Numerical Models for Landslide-Generated Waves

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ABSTRACT

This work presents two methods based on the Particle Finite Element Method (PFEM) [1] aimed to simulate numerically complex landslide-generated waves problems.

First, a holistic PFEM formulation capable to reproduce the entire multi-hazard scenario (i.e. landslide runout, impact on water reservoir, generation and propagation of waves in the water basin, and final runup) is presented. Depending on the nature of the triggered material, different constitutive models are used to model the landslide runout [2]. Thanks to its Lagrangian nature and efficient remeshing strategy, the PFEM is shown to be capable to track accurately the highly deforming shape of the landslide and water surface, as well as reproducing accurately the consequent wave generation and propagation.

The accuracy of the holistic model is tested against large-scale laboratory tests and other numerical results of the literature. Particular attention will be devoted to analyzing the Vajont disaster, which has been analyzed with a three-dimensional model [2, 3].

The second method is a one-way coupled method where the PFEM is only used for modelling the near field problem (i.e. from landslide motion to wave generation) while an Eulerian Shallow Water model is employed for the wave propagation [4]. Several numerical tests are presented to show the accuracy of this coupled scheme and to highlight the significant gain in terms of computational cost versus a holistic strategy.

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