Newton Explicit Decoupled Group Solution for Two-Dimensional Nonlinear Porous Medium Equation Problems

ABSTRACT

This paper presents a Newton Explicit Decoupled Group method based on a half-sweep implicit finite difference scheme as an efficient solution method for two-dimensional nonlinear porous medium equation problems. The mathematical problem is subjected to the initial and Dirichlet's boundary conditions. This paper used the half-sweep technique to derive the implicit finite difference scheme to discretize the considered differential equation. The stability of the two-dimensional half-sweep finite difference approximation is analyzed. Newton method is applied to form the system of the linearized equation before the solution is approximated using the proposed Explicit Decoupled Group method. The proposed method is tested on several problems. The obtained numerical result is compared with the numerical result from the existing method from the same family of Newton-Explicit Group and the classical Newton-Gauss–Seidel method. The efficiency of the proposed method is determined based on the number of iterations and computation time. Computational complexity analysis is also reported.