

A second-order semi-Lagrangian particle FEM method for the incompressible Navier-Stokes equations

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ABSTRACT

In this work, a second-order semi-Lagrangian particle finite element method (SL-PFEM) is presented. The method is based on the second order velocity Verlet algorithm, using an explicit scheme to integrate the particles' trajectories, and an implicit Crank-Nicholson scheme to integrate the particle's velocities. The projection of the particle's intrinsic variables onto the finite element (FE) mesh is based on a second-order global least-square. The elliptic part of the Navier-Stokes equations is discretized with the Crank-Nicholson scheme and solved using an iterative process. The method is verified against available analytical solutions, and applied to the classic flow around a cylinder problem.