

**A MODIFICATION OF IMPROVED OSTROWSKI'S METHOD
BASED ON MODIFIED NEWTON METHOD FOR SOLVING
ROOT OF NONLINEAR FUNCTIONS**

NUR SYAHZANANI BINTI SHAHIFUL KHARI

**Thesis submitted in fulfilment of the Requirement for
Bachelor of Science (Hons.) Mathematical Modelling and Analytics
College of Computing, Informatics and Mathematics
Universiti Teknologi MARA**

July 2024

ABSTRACT

Solving nonlinear functions has become a main concern in numerical analysis with various applications within mathematical and engineering fields. Common numerical methods like Newton method and Ostrowski's method have been widely applied since it is simple and easy to be used. Despite that, the speed of convergence is an ongoing concern for these numerical methods. This research tries to modify the Improved Ostrowski's method by substituting Newton method with Modified Newton method in the formula to enhance their performance in finding roots of nonlinear functions. This research employed four different methods which include Newton, Modified Newton, Improved Ostrowski's, and the new Combination of Improved Ostrowski's and Modified Newton method. Comparative analysis has been done using a set of eight nonlinear functions, four different initial guesses, and three levels of tolerance. The numerical results show that the new combined method outperformed other methods by lowering the number of iterations and CPU time.

ACKNOWLEDGEMENT

In the name of Allah, the Most Merciful and Gracious. I sincerely praise and worship to Allah SWT, the Cherisher and Sustainer of the world for providing me with the ability and determination to successfully complete this research project. I would like to extend my heartfelt thanks to all individuals who have contributed to ensure this research project is a success.

First and foremost, I am profoundly grateful to my supervisor, Dr. Mohd Rivaie bin Mohd Ali, for his excellent guidance, endless support, mindful feedback, and constant encouragement throughout this research process. His expertise, understanding, and patience have been invaluable in shaping the direction and quality of this research.

I owe a special debt of appreciation to my family, especially my parents, who have supported and loved me no matter what I have attempted. They have consistently offered me support and validation throughout the difficulties I have encountered. In addition, I also want to acknowledge my friends for their fascinating discussions, assisting, and emotional support as I complete my research. They have helped me stay motivated and concentrated.

Finally, I would want to thank everyone who has indirectly contributed to this research. Every support has been hugely acknowledged.

TABLE OF CONTENTS

	Page
DECLARATION BY THE SUPERVISOR	i
DECLARATION BY THE CANDIDATE	ii
ABSTRACT	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	x
LIST OF FIGURES	xii
LIST OF ALGORITHMS	xiii
CHAPTER ONE: INTRODUCTION OF RESEARCH	1
1.1 Introduction	1
1.2 Background study	1
1.3 Problem Statement	3
1.4 Objectives	5
1.5 Significance of the Research	5
1.6 Scope of the Research	6
1.7 Research Benefits	7
1.8 Definition of Terms and Concepts	7
1.9 Organization of Research	9
CHAPTER TWO: LITERATURE REVIEW	11
2.1 Introduction	11
2.2 Literature Review of Nonlinear Functions	11
2.3 Literature Review of Numerical Methods	12

2.3.1	Newton Method	13
2.3.2	Modified Newton Method	16
2.3.3	Ostrowski's Method	18
2.3.4	Improved Ostrowski's Method	20
2.4	Conclusion	21
CHAPTER THREE: METHODOLOGY		22
3.1	Introduction	22
3.2	Fundamentals concepts for finding root	22
3.2.1	Newton Method	24
3.2.2	Modified Newton Method	25
3.2.3	Improved Ostrowski's Method	26
3.2.4	New Combination of Improved Ostrowski's and Modified Newton Methods	27
3.3	Research Step	30
3.4	Conclusion	31
CHAPTER FOUR: IMPLEMENTATION		32
4.1	Introduction	32
4.2	Sample of functions	32
4.3	Implementation of Numerical Methods	37
4.3.1	Implementation of Newton Method	37
4.3.2	Implementation of Modified Newton Method	40
4.3.3	Implementation of Improved Ostrowski's Method	42
4.3.4	Implementation of Combination of Improved Ostrowski's and Modified Newton Methods	46
4.4	Error Calculation	49