. Español.

Phosphate buffered saline (PBS), National Center for Biotechnology Information (NCBI), ribonucleic acid (RNA), deoxyribonucleic acid (DNA), messenger RNA (mRNA), complementary DNA (cDNA), clustered regularly interspaced short palindromic repeats (CRISPR), and train à grande vitesse (TGV).

PBS, NCBI, RNA, DNA, mRNA, cDNA, CRISPR, and TGV.

### 1.1 Background

Inline math  $\vec{y} = f(\vec{x})$

$$\vec{E}_{\vec{u}\vec{v}} \tag{1.1}$$

$$F(x,y) = \int_{-\infty}^x \int_{-\infty}^y f(u,v) \, \mathrm{d}u \mathrm{d}v \tag{1.2}$$

---

<sup>1</sup>Need to use FreeSerif or Times New Roman font. newtxtext and newpxtext don't contain Cyrillic.

$$F_X(x) = P(X \leq x) = P(X \leq x, Y < +\infty) \quad (1.3)$$

$$= \int_{-\infty}^x \int_{-\infty}^{+\infty} f(u, v) \, du \, dv \quad (1.4)$$

$$= \int_{-\infty}^x \left[ \int_{-\infty}^{+\infty} f(u, v) \, dv \right] du \quad (1.5)$$

$$= \int_{-\infty}^x f_X(x) \, du \quad (1.6)$$

$$F_X(x) = P(X \leq x) = P(X \leq x, Y < +\infty) \\ = \int_{-\infty}^x \int_{-\infty}^{+\infty} f(u, v) \, du \, dv \quad (1.7)$$

$$= \int_{-\infty}^x \left[ \int_{-\infty}^{+\infty} f(u, v) \, dv \right] du$$

$$= \int_{-\infty}^x f_X(x) \, du$$

$$R_{11} = \cos \alpha \cos \gamma - \cos \beta \sin \alpha \sin \gamma \quad (1.8a)$$

$$R_{12} = \sin \alpha \cos \gamma + \cos \beta \cos \alpha \sin \gamma \quad (1.8b)$$

$$R_{13} = \sin \beta \sin \gamma \quad (1.8c)$$

$$R_{21} = -\cos \alpha \sin \gamma - \cos \beta \sin \alpha \cos \gamma \quad (1.8d)$$

$$R_{22} = -\sin \alpha \sin \gamma + \cos \beta \cos \alpha \cos \gamma \quad (1.8e)$$

$$R_{23} = \sin \beta \cos \gamma \quad (1.8f)$$

$$R_{31} = \sin \beta \sin \alpha \quad (1.8g)$$

$$R_{32} = -\sin \beta \cos \alpha \quad (1.8h)$$

$$R_{33} = \cos \beta \quad (1.8i)$$



## 1.2 Statement of Problems

---

$$a'' = \frac{\cos \alpha \cos \gamma - \cos \beta \sin \alpha \sin \gamma}{\cos \theta} a + \frac{\sin \alpha \cos \gamma + \cos \beta \cos \alpha \sin \gamma}{\cos \theta} b + \frac{\sin \beta \sin \gamma}{\cos \theta} c \quad (1.9a)$$

$$b'' = a(-\cos \alpha \sin \gamma - \cos \beta \sin \alpha \cos \gamma) + b(-\sin \alpha \sin \gamma + \cos \beta \cos \alpha \cos \gamma) + c(\sin \beta \cos \gamma) \quad (1.9b)$$

$$c'' = (\cos \beta - \sin \theta \sin \beta \sin \gamma) c - (-\sin \beta \cos \alpha - \sin \theta (\sin \alpha \cos \gamma + \cos \beta \cos \alpha \sin \gamma)) b + (\sin \beta \sin \alpha - \sin \theta (\cos \alpha \cos \gamma - \cos \beta \sin \alpha \sin \gamma)) a \quad (1.9c)$$

## 1.2 Statement of Problems

## 1.3 Research Objectives

In brief, the research objectives of this study are enumerated as follows:

1. AAA;
2. BBB;
3. CCC.

## 1.4 Methodologies and Significance

The major methodologies and their significance are discussed below.

