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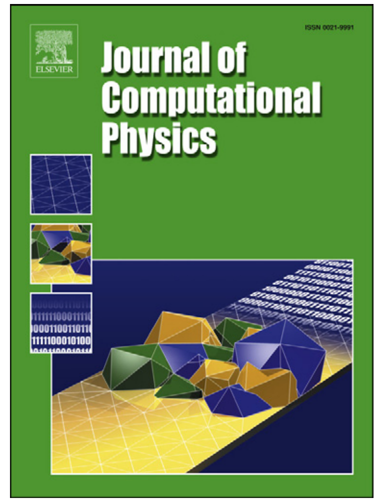


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# A fifth-order finite difference scheme for hyperbolic equations on block-adaptive curvilinear grids

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**Abstract**

We present a new fifth-order accurate finite difference method for hyperbolic equations on block-adaptive curvilinear grids. The scheme employs the 5th order accurate monotonicity preserving limiter MP5 to construct high order accurate face fluxes. The fifth-order accuracy of the spatial derivatives is ensured by a flux correction step. The method is generalized to curvilinear grids with a free-stream preserving discretization. It is also extended to block-adaptive grids using carefully designed ghost cell interpolation algorithms. Only three layers of ghost cells are required, and the grid blocks can be as small as $6 \times 6 \times 6$ cells. Dynamic grid refinement and coarsening are also fifth-order accurate. All interpolation algorithms employ a general limiter based on the principles of the MP5 limiter. The finite difference scheme is fully conservative on static uniform grids. Conservation is only maintained at the truncation error level at grid resolution changes and during grid adaptation, but our numerical tests indicate that the results are still very accurate. We demonstrate the capabilities of the new method on a number of numerical tests, including smooth but non-linear problems as well as simulations involving discontinuities.

*Keywords:* hyperbolic equations, high-order schemes, finite-difference schemes, curvilinear grids, adaptive mesh refinement

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