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A new approach to computing open-boundary flows with SPH S. MAJID HOSSEINI, JAMES FENG, Department of Chemical and Biological Engineering, University of British Columbia, Vancouver, BC V6T 1Z3, Canada —
In Smoothed Particle Hydrodynamics (SPH) methods, incompressibility is typically imposed by a projection method. This entails an artificial Neumann boundary condition for the pressure Poisson equation, which is often inconsistent with physical conditions at inflow and outflow boundaries. For this reason open-boundary flows have rarely been computed using SPH. In this work, we demonstrate that the classical pressure boundary condition produces a numerical boundary layer that compromises the solution near the boundaries. We resolve this problem by utilizing a "rotational incremental pressure-correction scheme" with a consistent pressure boundary condition. We show that this scheme computes the pressure and velocity accurately near open boundaries, and extends the scope of SPH simulation beyond the usual closed and periodic boundary conditions.

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