1. AAA.

2. BBB.

3. CCC.

自定義編號和 siunitx 宏包

1 你

2 我

3 他

4 1.0 mm/kg

## 1.5 Summary

# Chapter 2

## Literature Review

### 2.1 Introduction

[1–7].

[8–10].

AAABBBCCC
-----------

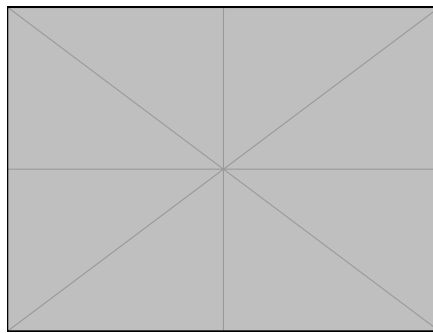
### 2.2 Summary



Fig. 2.1 caption

## 2.2 Summary

---

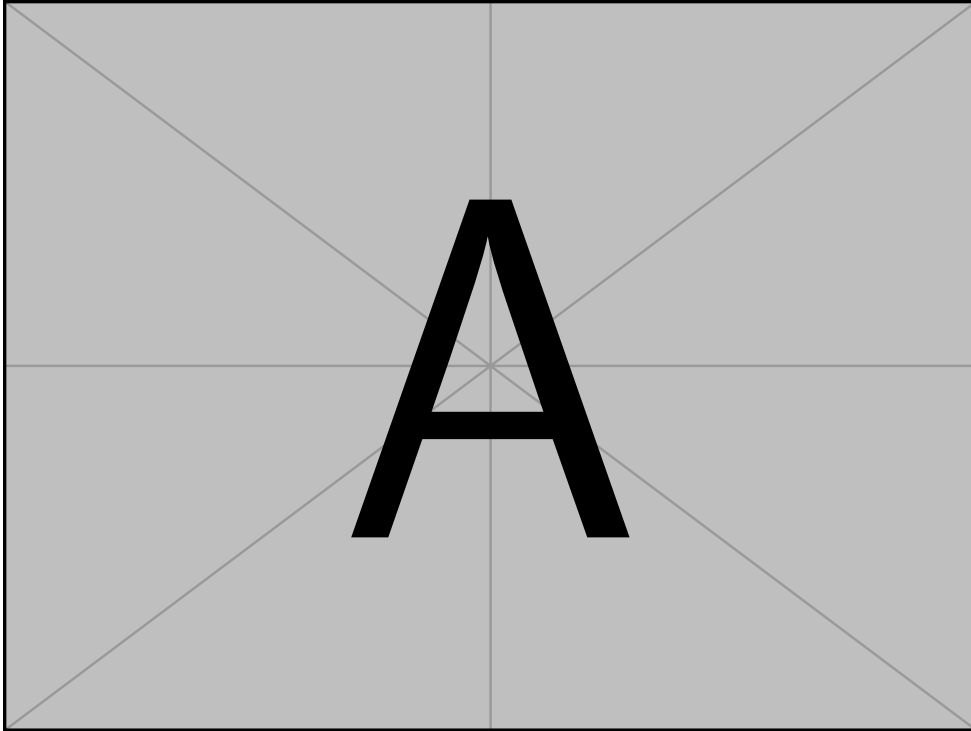


(a)

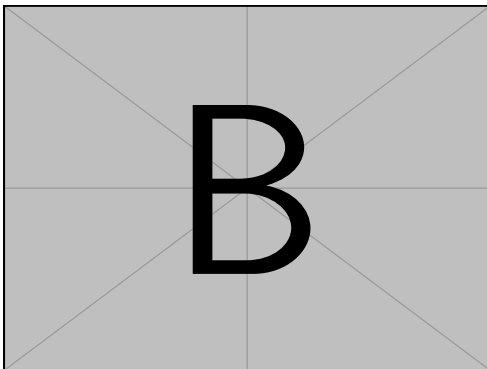


(b)

