PhD Position
From microstructure to rheology of dense elastic particulate systems

SECTOR: Higher Education Institution

LOCATION: France, Grenoble

RESEARCHER PROFILE:
□ First stage researcher,

INSTITUTION: Univ. Grenoble Alpes, University of Innovation

One of the major research-intensive French universities, Univ. Grenoble Alpes enjoys an international reputation in many scientific fields, as confirmed by international rankings. It benefits from the implementation of major European instruments (ESRF, ILL, EMBL, IRAM, EMFL*). The vibrant ecosystem, grounded on a close interaction between research, education and companies, has earned Grenoble to be ranked as the 5th most innovative city in the world. Surrounded by mountains, the campus benefits from a natural environment and a high quality of life and work environment. With 7000 foreign students and the annual visit of more than 8000 researchers from all over the world, Univ. Grenoble Alps is an internationally engaged university.

A personalized Welcome Center for international students, PhDs and researchers facilitates your arrival and installation.

In 2016, Univ. Grenoble Alpes was labeled «Initiative of Excellence ». This label aims at the emergence of around ten French world class research universities. By joining Univ. Grenoble Alpes, you have the opportunity to conduct world-class research, and to contribute to the social and economic challenges of the 21st century ("sustainable planet and society", "health, well-being and technology", "understanding and supporting innovation: culture, technology, organizations" "Digital technology").

* ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin), IRAM (International Institute for Radio Astronomy), EMBL (European Molecular Biology Laboratory), EMFL (European Magnetic Field Laboratory)

Key figures:

- + 50,000 students including 7,000 international students
- 3,700 PhD students, 45% international
- 5,500 faculty members
- 180 different nationalities
- 1st city in France where it feels good to study and 5th city where it feels good to work
- ISSO: International Students & Scholars Office affiliated to EURAXESS
SUBJECT DESCRIPTION:
Many dense complex fluids, such as foams, dense emulsions, microgel suspensions, are made of amorphous assemblies of microscopic deformable elastic units (particles). This microscopic communality translates at a macroscopic level into a common rheology, with a yield stress and a Herschel-Bulkley constitutive behavior [1]. Most theoretical efforts seek to rationalize the mechanical response close to the yield transition, at vanishing shear rates, when the deformation of the material occurs through mesoscopic plastic events which are localized in space and time. However, there is no micromechanical description of the flow for large shear rates, away from the yield criticality. This regime corresponds to shear rates larger than the relaxation time of plastic events. In this case, the flow is no more a succession of plastic events, but rather a more continuous and spatially homogeneous deformation. The associated rheology is complex, with shear-thinning and sometimes shear-thickening [2] (resp. decrease and increase of the viscosity with shear rate), and a significant amplitude and anisotropy of normal stresses [3]. Also, transient effects have so far been rather neglected in favor of the steady state behavior, which prohibits a consistent description of the flow of these materials under time-dependent driving.

The goal of this project is to develop an analytical description of the flow of a system of overdamped elastic particles subject to a large rate deformation, with techniques borrowed from rheo-physics of polymer systems [4, 5]. In parallel, we will perform numerical simulations of this system, under simple or planar extensional shear, in order to guide and test theoretical progress that will be relying on approximations which must be validated.

As a mid-term goal, we want to bridge the above approach with elasto-plastic models used to describe the low rate rheology [6] in order to obtain an unified view on the flow curve for dense systems of elastic particles.

Candidates should have a strong background in statistical mechanics and continuum mechanics, and show good command of analytical tools, as well as some knowledge of numerical simulations.

References

ELIGIBILITY CRITERIA
Applicants must hold a Master's degree (or be about to earn one) or have a university degree equivalent to a European Master's (5-year duration).

Applicants will have to send an application letter in English and attach:
- Their last diploma
- Their CV
- A short presentation of their scientific project (2 to 3 pages max)
- Letters of recommendation are welcome.

Address to send their application: romain.mari@univ-grenoble-alpes.fr and eric.bertin@univ-grenoble-alpes.fr

**SELECTION PROCESS**
Application deadline: June 22, 2018 at 17:00 (CET)
Applications will be evaluated through a three-step process:

1. Eligibility check of applications in June 25, 2018
2. 1st round of selection: the applications will be evaluated by a Review Board on June 25, 2018. Results will be given on June 26.
3. 2nd round of selection: shortlisted candidates will be invited for an interview session in Grenoble on July 2, 2018 (if necessary)

**TYPE of CONTRACT:** temporary-3 years of doctoral contract
**JOB STATUS:** Full time
**HOURS PER WEEK:** 35
**OFFER STARTING DATE:** October 1, 2018
**APPLICATION DEADLINE:** June 22, 2018
**Salary:** between 1768.55 € and 2100 € brut per month (depending on complementary activity or not)