OPEN CALL – PhD position

Host organization: CIMNE International Center for Numerical Methods in Engineering

Organization issuing the PhD title: UPC Barcelona TECH – Civil engineering school

Project title: Coupled problems for the simulation of particulate flows and their interaction with critical structures

Advisors: A. Larese, E. Oñate

One doctoral position is offered to work in the framework of the PRECISE project (Numerical methods for PREdicting the behaviour of CIvil StructurEs under water natural hazards – MINECO - BIA2017-83805-R)

The ultimate goal of PRECISE is to aid engineers, planners and other relevant stakeholders to take decisions regarding the design and implementation of mitigation measures to protect population, civil infrastructures and the environment under outstanding water flow events induced by natural hazards (floods, spills, tsunamis etc). This will be achieved through the development and experimental validation of a new generation of mathematical models and computational methods for the study of natural hazards involving flows with particles of different sizes (hereafter called particulate flows) and their interaction and damaging effects on structures and landscape. These computational methods will allow to solve Particulate-Fluid-Structure-Interaction (PFSI) problems to obtain an accurate and reliable prediction of the behaviour of landscape and constructions under extreme water hazards. The constructions of interest are dams, dykes, breakwaters, buildings, bridges and similar structures. The natural hazards considered include flash floods generated by heavy rain, or water overspills due to the collapse of dams, dykes and reservoirs under landslides and earthquakes, as well as slurry flows and tsunami flows, among others. Despite the research deployed in this field in the last few decades, the study of the deformation and failure of a construction and the erosion of a landscape area under a particulate water stream is still far from being a real possibility using the currently available computational resources.

In PRECISE we will develop and integrate continuous, particle and discrete numerical techniques based on the research conducted during the last years by the principal investigators on an innovative combination of particle-based methods (such as the Particle Finite Element Method, PFEM and the Material Point Method, MPM) and the Finite Element Method (FEM) and, in particular, on the blending of these techniques with the Discrete Element Method (DEM). The practical objectives of the research are:

a) The development of a new generation of Lagrangian computational methods for analysis of particulate flows,

b) The solution of particle fluid structure interaction problems involving soil erosion and structural failure. In the project we will validate the numerical methods using both laboratory tests on scale models of structures and landscape under controlled particulate flows and data from real flooding events available in the literature

Goal of the position offered:

Analysis of structural failure induced by particulate flows accounting for particle-fluid-soil interaction

Specific objectives of the position offered:

- **Become advanced user of GiD and developer of KRATOS Multiphysics**
- **Development of new accurate and robust numerical techniques for simulating particle-fluid-soil-interaction combining finite elements and particle techniques.**
- **Minimum number of publications to be submitted in JCR journals: 3**

Prerequisites

- **MSc degree (or equivalent) in Engineering, Physics or Mathematics**
- **Strong background in numerical methods and computational mechanics (FEM, CFD, ...)**
- **Basic programming skills (C++, Python)**
- **Good English level**

Duration: 4 years

How TO APPLY:

DOCUMENTATION REQUIRED:

- **A personal CV (in English, free format)**

- **Transcript of the marks of the Master Degree**
- **Covering letter indicating two referees.**

Send the required documentation to antoldt@cimne.upc.edu before *July 31th 2018.*