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Block Hybrid Numerical Integrators for the Solution of Stiff Equations

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Abstract

Stiff equations occur in a wide variety of applications including springs, damping systems and chemical reactions. The stiffness occurs due to the great difference among the reaction constants.Due to step size restriction, it becomes necessary to search for numerical methods with large regions of absolute stability . In this paper, new block hybrid linear integrators of the Adams Moulton class for the solution of stiff systems are constructed. This is achieved through the multistep collocation approach which yielded discrete schemes used simultaneously in block form as block integrators. This approach eliminates the use of starting values and overlap of pieces of solutions. The stability analysis of the new methods carried shows that they A-stable, a property desirable of any numerical method suitable for the solution of stiff systems. The new methods are tested on circular reaction equations, conserved systems, Robertson problem and a chemical reaction problem. The results shows that the new methods are efficient as they compare favorably with the state of the art Mat lab ode solver, ode23s.

Key words: Block Linear integrators ,multi step collocation, A-stability, stiff systems, chemical reactions.