Call for proposals: MSCA Postdoctoral Fellowship (H/F)
Function level: Post-doc R1/R2
Département: LHEEA – Methric

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 a background in scientific computing, particularly numerical fluid mechanics, reduced-order modelling, or machine learning. You are passionate about performing original research at the intersection of these different subjects, and interested in fundamental questions with practical applications. You are a good written and oral communicator. Finally, you have a strong academic track record, compatible with the highly selective MSCA programme.

Project description

Supervisor: Jeroen WACKERS

Keywords: Surrogate modelling, Multi-fidelity, Error estimation, Shape optimisation.

Topic open: Simulation-driven design optimisation in aero- and hydrodynamics concerns the automatic optimisation of vehicle performance, and reduction of environmental impact, based on high-fidelity numerical simulation. To reduce the cost associated with the large number of simulations required, surrogate models, which replace expensive simulations by a simplified model fitted through a reduced number of simulation results, are essential. The efficiency of surrogate models is increased further by multi-fidelity approaches, which combine a few high-accuracy simulations with many cheap low-fidelity results. Finally, adaptive surrogate models generate the input simulation results iteratively, to achieve a maximum precision for the computational budget available [1].

However, adaptive processes for the selection of multi-fidelity input data points are much more sensitive to the exact behaviour of the simulation data, than is often assumed in the literature. Therefore, the choices of the simulation points and the fidelity levels must be exactly right for the data in each stage of the iterative improvement. Otherwise the surrogate can get locked in a suboptimal state which leads to stagnation of the optimisation process that wastes computational resources, annihilating the advantages of the multi-fidelity adaptive sampling.

This project aims to automatically create surrogate models with optimal efficiency, through full adaptation of the surrogates to the behaviour of the data on which they are based. To guide this adaptivity, the heart of the approach is an innovative estimation of the surrogate uncertainty, for which initial ideas have been published in [2]. This estimation for radial basis function (RBF) surrogate models with noisy (i.e. unreliable) input data combines separate models for the interpolation error, the noise-filtering uncertainty, and the uncertainty due to the multiple fidelity levels. In the project, the uncertainty estimation will be perfected through theoretical studies and application to realistic problems, to obtain a reliability level well above the state of the art.

Then, the uncertainty estimation will be used to adaptively guide the selection of new training points and fidelity levels. Furthermore, the surrogate will adaptively and locally adjust which fidelity levels are used to construct the surrogate. Thus, an optimisation can start with low-fidelity data to efficiently evaluate many different designs, and then locally switch to mostly high-fidelity information once the optimum posiition is determined approximately.

To test its suitability for complex industrial-type optimisation problems, the approach will be applied to the hydrodynamic shape optimisation of a bio-inspired underwater robot, which creates propulsion by underwater gliding thanks to changes in buoyancy. The research will be performed as part of an on-going collaboration between the Institute of Marine Engineering (CNR-INM) in Rome, and Centrale Nantes.

[1] R. Pellegrini et al. A multi-fidelity active learning method for global design optimization problems with noisy evaluations. Eng. with Comput. 39(5), (2023).

[2] J. Wackers et al. Adaptivity and uncertainty of multi-fidelity surrogate models for shape optimization. Proceedings of WCCM / PANACM 2024, Vancouver, Canada.

Call information

Organisation	Ecole Centrale Nantes
Research field(s)	Shape optimisation, Machine learning
Researcher Profile	R1 – First stage researcher OR R2 – Recognised 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.