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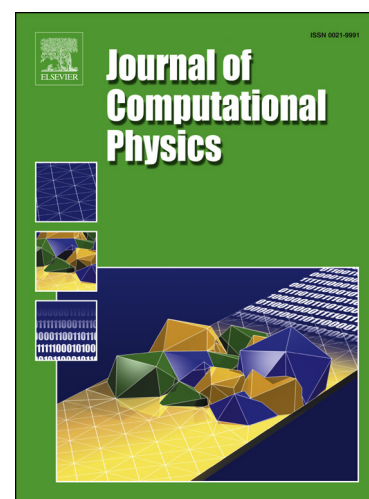
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Compact high order finite volume method on unstructured grids II: Extension to two-dimensional Euler equations

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Abstract:

In this paper, the compact least-squares finite volume method on unstructured grids proposed in our previous paper is extended to multi-dimensional systems, namely the two-dimensional Euler equations. The key element of this scheme is the compact least-squares reconstruction in which a set of constitutive relations are constructed by requiring the reconstruction polynomial and its spatial derivatives on the control volume of interest to conserve their averages on the face-neighboring cells. These relations result in an over-determined linear equation system. A large sparse system of linear equations is resulted by using the least-squares technique. An efficient solution strategy is of crucial importance for the application of the proposed scheme in multi-dimensional problems since both direct and iterative solvers for this system are computationally very expensive. In the present paper, it is found that in the cases of steady flow simulation and unsteady flow simulation using dual time stepping technique, the present reconstruction method can be coupled with temporal discretization scheme to achieve high computational efficiency. The WBAP limiter and a problem-independent shock detector are used in the simulation of flow with discontinuities. Numerical results demonstrate the high order accuracy, high computational efficiency and capability of handling both complex physics and geometries of the proposed schemes.

Keywords: Multi-dimensional compact reconstruction, High order finite volume method, Unstructured grids, Coupled reconstruction and temporal integration method.

1 Introduction

A compact high order finite volume method on unstructured grids, termed as the compact

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