Performance of similarity explicit group iteration for solving 2D unsteady convection-diffusion equation

ABSTRACT

In this paper, a similarity finite difference (SFD) solution is addressed for the two-dimensional (2D) parabolic partial differential equation (PDE), specifically on the unsteady convection-diffusion problem. Structuring the similarity transformation using wave variables, we reduce the parabolic PDE into elliptic PDE. The numerical solution of the corresponding similarity equation is obtained using a second-order central SFD discretization scheme to get the second-order SFD approximation equation. We propose a fourpoint similarity explicit group (4-point SEG) iterative method as a numerical solution of the large-scale and sparse linear systems derived from SFD discretization of 2D unsteady convection-diffusion equation (CDE). To show the 4-point SEG iteration efficiency, two iterative methods, such as Jacobi and Gauss-Seidel (GS) iterations, are also considered. The numerical experiments are carried out using three different problems to illustrate our proposed iterative method's performance. Finally, the numerical results showed that our proposed iterative method is more efficient than the Jacobi and GS iterations in terms of iteration number and execution time.