International Centre for NUMERICAL METHODS IN ENGINEERING

ANNUAL REPORT 2024

CIMNE

COMPUTATIONAL ENGINEERING RESEARCH
FOR A SUSTAINABLE WORLD

Annual Report 2024

CIMNE

COMPUTATIONAL ENGINEERING RESEARCH
FOR A SUSTAINABLE WORLD

Table of Contents

We are CIMNE

The International Centre for Numerical Methods in Engineering is an R&D&I centre created in 1987 focused on research, technology transfer, and dissemination of computational engineering and numerical methods in engineering.

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CIMNE was established in 1987 through a collaboration between the Technical University of Catalonia (UPC), the Government of Catalonia, and UNESCO. Headquartered in Barcelona and part of the CERCA network of Catalan Research Centres, CIMNE has evolved into a leading research institution in computational mechanics and engineering. Over the decades, it has advanced the fields of civil, mechanical, environmental, biomedical, and interdisciplinary engineering, as well as computational physics.
Employing a large international team of researchers, CIMNE nurtures academic exchange through a network of university-linked CIMNE Labs (*Aulas CIMNE*) in Spain and Latin America. It has participated in thousands of research and technology projects in collaboration with companies, universities, and institutions worldwide.
Balancing education and innovation, CIMNE offers master's programs, seminars, and doctoral training with global academic partners. Its Publications Department disseminates research findings through various scholarly works, while its active organization of international conferences bridges the gap between academia and industry. As a pioneer in technology transfer, CIMNE has also launched several spin-offs to commercialize its innovative developments.

A Consortium of:

Generalitat de Catalunya

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

In collaboration with:

unesco Chair

CERCA Centres de Recerca de Catalunya

DIRECTOR'S LETTER

Javier Bonet // General Director of CIMNE

Strengthening Foundations, Expanding Horizons

The International Centre for Numerical Methods in Engineering (CIMNE) was created in April 1987. Following my appointment as Director in mid-2022, the Governing Body of CIMNE approved the new 5-year strategy for the Centre in 2023. In 2024, the Centre has taken forward the implementation of this strategy, applying actions agreed in the plan with the aim of preparing the Centre to meet the research challenges and objectives that we have set out for ourselves. This has required the help and support of the leadership team and all staff at CIMNE, for which I am tremendously grateful. The main actions and changes adopted in 2024 are listed below within each of the 5 sections of the strategy.

1- Developing a research strategy and structure fit for the next phase of CIMNE.
CIMNE has continued to focus its research along 5 key themes and 4 enabling technologies. The key application themes respond to UN Sustainable Development Goals and government priorities at EU, Spanish and Catalan levels. These are:
• Adaptation to Climate Change
• Mobility, Cities and Territory
• Energy and Environment
• Industrial processes
• Health

The key enabling methodologies are:
• Discretization techniques
• Physical and mathematical models
• Data driven technologies
• High performance computational models

Based on these themes and methodologies, CIMNE has consolidated its structure in 9 Research Clusters and 3 Innovation Units. The Research Clusters are responsible for leading the development of research at the highest levels of international excellence, whereas the Innovation units are focused on applied research and its application to create excellence through impact in society. The work of the Centre is now being reported according to this revised research structure.

Five of the Research Clusters are closely aligned with the application themes and are:
• **Geomechanics & hydrogeology:** aligned to themes of territory, mobility and adaptation to climate change.
• **Machine learning and models in hydro-environmental engineering:** aligned to themes of environment and adaptation to climate change
• **Aeronautaical, automotive, marine and energy engineering**: aligned to themes of mobility
• **Solid and fluid simulation in industrial processes**: aligned to the application theme of industrial processes
• **Computational mechanics in medical engineering and living matter:** closely aligned to the theme of health

The four Research clusters are aligned with enabling methodologies and are:
• **Mechanics of advanced materials and metamaterials:** aligned to physical and mathematical models

• **Credible high fidelity and data driven models:** aligned to data driven technologies
• **Structural and particle mechanics:** aligned to discretisation techniques
• **Kratos multiphysics:** aligned to discretisation techniques and high performance computing

The three Innovation Units are:
• **CENIT:** The Centre for Innovation in Transport; strongly aligned to the themes of mobility, cities and territory.
• **BeeGrup:** Building, Energy and Environment Group; closely aligned to the themes energy & environment and adaptation to climate change.
• **DIGIT:** Digital services for research and engineering. This unit provides support and development of key industrial software such as GiD and other digital technologies.

Each cluster or unit includes a number of academic leaders who are the Principal Investigators (IP´s) responsible for defining its lines of research, identifying specific projects and securing financial resources.

The Scientific Advisory Council visit took place in November and in addition to meeting with the senior leadership of the Centre, the Council had in depth discussions with 4 of the new clusters. The aim is that in a period of two years the Council will have an opportunity to meet with each research cluster and comment on its developments and level of international excellence. A summary report from the Scientific Council was presented to the governing bodies of CIMNE.

2- **Enhancing relationships with our patrons and international partners.**
The four-year contract between CIMNE and the Catalan Government to provide core funding ended in 2023. In order to extend the funding, an interim one-year action plan was agreed for 2024 with the Department of Territori. In the meantime, a revised version of the four-year contract and its associated programme of work has been discussed and agreed with the new Government. This includes specific commitments to enhance the collaboration with sections of the Department, including embedding CIMNE staff within the offices of the Government departments. The overall government support to CIMNE still represents less than 20% of its total funding but it provides a much-valued contribution to ensuring the financial stability of the Centre.

CIMNE has continued to work closely with UPC given that a significant number of our principal investigators and academic leaders are also professors at the university. Discussions have finally reached a signed agreement in relation to complex issues such as premises in the Castelldefels campus and the renewal of the memorandum of agreement that governs the formal relationships between the two institutions in 2024.

3- **Attracting, retaining and developing the best international researchers, innovators and professional support staff.**
CIMNE incorporated a number of Distinguished Senior Researchers who are international figures in our field and have recently retired from their primary positions but maintain strong links with the Centre. In 2024, figures such as Carmen Andrade, Jordi Coromines and Michael Ortiz have been appointed to this role. In particular, Michael Ortiz is also the new holder of the UNESCO Chair in Numerical Methods in Engineering and will join the Centre in 2025. Prof Ortiz is a leading international figure in the area of computational mechanics and is opening new fields such as the use of quantum computers for numerical methods in engineering. His incorporation at CIMNE will place the centre at the forefront of these exciting technological advances.

