NAZURAH SYAHZANANI BINTI AMIRUDDIN

BACHELOR OF SURVEYING SCIENCE AND GEOMATICS (HONOURS)

JULY 2024

FUSION OF LINEAR AND NONLINEAR FUNCTIONAL MODEL FOR CADASTRAL NETWORK ADJUSTMENT

NAZURAH SYAHZANANI BINTI AMIRUDDIN

2020618086

SCHOOL OF GEOMATICS SCIENCE AND NATURAL RESOURCES

COLLEGE OF BUILT ENVIRONMENT

UNIVERSITI TEKNOLOGI MARA MALAYSIA

JULY 2024

FUSION OF LINEAR AND NONLINEAR FUNCTIONAL MODEL FOR CADASTRAL NETWORK ADJUSTMENT

NAZURAH SYAHZANANI BINTI AMIRUDDIN

2020618086

Thesis submitted to the Universiti Teknologi MARA Malaysia
in partial fulfilment for the award of the degree of the
Bachelor of Surveying Science and Geomatics (Honours)

JULY 2024

DECLARATION

I declare that the work on this project/dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA (UiTM). This project/dissertation is original and it is the result of my work, unless otherwise indicated or acknowledged as referenced work.

In the event that my project/dissertation be found to violate the conditions mentioned above, I voluntarily waive the right of conferment of my degree of the Bachelor of Surveying Science and Geomatics (Honours) and agree be subjected to the disciplinary rules and regulations of Universiti Teknologi MARA.

Name of Student	:	Nazurah Syahzanani Binti Amiruddin
Student's ID No	:	2020618086
Project/Dissertation Title	:	Fusion of Linear and Non-Linear Functional Model for Cadastral Network Adjustment
Signature and Date	:	26 July 2024

Approved by:

I certify that I have examined the student's work and found that they are in accordance with the rules and regulations of the School and University and fulfils the requirements for the award of the degree of Bachelor of Surveying Science and Geomatics (Honours).

Name of Supervisor	:	Prof. Madya Sr Dr Mohd Azwan bin Abbas
Signature and Date	:	26 July 2024

ABSTRACT

The eCadaster system's development aims to modernize the current implementation by digitalizing the land record, aligning with advancements in information technology. Subsequently, the Coordinate Cadastral System (CCS) has been introduced to serve the purpose of enhancing the efficiency of the cadastral surveying procedure. Nonetheless, in accordance with DSMM Circular No. 1/2010, the NDCDB has not completely preserved the expected positional accuracy. To systematically detect outliers in cadastral records, it is essential to have well-distributed constraints that are connected to existing cadastral boundary marks. However, the traverse method can lead to error propagation and involves significant costs, time, and labor. Instead of relying on traditional traversing, this study aims to quantify the reliability of GNSS baseline vectors in constraining the cadastral network adjustment. Due to the significant discrepancy in functional models, this study begins with the identification of an algorithm to harmonize the linear (GNSS vectors) and non-linear (traverse) models. Later, with the intention to numerically verify the reliability of the hybrid solution, experiments have been performed by employing multi-range configurations, which are: i) 0.5km; ii) 1.0km; iii) 1.5km; and iv) 2.0km. To scrutinize the solution, additional experiments have been carried out by taking into account the variation of measurement time: i)10 minute; ii) 15 minutes; iii) 20 minutes; and iv) 30 minutes. With the vector displacement of less than 0.050m, it is proven that the hybrid algorithm is effective and the solution manage to preserve the positional accuracy. Consequently, the findings have demonstrated the reliability of a hybrid algorithm as an alternative for cadastral network adjustment. With less augmentation by error propagation and simple in implementation, the hybrid algorithm is expected to realize the solution of enhancing the positional accuracy of NDCDB.

Keywords: Cadastral Network Adjustment, Functional Model, Positional Accuracy, Homogenous Control, National Data Cadastral Database (NDCDB)

TABLE OF CONTENTS

CONFIRMATION BY PANEL OF EXAMINERS ..... **iii**
DECLARATION ..... **iv**
ABSTRACT ..... **v**
ACKNOWLEDGMENT ..... **vi**
LIST OF TABLES ..... **x**
LIST OF FIGURES ..... **xi**
LIST OF SYMBOLS ..... **xv**
LIST OF ABBREVIATION ..... **xvi**

CHAPTER 1 INTRODUCTION **1**
1.1 Research Background 1
1.2 Problem Statement 5
1.3 Research questions 7
1.4 Research Aim 7
1.5 Research Objectives 7
1.6 Scope and Limitation 7
1.7 Significance study 9
1.8 Summary 9

CHAPTER 2 LITERATURE REVIEW **10**
2.1 Introduction 10
2.2 Cadastral Modernization 10
2.2.1 Digital Cadastral Database (DCDB) 11
2.2.2 eCadaster (National Digital Cadastral Database, (NDCDB) 12
2.3 Positional Accuracy Improvement 15
2.3.1 Data Legacy 16
2.3.2 Data Acquisition 17
2.3.4 Spatial Database (GIS) 19
2.4 Cadastral Control Network 19
2.4.1 Control Point 20