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Multidimensional upwinding. II: Decomposition of the Euler equations into advection equations. (English) Zbl 0932.76051

J. Comput. Phys. 143, No. 1, 181-199 (1998).

Summary: Based on a genuine multidimensional numerical scheme, called the method of transport, we derive a form of the compressible Euler equations, capable of a linearization for any space dimension. This form enables a rigorous error analysis of the linearization error without the knowledge of the numerical method used to solve the linear equations. The generated error can be eliminated by special correction terms in the linear equations. Hence, existing scalar high-order methods can be used to solve the linear equations and obtain high-order accuracy in space and time for the nonlinear conservation law. In this approach, the scalar version of the method of transport is used to solve the linear equations. This method is multidimensional and reduces the solution of the partial differential equation to an integration process. Convergence histories presented at the end of the paper show that the numerical results agree with the theoretical predictions. © Academic Press.

MSC:

76M20 Finite difference methods applied to problems in fluid mechanics
76N15 Gas dynamics (general theory)

Keywords:

method of transport; error analysis; linearization error

Software:

CLAWPACK

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