Numerical simulation of water waves generated by landslides impact. Application to Vajont disaster

Massimiliano Cremonesi*, Alessandro Franci†, Umberto Perego*, Giovanni Crosta#, Eugenio Oñate†

* Politecnico di Milano
Department of Civil and Environmental Engineering
Piazza Leonardo da Vinci 32, 20133, Milano, Italy
e-mail: massimiliano.cremonesi@polimi.it; umberto.perego@polimi.it
† Centre Internacional de Mètodes Numèrics en Enginyeria (CIMNE)
Universidad Politècnica de Catalunya (UPC)
Campus Norte UPC, 08034 Barcelona, Spain
e-mail: falessandro@cimne.upc.edu; onate@cimne.upc.edu
Università degli Studi di Milano Bicocca
Department of Earth and Environmental Science
Piazza della Scienza, 4, Milan, Italy
e-mail: giovannibattista.crosta@unimib.it

ABSTRACT

Catastrophic landslides impinging into water reservoir may generate impulsive waves whose propagation can cause considerable damages. The prediction of velocity, runout distance and travelling path can be useful for preventing and mitigating the catastrophic consequences of these extreme natural events.

Recent developments in the simulation techniques of coupled problems have led to efficient analysis procedures allowing for reproducing landslide-reservoir interactions. The numerical analysis of these events implies capabilities for tracking interfaces and free surfaces undergoing large displacements, simulating the mixing of different constituents, and accounting for complex constitutive behaviours. In this work Particle Finite Element Method [1], is adapted to the specific case of landslide-reservoir interaction. Owing to its capability of automatically tracking free surfaces and interfaces, the proposed method is particularly suitable for these applications, which are dominated by fast propagating waves and interfaces.

After validating the proposed approach with literature benchmarks, the numerical technique is applied to the historical Vajont case study with a fully-resolved three-dimensional model. The numerical results are compared to the post-event observations showing a good agreement in terms of landslide velocity and runout, geometry of the deposit, maximum water runup, dam overtopping wave, and water discharge in the downstream valley [2].

Finally, alternative scenarios of the Vajont disaster are considered. In particular, the separated collapse of the eastern and western lobes of the Vajont rockslide, and the study of the dynamics for different initial water levels of the reservoir have been deeply analysed [3].

REFERENCES

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