The space-time generalized finite difference method for solving two-dimensional Burgers' equations

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Abstract

As an original knowing, the generalized finite difference method (GFDM) is one of the most-promising meshless numerical method, and can be applied for dealing the spatial derivatives in partial differential equations. In this research, the distribution of nodes are both set up in space and time coordinate, means the axis of time is treated as one of the spatial dimension. Therefore, the temporal derivative in governing equations can be presented as spatial derivatives, and the GFDM is applied in this research to stably solve the two-dimensional Burgers' equations. As a meshless numerical method, the GFDM can avoid the time-consuming tasks of mesh generation, and the partial derivatives at each node in computational domain can be described as a linear combination of nearby functional values with weighting coefficients. By the property of the moving least-square approximation in GFDM, the final matrix system can be formed as a sparse matrix and is suitable for large-scale problem. In this work, several numerical examples are proposed to illustrate the consistency and accuracy of the presented space-time meshless numerical scheme.

Keywords: Meshless method, Generalized finite difference method, Space-time numerical scheme, Burgers' equations.