PhD Position in Geomechanics Group (VAC-2021-35)

Title of the PhD project: Coupled modelling of polymeric reinforced geotechnical structures subjected to environmental conditions

INTRODUCTION:

The International Centre for Numerical Methods in Engineering (CIMNE, 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** Candidate **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 on Geotechnical Engineering and Geosciences (Enginyeria del Terreny) 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 JCR journals during the PhD period, author and co-author articles in high-impact international journals.
- 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.

cimne@cimne.upc.edu
+34 93 401 74 95
CIMNE - Edifici C1 Campus Nord
UPC C/ Gran Capità, S/N 08034
Barcelona, Spain

DESCRIPTION OF THE PDH PROJECT:

Polymeric reinforcement materials are now used routinely as soil reinforcement and stabilization, as well as barrier systems and hydraulics, within the framework of Civil Engineering. These geosynthetic materials can play a role in meeting the global challenges facing society in terms of United Nations sustainability goals, approaches for counting carbon in both mitigating, and adapting to the impacts of climate change (Dixon et al. 2018. Keynote Lecture at 11ICG).

As example, in mechanically stabilized earth structures, the important role of temperature and relative humidity on the chemical degradation of polyester (PET) fibres due to hydrolysis is well documented in the literature. Strength and stiffness of the polyester fibers can be expected to decrease with increasing temperature and in the presence of moisture. This has practical implications for the selection of the partial factor for creep and chemical degradation that is used in internal stability limit state design for PET strap MSE walls. The PET multi-filament core of the straps is protected against installation damage and moisture by a polyethylene sheath. Nevertheless, this sheath still permits the exposure of the polyester filaments to moisture over the life of reinforcement. For example, HDPE coatings are permeable to water vapor over the long term and thus moisture can accumulate in the air voids between the PET fibers. The rate of degradation due to hydrolysis will vary with temperature which can vary widely depending on the environment (location) in which the straps are placed, and temporally with time of day and season.

The project will focus on the analyses using numerical simulations carried out to estimate, first, all significant environmental features (e.g., temperature, relative humidity, liquid water content, rainfall precipitation filtration, etc.) that change in-soil regarding different ground properties and atmospheric boundary conditions, and second, to reliably predict the long-term strength loss and stiffness relaxation in polymeric materials buried in different soil environments while subjected to different tensile loads and temperatures.

The research shall include the development of the necessary theoretical and numerical approaches and strategies to model polymeric reinforcements and other engineering components present in geotechnical structures such as reinforced soil walls. Coupled THMC problems will be simulated using CODE_BRIGHT/GID software platform. The research will benefit from current synergies in the Geotechnical group and CODE_BRIGHT Team

References

Damians, I. P. Bathurst, R. J. Olivella, S. Lloret, A. Josa, A. 2020, 3D modelling of strip reinforced MSE walls, Acta Geotechnica, 1861-1133, https://doi.org/10.1007/s11440-020-01057-w

Damians, I.P., Bathurst, R.J. Adroguer E., Josa, A., and Lloret, A.; 2018. Environmental assessment of earth retaining wall structures. ICE Environmental Geotechnics. https://doi.org/10.1680/jenge.15.00040

Greenwood, J.H., Schroeder, H.F., and Voskamp, W.; 2012. Durability of Geosynthetics (Publication 243). CUR Committee C 187. Building and Infrastructure. ISBN 978-90-376-0533-4.

REQUIREMENTS

1. Civil / Construction / Geotechnical Engineering (Master level or equivalent). Specialization in Geotechnical Engineering.
2. Experience in numerical modelling by finite element methods, particularly, with non-linear models.
3. Experience in mechanically stabilized earth structures and reinforced soil structures, and in geosynthetics / polymeric materials for reinforced fill applications, will be valuable.
4. A good command of English.

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 (60%)
- Previous research and academic experience in the field of the position (20%)
- Programming skills (10%)
- Language skills (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 31st 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.