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Treatment of immersed boundaries for the Vortex Particle-Mesh method[1] THOMAS GILLIS, GREGOIRE WINCKELMANS, PHILIPPE CHATELAIN, UCLouvain — The Vortex Particle-Mesh (VPM) method combines the advantages of a particle method, i.e. low numerical dissipation and dispersion errors, with those of a Cartesian mesh-based approach: highly efficient Poisson solvers and finite difference stencils. However, the accurate treatment of the immersed boundaries in the VPM framework is still an open challenge as the formulation of the boundary condition for the vorticity is not as straightforward as in a classical velocity-pressure formulation. This complexity is further increased since the VPM method relies on a non-body-conforming Cartesian mesh; hence the obstacle may intersect the grid at arbitrary locations. The two current state-of-the-art methods are the (iterative) penalization approach and the Boundary Element Method coupled with the VPM approach. The first one, the penalization technique, suffers from a lack of accuracy due to the smearing of the interface, hence offering an unsatisfactory surface treatment. The second one, the Boundary Element Method (BEM) approach suffers from a first order time convergence due to the splitting of the diffusion operation. This presentation focuses on this challenge: the treatment of immersed boundaries in order to accurately predict the interactions between the fluid and these structures.

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