UNIVERSITI TEKNOLOGI MARA

A MODIFIED w-TH SECTION LINE SEARCH IN CONJUGATE GRADIENT METHODS FOR SOLVING UNCONSTRAINED OPTIMIZATION

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science
(Mathematics)

Faculty of Computer and Mathematical Sciences

April 2018

ABSTRACT

Conjugate Gradient (CG) method are well-known method for solving unconstrained optimization problems. A lot of efforts have been done in order to improve the efficiency of this CG methods. For unconstrained optimization, line search act as a pillar for solving optimization problems. In this research, a new modification of inexact line search in CG methods is proposed. It is based on classical bisection line search method. Generally, bisection method is the easiest method to solve root of a function. Thus, it is an ideal method to employ as a line search in CG methods. This new modification that was proposed by Hayati (2015) is named as n-th section method. However, n-th section method inherits the same behaviour as bisection method which is slow convergence. Thus, a re-modification on n-th section algorithm is conducted to reduce its CPU time per execution. Overall, six line search methods that are employed in CG methods which are classical bisection, 4^{th} section, 6^{th} section, modified bisection, modified 4^{th} section and modified' 6^{th} section are compared through performance profile analysis based on number of iterations and CPU times. These line search methods are tested based on six standard optimization test problems. The CG methods used in this research are classical formulas known as Fletcher-Reeves (FR), Polak-Ribiere-Polyak (PRP) and Rivaie-Mustafa-Ismail-Leong (RMIL). All algorithms are written and executed using Maple 16 software. Numerical results show that modified 6^{th} section is the best method in term of number of iterations while modified 4^{th} section is the best based on CPU times. Other than that, the modified version of n-th section line search method has less amount of CPU time allocated to execute CG's algorithm when compared to the original version of n-th section line search method. In a nutshell, modified n-th section line search method is more promises and efficient compared to the classical bisection line search.

ACKNOWLEDGEMENT

Praise to Allah S.W.T for showering me the absolute graces and endless blessings, giving me the strength and determination to complete this research successfully. It has been quite a rollercoaster ride throughout this journey. Nevertheless, there are always nice people willing to lend their helping hands, lifting me up at the time that I am falling down and heal my spirit at the moment that I felt almost impossible to make it on my own. It taught me that, walking away is never an option.

It is a genuine pleasure to express my first and sincere gratitude to Dr. Mohd Rivaie Mohd AH as my main supervisor. He gave a huge contribution of knowledge to my work and never felt reluctant in sharing his tremendous ideas and opinions. He is indeed my role model, philosopher and motivator since day one of my master journey. I am indebted to his willingness to be my main supervisor for almost two years to complete this study which is often fraught with unpredictable circumstances.

Next, I would like to thank to Prof. Assoc. Dr. Khairil Iskandar Othman as my co-supervisor and the same goes to Dr. Ibrahim Jusoh. Despite of their overwhelming works, they manage to spend their time with students. Their timely advice, great supervision and follow up are undeniably meaningful to my research development. I am also extending my thankfulness to Dr. Fuziyah Ishak and Dr. Nurul Izzah Othman for their keen of interests towards my works at every stage of my research. Their prompt inspiration, helpful advices during colloquium and guidance help me to fulfill the research requirements. Thanks to the Faculty of Computer and Mathematical Sciences (FSKM), UiTM for providing this land of opportunity for me to keep broaden my knowledge whilst enhancing my research, technical and soft skills. It is an honour to be part of UiTM students. Credits also given to Mr. Muhammad Fauzi Embong, Madam Roslina Ramli and other lecturers that willing to share some of their knowledge and experiences.

I am also happy to acknowledge my gratitude to Madam Nor Shida Hussain and Madam Norhartini Abdul Wahab, the staffs of UiTM Kuala Terengganu residential college management for providing the accommodation during my period of study. Besides, they were nice, very supportive and gave many advices that truly boost my enthusiasm.

Special appreciation also goes to my batchmate and colleague, Nurul Atikah Mohamed Ramli. I am never felt alone doing my research with her presence. She is very pro-active in term of exchanging ideas and never felt hesitate to share her opinions. I am also grateful to have her as my teamwork in some research activities.

Never forget to my parent and siblings, whom had given endless moral support, continuous encouragement and being my financial support. Last but not least, special thanks to Syamim Sarifuddin, Izzul Azim, Rashiruddin Sahidan, Nur Fara Ain, Nujma Hayati, Hafawati Fadhilah and to all my beloved friends, who had sacrificing their time to help and support me throughout my research. Without every single person as mentioned in this acknowledgement, my research journey would be meaningless.

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