

ESR 3.4 – From fault rupture to city seismic response: 3D multi-scale physics-based scenarios for earthquake effects in large urban areas

A Research PhD position in the URBASIS ITN funded by the EC

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Recent devastating earthquakes and induced seismicity near infrastructures must become the centrepiece of analysis in reducing risk and increasing resilience, facing up to global urban population growth in the coming decades and the concentration of wealth in cities. The prediction of seismic ground motion and response of structures are key issues in reduction of seismic urban risk. There is therefore a demand for highly trained scientists with a broad understanding of engineering seismology and earthquake engineering, skills being essential in academic research, in private companies with activities related to risk mitigation and energy facilities and for policy makers. The URBASIS-EU project aims to provide a multi-disciplinary training platform for young scientists in order to develop their individual project and to promote their entrepreneurship and their employability toward the academic, private and insurance or decision-making sector. High-quality supervision of the young scientists will be ensured through the international recognition of the URBASIS-EU partners. A comprehensive set of transferable skills will be developed through innovative and interdisciplinary joint research projects between academic and non-academic partners on the prediction of seismic hazard in urban areas considering low-probability/high-consequences events and induced seismicity related to the exploitation of energy resources; the seismic ground motion prediction within the non-free-field urban area; the coupling between ground motion and structures/infrastructures responses for natural and induced seismicity including time dependent vulnerability; and the systemic risk of interconnected urban systems. URBASIS-EU will create a lasting collaboration for the establishment of a European network of academic and non-academic experts, improving the interface with decision-makers.

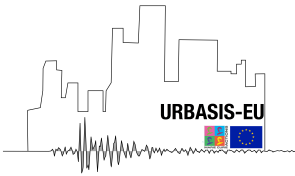
More information: <https://urbasis-eu.osug.fr/?lang=en>

Job description

In the current approaches to seismic design, the structure is conceived as a stand-alone system, the performance of which is independent from that of the surrounding structures and infrastructural networks. The experience from recent earthquakes, such as L'Aquila, Italy, 2009, and Christchurch, New Zealand, 2011, showed that also the performance of the urban system as a whole should be considered to properly predict its overall performance and its recovery time after a strong earthquake.

The objective of the ESR is to provide a significant contribution towards prediction of multi-scale physics-based scenarios of earthquake effects in large urban areas, from the fault rupture to the propagation in complex heterogeneous soil materials and eventually to the interaction with built environment. To achieve this goal, an existing open-source high-performance numerical code will be used, namely SPEED - SPectral Elements in Elastodynamics with Discontinuous Galerkin (<http://speed.mox.polimi.it>). Treating multi-scale numerical problems with such a wide range of spatial dimensions is allowed in SPEED by a non-conforming strategy implemented through a Discontinuous Galerkin Spectral Element Method (DGSEM).

The specific objectives of the ESR concern first the improvement of the capability of SPEED by the implementation of up-to-date, albeit simplified, non-linear constitutive models for soil response and by the vali-



dition both against earthquake records and within the framework of international benchmarks. With such an improvement, the code will subsequently be applied to study the soil-city-site interaction problem in a selected urban area (e.g., L'Aquila, Christchurch) for which a sufficient volume of both records and building damage catalogs are available.

The project is funded by ITN EU program. The ESR activity will mostly take place at the Department of Civil and Environmental Engineering of Politecnico di Milano (IT), with a secondment of several months at IFSTTAR Paris (France).

Requirements and Application

The successful applicant must have a Master degree in Civil Engineering or Earthquake Engineering and Engineering Seismology or similar. A Master degree in Applied Mathematics or similar may also be eligible. The applicant is expected to have excellent skills in computational engineering and scientific modelling. Furthermore, expertise in programming languages (including Fortran, Matlab and Python) is desirable. Excellent undergraduate and master degree grades are expected. A high level of written and spoken English is also expected.

PhD stipends are allocated to individuals who hold a Master's degree. PhD stipends cover the period of 3 years, starting from the enrollment in the PhD School. It is a prerequisite for allocation of the stipend that the candidate be enrolled as a PhD student at the Doctoral School of Politecnico di Milano – PhD Programme in Structural, Seismic and Geotechnical Engineering – in accordance with the regulations of the PhD School of Politecnico di Milano. According to URBASIS-EU, the progress of the PhD student shall be assessed every 12 months. It is a prerequisite for continuation of salary payment that the previous progress is approved at the time of the evaluation.

The qualifications of the applicant will be assessed by the Selection committee. On the basis of the recommendation of the Selection committee, the Administration of Politecnico di Milano will make the final decision for allocating the stipend.

URBASIS-EU wishes to reflect the diversity of society and welcomes applications from all qualified candidates regardless of personal background or belief. We encourage applications from everyone irrespective of gender and ethnic group but, as women and members of ethnic minority groups are currently under-represented at this level of post, we would encourage applications from members of these groups. Appointment will be based on merit alone.

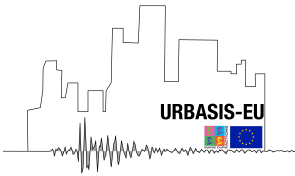
Application must be in a form of a single PDF file including a CV, a cover letter, academic transcripts, and the names and complete contact information and letter of two referees sent through :

- the consortium web-page <https://urbasis-eu.osug.fr/?lang=en>
- the EU EURAXESS portal <https://euraxess.ec.europa.eu/>

Vacancy number : URBASIS-EU ESR3.4 (to be reminded in the application form)

Deadline : February, 23rd 2019

Salary : According to the European Commission and local standards ; minimum gross wage is 3500 euros before local taxes



Contact Information

You may obtain further information from :

- Philippe Guéguen, URBASIS project coordinator : philippe.gueguen@univ-grenoble-alpes.fr (Earth Science Institute, Université Grenoble Alpes) for general questions regarding the URBASIS consortium or concerning the scientific and training aspects of the ITN program.
- Roberto Paolucci : roberto.paolucci@polimi.it for specific questions regarding this PhD project.
- **Florence Cataye**, URBASIS project manager : florence.cataye@univ-grenoble-alpes.fr for administrative questions.

For more information of Doctoral School: <http://www.dottorato.polimi.it/en/phd-programmes/active-phd-programmes/structural-seismic-and-geotechnical-engineering/>