Developing Parallel Block Method for Solving Higher Order ODEs Directly

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Introduction

Numerous problems that are encountered in various branches of science and engineering involve ordinary differential equations (ODEs). Some of these problems require lengthy computation and immediate solutions. With the availability of parallel computer, the demands can be achieved.

However, most of the existing methods for solving ODEs directly, particularly of higher order, are sequential in nature. These methods approximate numerical solution one point at a time and therefore do not fully exploit the capability of parallel computers. Hence, the development of parallel algorithms to suit these machines becomes essential. Some earlier work on parallisation of methods for solving ODEs are given in. Tam, 1992 and Gear et al, 1993.

Materials and Methods

In this research, new explicit and implicit parallel block methods for solving a single equation of ODE directly using constant step size and order are developed. These methods, which calculate the numerical solution at more than one point simultaneously, are parallel in nature. The programs of the methods employed are run on a shared memory Sequent Symmetry S27 parallel computer. The numerical results show that the new methods reduce the total number of steps and execution time. The accuracy of the parallel block and 1-point methods is comparable particularly when finer tolerances are used.

Results and Discussion

A new parallel algorithm for solving systems of ODEs using variable step size and order is also developed. The strategies used to design this method are based on both the Direct Integration (DI) and parallel block methods. The results demonstrate the superiority of the new method in terms of the total number of steps and execution times especially with finer tolerances. We have also successfully worked on partitioning the ODEs and solving by Runge-Kutta type methods with a view of parallising the partitioning techniques.

Conclusions

In conclusion, the new methods developed can be used as viable alternatives for solving higher order ODEs directly.

Benefits from the study

The new methods developed can be used for solving higher order ODEs directly.

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