

TABLE OF CONTENTS

TITLE PAGE	i
ADVISOR APPROVAL SHEET	ii
EXAMINER APPROVAL SHEET	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	iv
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF APPENDICES	x
LIST OF NOTATIONS AND ABBREVIATION	xi
ABSTRACT	xii
CHAPTER I INTRODUCTION	1
1.1 Background	1
1.2 Research Problem	3
1.3 Scopes and Assumptions	4
1.4 Research Objectives	4
1.5 Research Benefit	4
CHAPTER II LITERATURE REVIEW	5
2.1 Facility Layout Problem	5
2.1.1 Facility Layout Problem with Unequal Areas (UA-FLP)	7
2.1.2 FLP with Safety Concern Objectives	11
2.1.3 UA-FLP Constraints	11
2.2 Approaches to FLP	14
2.3 Multi-objective FLP Optimization Algorithm	15
2.4 Research Position	17
CHAPTER III THEORETICAL BACKGROUND	22
3.1 Layout Optimization	22
3.2 Non-dominated Sorting Genetic Algorithm-II	22
3.3 Multi-objective Particle Swarm Optimization	28
3.4 Multi-objective Metaheuristic Performance Evaluation	29
3.5 Hypothesis Testing	31

3.5.1 Parametric Test	32
3.5.2 Nonparametric Test	34
CHAPTER IV RESEARCH METHODOLOGY	35
4.1 Research Object	35
4.2 Research Tools	35
4.3 Research Stages	35
CHAPTER V RESULTS AND DISCUSSION	39
5.1 UA-FLP Model Formulation	39
5.1.1 Decision Variable	40
5.1.2 Model Parameter	41
5.1.3 Model Constraint	42
5.2 Non-dominated Sorting Genetic Algorithm-II for UA-FLP	46
5.2.1 Two-point Crossover NSGA-II for UA-FLP	47
5.2.2 One-point Crossover NSGA-II for UA-FLP	51
5.2.3 Fitness Evaluation	52
5.3 MOPSO for UA-FLP	60
5.4 Datasets	62
5.4.1 Small Instance Data	62
5.4.2 Medium Instance Data	62
5.4.3 Large Instance Data	62
5.5 Model Verification	63
5.5.1 Chromosome Checking	63
5.5.2 Placement Checking	63
5.5.3 Fitness Checking	64
5.6 Parameter Setting	64
5.7 Experiment and Results	66
5.8 Solution Representation	78
5.9 Statistical Test	82
5.10 Time Consumption	85
CHAPTER VI CONCLUSION AND RECOMMENDATION	87
6.1 Conclusions	87
6.2 Suggestions	88
REFERENCES	89
APPENDICES	92