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Development and Implementation of Block Unification Multi-step Methods for the Solution of Second Order Ordinary Differential Equations

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In this paper, linear multi-step hybrid block methods with three-, four- and fivestep numbers are developed for approximating directly the solution of second order Initial and Boundary Value Problems (IBVPs). Multiple finite difference formulas are derived and combined in a block formulation to form a numerical integrator that provides direct solution to second order IBVPs over sub-intervals. A new class of orthogonal polynomials constructed as basis function to develop the hybrid block methods adopting collocation technique with a non-negative weight function. The scheme is applied as simultaneous integrator to second order initial value and boundary value problems of ODEs. The properties and convergence of the proposed method are discussed. The derived schemes were used to solve some problems and the numerical result shows the effectiveness, accuracy and superiority of the method over the existing methods found in the literature.

Keywords : *Second Order ODEs; Multi-step Methods; Orthogonal Polynomials; Collocation Methods*

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An Experimental Study of The Modified Accelerated Overrelaxation (MAOR) Scheme on Stationary Helmholtz Equation

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The theoretical idea of the MAOR scheme has been done by Hadjidimos et. al. [1]. Thus, this research experiment the Modified Accelerated Overrelaxation (MAOR) scheme on second order iterative method for solving two dimensional (2D) Helmholtz Equation. The equation is discretized using the standard second order (Full Sweep) finite difference method. Several numerical experiments were conducted on two different equations to test the feasibility of this scheme. The MAOR scheme is compared with previous well known relaxation schemes to show its superiority on different mesh size.

Keywords : *Modified Accelerated Overrelaxation; Second Order Iterative Method; Partial Differential Equations; Finite Difference Approximation; Red-Black Ordering Strategy*