

## Research Scholarship - Master (M/F)

A call for applications is currently open to award a Research Scholarship within the framework of the H2020 research project “LIQUEFACT - Assessment and mitigation of liquefaction potential across Europe: a holistic approach to protect structures/infrastructures for improved resilience to earthquake-induced liquefaction disasters” ([http://cordis.europa.eu/project/rcn/202709\\_en.html](http://cordis.europa.eu/project/rcn/202709_en.html)) of the Faculty of Engineering of the University of Porto.

**Scientific Area:** Civil Engineering - Geotechnics/Structures

### Application Requirements:

Applicants need to hold a pre-Bologna Civil Engineering or post-Bologna Civil Engineering Master degree by the end of the call, with specialization on Geotechnics.

Experience in scientific fields of the project, in particular knowledge in the analysis of seismic liquefaction consequences in soil-structure interaction, are considered a positive aspect for the ranking of applications. Applicants with knowledge and experience in the use of numerical modelling of the response of soil structure, particular using the finite difference software FLAC, the “Fast Lagrangian Analysis of Continua” (vs.9), developed by Itasca Consulting Group, Inc<sup>®</sup>, is available in our department, will be favoured.

Experience in using PM4Sand constitutive model (Boulanger and Ziotopoulou, 2015) for numerical analysis, will also be favoured. This model in its Version 3 is available in our department with a package with UDM (User Defined Models) modulus which will be used for the purpose of this research.

Since the validation of the numerical simulation will be made by cross-analysing these results against an extensive set of recorded experimental results from centrifuge tests, in order to obtain a satisfactory agreement between the two, the applicants need to have knowledge and experience in programming, particularly in Python<sup>®</sup>. So this knowledge will also be favoured.

A good level of English proficiency (spoken and written) is also required.

### Objectives of the Scholarship:

The scholarship holder will perform studies related with numerical simulation of liquefaction effects and soil-structure interaction analysis. Numerical models with different degrees of complexity will be developed in order to establish simplified models with a suitable accuracy. The validated numerical simulation will be utilized to perform a parametric investigation on selected properties of the model, and investigate their effect on the obtained response.

Taking into consideration that strong shaking can happen pre- and post-liquefaction development, there is a need to better understanding of soil-liquefaction-foundation-structure interaction, as well as to develop a framework to consider the combined damage of both soil-foundation deformation and ground shaking. The numerical simulation of buildings on liquefiable soil that can simulate both the fully-coupled soil-fluid effective stress behaviour of the soil and the degradation and collapse of the structure will be conducted with simpler analytical and empirical techniques that may provide useful insights into the expected level of damage from soil-foundation deformation and damage from ground shaking. Ground motions are modified as they travel up through a soil deposit, and some frequency content is amplified while other frequencies are de-amplified, largely based on the natural period of the site and the standing waves that develop.

A comprehensive parametric study will be developed for the assessment of how distinct soil simplified profiles (up to 3 layers of soils with distinct shear wave velocities and factor of safeties toward liquefaction – changing the damping ratios) affect the amplification response around the spectrum. The evaluation of how the liquefied deposit shows a reduction in response in the low period range, due to the increase in damping, will be analysed. Being this full analysis complex, because the deposit is constantly changing so amplification does not develop at a single period, recent proposals suggests that elastic design spectra can be obtained from the envelope of two equivalent linear analyses. The first analysis considers the response of pre-liquefaction ground motion and site conditions and the second analysis considers the ground motion after liquefaction using post-liquefaction site conditions.

The cross-checking of these full nonlinear problem and the simplified approach will be pursued by the researcher.

**Applicable legislation and regulations:**

Law Nº. 40/2004, of August 18, amended by the Decree-Law n.º 202/2012, of August 27 and amended by the Decree-Law nº 233/2012, of October 29, by Law nº 12/2013, of January 29 and by the Decree-Law nº 89/2013, of July 9; Scholarship Regulation of the University of Porto.

**Selection criteria:**

The applications of the candidates will be ranked according to their suitability to fulfil the objectives of the research work based on the documents submitted and possible individual interviews. The main ranking and selection criteria will be:

- i) Academic profile of the candidate: a pre-Bologna Civil Engineering or post-Bologna Civil Engineering Master degree by the end of the call, with specialization on Geotechnics (mandatory) (1-5 points);
- ii) Research experience (or other) relevant to the research project, as described in Application Requirements (1-5 points);
- iii) Relevant publications (1-5 points);
- iv) General CV assessment (including English proficiency) and applicant's motivation (1-5 points);
- v) Interview (1-5 points).

The weights assigned to these criteria are, respectively, 40%, 20%, 5%, 10%, 25%

The jury reserves the right not to award the scholarship if the quality of the applicants does not fulfil the necessary requirements.

**Jury Committee:**

President - António Viana da Fonseca, Associate professor, FEUP  
1<sup>st</sup> Effective Member – Sara Rios Silva, Invited Assistant professor, FEUP  
2<sup>nd</sup> Effective Member – Maxim Millen, Researcher  
1<sup>st</sup> Alternative Member - António Silva Cardoso, Full Professor, FEUP  
2<sup>nd</sup> Alternative Member - Xavier Romão, Assistant Professor, FEUP

**Scientific Supervision:**

The Scientific Supervision will be carried out by Prof. António Viana da Fonseca and the post-doc researchers Dr. Maxim Millen and Dr. Sara Rios from the Civil Engineering Department of the Faculty of Engineering of the University of Porto.

**Duration and General Terms of the Scholarship:**

The scholarship will have duration of 3 months, with predicted start on the March 2018 and may eventually be extended to a maximum of 12 months. The scholarship holder may not simultaneously benefit from another scholarship or fellowship. The research carried out within the scope of the scholarship will be performed under a scheme of exclusive dedication.

**Scholarship Stipend Conditions:**

A monthly stipend with a value of 980.00 € will be paid to the scholarship holder by bank transfer. The scholarship holder is entitled to a personal accident insurance covering research activities and to voluntary social insurance.

**Application Documents:**

An application letter addressed to the President of the Jury Committee needs to be sent as well as:

- Cover letter (no longer than on A4 page);
- Supporting documents attesting that the applicant fulfils all the required conditions for the scholarship, namely certificates of all the academic degrees obtained, with the final average grade and marks in all subjects;
- The applicant's detailed Curriculum Vitae;
- Copy of relevant scientific publications authored or co-authored by the applicant;
- (Optional) Additional documents such as reference letters (maximum 2) as well as proofs of internships or of additional courses or training taken by the applicant.

The documents can be submitted in Portuguese or in English. However, an English version of the cover letter always needs to be included (to analyse the applicant's English proficiency).

**Notification of the scholarship application results:**

The results of the selection process will be sent to the candidates by email and by registered letter. Candidates therefore need to provide their full postal address in their application documents.

**Application deadline and documents to be submitted:**

Applications will be accepted between 11/01/2018 and 24/01/2018.

Applications need to be sent before the deadline by normal post to Prof. António Viana da Fonseca, Project LIQUEFACT, Departamento de Engenharia Civil, Faculdade de Engenharia da Universidade do Porto, must be sent by email to [recursoshumanos@fe.up.pt](mailto:recursoshumanos@fe.up.pt) and [viana@fe.up.pt](mailto:viana@fe.up.pt), with the subject (**FEUP – LIQUEFACT**)