PhD subject
Université Grenoble Alpes (UGA)
École Spéciale des Travaux Publics, du Bâtiment et de l'Industrie de Paris (ESTP Paris)

Prediction ability of discrete modelling
for the design of complex geotechnical structures

Research institutions
Joint research project between Laboratoire 3SR (UGA, Grenoble) and IRC (ESTP, Cachan).

Project description
The objective of the PhD project is to propose a discrete numerical model (DEM) simple enough to be used in engineering on geotechnical structures, and complex enough to provide a prediction capability of better quality than conventional elasto-plastic relationships (with 1 or 2 load surfaces), in particular in the case of complex loading paths (e.g. with rotation of principal stress axes and/or cyclic loading).

The work of the PhD student will be devoted to:
- the study of the local ingredients (grain shape or contact law) constituting the best compromise to enhance the prediction ability of the DEM, in particular for kinematically constrained loading paths (undrained constitutive response), for loose or very loose soils, or even when both are combined (e.g. liquefaction of loose soils under undrained cyclic loading);

- the definition of calibration methods that are both robust and simple, based on in-situ tests (pressuremeter and/or static penetrometer), and on laboratory tests;

- the definition of an initial state of the micro-structure of the numerical granular assembly representative of the initial state of the soil (porosity, connectivity, anisotropy), in order to propose methodologies that meet the best compromise between prediction quality and simplicity of implementation;

- the validation of the model from laboratory tests,

- the application and validation of the model on geotechnical structures (boundary problems), such as the different construction phases of embedded walls, or the foundation piles of wind turbines. Boundary problems will be addressed either through the FEMxDEM double scale numerical method, or through DEM only by adopting an adaptive discretization to significantly reduce the number of particles and thus the computation cost.

Location
The PhD student will spend half of the time in IRC – ESTP Paris (Cachan, France) and half of the time in 3SR – UGA (Grenoble, France).

Desired skills
- Good knowledge in soil mechanics or mechanics of granular matters.
- General knowledge about geotechnical engineering.
- Experience in programming.
- Experience in numerical modelling.

Supervision team
Luc Sibille, 3SR – UGA, luc.sibille@3sr-grenoble.fr
Abdelkrim Bennadi, IRC – ESTP, abennabi@estp-paris.eu
Rodaina Aboul Hosn, IRC – ESTP, raboulhosn@estp-paris.eu

Application
Please send to the three emails above: a CV, a cover letter, and academic results (grades of the last year of master only, and rank of the candidate within the master class).
Deadline: send applications by **Monday, May 25, 2020, but as soon as possible is better.**