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A Multigrid Accelerated High-Order Compact Fractional Step Method for Unsteady Incompressible Viscous Flows OMER SAN, ANNE STAPLES, Virginia Polytechnic Institute and State University — An efficient high-order compact scheme is presented for computing unsteady incompressible viscous flows. The scheme is constructed on a staggered Cartesian grid. Using the fractional step framework, the Navier-Stokes equations are advanced in time with the second-order Adams-Bashforth method without considering the pressure terms in the predictor step. The velocity field is then corrected so that the continuity equation is satisfied through a pressure Poisson equation. Since the efficiency of the fractional step method depends on the Poisson solver, a Mehrstellen-based V-cycle multigrid acceleration is implemented in the solution of the Poisson equation to enhance the computational efficiency. The method is validated by simulating a decaying Taylor-Green vortex. The results show that the method has high resolving efficiency, drastically reduced computational time, and high-order accuracy, making it applicable for the simulation of complex turbulent flows.

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