UNIVERSITI PUTRA MALAYSIA

COUPLED BLOCK METHOD FOR SOLVING ORDINARY AND DELAY DIFFERENTIAL EQUATIONS

HUE CHI SAN

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MASTER OF SCIENCE
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COUPLED BLOCK METHOD FOR SOLVING ORDINARY AND DELAY DIFFERENTIAL EQUATIONS

By

HUE CHI SAN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

October 2011

DEDICATION

To

My Dear Supervisors

And

My Lovely Family

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

COUPLED BLOCK METHOD FOR SOLVING ORDINARY AND DELAY DIFFERENTIAL EQUATIONS

By

HUE CHI SAN

October 2011

Chairman: **Zanariah Abdul Majid, PhD**

Faculty: **Science**

The idea of this thesis is to introduce two numerical methods which are known as coupled block methods for solving first order Ordinary Differential Equations (ODEs) using variable step size and order. The methods consist of two block methods which were presented as in the simple form of the Adams Moulton type.

Next, the methods were implemented for solving Delay Differential Equations (DDEs) using variable step size and order. The delay term was approximated using divided difference interpolation.

The stability properties of the developed block methods when applied to ODEs and DDEs were studied and their regions of stability were presented.

The numerical results showed that the performance of the proposed methods are acceptable in terms of total number of steps, maximum error and execution time for solving first order ODEs and DDEs using variable step size and order.

In conclusion, the methods were competitive and suitable for solving ODEs and DDEs.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KAEDAH BLOK PASANGAN BAGI MENYELESAIKAN PERSAMAAN PEMBEZAAN BIASA DAN LENGAH

Oleh

HUE CHI SAN

Oktober 2011

Pengerusi: Zanariah Abdul Majid, PhD

Fakulti: Sains

Idea dalam tesis ini adalah untuk memperkenalkan dua kaedah berangka yang dikenali sebagai kaedah blok pasangan untuk menyelesaikan Persamaan Pembezaan Biasa (PPB) peringkat pertama menggunakan peringkat dan panjang langkah berubah. Kaedah ini mengambilkira dua kaedah blok di mana kaedah blok ini dipersembahkan dari jenis Adams Moulton yang ringkas.

Seterusnya, kaedah ini dilaksanakan untuk menyelesaikan Persamaan Pembezaan Lengah (PPL) menggunakan peringkat dan panjang langkah berubah. Sebutan lengahnya diperolehi dengan menggunakan interpolasi beza bahagi.

Ciri-ciri kestabilan bagi kaedah blok yang dibangunkan untuk menyelesaikan PPB dan PPL dikaji dan rantau kestabilannya diberikan.

Keputusan berangka menunjukkan prestasi kaedah yang dicadangkan boleh diterima dari segi jumlah langkah, ralat maksima dan masa pelaksanaan penyelesaian bagi menyelesaikan PPB dan PPL peringkat pertama menggunakan peringkat dan panjang langkah berubah.

Kesimpulannya, kaedah adalah berdaya saing dan sesuai bagi penyelesaian PPB dan PPL.

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I certify that a Thesis Examination Committee has met on 11 October 2011 to conduct the final examination of Hue Chi San on her thesis entitled "Coupled Block Method for Solving Ordinary and Delay Differential Equations" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

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Professor and Deputy Dean
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Date: 20 December 2011

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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HUE CHI SAN

Date: 11 October 2011

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