Researchers at CIMNE have continued to distinguished themselves nationally and internationally. For instance, the founding director Prof. Eugenio Oñate received the 2024 Spanish National Research Award, and was appointed president of the IMDEA Materials Institute Governing body. Prof. Pedro Diez, the Scientific Director of CIMNE, was appointed president of the Spanish Association of Mechanical and Computational Engineering (SEMNI) and Prof. Javier Bonet received the Grand Prize of the Japanese Society for Computational Engineering and Sciences in 2024.

4- Ensuring that our research has maximum impact in society.
During 2024, the Impact, Innovation and Technology Transfer unit has developed a number of specific impact case studies for submission to iCERCA. In particular, two success stories were presented: namely, the collaboration with ANAV in the safety certification of nuclear containment buildings through advanced numerical modelling; and the spin-off Build-Air which enabled the deployment of inflatable membrane structures through numerical simulation.

A significant effort during the year has been the execution of an extensive Road mapping exercise in collaboration with the Institute of Manufacturing of the university of Cambridge. The workshop component of the exercise took place in January 2024. More than 110 delegates participated in the workshop, from industry, government and other entities that use our technology. The workshop identified 247 industrial trends and drivers, 176 research challenges and 138 technology transfer pathways. This exhaustive analysis led to the development of 18 proposals for research projects in themes such as sustainable processes or new materials. The outcome of the road mapping exercise is being internally processed during 2025.

RESEARCH FOCUS, OUTCOMES and ACHIEVEMENTS

During 2024, research at CIMNE has focused on the development of NM of interest to the following scientific fields: structural mechanics, geomechanics, fluid dynamics, material sciences, optimization, biomechanics coupled multi-physics processes and high-performance computing. Applications include problems in civil, mechanical, aeronautics, naval/marine, biomedical and environmental engineering, energy efficiency and fusion technology, among others.

A description of the different activities carried out at CIMNE can be seen at the CIMNE web page

In 2024 CIMNE researchers published about 200 papers in JCR journals, of which 152 were published in first quartile journals, and have received close to 6,500 citations to their work according to Scopus. CIMNE scientists are chief editors or associated editors of **6 JCR journals** and members of the editorial board of **11 JCR journals**. In 2024, CIMNE researchers have taken part in **97 RTD projects** funded by international (**31 projects**) and Spanish (**66 projects**) organizations which have meant **funding of € 3.9 M** for CIMNE. In the same period, CIMNE had **121 RTD contracts** with companies and private organizations, amounting some **€ 4.4 M turnover** for that period. CIMNE has implemented a self-sustainable financial model with limited annual public funding. This has been possible by combining public seed funding (mainly from the Catalan Government) with income from RTD projects sponsored by public and private organizations, dissemination activities, revenues from CIMNE spin-off companies and an efficient management structure. In 2024, the self-obtained income attained by CIMNE represented, on average, around **85%** of its total annual budget. Details of the sources of CIMNE funding in 2024 and in recent years can be found on **page 25**.

I thank CIMNE staff and its many partners and friends in universities, research centres and industry worldwide for their cooperation that contributes to making of CIMNE a centre of reference in its field.

Prof. Javier Bonet
General Director

CIMNE Scientific Advisory Council

The Scientific Advisory Council (SAC) of CIMNE is composed of renowned international researchers in the field of numerical methods in engineering. These multidisciplinary experts advise the Executive and Governing Council on the centre's scientific policy and research priorities.

Prof. Peter Wriggers
Leibniz University
Hannover, Germany
SAC Chair

Prof. **Francisco Chinesta**
ENSAM
Paris, France

Prof. **Laura De Lorenzis**
ETH
Zurich, Switzerland

Prof. **Josef Eberhardsteiner**
Universität Wien
Vienna, Austria

Prof. **Pär Jonsen**
Luleå University
Luleå, Sweden

Prof. **Michal Kleiber**
Polish Academy of Sciences
Poland

Prof. **Rainald Lohner**
George Mason University
Fairfax, VA, USA

Prof. **Manolis Papadrakakis**
National Technical University
Athens, Greece

Prof. **Estefanía Peña**
University of Zaragoza
Zaragoza, Spain

Prof. **Umberto Perego**
Politecnico di Milano
Milan, Italy

Prof. **Simona Perotto**
Politecnico di Milano
Milan, Italy

Prof. **Ekkehard Ramm**
Stuttgart University
Stuttgart, Germany

Prof. **Bernard Schrefler**
Pavoda University
Padova, Italy

Prof. **Spencer Sherwin**
Imperial College
London, United Kingdom

Prof. **Karen Veroy**
Eindhoven University
Eindhoven, The Netherlands

Prof. **Karen Willcox**
Oden Institute
Austin, TX, USA

Prof. **Roland Wuchner**
Technical University of Braunschweig
Braunschweig, Germany

Senior Distinguished Researchers

CIMNE is honoured to have 11 esteemed professors as senior members of its research community. These distinguished academics bring exceptional intellectual reputations and international recognition in fields relevant to CIMNE, ensuring research excellence and intergenerational knowledge transfer. This honorary position reinforces CIMNE's scientific leadership and enhances collaboration with other leading institutions.

- Research Cluster
- Research Group

Prof. **Eduardo Alonso**
Geomechanics and Hydrogeology
Geomechanics

Prof. **Mª del Carmen Andrade**
Structural Mechanics
Structural and Particle Mechanics

Prof. **H. Alejandro Barbat**
Structural and Particle Mechanics
Disaster Risk and Resilience Group

Prof. **Jordi Corominas**
Geomechanics and Hydrogeology
Geomechanics Group

Prof. **Antonio Gens**
Geomechanics and Hydrogeology
Geomechanics

Prof. **Sergio R. Idelsohn**
Solid and Fluid Simulation for Industrial Processes
Fluid Mechanics

