

# ABSTRACT

## SOLUTION OF NONLINEAR DIFFUSION EQUATION USING DUAL RECIPROCITY BOUNDARY ELEMENT METHOD AND RELAXATION TYPE TIME INTEGRATION SCHEME

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In this thesis, the combined application of dual reciprocity boundary element method (DRBEM) and finite difference method (FDM) with a relaxation parameter to nonlinear diffusion equation is presented.

The DRBEM is employed to discretize the spatial partial derivatives by using the fundamental solution of Laplace operator, keeping the time derivative and the nonlinearity as the nonhomogeneous terms in the equation. The resulting system of ordinary differential equations is solved using FDM with a relaxation procedure.

A relaxation parameter is used to position the solution from the two time levels aiming to increase the convergence rate to the steady state and obtain stable solution. The nonlinear terms do not present problems since they are treated as the nonhomogeneity of the diffusion equation with the help of DRBEM.

The solution procedure described here is also applicable to diffusion and convection-diffusion equation and can be considered as the extension to nonlinear diffusion equation. Numerical experiments are given to illustrate this scheme and to compare its performance with the other numerical schemes as well as exact solution whenever it is available. The solution agrees very well with the exact solution while some other numerical schemes may result with some unwanted oscillating solution. Optimal value of the relaxation parameter is obtained numerically for preventing to use very small time increments and to achieve stable solution. The DRBEM with a relaxation type time integration scheme exhibit superior accuracy at large time values for the problems

tending towards a steady state.

Keywords: Dual reciprocity boundary element method, reaction-diffusion equation.