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**CIMNE - Edifici C1 Campus Nord UPC**
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# JOB VACANCY ANNOUNCEMENT

## VAC-2025-44 – Postdoctoral Call

**Number of positions offered:** 6

**Category:** PostDoc

**Workplace:** Barcelona, Madrid, Lleida (depending on the position)

**Salary (gross):** €35,186.46

**Weekly working hours:** 40h/week

**Contract type:** Permanent, contingent to project duration

**Duration**: 2 years

CIMNE is a globally recognized research centre based in Barcelona, dedicated to the development and application of numerical methods in engineering and applied sciences. Since its foundation in 1987, CIMNE has been a hub for scientific excellence, technology transfer, and the training of highly qualified researchers.

As part of the Program Contract signed with the Government of Catalonia, CIMNE is opening a competitive call to recruit highly qualified postdoctoral researchers across a broad range of strategic research areas. This initiative forms part of an institutional plan to strengthen knowledge generation, accelerate innovation, and enhance the international competitiveness of the Catalan research system.

Selected candidates will join dynamic and well-established research groups, working on cutting-edge projects with real-world impact in fields such as computational mechanics, artificial intelligence, sustainable infrastructure, biomedical engineering, and climate resilience. They will also benefit from access to advanced simulation platforms, collaboration with industrial and academic partners, and a supportive environment for professional growth and leadership development.

Through this call, CIMNE reinforces its commitment to building a new generation of scientific leaders ready to address global challenges through high-impact research and innovation.

## General requirements:

- Candidates must have a PhD degree prior to the start of the contract.

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- Candidates must have an academic background in engineering, applied mathematics, physics or similar cognate discipline.

## Qualification system:

The requisites and merits will be evaluated with a maximum note of 100 points. Such maximal note will be obtained summing up the following points:

- Academic qualifications: 30%
- Training and development: 20%
- Professional experience: 10%
- Knowledge of the English language: 10%
- Selective tests and interview: 30%

## Research Areas for Postdoctoral Positions at CIMNE:

Possible topics for research are listed below together with the academic staff that will supervise the project.

**Candidates may select up to three topics, in order of preference, in the application form.**

### **Ref. PDOC#1**: Hydroelasticity of very flexible FRP structures

**Supervisor(s):** Xavier Martinez, Borja Serván

**Description:** Up to date, marine structures such as ships and offshore platforms are design to be stiff by requirements. And one reason is the lack of tools for an efficient structural assessment in the marine environment. However, with the increasing interest in the marine renewable energy, new devices are being developed to harvest the marine wind, wave and tidal energies. With the appearance of these and other devices, new challenges show up, and FRP materials are seen as interesting alternatives to steel and concrete.

FRP material offer great ratio in terms of strength/weight, which enables its application for lighter structures. However, FRP structures are not as stiff as steel structures, which nowadays limits its application within the marine environment. Although lighter structures allow for larger payloads in ships and cheaper handling (lifting, towing, …), which lead to a cost reduction and efficiency improvement.

In order to enable the use of FRP materials in marine structures, this project aims at developing computational tools to enable the hydroelastic simulation of very flexible marine structures made of sustainable and eco-friendly FRP materials. These tools will be use to analyse the performance of FRP respect to steel and concrete. And the hydroelastic tool will be based on previously in-house developed tools.

The seakeeping hydrodynamics module will be SeaFEM, developed by the CIMNE-Marine group. SeaFEM has been recently enriched with a structural solver that relies on either the structural matrices, or a reduce order model based on modal matrix reduction (MMR). Once SeaFEM is fed with the structural particulars, the hydroelastic simulation can be performed.

The FRP structural modules will be based on FEMUSS, developed by the CIMNE-CAMMS. This module will be used and further developed to characterize the material properties. Then, the structural properties will have to be exported to SeaFEM to carry out the hydroelastic simulations.

The research will focus on very flexible FRP structures, finding the limitations of the current simulation tools and looking for overcoming these limitations in both sized, the seakeeping hydrodynamics and the structural characterization.

**Specific requirments:**

- Ph.D. in Engineering, Mathematics, or Physics
- C++ programming skills
- Knowledge of hydrodynamics

## **Ref. PDOC#2**: Multiscale Computational Modelling of Vascular Growth and Remodelling

**Supervisor(s):** Marino Arroyo, José Muñoz, Miquel Aguirre, Eduardo Soudah

**Description:** Vascular cells, tissues, vessels and organs exhibit a remarkable ability to grow and remodel by changing their mass and internal structure due to external and/or internal stimuli. This drives adaptations and they mediate many responses to injury, disease and therapeutic interventions. Macroscale growth and remodelling processes depend strongly on mechanobiological processes at the cellular level. It has been shown that their mathematical modelling can provide valuable and potential insight into the basic biology and physiology, guide the design and interpretation of appropriate experiments, and inform the planning of therapeutic intervention. Yet, computational techniques able to model the coupled phenomena at the macro (organ, tissue) and micro (cellular) scales have been seldom explored.