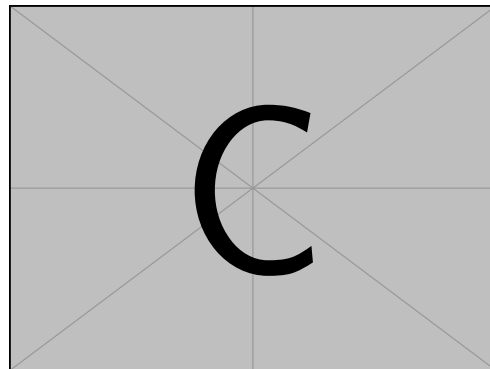
Fig. 2.2 caption.



(a)



(b)



(c)

Fig. 2.3 caption

# Chapter 3

## Your Main Work

### 3.1 Introduction

Chapter 2 reviews the literature on the following subjects ...

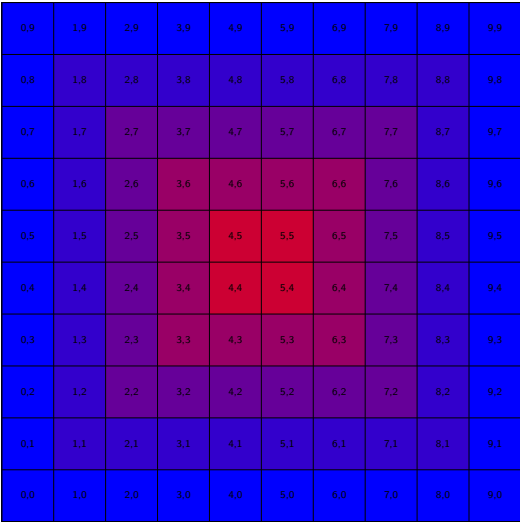


Fig. 3.1 caption.

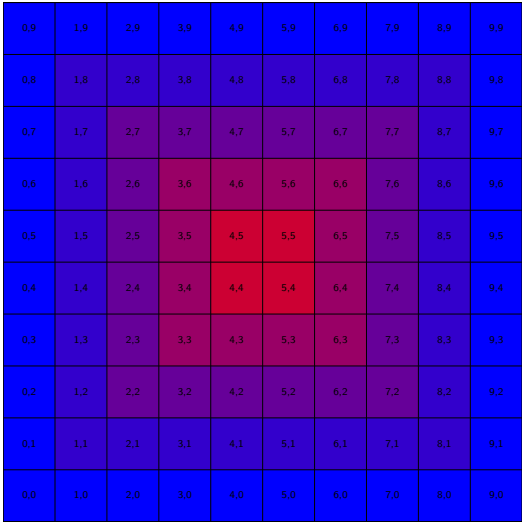


Fig. 3.2 caption.

3.2 Conclusions

Table 3.1 表格

a	b	c	d	e
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15

Table 3.2 The Skewing Angles ( $\beta$ ) for  $\text{Mu(H)} + \text{X}_2$  and  $\text{Mu(H)} + \text{HX}$  <sup>a</sup>

	$\text{H(Mu)} + \text{F}_2$	$\text{H(Mu)} + \text{Cl}_2$
$\beta(\text{H})$	$80.9^\circ$ <sup>b</sup>	$83.2^\circ$
$\beta(\text{Mu})$	$86.7^\circ$	$87.7^\circ$

<sup>a</sup> for the abstraction reaction,  $\text{Mu} + \text{HX} \rightarrow \text{MuH} + \text{X}$ .

<sup>b</sup> 1 degree =  $\pi/180$  radians.

