Half-Sweep Refinement of SOR Iterative Method via Linear Rational Finite Difference Approximation for Second-Order Linear Fredholm Integro-Differential Equations

ABSTRACT

The numerical solutions of the second-order linear Fredholm integro-differential equations have been considered and discussed based on several discretization schemes. In this paper, the new schemes are developed derived on the hybrid of the three-point half-sweep linear rational finite difference (3HSLRFD) approaches with the half-sweep composite trapezoidal (HSCT) approach. The main advantage of the established schemes is that they discretize the differential terms and integral term of second-order linear Fredholm integro-differential equations into the algebraic equations and generate the corresponding linear system. Furthermore, the half-sweep (HS) concept is combined with the refinement of the successive over-relaxation (RSOR) iterative method to create the new half-sweep successive over-relaxation (HSRSOR) iterative method, which is implemented to get the numerical solution of a system of linear algebraic equations. Apart from that, the classical or full-sweep Gauss-Seidel (FSGS) and full-sweep successive over-relaxation iterative (FSSOR) methods are presented, which serve as the control method in this paper. In the end, we employed FSGS, FSRSOR and HSRSOR methods to obtain numerical solutions of three examples and make a detailed comparison from three aspects of the number of iterations, elapsed time and maximum absolute error. Numerical results demonstrate that FSRSOR and HSRSOR methods have lesser iterations, faster elapsed time, and are more accurate than FSGS. In addition, HSRSOR is the most effective of the three methods. To sum up, this paper has successfully proposed the applicability and superiority of the new HSRSOR method based on 3HSLRFD-HSCT schemes.