Shape Optimization for the Mitigation of Coastal Erosion via Smoothed Particle Hydrodynamics

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Adjoint-based shape optimization most often relies on Eulerian flow field formulations. However, since Lagrangian particle methods are the natural choice for solving sedimentation problems in oceanography, extensions to the Lagrangian framework are desirable. For the mitigation of coastal erosion, we perform shape optimization for fluid flows, that are described by incompressible Navier-Stokes equations and discretized via Smoothed Particle Hydrodynamics. The obstacle's shape is hereby optimized over an appropriate cost function to minimize the height of water waves along the shoreline based on shape calculus. Theoretical results will be numerically verified exploring different scenarios.