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Simulation technique for wave generation. (English) Zbl 1069.76028
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Summary: We present a finite element technique for simulation of water waves impacting on floating structures. The emphasis is on numerical methods for water wave generation and propagation. In our approach, the governing equations are Navier-Stokes equations written for two incompressible fluids. An interface function with two distinct values serves as a marker identifying the location of free surface. This function is transported throughout the computational domain with a time-dependent advection equation. The stabilized finite element formulations are written and integrated in an arbitrary Lagrangian-Eulerian domain. This allows us to handle the motion of physical boundaries, such as the wave generator surface, by moving the computational nodes. In the mesh-moving scheme, we assume that the computational domain is made of elastic materials. The linear elasticity equations are solved to obtain the displacements for each computational node. The numerical examples include 3D wave generation and wave breaking as they approach the coast, and the waves impacting on near-shore support columns.

MSC:

76M10 Finite element methods applied to problems in fluid mechanics
76D33 Waves for incompressible viscous fluids
76D27 Other free boundary flows; Hele-Shaw flows

Keywords:

free-surface flows; stabilized finite element formulation; Navier-Stokes equations

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