

SOLVING HEAT EQUATION USING RADIAL BASIS FUNCTION FINITE DIFFERENCE METHOD

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Heat conduction in a surface layer is crucial for diverse applications in geophysics, environmental science, and engineering influencing processes from geothermal energy extraction to underground cable system efficiency and building foundation stability. The Radial Basis Function Finite Difference (RBFFD) method is a powerful numerical technique for solving interpolation problems and partial differential equations (PDEs), particularly in domains with complex boundary conditions. This approach discretises and solves PDEs effectively by fusing the accuracy of finite differences with the flexibility of radial basis functions (RBFs). When it comes to tackling heat conduction problems, the RBFFD method has several advantages over traditional numerical techniques, particularly over the Finite Difference Method (FDM) and Finite Element Method (FEM). The objective of this study was to investigate the use of the RBFFD approach in the domain $\Omega = [-1, 1]$ to solve a one-dimensional time-dependent heat equation. A MATLAB algorithm was written to solve PDEs using the RBFFD method and specifically to solve the heat conduction problems. The solution graphs obtained using the RBFFD method were compared with the analytical solution to validate the accuracy of the numerical approach. The maximum absolute error of the approximated solution was calculated to be 0.00524. Based on this error and the solution graphs, the approximated solution can be considered very accurate.

Keywords: Heat equation, Numerical methods, Radial Basis Function Finite Difference method