PhD position at University Grenoble Alpes

Roots-soil interactions: effects on soil micro-structure

Context and objectives

Mechanical properties of root-soil systems have been mostly investigated from the point of view of the plant – measuring for example the pull-out force of the whole root system. Previous macro-scale studies of soil reinforcement by roots usually rely on an overly simplified, phenomenological description – for example, by adding an additional cohesion. Few attempts exist to describe and understand how the soil itself is affected at the constitutive level by the presence of a root system and all these efforts suffer from a lack of experimental observations of the root-soil interaction at the grain/pore scale.

The objective of this PhD work is to investigate the interaction of plants with their underground environment, more specifically root growth under varying geometric and environmental constraints, ***and the consequent effects on soil micro-structure***. To this end the successful candidate will implement ***advanced experimental*** and ***numerical tools*** such as:

- x-ray tomographies to characterize natural root growth in sand,
- Roots System Architecture (RSA) model for simulating root deployment, growth and adaptation to environmental constraints,
- Discrete Element Models (DEM) to investigate soil microstructure evolution close to the root tip.

Context

This PhD position is part of the BIOinMECH project (The Mechanics of bio-inspired processes: a multiscale study of multifunctional systems) supported by the ***IDEX ("Initiative d'Excellence")*** of the ***University Grenoble Alpes*** (France) and the ***Center for Bio-mediated and Bio-inspired Geotechnics*** of ***Georgia Institute of Technology*** (USA).
The future PhD student will work in close relation with the researchers involved in BIOinMECH (E. Andò, R. Peyroux, L. Sibille and G. Viggiani from Laboratoire 3SR and C. Arson, D. Frost from G-Tech) and the two others PhD students hired for the project.
He/she will be based at the Laboratoire 3SR in Grenoble and will perform secondments of several months at Georgia Tech in Atlanta.

Qualifications

We are looking for applicants with both ***skill and interest for laboratory experiments*** and ***proficiency in numerical methods and computer programming***. An ideal candidate should have a recent Masters degree with a high school ranking as required by the IDEX. A strong background in the mechanics of soils or granular media is expected. Knowledge in Biophysics will be appreciated but is not essential.

Application

This PhD position is available to start from September/October 2017 and for a duration of 3 years (gross salary: 1758 €/month). ***Interested candidates with the required qualifications should send their CV with a cover letter and their master transcript by e-mail to:***

- Luc Sibille (3SR Lab, University Grenoble Alpes): luc.sibille@3sr-grenoble.fr

and

- Chloe Arson (Georgia Institute of Technology): chloe.arson@ce.gatech.edu

Applications should be received via email by 1st June 2017. The ranked list of the selected candidates will be constituted on 9th June 2017.