CIMNE
EXCELENCIA SEVERO OCHOA
International Centre for Numerical Methods in Engineering

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ANNOUNCEMENT FOR PROVISION OF THE WORKPLACE

VAC-2023-56 – Research Engineer

Centre Internacional de Mètodes Numèrics a l'Enginyeria ® Q5850006G

Number of places: 1

Category: Research Engineer – RENG 3

Workplace: Barcelona

Salary (gross): 33.329,98 €

Weekly working hours: 40h

Duration: until 30/10/2024

Functions to be developed:

Development work of GPFEM code and its application to soil-root interactions. Development of structural root elements. In particular:

The numerical simulation of the mechanical behaviour of a root, geometrically similar to a long-curved line with a characteristic section, can be done by using structural finite elements. The discretization of a root as three-dimensional volumetric body, seems appropriate only for main large roots where the geometrical size of the soil elements and root thickness are comparable. In the other situations, the best representation for a root is a structural line element in a 3D space. There are several formulations for the modelling of beam elements with large displacements and rotations. Typically, the co-rotational formulation and the geometrically exact formulation are the most well-known, being the first (co-rotational) one of the easiest to implement and the second (the geometrically exact) one the most complex but also more consistent with the non-linear continuum mechanics theory. The research engineer task will be to explore, test and implement the large displacement beam theory that fits better with the G-PFEM.

A hybrid solution, without known precedent in the literature, will be also explored: large roots can be modelled as beam elements with a covering mesh of shell elements representing the root surface. Movements on the surface mesh will be governed by point constraints (movements of beam nodes). The mesh of shell elements (representing the root surface) can be used for the finite element interaction between the soil and the root, while the root behaviour will be represented by the deformation of a large displacement beam element. For the large main deformable roots (represented by volumetric finite elements or with a beam with a shell-surface auxiliary mesh) adhesion with the surrounding soil and the mechanical contact conditions must be considered. Extended developments of the current contact conditions available in G-PFEM have to be implemented to

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cope with these 3D contact interactions. When roots are defined as beam structural elements, a correspondence between the rotational degrees of freedom of beam elements and the solid elements must be defined. The developments of this task will follow all presented strategies, selecting the best option for the modelling of the contact interaction in each case. All cases must face large deformations and simulate complex geometrical contacts.

Required skills:

- Familiarity with geotechnical application of the Particle Finite Element Method
- Experience in coding the Particle Finite Element 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:

- Publication and career track: 30%
- Previous research and academic experience in the field of the position: 40%
- Programming skills: 10%
- Language skills: 10%
- Communication/Teaching skills: 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 October 10th, 2023 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.

Proyecto TED2021-131426B-I00 financiado por MCIN/AEI /10.13039/501100011033 y por laUnión EuropeaNextGenerationEU/ PRTR

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