Postdoctoral Research Associate in Discrete/Continuum Modelling of Cohesive Granular Flows

Institut Le Rond d'Alembert, Sorbonne Université, Paris

Fixed term position for 1 year. Closing Date: December 31st 2018

Modelling of Cohesive Granular Flows.

Granular matter is important in a wide variety of engineering and industrial applications, as well as for the mitigation of catastrophic geophysical flows. Although our understanding of this class of material has steadily improved in the last twenty years, many open questions remain. The behaviour and rheology of cohesive granular systems forms one of them. Cohesion between rigid macroscopic grains occurs commonly in the presence of humidity (capillary bonds), when the size of the grains becomes critically small (van der Walls forces, for instance in most powders), or may be intrinsic to the system studied (as is snow and ice avalanches, or for material subject to electrostatic/magnetic forces). Cohesive contacts in a granular system induce the emergence of intermediate length scales controlling the co-existence of flowing and rigid zones. The way the "flowability" of the system is affected, and the translation in terms of a modified rheological model for cohesive granular flows, is unclear in most flow configurations.
The aim of the project is to investigate the flowability/rheology of cohesive flows in two challenging test configurations. A Bagnold flow over a bump, and the collapse of a step, will be both considered.
Discrete (Contact Dynamics) and continuum (Basilisk) numerical simulations tools will be applied to explore the flow characteristics and test rheological models.

The position will take place in the granular team within the FCIH group in Institut D'Alembert to work with Pierre-Yves Lagrée, Lydie Staron, Stéphanie Deboeuf and Stéphane Popinet, in the framework of the ANR Coprint on Cohesive Powders (PI Maxime Nicolas). As such, it will benefit from interactions with the granular team in IUSTI (Marseille) and with Saint Gobain-CREE. Interactions with the University of Twente will be funded by an existing Van Gogh grant.

The ideal candidate will demonstrate experience/knowledge in fluid mechanics, particulate systems and numerical modelling. Application should be sent to P-Y. Lagrée (pierre-yves.lagree@upmc.fr) and L. Staron (lydie.staron@upmc.fr), including a detailed CV. Closure date for application is 31st December 2018.

Team Track Record on Granular Flows:

G. Saingier, S. Deboeuf and P.-Y. Lagrée, On the front shape of an inertial granular flow down a rough incline, PHYS. FLUIDS 28 (5), 053302, 2016
L. Staron, P.-Y. Lagrée and S. Popinet, Continuum simulation of the discharge of the granular silo: a validation test for the mu(I)-visco-plastic flow law,
EURO. PHYS. J. E 37, 5, 2014
L. Staron, P.-Y. Lagrée, P. Ray and S. Popinet, Scaling Laws for the Slumping of a Bingham Plastic Fluid, J. RHEOLOGY 57, 1265 (doi: 10.1122/1.4802052), 2013
L. Staron, P.-Y. Lagrée & S. Popinet, The granular silo as a continuum plastic flow: The hour-glass vs the clepsydra, PHYS. FLUIDS 24 (10), 113303, doi:10.1063/1.4757390, 2012
P.-Y. Lagrée, L. Staron & S. Popinet, The granular column collapse as a continuum: validity of a two-dimensional Navier-Stokes model with the mu(I) rheology, J. FLUID MECH. , vol 686, pp 378-408, 2011