Numerical Solution of Nonlinear Fredholm Integral Equations Using Half-Sweep Newton-PKSOR Iteration

ABSTRACT

This paper is concerned with producing an efficient numerical method to solve nonlinear Fredholm integral equations using Half-Sweep Newton-PKSOR (HSNPKSOR) iteration. The computation of numerical methods in solving nonlinear equations usually requires immense amounts of computational complexity. By implementing a Half-Sweep approach, the complexity of the calculation is tried to be reduced to produce a more efficient method. For this purpose, the steps of the solution process are discussed beginning with the derivation of nonlinear Fredholm integral equations using a quadrature scheme to get the half-sweep approximation equation. Then, the generated approximation equation is used to develop a nonlinear system. Following that, the formulation of the HSNPKSOR iterative method is constructed to solve nonlinear Fredholm integral equations. To verify the performance of the proposed method, the experimental results were compared with the Full-Sweep Newton-KSOR (FSNKSOR), Half-Sweep Newton-KSOR (HSNKSOR), and Full-Sweep Newton-PKSOR (FSNPKSOR) using three parameters: number of iteration, iteration time, and maximum absolute error. Several examples are used in this study to illustrate the efficiency of the tested methods. Based on the numerical experiment, the results appear that the HSNPKSOR method is effective in solving nonlinear Fredholm integral equations mainly in terms of iteration time compared to rest tested methods.