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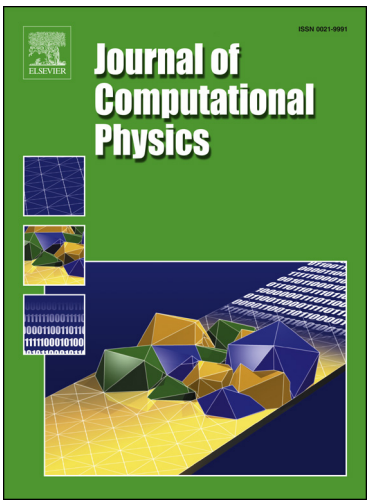

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A Versatile Embedded Boundary Adaptive Mesh Method for Compressible Flow in Complex Geometry

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Abstract

We present an embedded ghost-fluid method for numerical solutions of the compressible Navier Stokes (CNS) equations in arbitrary complex domains. A PDE multidimensional extrapolation approach is used to reconstruct the solution in the ghost-fluid regions and imposing boundary conditions on the fluid-solid interface, coupled with a multi-dimensional algebraic interpolation for freshly cleared cells. The CNS equations are numerically solved by the second order multidimensional upwind method. Block-structured adaptive mesh refinement, implemented with the Chombo framework, is utilized to reduce the computational cost while keeping high resolution mesh around the embedded boundary and regions of high gradient solutions. The versatility of the method is demonstrated via several numerical examples, in both static and moving geometry, ranging from low Mach number nearly incompressible flows to supersonic flows. Our simulation results are extensively verified against other numerical results and validated against available experimental results where applicable. The significance and advantages of our implemen-

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