**Half-Sweep Newton-KSOR with wave variable transformation to solve forced porous medium equations**


## ABSTRACT

This paper intends to numerically solve the Forced Porous Medium Equation (FPME). The FPME is a Partial Differential Equation (PDE) that suffers from nonlinearity, making finding their exact solutions quite challenging. Therefore, approximate solutions to the FPME are necessary, leading to researchers' efforts to invent various analytical and numerical methods. Some existing numerical methods are sufficient to solve nonlinear PDEs. However, the computational costs are another issue to deal with. Hence, an alternative strategy to handle the nonlinearity and the computational costs is presented in this work. First, the FPME will be reduced into its corresponding travelling wave equation via a wave variable transformation. This reduction will significantly minimize the computational burden since the transformation results in an ordinary differential equation. Then, the reduced FPME will be discretized using the Half-Sweep central finite difference scheme to generate a system of nonlinear approximation equations. The Newton method addresses nonlinearity, producing a system of linear equations. Furthermore, the Kaudd Successive Over Relaxation (KSOR) iterative method is utilized to solve the linear system efficiently. Thus, with the combination of wave variable transformation, the Half-Sweep iteration technique, and the KSOR iterative method, the computational costs of finding approximate FPME solutions will be significantly minimized. This combination of techniques may be denoted as a Half-Sweep Newton-KSOR iterative method (HSN-KSOR). Finally, the efficiency of the HSN-KSOR iterative method in solving the FPME has been verified by numerical trials.