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Simulation of Marine Hydrokinetic Turbines in Unsteady Flow using Vortex Particle Method DANNY SALE, ALBERTO ALISEDA, University of Washington — A vortex particle method has been developed to study the performance and wake characteristics of Marine Hydrokinetic turbines. The goals are to understand mean flow and turbulent eddy effects on wake evolution, and the unsteady loading on the rotor and support structures. The vorticity-velocity formulation of the Navier-Stokes equations are solved using a hybrid Lagrangian-Eulerian method involving both vortex particle and spatial mesh discretizations. Particle strengths are modified by vortex stretching, diffusion, and body forces; these terms in the vorticity transport equation involve differential operators and are computed more efficiently on a Cartesian mesh using finite differences. High-order and moment-conserving interpolations allow the particles and mesh to exchange field quantities and particle strengths. An immersed boundary method which introduces a penalization term in the vorticity transport equations provides an efficient way to satisfy the no-slip boundary condition on solid boundaries. To provide further computational speedup, we investigate the use of multicore processors and graphics processing units using the OpenMP and OpenCL interfaces within the Parallel Particle-Mesh Library.

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