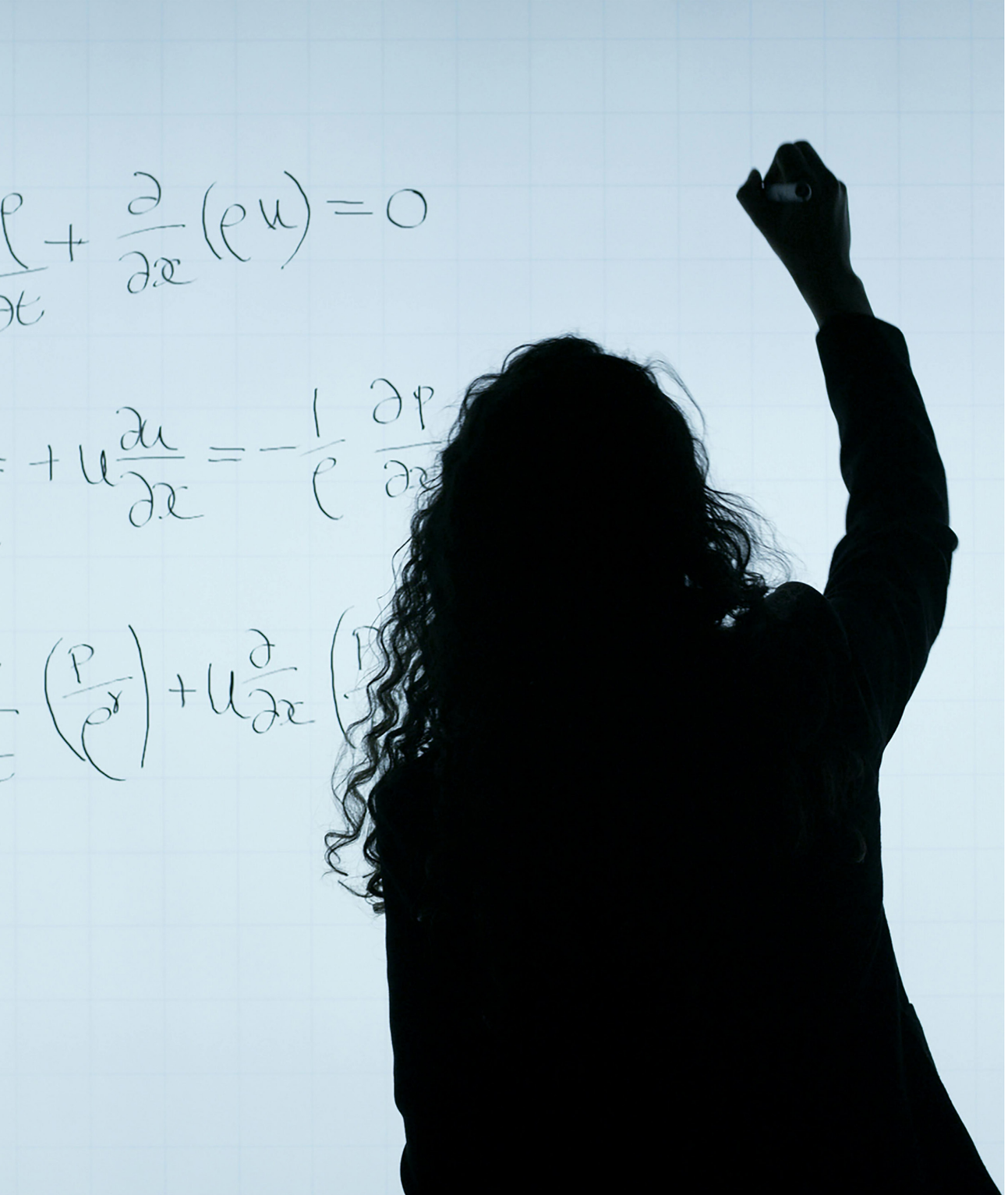
Prof. **Juan Miquel**
Structural and Particle Mechanics
Civil and Environmental Engineeeing

Prof. **Fco. Javier Oliver**
Mechanics of Advanced Materials and Metamaterials
Computational Design & Analysis of Engineering Metamaterials

Prof. **Sergio H. Oller**
Structural and Particle Mechanics
Civil and Environmental Engineering

Prof. **Eugenio Oñate**
Structural and Particle Mechanics
Structural Mechanics

Prof. **Jaques F. Periaux**
Aeronautical, Marine, Automotive and Energy Engineering
Aeronautics



Organization Chart

GOVERNING COUNCIL
Chair: **Sílvia Paneque i Sureda**

EXECUTIVE COUNCIL
Chair: **Ferran Falcó**

ADVISORY SCIENTIFIC COUNCIL
Chair: **Peter Wriggers**

MANAGING BOARD

GENERAL DIRECTOR
Chair: **Javier Bonet**

SCIENTIFIC DIRECTOR
Pedro Díez

PROJECT DEVELOPMENT DIRECTOR
Fernando Salazar

INSTITUTIONAL RELATIONS DIRECTOR
Gabriel Bugeda

MANAGING DIRECTOR
Anna Font

MANAGEMENT TEAM
Mª Carmen Linares
Irene Martínez
Sandra Pérez

RESEARCH

RESEARCH CLUSTERS

Geomechanics and Hydrogeology
Contact point: Sebastià Olivella
Machine Learning and models in Hydro-Environmental Engineering
Contact point: Fernando Salazar
Aeronautical, Marine, Automotive and Energy Engineering
Contact point: Xavier Martínez
Solid and fluid simulation for Industrial Processes
Contact point: Ramon Codina
Computational Mechanics in Medical Engineering and Living Matter
Contact point: Eduardo Soudah
Structural and Particle Mechanics
Contact point: Javier Bonet
Mechanics of Advanced Materials and Metamaterials
Contact point: Irene Arias
Credible High Fidelity and Data Driven Models
Contact point: Pedro Díez
Large Scale Multiphysics Computations
Contact point: Riccardo Rossi

INNOVATION UNITS

Innovation Unit in transport (CENIT)
Contact point: Sergi Saurí
Innovation Unit in Building, Energy and Environment (BeeGroup)
Contact point: Jordi Cipriano
Innovation Unit in Pre, Post and Digital Technologies
Contact point: Abel Coll

UNESCO CHAIR

UNESCO Chair in Numerical Methods in Engineering (CIMNE - UPC)
Michael Ortiz

TECHNOLOGY DEVELOPMENT

Tech Transfer & Innovation
Jordi Jiménez
Proposal Develoment
Fernando Salazar
CIMNE Tecnología
Javier Marcipar

RESEARCH SUPPORT

Communication
Josep A Palacios
Congress Bureau
María del Mar Santiago
Finances
Mª Carmen Linares
People
Irene Martínez
Project Management
Francisco José de la Rosa
General Services
Assistant: Berta Claramunt
IT Development: Javier Tous
IT Services: Miguel Alonso
Publications: María Jesús Samper
Quality: Ignacio Valero
Receptionist: Jordi López

Research

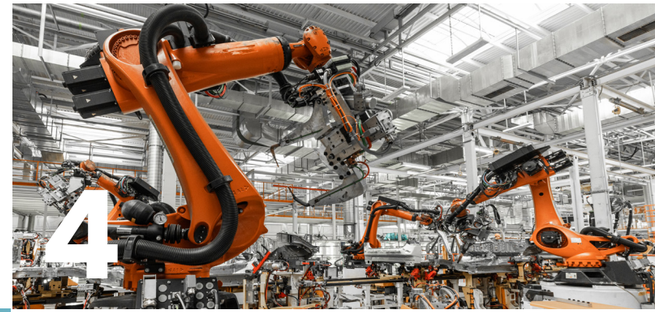
Our Research Challenges

At CIMNE, we have identified five themes that guide and inform our research efforts, based on local and global priorities, and pressing societal needs. We work alongside cross-cutting experts and institutions to develop a leading scientific research programme for a sustainable and equitable future.

