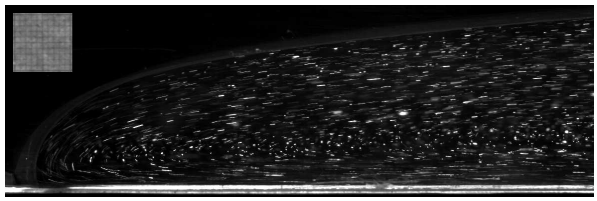
Post-doctoral position at University Grenoble-Alpes

Numerical and experimental cross analysis of the solid-fluid transition in geomaterials

Project description

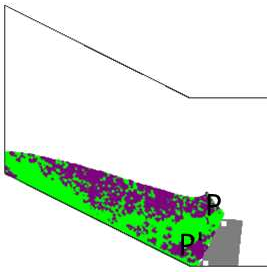
Among all the complex mechanical properties exhibited by geomaterials, their ability to undergo solid-fluid or fluid-solid transitions as a function of the loading is probably one of the most important for geophysical (landslides, avalanches, etc.) and industrial (concrete casting, etc.) applications. Yet, the mechanical and numerical models currently in use to describe this transition remain extremely crude, and, in most cases, the physical processes active in the materials are still poorly known. **This project aims at finely documenting the dynamics of the solid-fluid transition in model materials on a slope, and at developing and validating a numerical tool capable of simulating this transition in a unified framework**.

In detail, the objectives of the project are threefold:
Experiments will be performed on an **inclined plane** in order to reach the **solid-fluid transition** in an initially steady volume of material. A transparent model material with a relatively simple elasto-visco-plastic rheology will first be used in order to follow the internal dynamics of the fluidization through PIV. These experimental data in several configurations will be used to calibrate and/or validate the numerical model.



Fluid trajectories in the front of a viscoplastic surge in a flume experiment.

The numerical tool *ellipsis* based on the **finite element method with Lagrangian integration points** (FEMLIP), well suited to the modelling of **complex materials in large deformation processes**, will be used to simulate the experiments. Development efforts will be devoted to the implementation of proper constitutive laws and of inertial terms.



Numerical model of a landslide with an obstacle interaction using ellipsis

After the validation steps, **more realistic and thus complex geomaterials** will be tested. The experiment will be used as a complex rheometer to infer appropriate constitutive laws for describing the solid-fluid transition, and to calibrate the associated parameters by inverse analysis using *ellipsis*.

Practical aspects

The present offer is a one-year post-doc position funded by ANR (Agence Nationale de la Recherche) in the frame of the Laboratory of Excellence Tec21 “The engineering of complexity”. Additional funding for one supplementary year will be requested to Irstea (internal call). The successful applicant will be hosted jointly by two laboratories in Grenoble (France): Soils-Solids-Structures-Risks (3SR), and Unité de Recherche Erosion Torrentielle, Neige et Avalanches (ETNA) of Irstea.

Applications

Applicants must hold a PhD Degree in the fields of mechanics or physics, with a strong background in computational solid mechanics. Additional background in non-Newtonian fluid rheology and previous experience of experimental research will be appreciated. To apply, send a CV with references and a list of publications to F. Dufour (frederic.dufour@3sr-grenoble.fr) and G. Chambon (guillaume.chambon@irstea.fr).

Applications will close as soon as a suitable candidate is found