

ESR 1.3 – Hazard and risk assessment in urban areas based on 3D physics-based ground shaking scenarios

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

Key ingredients to carry seismic hazard and risk assessment studies at urban scale are, on one side, a proper evaluation of earthquake ground motion and of its spatial variability, and, on the other side, accurate vulnerability models of the physical elements at risk. Standard approaches for earthquake ground motion prediction based on Ground Motion Prediction Equations (GMPEs) suffer of some intrinsic limitations, such as: (i) they are poorly calibrated in the range of major interest for engineering applications, specifically in the near-source region of large earthquakes; (ii) they refer to generic site conditions, not apt to reproduce complex site effects; (iii) they provide only peak values of ground motion without the full waveform; (iv) they do not provide a realistic description of spatial correlation of ground motion. In recent years, physics-based numerical simulations (PBS) of seismic ground motion, from the seismic source to the site, have emerged as a promising tool to give an accurate assessment of earthquake ground motion and of spatial variability during realistic earthquakes in large urban areas.

In this context, the main goal of the proposed research is to implement an innovative approach for seismic hazard and risk assessment in densely populated urban areas, where ground motion prediction models are calibrated on 3D physics-based ground shaking scenarios, and to apply it to one or two large urban areas in the world. The numerical tool to generate PBS scenarios is the high-performance spectral element code SPEED - SPectral Elements in Elastodynamics with Discontinuous Galerkin (<http://speed.mox.polimi.it>). To

achieve this goal, the ESR will focus on: (i) the simulation of 3D “source-to-site” earthquake scenarios for selected large urban areas worldwide using the SPEED code; (ii) the production of broadband ground motion scenarios, covering the range of frequencies needed for risk assessments; (iii) study of the spatial correlation and cross-correlation of simulated ground motions; (iv) the generation of physics-based risk scenarios, by convolving the synthetic ground shaking scenarios with state-of-the-art fragility curves for specific classes of buildings and infrastructures.

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, with a secondment at the Aristotle University of Thessaloniki and at Munich RE, Munich.

Requirements and Application

The successful applicant must have a Master degree in Civil Engineering or Earthquake Engineering and Engineering Seismology or similar. The applicant is expected to have a strong background in earthquake engineering and engineering seismology. Furthermore, expertise related to earthquake ground motion analysis and modeling 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 applicant's qualifications 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.

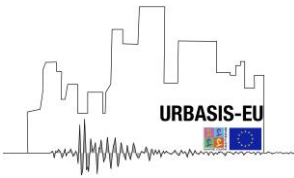
Application must be in a form of a single PDF file including a CV, a cover letter, academic transcripts, and the names and complete contact information and letter of two referees sent through :

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

Vacancy number : URBASIS-EU ESR1.3(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
- **Chiara Smerzini** : chiara.smerzini@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 at Politecnico di Milano see:
<http://www.dottorato.polimi.it/en/phd-programmes/active-phd-programmes/structural-seismic-and-geotechnical-engineering/>