Our priorities

Adaptation to Climate Change
- Assessment of induced damage, risk of extreme events
- Protection of costs against floods and droughts
- Infrastructure assessment and adaptation
- Sustainable and resilient land management

Industrial processes
- Advanced and innovative manufacturing
- Automation and optimisation of industrial processes
- Emerging materials: metamaterials
- Intelligent construction



Mobility, cities, and territory
- Transport and civil infrastructure
- Cities and urban mobility
- Transport and logistics systems
- Aerospace and vertical mobility
- Maritime transport
- Automobile transport
- Sustainable and resilient land management

Health
- Modelling of biosystems and biomaterials
- Patient-centred approaches to detect and predict disease
- Medical devices
- Biological systems
- Mechanobiology

Energy and the environment
- Renewable energies
- Materials for energy
- Fusion, treatment of nuclear waste
- Energy conversion technologies
- Energy efficiency and distribution
- Water production, storage, treatment, and distribution
- Air, water, and land pollution

Our motivation

CIMNE research priorities are driven by multiple external impulses.

UN 17 Sustainable Development Goals

The 5 EU Missions

Spanish Government Strategic Lines

R+D Themes of the Catalan Government

Our Research Methodologies

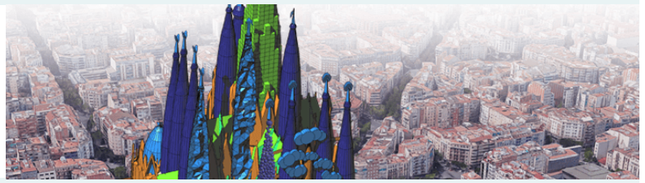
We use state-of-the-art and cross-cutting technologies within the field of numerical methods and computational modelling to tackle pressing societal issues.

Discretization Techniques

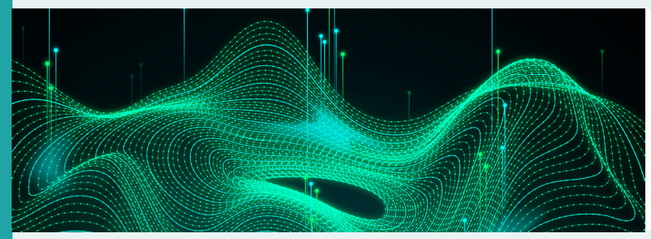
- Innovative approaches in meshing methods
- Particle and meshfree methods
- Unfitted methods
- Techniques for coupledproblems
- Error assessment and adaptability
- Geometry and simulation representation

Physical and Mathematical Models

- Constitutive formulations
- Models of materials for multiphysical and multiscale phenomena
- Innovative variational formulations
- Optimisation
- Models based on agents or subjects



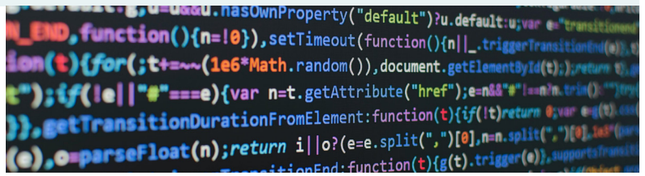
Data-driven Models



- Science based Machine Learning and Artificial Intelligence
- Reduced order modelling
- Inverse methods
- Big data management
- Uncertainty Quantification
- Digital Twins
- Geometry and simulation representation

High Performance Computational Models

- Domain decomposition and preconditioning
- Emerging architectures (e.g. quantum computing)
- New coding paradigms



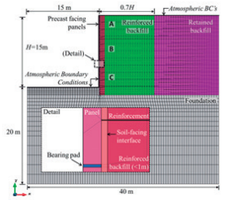
Research and Innovation

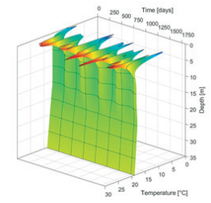
CIMNE is organised into nine research clusters and three innovation units. The clusters promote cutting-edge research in areas of interest to CIMNE. Innovation units focus on applied research, combining cutting-edge discovery with technology transfer solutions.

Research Clusters

Geomechanics and Hydrogeology

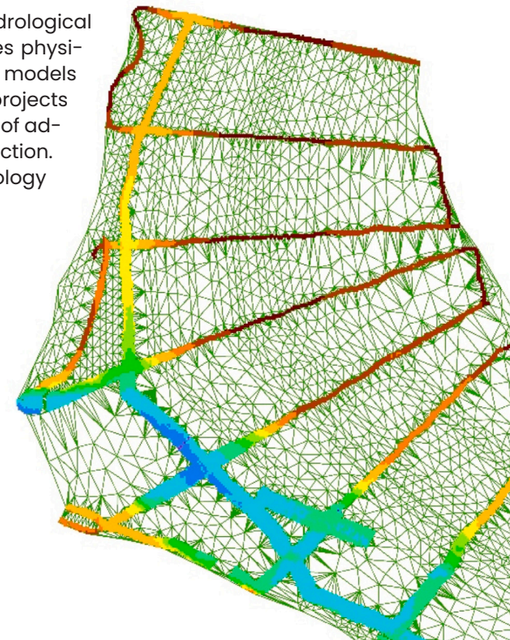
The Geomechanics and Hydrogeology Research Cluster at CIMNE advances fundamental understanding and computational modelling of soil and rock behaviour, focusing on coupled thermal, hydraulic, mechanical, and chemical (THMC) processes in porous media. The cluster develops cutting-edge numerical tools and experimental methods to support the design and analysis of underground structures, rockfill dams, and fluid–soil–structure interaction challenges. Its expertise extends to applications such as groundwater management, aquifer studies, nuclear waste disposal, and large-scale geotechnical engineering projects, contributing to both scientific innovation and practical engineering solutions.





