

**COMPARATIVE STUDY OF MODIFIED BFGS AND NEW
SCALE MODIFIED BFGS FOR SOLVING UNCONSTRAINED
OPTIMIZATION**

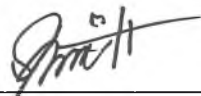
SHAHIRAH ATIKAH BINTI MOHAMAD HUSNIN

**BACHELOR OF SCIENCE (HONS.) COMPUTATIONAL
MATHEMATICS UNIVERSITI TEKNOLOGI MARA**

2018

DECLARATION BY CANDIDATE

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Teknologi MARA or other institutions.



SHAHIRAH ATIKAH BINTI MOHAMAD HUSNIN
2015418966
JUNE 6, 2018

ABSTRACT

Broyden-Fletcher-Goldfarb-Shanno (BFGS) is one of a well-known Quasi-Newton update formula. This method is generally considered as the most efficient method among other variable metric methods for solving unconstrained optimization problems. To improve the BFGS methods, numerous studies and modifications have been devoted recently. In this research, the modified BFGS (mBFGS) works by Liao (1997) is scaled with a new scalar to reduce the number of iterations. A new scaled modified BFGS (smBFGS) is compared with the mBFGS in terms of iteration numbers and CPU time. These methods were tested with several selected functions by using code Maple 18 software. The numerical analysis shows a strong evidence that the smBFGS is more efficient than the mBFGS method. This indicated that the new scaled mBFGS algorithm performance is better than mBFGS algorithms.

TABLE OF CONTENTS

DECLARATION BY SUPERVISOR	i
DECLARATION BY CANDIDATE	ii
ABSTRACT	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENT	v
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ABBREVIATIONS AND SYMBOLS	x
LIST OF ALGORITHMS	xi
1. INTRODUCTION OF RESEARCH	1
1.1 Introduction	1
1.2 Background of Study	1
1.3 Problem Statement	5
1.4 Objectives	6
1.5 Significant of the Project	6
1.6 Scope of the Project	7
1.7 Project Benefit	8
1.8 Organization of Project	8
2. METHODOLOGY	11
2.1 Introduction	11
2.2 Literature Review	11
2.3 Definition of Term and Concepts	16

2.3.1	Optimization	16
2.3.2	Quasi-Newton method	16
2.3.3	Broyden-Fletcher-Goldfarb-Shanno method	17
2.3.4	Number of Iteration	17
2.3.5	Central Processing Unit (CPU) time	17
2.4	Research step	18
2.5	Fundamental Concept of Unconstrained Optimization Method	22
2.5.1	Broyden-Fletcher-Goldfarb-Shanno (BFGS)	24
2.6	Stopping Criteria	26
2.7	Conclusion	27
3.	IMPLEMENTATION	28
3.1	Introduction	28
3.2	Standard optimization test functions	28
3.2.1	Problem 1 (Example 5.94, Bhatti, 2012)	29
3.2.2	Problem 2 (White & Holst function, n=2)	30
3.2.3	Problem 3 (Quadratic QF2 function, n=2)	31
3.2.4	Problem 4 (Cube function, n=2)	32
3.2.5	Problem 5 (Extended Himmelblau function, n=2)	33
3.2.6	Problem 6 (Strait function, n=2)	34
3.2.7	Problem 7 (Rosenbrock function, n=2)	35
3.2.8	Problem 8 (Six-hump camel back function)	36
3.3	Implementation of Unconstrained Optimization Method	37
3.3.1	Implementation of Modified BFGS algorithm	37
3.3.2	Implementation of new Scaled Modified BFGS algorithm	41