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DEBRIS FLOW MODELLING WITH HIGH-PERFORMANCE MESHLESS METHODS

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Debris flows represent some of the most relevant phenomena in geomorphological phenomena. Due to the potential destructiveness of such flows, they are the target of a vast amount of research. Numerical work traditionally focuses on unresolved single-phase solvers with modified rheological considerations, usually derived from simplified theoretical frameworks or experimental data. Due to the flow characteristics, both time and spatially resolved data are difficult to compile in an experimental set-up.

The DualSPHysics [1] meshless numerical implementation based on Smoothed Particle Hydrodynamics (SPH) is expanded with a Distributed Contact Discrete Element Method (DCDEM) in order to explicitly solve the fluid and the solid phase. This represents a resolved model, were no ad-hoc formulations are used concerning the momentum exchanges between the phases. The model is validated for buoyant flows and wet solid-solid interactions, using both analytical and experimental data. Implementation is done using optimized algorithms for massively parallel architectures.

An experimental set-up for stony debris flows in a slit check dam is reproduced numerically, with retention curves being derived and compared. The results show similar quantities of retained solid material, indicating that the model seems to provide reliable results and can provide both meaningful industry solutions and new research prompts regarding debris flows.

[1] Crespo, A.J.C., Domínguez, J.M., Rogers, B., Gómez-Gesteira, M., Longshaw, S., Canelas, R.; Vacondio, R.; Barreiro, A. & Garcíafeal, O. (2015) DualSPHysics: open-source parallel CFD solver on Smoothed Particle Hydrodynamics (SPH) Computer Physics Communications, 187, 204-216