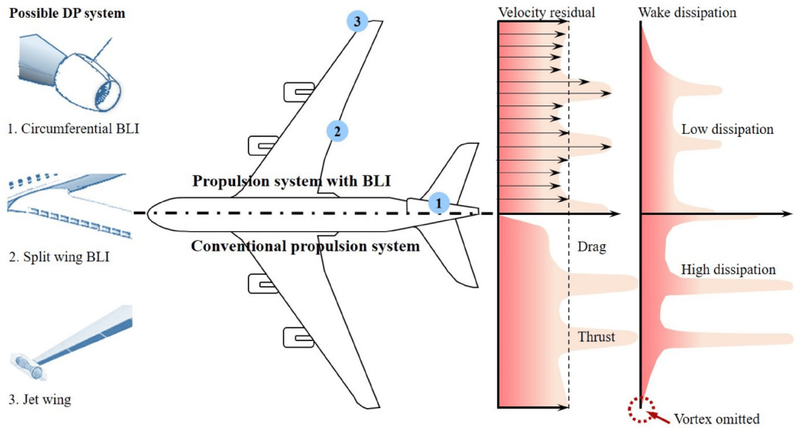
Machine Learning and models in Hydro-Environmental Engineering

The main activity of this cluster is related to hydraulic and hydrological engineering. To solve practical problems, the cluster combines physically based numerical models, data-driven machine learning models and laboratory tests. Its activities also include participation in projects in other areas, such as railway ballast, landslides, optimisation of advanced wastewater disinfection processes or air quality prediction. Its activities include research, consultancy, training, and technology transfer.



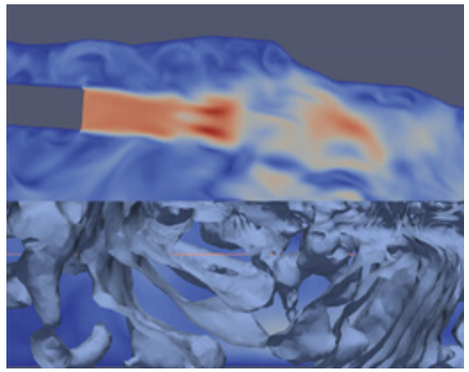
Aeronautical, Marine, Automotive and Energy Engineering

The cluster focuses on the development of numerical models to address problems in the fields of aerospace, oceanic and marine engineering, automotive, and energy. These problems may involve structural analysis, fluid-structure interaction, and/or optimisation of behaviour and performance. Recent developments from the group include the creation of digital models for ocean energy converters, the development of formulations for simulating composite materials, topological optimisation, creation of fatigue simulation algorithms for materials, and the development of optimisation algorithms to assist decision-making in air traffic management.

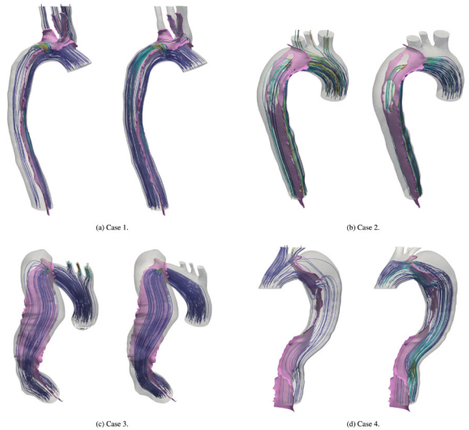


Solid and fluid simulation for Industrial Processes

The cluster focuses on industrial process modelling, including fluid mechanics simulation and thermo-mechanical simulation. In fluid mechanics, the group studies high-speed flows, turbulence, porous media, aeroacoustics and coupled problems such as magnetohydrodynamics, using advanced numerical methods such as stabilized finite elements, reduced models and parallel computing. In thermo-mechanics, the group develops nonlinear analysis tools with various element formulations and constitutive laws, applied to additive manufacturing, friction stir welding and 3D printing of concrete.



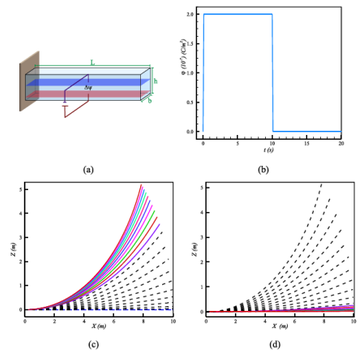
Computational Mechanics in Medical Engineering and Living Matter



This cluster develops advanced computational methods to model, predict and analyse the mechanical behaviour of biological structures. Its goals include understanding biological system evolution, simulating pathology treatments and optimising medical device design. The main focus areas of the cluster are: 1) Biomechanical modelling of tissues/organs, 2) Pathology research and therapeutic development, 3) Analysis of biological/biomaterials for medical engineering, and 4) Design of safer, more efficient medical devices. Researchers in this cluster create theoretical and computational models to study biological interfaces (e.g., mechanobiology, cells, tissues). These tools enable quantitative insights into biological systems, rational manipulation of active living materials, and the design of innovative bionic materials for biomedical applications.

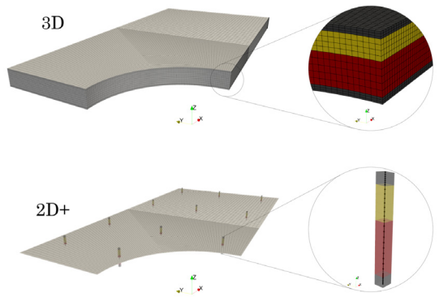
Structural and Particle Mechanics

The Structural and Particle Mechanics cluster at CIMNE specializes in advanced computational methods for solving complex multidisciplinary mechanical and structural challenges. The cluster develops predictive technologies for analysing structural systems under dynamic conditions and multiphysical interactions using a variety of innovative techniques that combine Finite Element Methods (FEM) with particle-based techniques, such as the Discrete Element Method (DEM), Particle Finite Element Method (PFEM), Smooth Particle Hydrodynamics (SPH) and others. Their research spans diverse engineering domains, including civil, aerospace, marine, transportation, and energy infrastructure. The cluster focuses on sophisticated computational approaches that integrate sensor information, artificial intelligence (AI), and real-time simulation to model intricate phenomena such as thermo-mechanical coupling, fluid-structure interaction, and friction contact effects. Emerging research directions include extending computational methods for nonlinear structural electro and magneto active mechanics, developing novel conservation formulations, and creating advanced dynamic fracture models. By leveraging digital modelling technologies and emerging computational techniques, the cluster aims to enhance structural safety predictions, optimise design solutions, and ensure sustainable structural integrity across multiple engineering sectors.



