Call for proposals: MSCA Postdoctoral Fellowship (H/F)
Function level: Post-doc R1
Département: GeM – DYNAST

Willing to experience intersectoral, interdisciplinary and/or international research? Apply with Centrale Nantes to the MSCA Postdoctoral fellowship 2025 call for proposals and join us!

Candidate profile

We are seeking a highly motivated Postdoctoral Researcher with expertise in numerical analysis applied to Earthquake Engineering. Strong skills in nonlinear mechanics, soil-structure interaction, and beam finite element theory are particularly desirable. Proficiency in programming, especially using Matlab or Python, would be highly valued.

Project description

Supervisor: Panagiotis KOTRONIS

Keywords: Nonlinear dynamics, earthquake engineering, soil-structure interaction, finite elements, beam theory, programming.

Topic open: In recent years, a new class of macroscopic models has been developed, primarily for soil-foundation-structure interaction applications. These models can be considered an "upscaled" version of traditional macroscopic models, treating the soil as a continuous medium. This approach, known as macroelement modelling, condenses the global behavior of the foundation and the surrounding soil volume into a single, integral constitutive equation. This equation links the evolution of the resultant forces and moments on the foundation to the corresponding histories of displacements and rotations.

The concept of the macroelement was first introduced in foundation engineering by Nova and Montrasio. However, it shares similarities with simplified methods developed in structural engineering, such as those used to model plastic hinge areas in beam-column joints. Compared to macroscopic approaches based on continuum mechanics, the macroelement approach offers notable advantages, including exceptional computational efficiency, relatively simple constitutive formulations, and ease of numerical implementation into general-purpose finite element codes.

At EC Nantes, the research team has already developed several macroelements for various configurations, including shallow foundations, piles, caissons and rigid inclusions foundations but also reinforced beam-columns. In the case of reinforced beam-columns, the macroelement approach has been integrated with a kinematically enhanced Timoshenko beam formulation. This coupling enables the assessment of the vulnerability of reinforced concrete frame structures subjected to static (monotonic, cyclic) or dynamic (seismic) loading, all the way to complete failure (no stress transfer).

The responsibilities of the Postdoctoral Researcher will include:

- Integrating Previous Developments: Consolidating all prior developments by the research team into a single Matlab (or Python)-based environment.
- Automating Swipe Tests: Programming an automated procedure to numerically reproduce swipe tests, enabling the identification of 3D interaction diagrams for various structural configurations.
- Macroelement Generation: Developing a gateway that automatically generates a macroelement based on a user-provided 3D interaction diagram.
- Simulating Complete Failure: Coupling the existing macroelements with generalized beam formulations to simulate complete structural failure of frame type structures submitted to static (monotonic, cyclic) or dynamic (seismic) loadings.
- Multifiber Beam Coupling: Integrating the existing macroelements with multifiber beam models.
- Extending Macroelements: Expanding the existing macroelements to account for different environmental conditions, such as the presence of water.

Call information

Organisation	Ecole Centrale Nantes
Research field(s)	Earthquake Engineering
Researcher Profile	R1 – First stage researcher
Country	France
Application deadline	31 March 2025
Type of contract	Temporary
Job status	Full-time
Hours per week	39
Offer starting date (estimated)	1 Apr 2026
Is the job funded through the EU Research Framework Programme?	Horizon Europe – MSCA European Postdoctoral Fellowship

Research environment

Centrale Nantes is a top-ranked institution recognized internationally for its excellence in research and education, particularly in engineering and technology. It is known for its leadership in fields such as **marine engineering**, **civil engineering**, and **mechanical engineering**, frequently appearing in the upper echelons of global rankings. For example, it ranks **125th worldwide in Mechanical Engineering** according to the **QS World University Rankings by Subject 2024**, reflecting its prominence in this area.

Additionally, Centrale Nantes is positioned in the **top 300 globally for Engineering,** and in the **top 500 for Physical and Computer Sciences** in the **Times Higher Education World University Rankings by Subject 2024**, highlighting its multidisciplinary strength.

