International Centre for Numerical Methods in Engineering

cimne@cimne.upc.edu
+93 401 74 95
CIMNE - Edifici C1 Campus Nord UPC
C/ Gran Capità, S/N
08034 Barcelona, Spain

CIMNE hr EXCELENCIA SEVERO OCHOA — HR EXCELLENCE IN RESEARCH

Centre Internacional de Mètodes Numèrics a l'Enginyeria ® Q5850006G

JOB VACANCY ANNOUNCEMENT

VAC-2024-26 – PostDoctoral Researcher

Number of places: 1

Category: Innovation Developer - ID2

Workplace: Barcelona

Salary (gross): 34.496,53 € / year

Weekly working hours: 40h / week

Contract type: PRTR

Duration: 01/09/2024 to 30/11/2024

Functions to be developed:

Development work of GPFEM code and its application to soil-root interactions. Development of the hydraulic interaction between structural roots and soils within saturated and unsaturated conditions. In particular:

- Creation of the root external shell to interact as a volumetric body with the soil. The behaviour of the root is going to be modelled with a large displacement beam theory currently under development by the research group. A shell-surface cover must be generated to represent the three-dimensional shape of the root. The kinetics of that shape is going to be governed by the beam modelling. The proper transfer or the constrained behaviour needs to be formulated and implemented.

- Integration of the roots into the soil domain, based on saturated and unsaturated conditions. The study and knowledge of the constitutive behaviour of soils and Finite Element formulation for the modelling of soils will be needed to develop the conditions for the integration of both domains and the characterization of the interaction.

- Development of the contact domain method to characterize the mechanical and hydraulic interaction of the root and soil. An ancillary mesh is going to be created between the shell -representing the root boundary- and the soil -modelled by volumetric elements- and it will be used to impose the contact constraint. This constraint is not only mechanical, but it must also consider the presence of water and how it is affecting the contact interaction. The modelling of suction and the viscous friction between the domains must be formulated and included in the contact constraint. Fracture growth induced by roots must be also explored.

The post-doctoral tasks will cover the mathematical extension of the contact domain to include the hydraulic part, the adaptation of the constitutive laws and the geometrical characterization of the shell-cover for roots. The implementation of the mentioned developments will be done into the GPEM code. A C++ code based on large deformation theory and a continuous remeshing strategy. The PFEM is a particle method supported by a mesh, so previous experience in the development finite elements in soil mechanics would be appropriate.

A CONSORTIUM OF

Generalitat de Catalunya

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

IN COOPERATION WITH

unesco Chair

CERCA Centres de Recerca de Catalunya

International Centre for
Numerical Methods in Engineering

cimne@cimne.upc.edu
+93 401 74 95
CIMNE - Edifici C1 Campus Nord UPC
C/ Gran Capità, S/N
08034 Barcelona, Spain

Required skills:

- A PhD degree in Geotechnical Engineering.
- Familiarity with geotechnical application of the Particle Finite Element Method
- Experience in coding the Particle Finite Element Method and the Contact Domain Method.
- Ability to communicate research findings as evidenced from a published track record.

Other valued skills (not mandatory):

- Catalan

Qualification system:

The requisites and merits will be evaluated with a maximum note of 100 points. Such maximal note will be obtained summing up the following points:

- Academic qualifications: 20%
- Training and development: 20%
- Professional experience: 40%
- Knowledge of the Catalan language: 5%
- Knowledge of the English language: 5%
- Selective tests and interview: 10%

Candidates must complete the "Application Form" form on our website, indicating the reference of the vacancy and attaching the required documents.

The deadline for registration to the offer ends on June 11th, 2024 at 12 noon.

The preselected candidates may be requested to send the documentation required in the "Requirements" and "Merits" sections, duly scanned, and may be called to go through selection tests (which might be of eliminatory nature) and / or personal interviews.

Commitment to inclusitvity:

At CIMNE, we champion workplace equity, diversity, and inclusion. We're committed to fostering a culture where everyone can thrive, leveraging diverse talents and backgrounds. We welcome all applicants regardless of color, religion, gender, origin, abilities, gender identity, sexual orientation, pregnancy or any other characteristic. Join us in building a community that values, celebrates, and respects every individual.

HR Excellence in Research:

CIMNE welcomes and supports the principles of European Commission's *European Charter for*

**International Centre for
Numerical Methods in Engineering**

Researchers and the *Code of Conduct for the Recruitment of Researchers*, embracing a transparent, attractive, and open labour market in research. The centre's Human Resources Strategy for Researchers (HRS4R) includes an action plan with actionable short and long-term actions to support a high-quality working environment for all. Further information can be found here.

A CONSORTIUM OF

IN COOPERATION WITH