

Numerical Solution for Fuzzy Diffusion Problem via Two Parameter Alternating Group Explicit Technique

ABSTRACT

The computational technique has become a significant area of study in physics and engineering. The first method to evaluate the problems numerically was a finite difference. In 2002, a computational approach, an explicit finite difference technique, was used to overcome the fuzzy partial differential equation (FPDE) based on the Seikkala derivative. The application of the iterative technique, in particular the Two Parameter Alternating Group Explicit (TAGE) method, is employed to resolve the finite difference approximation resulting after the fuzzy heat equation is investigated in this article. This article broadens the use of the TAGE iterative technique to solve fuzzy problems due to the reliability of the approaches. The development and execution of the TAGE technique towards the full-sweep (FS) and half-sweep (HS) techniques are also presented. The idea of using the HS scheme is to reduce the computational complexity of the iterative methods by nearly/more than half. Additionally, numerical outcomes from the solution of two experimental problems are included and compared with the Alternating Group Explicit (AGE) approaches to clarify their feasibility. In conclusion, the families of the TAGE technique have been used to overcome the linear system structure through a one-dimensional fuzzy diffusion (1D-FD) discretization using a finite difference scheme. The findings suggest that the HSTAGE approach is surpassing in terms of iteration counts, time taken, and Hausdorff distance relative to the FSTAGE and AGE approaches. It demonstrates that the number of iterations for HSTAGE approach has decreased by approximately 71.60-72.95%, whereas for the execution time, the implementation of HSTAGE method is between 74.05-86.42% better. Since TAGE is ideal for concurrent processing, this method has been seen as the key benefit as it consumes sets of independent tasks that can be performed at the same time. The ability of the suggested technique is projected to be useful for the advanced exploration in solving any multi-dimensional FPDEs.