**Specific requirements:**

- PhD in Applied Mathematics, Physics, Computational Engineering, or a related discipline.
- Strongly motivated person.

**Desirable:**

- Previous experience in biomechanics and/or mechanobiology

## **Ref. PDOC#3**: High-Fidelity Modelling for Battery Thermal Management Simulation and Design

**Supervisor(s):** Antonio Huerta, Matteo Giacomini

**Description:** Electromobility plays a key role in achieving EU climate neutrality by 2050. Internal combustion engines are being replaced by electric drive systems consisting of electric motors, drive power electronics and batteries for energy storage. However, significant progress in electromobility is still needed. Battery design needs to respond to the crucial requirement of battery thermal management, which critically affects both battery lifetime and range. In this context, optimal design (i.e., most favorable thermal-flow coupled arrangement) of cooling systems is critical to attain the ambitious emission target envisioned. This project aims to develop an innovative computational framework to model, simulate and virtually prototype the next generation of battery thermal management systems. The project will encompass several frontier research topics including: high-fidelity CFD and thermal (coupled) simulations, exact geometrical description, immersed boundaries for high-order approximations, shape and topology optimization, scientific machine learning for surrogate-based optimization.

**Specific requirements:**

- PhD, with expertise in either mathematical modelling, computational engineering, and/or scientific machine learning.

**Desirable:**

- Background in the following topics: development and programming for finite elements (high-order methods), adaptivity and/or immersed methods, transient Navier-Stokes modeling, coupled multi-physics simulations, reduced order models, neural networks
- Programming skills (Matlab/Python and Fortran/C++).
- Track record of productive research and publications.

## **Ref. PDOC#4**: Data driven multiphysics methods applied towards the design of smart materials for biomechanics and regenerative medicine

**Supervisor(s):** Alberto García González, Javier Bonet

**Description:** Development and investigation of computational techniques involving data driven multiphysics modelling, including electrical, magnetic, mechanical and thermal components. The techniques will be applied towards the computational design of smart materials and their effects in direct application to biomechanical systems and regenerative medicine. The project involves a highly multidisciplinary environment (mathematics, engineering, machine learning and biomechanics) and it is expected to bring strong outcomes and insights supporting biomedical research.

**Specific requirements:**

- PhD in Engineering, Biomedical Engineering, Computational Mechanics, Mathematics or related disciplines.
- Knowledge of numerical methods, computational solid mechanics and simulation.
- Excellent programming skills.

## **Ref. PDOC#5**: Numerical and sustainability assessments of geosynthetic-based geotechnical structures

**Supervisor(s):** Ivan Puig, Sebastià Olivella

**Description:** Numerical and sustainability assessments of geosynthetic-based geotechnical structures

**Specific requirements:**

- PhD in Geotechnical Engineering

## **Ref. PDOC#6**: GeoAI+E: Generative and Predictive Models for Energy, Environment and Equity

**Supervisor(s):** Jordi Cipriano

**Description:** Develop advanced AI models—including generative, anomaly detection, and predictive techniques—for high-resolution geospatial analysis in the context of buildings, energy, and population dynamics.

**Specific requirements:**

- PhD in Data science, Geo Computing or Data-driven methods

## **Ref. PDOC#7**: Hybrid Data-Driven and Physics-Based Modeling for Multiscale Solid Mechanics

**Supervisor(s):** Riccardo Rossi, Alejandro Cornejo

**Description:** The position will explore the integration of Machine Learning (ML) with Computational Continuum Mechanics, targeting the development of enhanced constitutive models and fast, reliable Digital Twins for multiscale structural systems. The work will leverage the team's leading expertise in Reduced Order Modelling (ROM) and multiphysics simulation.

**Specific requirements:**

- Basic programming skills and
- Knowledge of Structural Mechanics

## **Ref. PDOC#8**: Artificial Intelligence for the qualification of Metal Forming processes

**Supervisor(s):** Michele Chiumenti, Joan Baiges

**Description:** The proposed research topic aims to explore the application of artificial intelligence for optimizing and qualifying metal forming processes, including additive manufacturing (AM), friction stir welding (FSW), and forging.

