

# **An unconditionally stable implicit difference scheme for 2D porous medium equations using four-point NEGMSOR iterative method**

## **ABSTRACT**

In this paper, a numerical method has been proposed for solving several two-dimensional porous medium equations (2D PME). The method combines Newton and Explicit Group MSOR (EGMSOR) iterative method namely four-point NEGMSOR. Throughout this paper, an initial boundary value problem of 2D PME is discretized by using the implicit finite difference scheme in order to form a nonlinear approximation equation. By taking a fixed number of grid points in a solution domain, the formulated nonlinear approximation equation produces a large nonlinear system which is solved using the Newton iterative method. The solution vector of the sparse linearized system is then computed iteratively by the application of the four-point EGMSOR method. For the numerical experiments, three examples of 2D PME are used to illustrate the efficiency of the NEGMSOR. The numerical result reveals that the NEGMSOR has a better efficiency in terms of number of iterations, computation time and maximum absolute error compared to the tested NGS, NEG and NEGSOR iterative methods. The stability analysis of the implicit finite difference scheme used on 2D PME is also provided.