A Moving Grid Algorithm Based on the Deformation Method

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Abstract

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A moving grid method based on a deformation method from differential geometry is presented. As the calculation proceedes, the nodes of an initial grid are moved in real time according to the solution through a set of deformation ODEs. The node velocity is determined by a monitor function constructed from physical variables through a scalar Poisson equation on the computational domain. It is proved mathematically that the cell volume is kept to be proportional to the monitor function when the grids are adapted to the solution at each time step. In particular, the moving grid has positive Jacobian and will not fold into itself. The moving grid method is then applied to 2D and 3D problems.