

# PhD Position in Geomechanics (VAC-2021-17)

**Title of the PhD project:** Triggering and propagation of liquefaction in brittle geotechnical materials. Fundamentals and applications.

## INTRODUCTION:

The International Centre for Numerical Methods in Engineering (CIMNE, [www.cimne.com](http://www.cimne.com)) is a research centre, created in 1987 by consortium between the Catalan Government and the Universitat Politècnica de Catalunya (UPC-BarcelonaTech), devoted to the development and application of numerical methods to a wide range of areas in engineering. CIMNE has been selected as a Severo Ochoa Centre of Excellence for the period 2019-2023, the highest level of recognition of excellence and leadership awarded to a research centre in Spain.

## POSITION DETAILS

**Number of vacancies:** 1

**Category:** PhD (PHD2)

**Location:** Barcelona

**Yearly salary (gross):** 17.563,14 EUR

**Working hours:** Full time

**Duration:** 3 years

**Starting date:** No later than Sept 2021

## FUNCTIONS TO BE DEVELOPED BY THE APPLICANT

CIMNE is looking for a **PhD Researcher** to be part of the Research and Technical Development (RTD) Group on Geomechanics.

The functions assigned to the candidate will be:

- Complete a PhD in Geotechnical Engineering at Universitat Politècnica de Catalunya – Barcelona Tech. The candidate is expected to complete the PhD thesis in a maximum of three years.
- Collaborate with various research groups within CIMNE and worldwide.
- To publish a minimum of two papers in high-impact international journals during the PhD period, as author or co-author.
- Carry out quality research, training and management.
- Participate on the dissemination and outreach activities associated with the project.
- Participate in international conferences presenting her/his work.

## DESCRIPTION OF THE PHD PROJECT:

Liquefaction of brittle geotechnical materials (such as hydraulic fills, mine tailings, landfills and sensitive or quick clays) causes catastrophic failures leading to major environmental disasters, crippling economic disruption and, often, losses of human life. Examples are the failure of Prat quay in Barcelona Port, the failure of Aznalcóllar dam or the failure of Brumadinho dam in Brazil where 270 people lost their lives. The group has developed in recent years numerical methods to deal with this phenomenon and it is expected that a PhD project would make a major contribution to the ongoing research. The work would include the following aspects: i) further development of a constitutive law for simulating liquefaction incorporating essential features such as anisotropy and rate dependence, ii) an examination of the fundamentals of the phenomenon from a microstructural perspective, using DEM, iii) the development of a numerical method to simulate the propagation dynamics of the liquefaction from a source zone throughout a soil mass, iv) incorporation of interface effects to explore liquefaction during installation of onshore and offshore foundations for energy structures, v) application to selected key cases. A collaboration with Queens' University (Kingston, Canada) is envisaged to have access to high-quality large-scale model tests of liquefaction propagation. The outcome would be a simulation tool able to predict the potential for liquefaction-driven failures and to assist in the design of preventive measures in a wide range of engineering problems. In this way it would contribute to the resilience of transport infrastructures and networks, the prevention of environmental disasters in the territory, to securing the supply of critical raw materials for the green economy transition and to optimizing new energy structures (e.g. wind turbines), onshore and offshore.

### References

Gens A. (2019). Hydraulic fills with special focus on liquefaction. Keynote Lecture. Proceedings of the XVII ECSMGE-2019: Geotechnical Engineering foundation of the future, 1-31. doi: 10.32075/17ECSMGE-2019-1108

Monforte, L., Ciantia, M.O., Carbonell, J.M., Arroyo, M., Gens, A. (2019). A stable mesh-independent approach for numerical modelling of structured soils at large strains. Computers and Geotechnics, 116 Article number 103215. <https://doi.org/10.1016/j.compgeo.2019.103215>

Monforte, L., Gens, A., Arroyo, M., Mánica, M., Carbonell, J.M. (2021). Analysis of cone penetration in brittle liquefiable soils. Computers and Geotechnics (accepted for publication)

## REQUIREMENTS

1. The candidate should hold a degree in Civil Engineering, Geological Engineering, Applied Mathematics or other relevant fields.
2. The candidate should have a good background in numerical methods, continuum mechanics and, preferably, geomechanics.
3. Good programming skills.
4. Good working knowledge of English, written and spoken.

## EVALUATION OF CANDIDATES

The requirements and merits will be evaluated with a maximum mark of 100 points. Such maximum mark will be obtained by adding up the points obtained in the following items:

- Academic record (35%)
- Previous research and academic experience in the field of the position (30%)
- Programming skills (15%)

- Language skills (10%)
- Personal interview (10%)

## HOW TO APPLY

Candidates must complete the "Application Form" form on our website, indicating the reference of the vacancy and attaching the following documents **in English**:

- Curriculum vitae
- A motivation letter
- Academic transcripts from all Undergraduate and MSc degrees
- Name and institutional contact information of two possible referees

The deadline for registration to the offer ends on 31<sup>st</sup> May, 2021 at 12 noon.

The shortlisted candidates may be called for an interview. They may also be required to provide further supporting documentation.

***CIMNE is an equal opportunity employer committed to diversity and inclusion. We are pleased to consider all qualified applicants for employment without regard to race, colour, religion, sex, sexual orientation, gender identity, national origin, age, disability or any other basis protected by applicable state or local law. CIMNE has been awarded the HRS4R label.***