Table 3.3 Alphabet

A2 / A3 A1	B <sup>1</sup>	C <sup>2</sup>
D	E	F
G	H	I

<sup>1</sup> B1

<sup>2</sup> C2



[illegible]

*Continued on next page*

*Continued on next page*

### 3.2 Conclusions

Table 3.4 – continued from previous page

First column	Second column	Third column
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778
One	abcdef ghijklmn	123.456778

<sup>a</sup> test test test test test test test test

<sup>b</sup> test2

*Source:* Made up by daleif



## Chapter 4

### Experiments

項籍者，下相人也，字羽。初起時，年二十四。其季父項梁，梁父即楚將項燕，爲秦將王翦所戮者也。項氏世世爲楚將，封於項，故姓項氏。

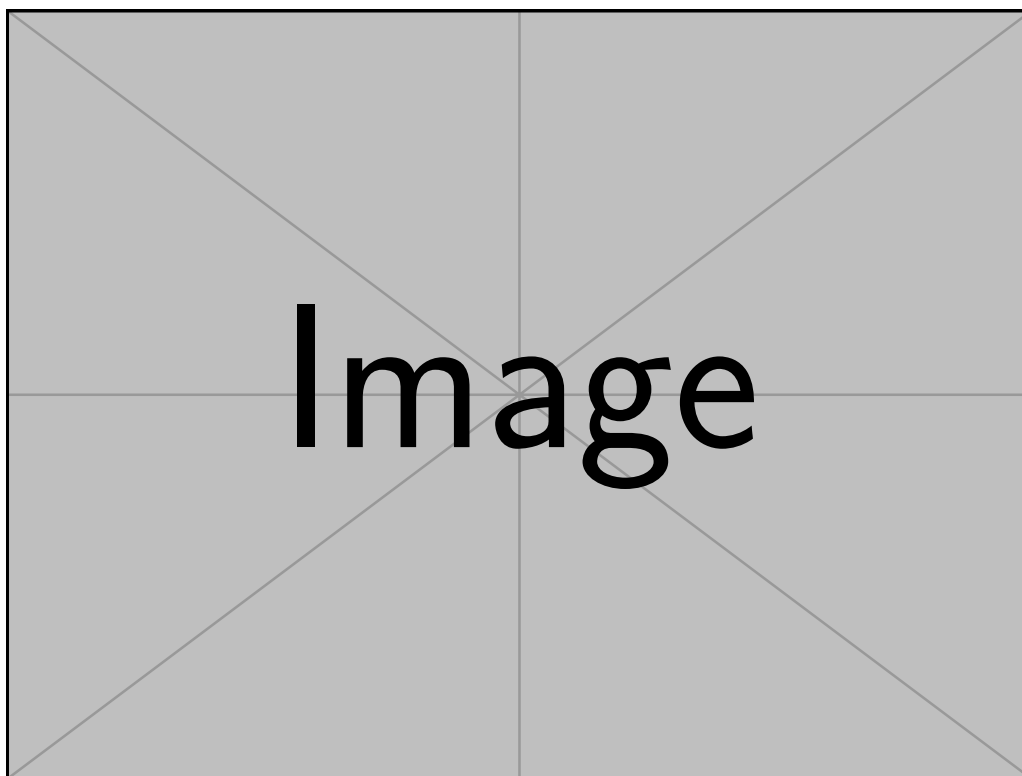


Fig. 4.1 這是一個測試

項籍少時，學書不成，去學劍，又不成。項梁怒之。籍曰：「書足以記名姓而已。劍一人敵，不足學，學萬人敵。」於是項梁乃教籍兵法，籍大喜，略

知其意，又不肯竟學。項梁嘗有櫟陽逮，乃請蕘獄掾曹咎書抵櫟陽獄掾司馬欣，以故事得已。項梁殺人，與籍避仇於吳中。吳中賢士大夫皆出項梁下。每吳中有大繇役及喪，項梁常爲主辦，陰以兵法部勒賓客及子弟，以是知其能。秦始皇帝游會稽，渡浙江，梁與籍俱觀。籍曰：「彼可取而代也。」梁掩其口，曰：「毋妄言，族矣！」梁以此奇籍。籍長八尺餘，力能扛鼎，才氣過人，雖吳中子弟皆已憚籍矣。

