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A LAGRANGIAN METHOD FOR TWO-PHASE FLOW SIMULATION

***Matthias Preisig[1], Thomas Zimmermann[1]**

[1] Ecole Polytechnique Fédérale de Lausanne (EPFL)
Institut des Structures (IS)
Computational Solid Mechanics Laboratory (LSMS)
CH-1015 Lausanne, Switzerland
matthias.preisig@epfl.ch, http://lsms.epfl.ch/

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ABSTRACT

This paper extends previous work presented at the WCCM 2006 in Los Angeles and at the USNCCM 2007 in San Francisco. The three phases of a mudflow, triggering of instability, transport and stopping, are simulated using a stabilized Petrov-Galerkin method. The unstable soil mass is determined in a static analysis of the elastic-plastic initial domain. The moving soil mass is tracked with an updated Lagrangian scheme. Mesh distortion is dealt with by a remeshing strategy with subsequent remapping of velocities and pressure.

This previous work is extended to a two-phase material. A formulation capable of representing the flow of a soil-water mixture in a Lagrangian description is presented. Focus is put on a model that favors an algorithmic approach to the problem rather than an overly complex constitutive model. The algorithmic framework for applying the Lagrangian update of both phases requires updating the positions of solid and fluid nodes, redefining the free surface, remeshing inside the envelope and remapping of the nodal quantities onto the new mesh.

The numerical method solves for the phase velocities and the pressure while keeping the volume fractions of each phase constant. In a post processing step at the end of each time step the volume fractions are updated.

The method is validated on simple examples of two-phase flow that illustrate the ability of the method for modeling mudflows.