

A Non-oscillatory Forward in Time Formulation for Incompressible Fluid Flows

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ABSTRACT

An edge-based finite volume non-oscillatory forward-in-time (NFT) approach is adopted in developments of a high resolution model for incompressible flows. The key features of the model include non-oscillatory advection scheme Multidimensional Positive Definite Advection Transport Algorithm (MPDATA) and non-symmetric Krylov-subspace elliptic solvers. The NFT framework is employed to solve the laminar flows. Theoretical considerations will be supported with numerical examples illustrating laminar solutions for incompressible flow over obstacles. The flexibility and robustness of the approach will be illustrated for complex geometries using optimal fully unstructured irregular meshes and composite structured/unstructured meshes, with the structured mesh layers employed in the boundary layer regions. The approach uses a non-staggered mesh arrangement for velocity and pressure. The present extension of the NFT method to incompressible flows allows evaluating its potential for an important class of engineering problems.