秦二世元年七月，陳涉等起大澤中。其九月，會稽守通謂梁曰：「江西皆反，此亦天亡秦之時也。吾聞先即制人，後則爲人所制。吾欲發兵，使公及桓楚將。」是時桓楚亡在澤中。梁曰：「桓楚亡，人莫知其處，獨籍知之耳。」梁乃出，誠籍持劍居外待。梁復入，與守坐，曰：「請召籍，使受命召桓楚。」守曰：「諾。」梁召籍入。須臾，梁眴籍曰：「可行矣！」於是籍遂拔劍斬守頭。項梁持守頭，佩其印綬。門下大驚，擾亂，籍所擊殺數十百人。一府中皆慄伏，莫敢起。梁乃召故所知豪吏，諭以所爲起大事，遂舉吳中兵。使人收下縣，得精兵八千人。梁部署吳中豪傑爲校尉、候、司馬。有一人不得用，自言於梁。梁曰：「前時某喪使公主某事，不能辦，以此不任用公。」眾乃皆伏。於是梁爲會稽守，籍爲裨將，徇下縣。

廣陵人召平於是爲陳王徇廣陵，未欲立嬰便爲王，異軍蒼頭特起。陳嬰母能下。聞陳王敗走，秦兵又且至，乃謂嬰曰：「自我爲汝家婦，未嘗聞汝先渡江矯陳王命，拜梁爲楚王上柱國。古之有貴者，今暴得大名，不祥。不曰：「江東已定，急引兵西擊秦。」項如有所屬，事成猶得封侯，事敗易以梁乃以八千人渡江而西。聞陳嬰已下東亡，非世所指名也。」嬰乃不敢爲王。陽，使使欲與連和俱西。陳嬰者，故東謂其軍吏曰：「項氏世世將家，有名於陽令史，居縣中，素信謹，稱爲長者。楚。今欲舉大事，將非其人，不可。我東陽少年殺其令，相聚數千人，欲置倚名族，亡秦必矣。」於是眾從其言，長，無適用，乃請陳嬰。嬰謝不能，遂以兵屬項梁。項梁渡淮，黥布、蒲將軍彊立嬰爲長，縣中從者得二萬人。少年亦以兵屬焉。凡六七萬人，軍下邳。

當是時，秦嘉已立景駒爲楚王，軍彭城東，欲距項梁。項梁謂軍吏

曰：「陳王先首事，戰秦嘉軍，軍胡陵，將引城堅守不下。已拔，皆阬不利，未聞所在。今秦嘉軍而西。章邯軍至栗，項之。還報項梁。項梁聞陳倍陳王而立景駒，逆無梁使別將朱雞石、餘樊君王定死，召諸別將會薛道。」乃進兵擊秦嘉。秦嘉與戰。餘樊君死。朱雞石計事。此時沛公亦起沛，軍敗走，追之至胡陵。嘉軍敗，亡走胡陵。項梁乃往焉。還戰一日，嘉死，軍降。引兵入薛，誅雞石。項梁景駒走死梁地。項梁已并前使項羽別攻襄城，襄

## 4.1 Introduction

Listing 4.1 My C-Code

```
1 int main() {  
2     printf("hello, world");  
3     return 0;  
4 }
```

Reference to [Listing 4.1](#).


