Post-Doctoral Position
« Creeping snow: modelling the force induced on structures»

Project summary

Climate change is causing snow pack mechanical characteristics to change, with an influence on snow creep. The resulting lower stability of snow packs on slopes leads to higher interaction forces with mitigation structures, as demonstrated by the increasing number of snow rack failures. The ultimate goal of the project is to enable the design of more robust structures for stabilising snow by developing a novel, adaptable 3D modelling tool for simulating forces on mitigation structures.

The model will account for different mechanisms of interaction between snow and the structures. The scientific novelty comes from the coupling between two types of numerical modelling for capturing the salient characteristics of the creeping snow: Discrete Element Method (DEM) near the structure and Smoothed Particle Hydrodynamics (SPH) in the far field.

The main objectives of the proposed post-doctoral position are:

- To develop a new coupled 3D SPH-DEM numerical method, that can capture fundamental mechanical interactions of snow-structure interaction in a computationally-feasible manner;
- To evaluate the model using field data available to INRAE-ETNA;
- To undertake a parametric study to attain a mechanically-based understanding of interactions between (i) dry and (ii) wet creeping snow packs with obstacles.

One of the main scientific challenges to be tackled is to develop and evaluate the properties of the DEM model for different types of snow, including the contact law, the size and shape of the aggregates being modelled, and the viscous properties relevant to creep; as well as identifying suitable rheological laws for the SPH model.

Location and practical aspects

The successful applicant will be hosted by the laboratory ETNA (INRAE). He/she will work under the supervision of Dr S. Lambert from Laboratory ETNA and Dr B. Chareyre, from Laboratory 3SR and will benefit from collaborations with Dr T. Faug and Dr G. Chambon, both from Laboratory ETNA.

The fellowship is for 12 months, ideally starting before end of 2022. The gross salary will be 2656 euros/months, equivalent to a net salary of 2134 euros/month.

Qualifications of the applicant

The candidate will have a PhD in mechanics with experience in numerical modelling, in particular using continuous approaches for modeling large deformations (e.g. MPM or SPH). Programming skills (python, C++) are also expected. Experience in DEM modeling, in studies of flow-structure interaction and in coupling different numerical methods will be an undeniable advantage.

Applications

Interested candidates should send their CV and cover letter to both S. Lambert (stephane.lambert@inrae.fr) and B. Chareyre (bruno.chareyre@univ-grenoble-alpes.fr).

Deadline for the application: 2022/09/30

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