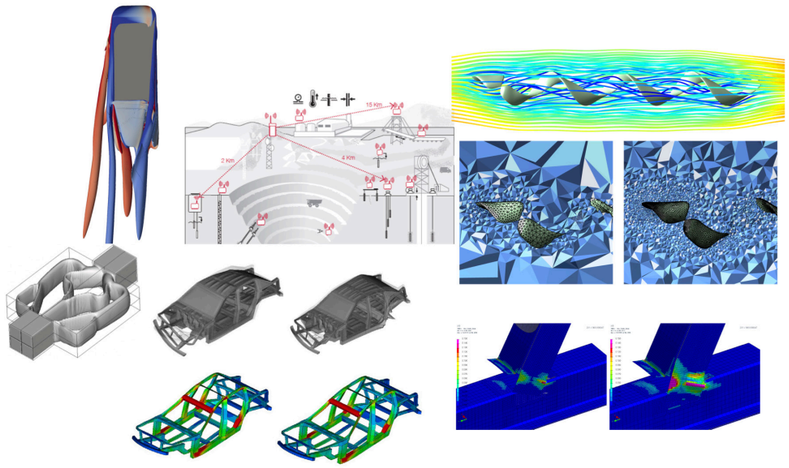
Mechanics of Advanced Materials and Metamaterials

The Mechanics of Advanced Materials and Metamaterials Research Cluster at CIMNE specializes in composites and advanced materials with enhanced properties, which require specific formulations for effective multiscale analysis and characterization. The cluster has a strong tradition of developing numerical strategies for analysing composite materials made from fibres embedded in matrix systems, ranging from enhanced versions of mixing theory to more advanced multiscale methods. Its work includes plasticity and damage, fibre-metal laminates, reinforced and prestressed concrete, topologically optimized materials, and fatigue analysis, all approached through comprehensive multiscale analysis techniques. Additionally, the cluster focuses on the design of metamaterials with extreme acoustic, mechanical, and electromagnetic properties, targeting innovative engineering applications.



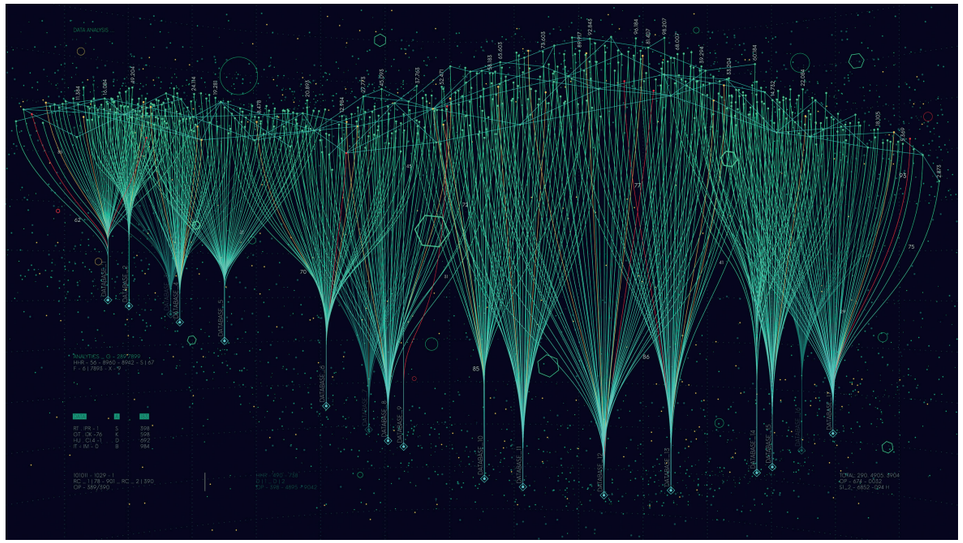
Credible High Fidelity and Data Driven Models

CIMNE's Credible High Fidelity and Data Driven Models Research Cluster is dedicated to developing innovative mathematical and computational models that empower quantitative and predictive science and engineering. It integrates rigorous physical models with rich data derived from numerical simulations, laboratory experiments, and real-world observations. A core focus of its work is to advance the state-of-the-art in modelling complex phenomena by harnessing partial differential equations and developing novel computational methods for their numerical approximation.



Large Scale Multiphysics Computations

The Large Scale Multiphysics Computations Research Cluster at CIMNE integrates cutting-edge expertise in the development and application of advanced numerical methods for solving complex multiphysics problems. Combining the strengths of the Kratos Multiphysics group and the Large Scale Scientific Computing group, the cluster focuses on creating innovative, high-performance computational tools capable of simulating real-world engineering challenges. By merging state-of-the-art capabilities across diverse fields, the cluster pioneers the integration of multiphysics models into a unified workflow, enhancing the versatility of the open-source Kratos framework. Additionally, the cluster specializes in scalable solver design for large-scale systems governed by PDEs, such as solid and fluid mechanics and electromagnetics. With a strong emphasis on collaboration, open-source development, and transversal research, the cluster drives advancements in computational science, enabling the simulation of increasingly complex and realistic multiphysics phenomena.



Innovation Units

Transport (CENIT)

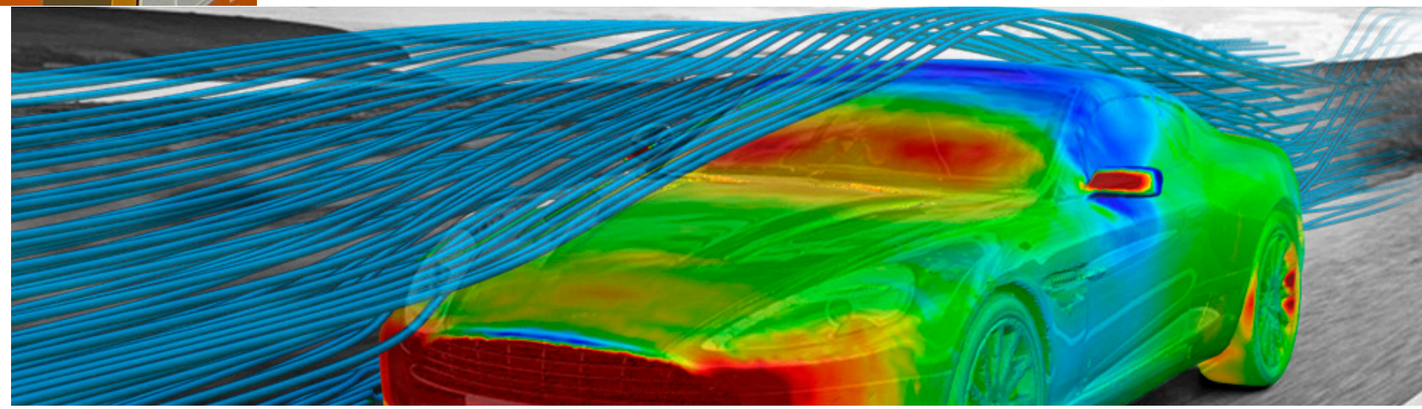
The Innovation Unit in Transport (CENIT) aims to help find sustainable and innovative solutions for transport and mobility. The unit has extensive experience in research, development and technology transfer projects, both at the local and global level. Its main lines of research are: urban mobility, logistics and maritime transport, and the management and financing of transport infrastructures. The CENIT multidisciplinary team has extensive experience in systems modelling and methodological development based on the foundations of operational research and economic behaviour. In addition to R&D activities, CENIT also organises courses and seminars aimed at professionals seeking to update their specific technical knowledge and learn about the latest developments in the transport sector.