## 4.2 Experimental Results

滄海月明珠有淚，藍田日暖玉生煙。此情可待成追憶，只是當時已惘然。

### 4.2.1 Some Results

微信圖標 


CV 

research gate 

overleaf 

orcid 

orcid 

open access 

---

**Algorithm 4.1** The Bellman-Kalaba algorithm

---

```
1: procedure BellmanKalaba( $G, u, l, p$ )
2:   for all  $v \in V(G)$  do
3:      $l(v) \leftarrow \infty$ 
4:   end for
5:    $l(u) \leftarrow 0$ 
6:   repeat
7:     for  $i \leftarrow 1, n$  do
8:        $min \leftarrow l(v_i)$ 
9:       for  $j \leftarrow 1, n$  do
10:        if  $min > e(v_i, v_j) + l(v_j)$  then
11:           $min \leftarrow e(v_i, v_j) + l(v_j)$ 
12:           $p(i) \leftarrow v_j$ 
13:        end if
14:      end for
15:       $l'(i) \leftarrow min$ 
16:    end for
17:     $changed \leftarrow l \neq l'$ 
18:     $l \leftarrow l'$ 
19:  until  $\neg changed$ 
20: end procedure

21: procedure FindPathBK( $v, u, p$ )
22:   if  $v = u$  then
23:     Write  $v$ 
24:   else
25:      $w \leftarrow v$ 
26:     while  $w \neq u$  do
27:       Write  $w$ 
28:        $w \leftarrow p(w)$ 
29:     end while
30:   end if
31: end procedure
```

---

**4.2.2 Discussion****4.3 Conclusions**



# **Chapter 5**

## **Conclusions**

### **5.1 Summary**

### **5.2 Future Work**



# References

- [1] 鹤麟 盖. *L<sup>A</sup>T<sub>E</sub>X* 科技文档排版. 2005 (cit. on p. 5).
- [2] Helin Gai. *The L<sup>A</sup>T<sub>E</sub>X Mathematics Companion*. 2006 (cit. on p. 5).
- [3] Azad Ghaffari. “Preparing Figures in Matlab and L<sup>A</sup>T<sub>E</sub>X for Quality Publications” (Cymer Center for Control Systems and Dynamics - UC San Diego). 2014 (cit. on p. 5).
- [4] 新刚 黄. 雷太赫排版系统简介 (*L<sup>A</sup>T<sub>E</sub>X Notes*). 2.03. 2013. 215 pp. (cit. on p. 5).
- [5] 海洋 刘. *L<sup>A</sup>T<sub>E</sub>X* 入门. 北京: 电子工业出版社, 2013. 566 pp. ISBN: 978-7-121-20208-7 (cit. on p. 5).
- [6] Tobias Oetiker, Hubert Partl, Irene Hyna, and Elisabeth Schlegl. 一份 (不太) 简短的 *L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>* 介绍. Trans. by CTeX 开发小组. 6.01. ETH Zurich, 2019. 136 pp. (cit. on p. 5).
- [7] Keith Reckdahl. *L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>* 插图指南. Trans. by 磊 王 and 文博 盛. 3.0.1. 2017. 137 pp. (cit. on p. 5).
- [8] Y. A. Abramovich, C. D. Aliprantis, and O. Burkinshaw. “Another Characterization of the Invariant Subspace Problem”. In: *Operator Theory in Function Spaces and Banach Lattices*. The A.C. Zaanen Anniversary Volume, *Operator Theory: Advances and Applications* 75 (1995). Birkhäuser Verlag, pp. 15–31 (cit. on p. 5).
- [9] Christophe Ancey, Philippe Coussot, and Pierre Evesque. “Examination of the possibility of a fluid-mechanics treatment of dense granular flows”. In: *Mechanics of Cohesive-frictional Materials* 1.4 (1996), pp. 385–403. URL: [http://doi.wiley.com/10.1002/\(SICI\)1099-1484\(199610\)1:4%3C385::AID-CFM20%3E3.0.CO;2-0](http://doi.wiley.com/10.1002/(SICI)1099-1484(199610)1:4%3C385::AID-CFM20%3E3.0.CO;2-0) (cit. on p. 5).
- [10] J. B. Conway. *Functions of One Complex Variable*. New York: Springer-Verlag, 1978 (cit. on p. 5).



# Index

## L

literature, 9

## R

research, 3



# **Appendix A**

## **Research Output**

1. AAA





# **Appendix B**

## **Curriculum Vitae**

### **Personal Data**

**Name:** PAN Fei

**Date of birth:** January 1, 1000