SPIN MONITORING A RESTLESS EARTH

SPIN ESR 4.2: Nonlinear seismology meets structural health monitoring

Host institution: University of Hamburg (UHH)

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

Supervisors:
main supervisor: Celine Hadziioannou (University of Hamburg, D)
co-supervisors: Andrew Curtis (University of Edinburgh, UK)
Ernst Niederleithinger (Federal Institute for Materials Research and Testing, BAM, D)

Application deadline April 1st, 2021
Starting date: June 1st 2021 – October 1st, 2021

General information

This PhD position is one of the 15 Early Stage Researcher (ESR) positions within the SPIN project (http://spin-itn.eu). SPIN is an Innovative Training Network (ITN) funded by the European Commission under the Horizon 2020 Marie Sklodowska-Curie Action (MSCA).

SPIN will focus on training 15 PhD candidates in emerging measurement technologies in seismology. We will research the design of monitoring systems for precursory changes in material properties, all while optimizing observation strategies. The unique interdisciplinary and inter-sectoral network will enable PhDs to gain international expertise at excellent research institutions, with a meaningful exposure of each PhD to other disciplines and sectors, thus going far beyond the education at a single PhD programme. For further information on the project, please consult our website at: http://spin-itn.eu.

Project description
Many bridges, dams, buildings and other structures in Europe have reached an age where deterioration and limited load capacity become a serious problem. Methods of nondestructive testing (NDT) and structural health monitoring (SHM) are important to assess the status and capacity of structures.

In this PhD project, we transfer knowledge between civil engineering and seismology. Our goal is to evaluate and monitor changes of mechanical properties of materials, which are associated with long-term damage development in civil structures. To do this, we will apply seismic wavefield-based techniques to detect and quantify changes in propagation velocity and scattering properties. We will investigate the optimal way to measure self-healing timescales after reversible damage is induced on a concrete test structure.

In parallel, we will assess the sensitivity of velocity changes and of healing timescales to environmental conditions (temperature, pore fluid content, etc). Through this, we investigate whether it is possible to distiguish these effects from the underlying, long-term changes in internal strength of the structure.

This part of the project will benefit from close interactions with other projects in the SPIN network, as well as with other PhD candidates within SPIN, who will evaluate array sensitivity towards transient changes.

Throughout the investigations described above, we will evaluate which benefits to the monitoring methods can be provided by the use of novel sensors (e.g. rotational, strain/DAS). We will design and perform

Funded by the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 955515.

experiments on concrete test structures at BAM (Federal Institute for Materials Research and Testing, Berlin), in close collaboration with the scientists there. Using an optimized sensor deployment based on the work by a different PhD candidate, the test structure, will be instrumented with complementary sensors and both active and passive measurements will be performed.

The long-term goal of this project is to develop seismic wavefield-based methodologies for detecting a monitoring damage and deterioration of dams, wind turbines, high-rise buildings, and other structures which are constantly under stress.

Required skills and experience

We welcome applications from candidates who fulfill the following criteria:

- A completed research-oriented university degree, such as a Master's degree or BSc Hons, in a relevant field (e.g. Geophysics, Physics, ..) The PhD enrollment requirements will depend on the hosting institute, please refer to the individual project descriptions and institute webpages.
- An outstanding academic track record
- An good command of English, both verbal and written
- Dedication and enthusiasm for research, combined with scientific curiosity, reliability and the capacity to teamwork in an interdisciplinary environment.
- A strong background in wave propagation, as well as experience in signal processing and programming
- Experience with seismic or acoustic laboratory experiments are a definite advantage

Please ensure that you fulfill the following **eligibility criteria** for ESR (Early Stage Researcher) positions in H2020 MSCA-ITNs, as ineligible candidates cannot be considered:
https://spin-itn.eu/recruitment/#eligibility-criteria

Application Procedure

The **application deadline** is April 1st, 2021. Application evaluations will start immediately, and will continue until all positions are filled. We wish to reflect the diversity of society and we welcome applications from all qualified candidates regardless of personal background. The selection will be exclusively based on qualifications, without regard to gender identity, sexual orientation religion, national origin or age.

Applications must include:

- A cover letter in which you describe your motivation and qualifications for the position.
- A CV including relevant competences, skills and publication list, if applicable
- Copies of degree certificate(s) and transcripts of records for previous studies (Bachelor and/or Master). Please indicate expected date of graduation if your Master's degree is not completed
- Contact information of two references
- Completion of the SPIN application form: http://uhh.de/min-spin-apply

Applications should be sent in **one single pdf file** with filename `SPIN_YourLastname_YourFirstname.pdf' to spin-applications.min@uni-hamburg.de

Data handling

By applying to a PhD position, you agree that all data concerning your application may be stored electronically and distributed among the supervisors involved in the selection procedure within the MSCA ITN SPIN. If you do not agree, your application can not be processed further, due to the project's centralised recruitment process. The data are used solely for the recruitment process and we do not share information about you with any third party.

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