Building, Energy, and Environment (BEE Group)

The Building, Energy and Environment Innovation Unit at CIMNE (BEE Group) is a team of over 20 researchers based in Terrassa and Lleida, dedicated to advancing decarbonization, energy efficiency, and the digital transformation of the building sector. The group has led 22 European projects and collaborated on more than 60, developing smart energy management technologies for buildings and cities. Its research lines include big data analytics for energy efficiency in buildings, demand response strategies to enhance grid flexibility, energy empowerment and user behaviour, the development of biodigesters adapted to cold climates, and the promotion of energy communities and positive energy districts. With a strong commitment to technology transfer, BEE Group turns research into innovative solutions for a more sustainable future.

Pre, Post, and Digital technologies

CIMNE's Innovation Unit in Pre, Post, and Digital Technologies pioneers advanced simulation and digital integration. It develops cutting-edge methods for efficient data generation and visualization of computational results, anchored by expertise in a universal pre and post-processing environment for numerical simulations. The unit seamlessly combines this technical foundation with state-of-the-art digital tools such as Artificial Intelligence, IoT platforms, GIS, Blockchain, and modern web technologies. By leveraging deep learning and computer vision techniques, it transforms complex, high-dimensional real-world data into actionable insights, driving innovative decision support systems and fostering advancements across diverse engineering disciplines.



CIMNE in Numbers (2024)

Research

202
publications
62% of which under Open Access
11% of which with Industry Partners

12
awards

Tech Transfer

11
Patents in force

121
Contracts
with industry

8
Spin-offs and start-ups with CIMNE Technology

€3.75 M income
from products made at CIMNE

Training

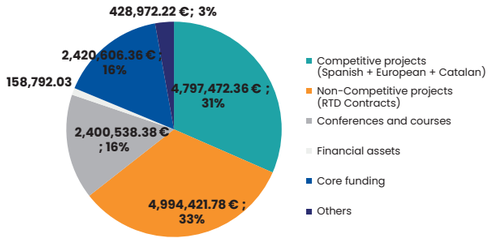
18
PhD Theses Defended in 2024

3
Postgraduate studies offered in 2024 with UPC

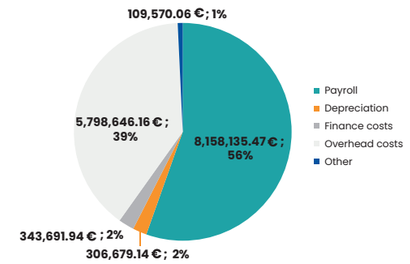
- Master on Numerical Methods in Engineering
- PhD Degree in Civil Engineering
- PhD Degree in Structural Analysis

