

## 2 PHD POSITIONS IN FAULT MECHANICS AND EARTHQUAKE CONTROL (FRANCE)

### AVAILABLE POSITIONS

The appointments form part of the cutting-edge project ERC-StG CoQuake (Controlling earthQuakes), funded by the European Research Council (ERC, <https://erc.europa.eu/>). Both positions offer the possibility of working on a challenging and stimulating research topic. The knowledge, innovation and skills to be developed will open perspectives for career development both in industry and academia.

The PhD candidates will carry out research under the supervision of the ERC-StG holder, Assoc. Pr. Ioannis Stefanou, in the Ecole des Ponts ParisTech facilities (Navier laboratory) situated close to Paris.

### RESEARCH CONTEXT

Earthquakes are responsible for more than half of the total human losses due to natural disasters (see CRED). CoQuake explores an alternative, ground-breaking approach for exploring the possibility of avoiding earthquakes in the future by inducing them at a lower energy level and mitigating seismic risk.



For more details: [https://cordis.europa.eu/project/rcn/212726\\_en.html](https://cordis.europa.eu/project/rcn/212726_en.html)

### REQUIREMENTS & DESCRIPTION OF PHD THESES

**Successful candidates are expected to have strong scientific skills and high motivation** to fulfill the requirements of the doctoral Thesis. Fluency in spoken and written English is highly advantageous. French is not required, but is appreciated.

The students will carry out their research project, write scientific articles and their PhD Thesis in close collaboration with their supervisor and the members of the CoQuake team (7-10 people).

Two *distinct* but related PhD topics are proposed:

#### 1) *Controlling earthQuakes in the laboratory using pertinent fault stimulating techniques*

Laboratory experiments with existing devices will be performed and a novel metric-scale laboratory apparatus will be designed and developed for studying fault mechanics, earthquake nucleation and control. Under adequate scaling laws, the target of the Thesis is to explore in the laboratory pertinent fault stimulating techniques and investigate the conditions under which earthquake control is possible (proof-of-principle).

The candidate should have:

- A strong background in experimental testing
- An interest in mechanical design

Knowledge of physics/mathematics, mechanics and industrial design will be appreciated.

#### 2) *Multiscale numerical modeling of earthquake faults*

The complex behaviour of faults will be studied through the development of physics-based, robust numerical models that take into account the various Thermo-Hydro-Chemo-Mechanical couplings and the dominant length- and time-scales that the earthquake phenomenon involves at the level of the fault gouge. This Thesis aims at developing advanced numerical multiscale tools (FEMxDEM) and enable

large-scale, predictive numerical simulations of fault systems, which are not based on phenomenological or empirical constitutive laws (Numerical Geolab).

The candidate is expected to have:

- A strong background in computational and continuum mechanics
- Skills in programming

Knowledge of dynamical systems, upscaling/homogenization techniques, bifurcation theory and/or neural networks will be appreciated.

## **CONDITIONS OF EMPLOYMENT**

The duration of each PhD Thesis is three years.

Personal initiative and independent research tasks related with the candidate's interests and CoQuake project will be encouraged. Other activities will include interaction with Master and undergraduate students. Participation in teaching in the Ecole des Ponts ParisTech is optional with additional salary.

The project will cover travel expenses for attending international conferences and making research visits.

## **APPLICATIONS**

The position is open and will start upon agreement.

Suitable, highly-motivated candidates should send an application (including a CV, a cover letter describing interests and qualifications related to the PhD Thesis and contact details of two reference Professors, all compiled in a single PDF file) to [ioannis.stefanou@enpc.fr](mailto:ioannis.stefanou@enpc.fr). Candidate selection will be performed on the basis of the excellence of the CV and motivation.

Selected candidates will be asked to apply for the doctoral school after an interview.

Doctoral school admissions are made in two batches with corresponding deadlines of May 31 and August 31. Therefore the **interested candidates are asked to send their application *as soon as possible***.