

## PROPOSITION DE STAGE – MASTER 2 DET

Dynamique des fluides, Énergétique et transferts

Université Toulouse 3 Paul Sabatier - Toulouse INP - INSA Toulouse - ISAE SUPAERO – IMT Mines Albi

### Titre : New frictional model for the numerical simulations of a silo discharge

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Durée / période : 5 months

Candidature [CV, lettre de motivation, références] à envoyer à : P. Fede (pascal.fede@imft.fr)

### Sujet

A wide range of industrial processes requires the handling of granular material in a pulverulent form. The subsequent dust emissions due to these processes can be harmful to the health of workers or hazardous explosion risks. In order to understand dust dispersion mechanisms, a case of a free falling granular jet discharged from a silo has been investigated in the PhD Thesis of F. Audard (2016) where Euler-Euler numerical simulations have been performed with NEPTUNE\_CFD code. It has been shown that the granular jet behaviour depends strongly on the granular flow inside the silo.

The numerical simulation with an Euler-Euler approach requires a specific model for the silo where the particles motion is governed by the inter-particle contacts. In the previous study, a model proposed by Srivastava & Sundaresan (2003) has been used. The results were encouraging because the solid mass flow rate at the nozzle was in accordance with the one measured in an experiment. However, the simulations fail to predict a part of the physics namely avalanches or arches those are probably at the origin of the flapping of the granular jet.

The work can be split in two steps. First, new boundary condition for the solid phase will be tested on the case of the silo discharge. This new boundary condition includes the instantaneous friction of the particles on the walls of the silo. The second part of the work consist in the implementation of a more sophisticated rheological law for taking into account the frictional effects.

The candidate must be interested by the numerical simulation of multiphase flows. The development of a semi-industrial software. Solid background on granular flows is expected.

### References

F. Audard, 2016, Modélisation Eulérienne de la vidange d'un silo et de l'expansion du panache, PhD

Y. Forterre and O. Pouliquen, Annual Review of Fluid Mechanics, vol. 40, no. 1, Art. no. 1, 2008

P. Jop and Y. Forterre, Nature, vol. 441, no. 7094, Art. no. 7094, Jun. 2006

S. Schneiderbauer, A. Aigner, and S. Pirker, Chemical Engineering Science, vol. 80, no. 0, Art. no. 0, 2012

A. Srivastava and S. Sundaresan, Powder Technology, vol. 129, pp. 72–85, 2003