Notably, Centrale Nantes was named **the top institution in France in the "Engineering Schools to Change the World"** ranking, compiled by **Les Echos START and ChangeNOW**, which evaluates schools based on their contributions to social and ecological transitions. This ranking showcases its dedication to sustainability and innovative solutions to global challenges.

Centrale Nantes' research extends beyond traditional engineering disciplines. It is recognized for pioneering work in **artificial intelligence** and **robotics**, often ranking among the **top 100 worldwide** in these fields. Its **computational mechanics** and **hydrodynamics** research centers are considered among the best in Europe, further cementing its status as a leader in cutting-edge scientific research.

Through strong global partnerships and innovative initiatives, Centrale Nantes continues to enhance its reputation as a world-class institution in scientific and technological research, with a strong focus on sustainability and impactful solutions for societal challenges. Please take look at our institution before submitting your application: https://www.ec-nantes.fr/

Profile required

Eligibility criteria - Specific Requirements

- **You are a First-stage or an Experienced Researcher** eg. in possession of a doctoral degree at the time of the call deadline (10th Sept 2025) and a maximum of 8 years full-time equivalent experience in research (self-assessment tool here).
- **You comply with the mobility rule**: eg. you must not have resided or carried out your main activity (work, studies, etc.) in France for more than 12 months in the 36 months immediately before the call deadline (September 10th, 2025). All nationalities welcome!
- **You want to carry out an innovative research:** only the best proposals will be selected by the European Commission. All domains of research are eligible!
- **You already have great achievements in research:** Curriculum Vitae is an important criterion of MSCA application.

Conditions of employment

Duration	12 to 24 months
Salary	Around €6 000 (fully loaded cost of employment) per month Exact salary to be published in the MSCA PF call in April 2025.
Support to mobility and family	mobility allowance (€ 710 per month) + family allowance (€ 660 per month) if applicable - both allowances are fully loaded cost of employment
Secondment	An interdisciplinary and/or intersectoral mobility (3 months up to 1/3 of fellowship) is possible **when relevant**
Additional benefits:	- Teleworking possible - 75% transport reimbursement - Sustainable mobility bonus (if cycling or car-pooling)

Selection process

How to apply to MSCA Postdoctoral Fellowship with Centrale Nantes:

Step 1: Find a supervisor at Centrale Nantes (application before March 31st, 2025)

- *Select a pre-determined topic*: You apply **in English** to one or two research subject(s) provided by supervisors (please see table 2 below) :
    - Detailed Curriculum Vitae (including list of publications);
    - A concise statement of research's relevance to the selected topic/duration, along with a detailed proposal outlining your project idea for the MSCA Postdoctoral Fellowship;
    - Link and/or information about your doctoral thesis;
    - Contact information of two references (not mandatory, recommended).

Please apply by sending your application to pauline.rouaud@ec-nantes.fr and yolaine.lebeau@ec-nantes.fr before **March 31st, 2025**. Please always include both contacts so that your request can be processed as quickly as possible.
If your application is retained (feedback at the latest: end of April 2025), then, the next step is to apply jointly to the MSCA PF (call launched by the European Commission - HORIZON-MSCA-2025-PF-01-01).

Step 2: Prepare the application to the MSCA PF

April-May 2025

- You receive an informative MSCA-PF starter package via an online meeting with advice on institutional aspects and horizontal issues (open science, gender, ethics and research data management…) - fellow + supervisors + EU project managers
- You elaborate jointly the research approach with your supervisor(s) (April 2025)

June 2025

- One joint meeting in Nantes. You receive a dedicated training session "Preparing for an Horizon Europe MSCA Postdoctoral Fellowship" advice on how to write your proposal - fellow + supervisors + EU project managers

July-August 2025

- Online meeting for proofreading - fellow + supervisors + EU project managers

September 2025

- Online meeting for administrative support for your MSCA PF application - fellow + supervisors + EU project managers
- We apply for you (deadline for the application: September 10th, 2025)

Please read this page to understand how MSCA PF works: https://marie-sklodowska-curie-actions.ec.europa.eu/actions/postdoctoral-fellowships/6-steps-to-prepare-your-application

Centrale Nantes is committed to equality and diversity. In line with our CSR commitments, this call is open to all.