

Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : HELLOU Given names : Mustapha

Status (prof., assistant prof., ...) : Prof.

Laboratory : Laboratory of Civil and Engineering Mechanics Website address : www.insa-rennes.fr/gcgm

Institution : INSA Rennes Website address : www.insa-rennes.fr

Scientific competence of the supervisor:

Fluid mechanics; porous media; multiphase flow; fluid and solid transport; Mass transport

Two major publications in the field proposed for the PhD :

1. Modelling Particle Capture Efficiency with Lattice Boltzmann, J. Fan, F. Lominé, M. Hellou, Communications in Computational Physics, Global Science Press, 2018, 23 (4), pp.932-950
2. Modeling of fluid-solid interaction in granular media with coupled LB/DE methods, F. Lominé, L. Scholtes, L. Sibille, P. Poullain, Int. J. Numer. Anal. Methods Geomech., Wiley, 2013, 37 (6), pp.577-596.

Website address of the personal page :

Supervisor's email : mustapha.hellou@insa-rennes.fr

Description of the research work proposed for a PhD **Topic # (see list) :** V-9, IV-12, VI-3

Title : Analysis of physical clogging of granular materials submitted to internal fluid flow for civil engineering applications

Subject :

Deposition of particle inside porous material submitted to fluid flow is widely encountered in civil engineering applications. Its consequences in terms of filtration and clogging phenomena are often responsible of important problems. In the framework of internal erosion of soils (such as embankments, dams), filtration phenomenon can modify fluid flow preferential paths and soil particle transport that can lead to an increase of erosion rate . At a result of this process, complete structure failure can be observed. In order to ensure structures sustainability, internal erosion and associated filtration is of great interest in scientific and engineering communities. The objective of this thesis project is to deepen the understanding of the relevant parameters allowing the characterization of the phenomenon of granular filtration and clogging. This study will follow the initiating work carried out by J. Fan during his PhD (CSC 2014). In this PhD project, particle accumulation inside porous space will be considered to analyze the influence of porosity evolution on fluid flow preferential paths, particle transport and deposition. Particle deposition rate will be characterized at the pore scale to derive an upscaled model to describe filtration phenomena and its consequences at larger scale. This PhD work will be mainly carried out via numerical simulations. It will be supervised by M. Hellou (Prof.) and F. Lominé (assist. Prof.)

Keywords :

porous media; granular media; fluid flow; clogging; filtration; lattice Boltzmann method (LBM); permeability

Expected collaborations :

BRGM, French Geological Survey, Orléans, France
Shandong University, Jinan, China

Background required from the applicant :

Civil engineering and/or granular material physics

Fluid mechanics

Transport in porous media

Skills in computer programming (C++, matlab, python, etc) and/or in numerical methods to simulate fluids and/or granular materials would be appreciated

Existence of a PDF file detailing the proposal ("yes" or "no") : yes

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