

SOLUTIONS OF GENERAL SECOND ORDER ODES USING DIRECT BLOCK METHOD OF RUNGE-KUTTA TYPE

(Penyelesaian bagi Persamaan Pembezaan Biasa Umum Peringkat Kedua dengan
Kaedah Blok Langsung Jenis Runge-Kutta)

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ABSTRACT

This paper presents a three point block variable step size method of Runge-Kutta type for solving general second order ordinary differential equations (ODEs). The block method is formulated using Lagrange interpolation polynomial. Most of the mathematical problems which involve higher order ODEs could be reduced to system of first order equations. The proposed method obtains the numerical solutions directly without reducing to first order systems of ODEs. The method is used to compute the solutions at three points simultaneously by integrating the coefficients over the closest point in the block. The stability region of the block method is also studied. The numerical results obtained shows that the proposed method is more efficient compared to existing block methods in terms of total steps and execution time.

Keywords: Block method; variable step size; ordinary differential equations

ABSTRAK

Dalam makalah ini diperkenalkan kaedah blok tiga titik jenis Runge-Kutta untuk penyelesaian peringkat kedua persamaan pembezaan biasa (PBB) umum menggunakan panjang langkah berubah. Kaedah blok ini dirumus menggunakan polinomial interpolasi Lagrange. Kebanyakan masalah matematik yang melibatkan peringkat tinggi PBB akan menurunkan masalah kepada sistem peringkat pertama PBB. Kaedah yang dicadangkan ini menentukan penyelesaian berangka secara langsung tanpa perlu diturunkan kepada sistem peringkat pertama PBB. Kaedah ini digunakan untuk mengira penyelesaian pada tiga titik secara serentak dengan mengamirkan pekali-pekali pada titik terdekat di dalam satu blok. Kestabilan kaedah blok ini juga turut dikaji. Keputusan berangka yang diperolehi menunjukkan kaedah yang dicadangkan adalah lebih cekap berbanding dengan kaedah blok sedia ada dari segi jumlah langkah dan masa pelaksanaan.

Kata kunci: Kaedah blok; panjang langkah berubah; persamaan pembezaan biasa

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