

Development Of Finite Difference Solution Applying Complexity Reduction Approach For Solving Partial Differential Equations

Abstract

Partial differential equations (PDE's) are widely used to form the basis of many mathematical models in various fields of applications in engineering, robotics, economics, physics, etc. Then solving partial differential equations (PDE's) numerically is, even today, still a great challenge. As a result, a lot of attention on the development of discretization schemes and iterative methods have been inspired and formulated to get numerical solutions of any PDE's. Again according to the findings of previous studies mainly in solving any system of linear equations generated by discretizing differential equations in mathematical models, various families of iterative methods have been also proposed and discussed. Following to that, the literature reviews on the concept of the quarter-sweep iterative methods have pointed out that these methods can accelerate their convergence rate in solving any system of linear equations in which linear systems are generated by the corresponding finite difference approximation equations. Therefore, these iterative methods can be categorized as one of the efficient iterative methods. Actually, the core characteristic of the quarter-sweep iterative methods is to reduce the computational complexity over the generated linear system. Due to the advantage of this characteristic via the combination between the concept of quarter-sweep iteration and several families of proposed standard iterative methods, it can be also observed that the convergence rate of modification over the families of the proposed iterative methods can be shown more superior than the standard full-sweep iterative methods. To sum up, the quarter-sweep iterative methods are suitable to be implemented in solving linear partial differential equations.

Keywords: Quarter-Sweep Iteration, Boundary Value Problems, Finite Difference Scheme