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The study will explore the use of both regression-based and convolutional artificial neural networks, alongside an investigation into physics-informed neural networks to enhance and expedite numerical simulations of these processes.

The primary objectives of this research are to optimize the manufacturing processes and validate the quality of the produced components, thereby contributing to advancements in the field of metal forming.

**Specific requirements**:

- Background in Continuum and Computational Mechanics (FEM)
- Programming skills (Python, Fortran)
- Knowledge of Machine Learning, Artificial Neural Networks (ANN), and Artificial Intelligence

## **Ref. PDOC#9**: Efficient Computational Modelling of Extreme Fluid-Structure Interaction in Coastal Regions

**Supervisor(s):** A. Franci, R. Zorrilla

**Description:** Sea-level rise and increasingly intense weather events, driven by climate change, pose a growing threat to coastal regions. The stability of civil structures and infrastructure along shorelines is becoming ever more vulnerable due to flooding and wave impact. Accurate prediction of these natural hazards is therefore crucial for designing effective engineering countermeasures and enhancing the resilience of coastal regions.

**Specific requirements:**

- PhD in Civil Engineering, Mechanical Engineering, Computational Mechanics, Applied Mathematics, or a closely related field.
- Strong background in numerical methods for computational fluid dynamics (CFD), structural mechanics, or fluid-structure interaction (FSI).

## **Ref. PDOC#10**: Towards Quantum Computing for Explicit Solid Mechanics

**Supervisor(s):** Javier Bonet, Michael Ortiz

**Description:** Quantum computers are fast becoming available and their application to computational mechanics is becoming an active area of research interest [1]. The project aims at the application of quantum computers in explicit solid dynamics problems which can be discretised in time and space preserving a Hamiltonian structure. The resulting algorithms are ideal candidates to exploit the possibilities of quantum computers and achieve significant efficiencies over traditional computer architectures. The project will first explore applications in simple non-dissipative systems and later-on extend the technology to dissipative problems formulated using a GENERIC framework and discretized in time with simple algorithms such as the YBABY method [2].

**Specific requirements:**

- PhD in Computational Mechanics, Computational Mathematics or related subject
- Strong mathematical background in applied mechanics and numerical methods.

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## **Ref. PDOC#11**: Design of metamaterials for flow control using machine learning.

**Supervisor(s):** Juan Carlos Cante, David Roca

**Description:** The proposed research aims to revolutionize the field of flow control by integrating advanced machine learning (ML) techniques with the design and optimization of metamaterials. Metamaterials, engineered structures with unique properties not found in natural materials, offer immense potential in manipulating flows to enhance both aerodynamic and structural efficiencies across a range of applications, from aerospace industry to the wind energy sector. This research area is largely unexplored due to the complexity of the underlying phenomena, which involves fluid-structure interactions across different scales. In this context, this project seeks to develop a data-driven computational approach, leveraging machine learning capabilities to automate and accelerate the discovery and optimization of novel metamaterial structures tailored for specific flow manipulation.

**Specific requirements:**

- Degree in Aerospace Engineering (preferred), Mechanical or Industrial Engineering, Applied Physics, or a related field, along with PhD studies in Computational Mechanics.
- Strong foundation in Fluid Mechanics and Computational Fluid Dynamics (CFD).

# Application process

**Candidates must complete the "Application Form" on our website**, indicating the reference of the vacancy and selecting up to three PhD topics in order of priority, along with the required documentation.

**The application deadline closes on July 7th, 2025 at 12:00 PM (CET).**

Preselected candidates may be requested to submit the necessary documents listed in the "Requirements" and "Merits" sections, duly scanned. They may also be asked to undergo selection tests, which may be eliminatory, and/or participate in personal interviews.

# Commitment to inclusivity:

At CIMNE, we champion workplace equity, diversity, and inclusion. We're committed to fostering a culture where everyone can thrive, leveraging diverse talents and backgrounds. We welcome all applicants regardless of colour, religion, gender, origin, abilities, gender identity, sexual orientation, pregnancy or any other characteristic. Join us in building a community that values, celebrates, and respects every individual.

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## HR Excellence in Research:

CIMNE welcomes and supports the principles of European Commission's *European Charter for Researchers* and the *Code of Conduct for the Recruitment of Researchers*, embracing a transparent, attractive, and open labour market in research. The centre's Human Resources Strategy for Researchers (HRS4R) includes an action plan with actionable short and long-term actions to support a high-quality working environment for all. Further information can be found here.