Resources

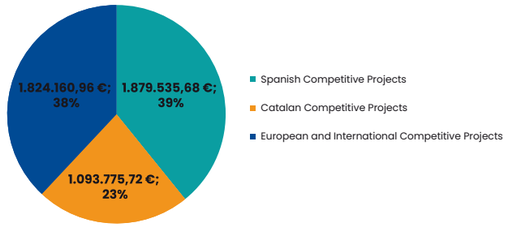
Revenue



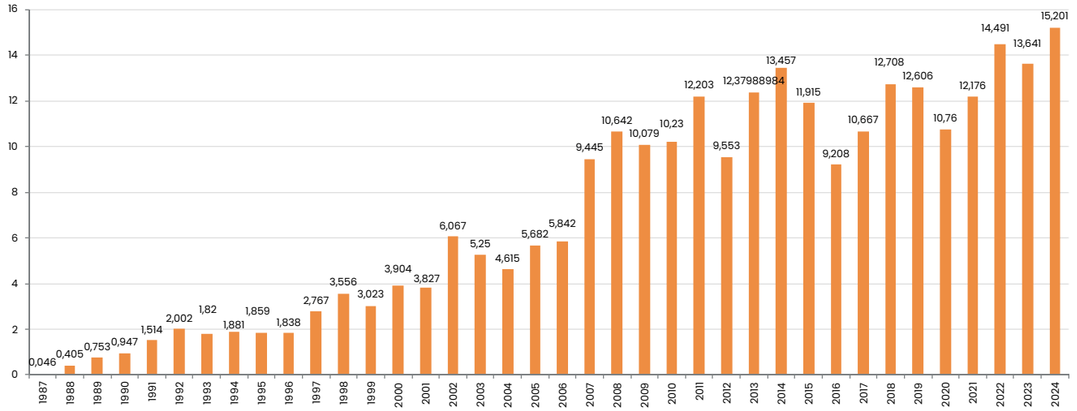
Expenses



Competitive Projects



Evolution Annual Revenue

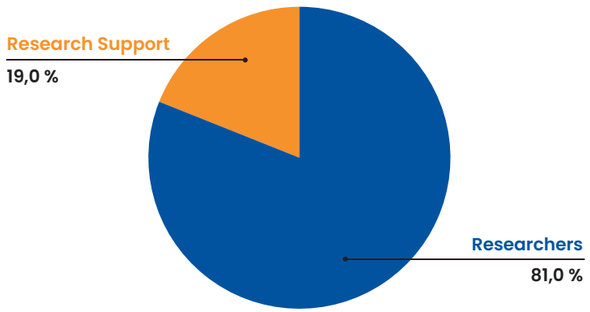


Talent

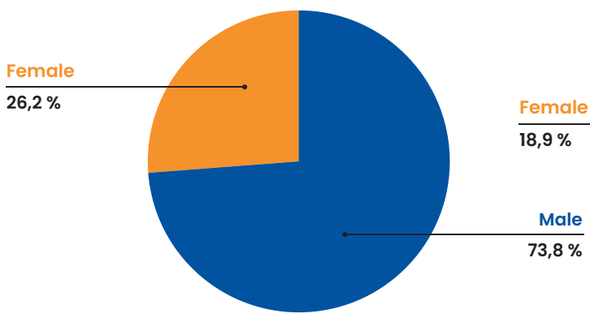
248
People
as of Dec 31, 2024

89
Positions offered in 2024
including admin staff, research positions, and student opportunities

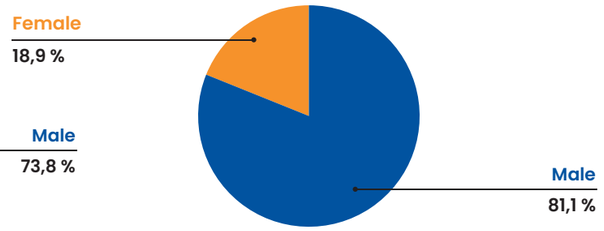
Role

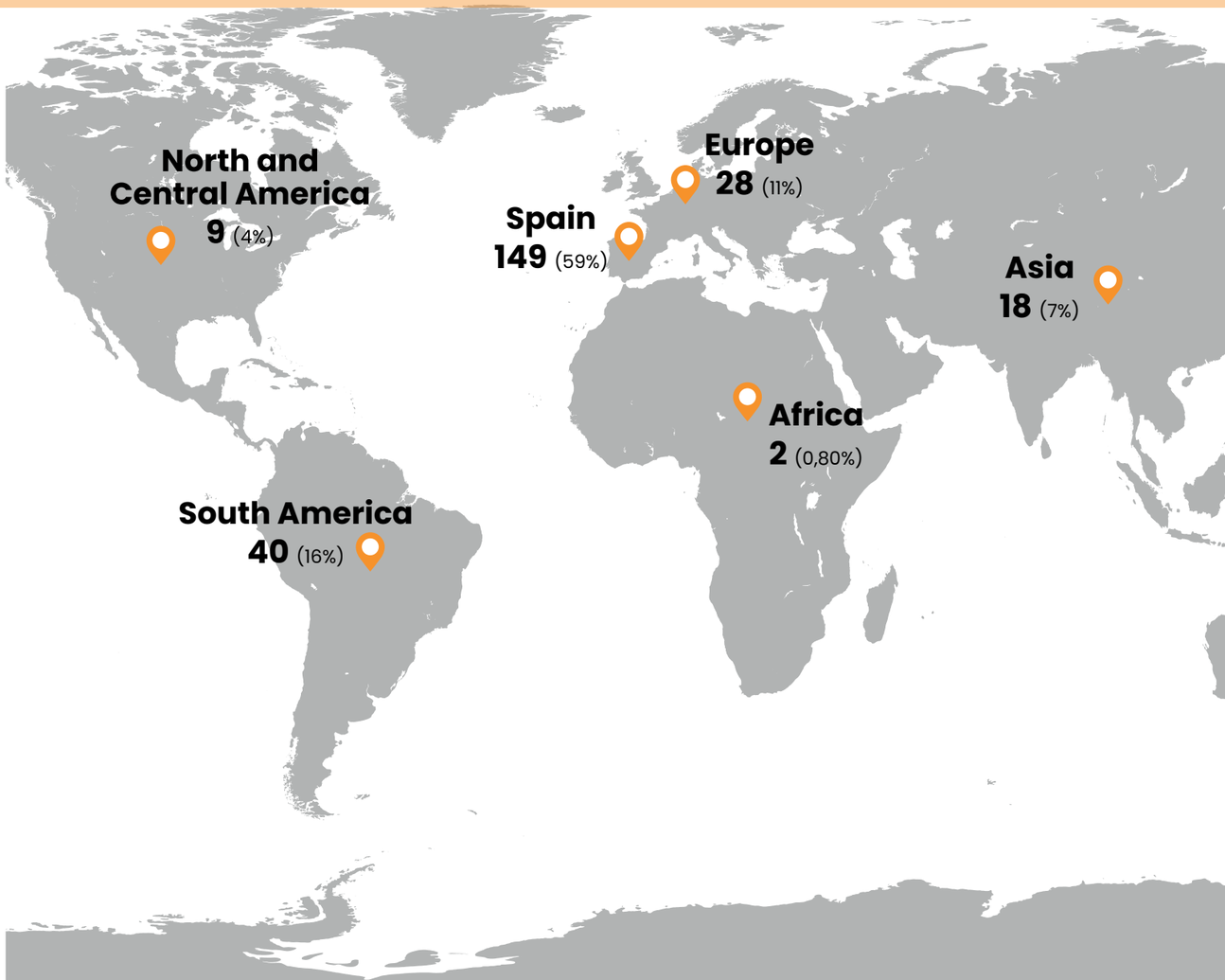


Gender



Researchers





Research Impact

A Year of Transformative Innovation

CIMNE Strategic Roadmapping Stirs the Future of Innovation

In January 2024, CIMNE conducted a cross-cutting Roadmapping Exercise to guide its research priorities for the next years. The event, a first for a research centre in Catalonia, brought together 110 delegates representing public and private industrial sectors, Catalan governmental institutions, CERCA research centres, and CIMNE staff. The workshop was supported by CERCA (Research Centres of Catalonia) and IfM Engage from the University of Cambridge.

Participants engaged in a two-day workshop, employing a methodology that included scanning the strategic landscape for trends and drivers, prioritizing research challenges, and exploring technology transfer alternatives across key thematic areas aligned with UN Sustainable Development Goals. These areas included CIMNE's strategic priorities in Adaptation to Climate Change, Mobility, Cities and Territory, Energy and Environment, Industrial Processes, and Health. Ultimately, the strategic roadmapping activity led to the **proposal of 18 research projects, the identification of 176 research challenges, 247 industrial trends and drivers, and 138 technology transfer alternatives.**

The outcomes of the roadmapping exercise, led by CIMNE's Tech Transfer & Innovation Unit, will inform CIMNE's strategic plan. This will focus research efforts on areas where CIMNE can add significant value and strengthen its international position as a leading centre in computational modelling technologies.

Success stories

Inflatable Structures: From Research to Global Impact

CIMNE's research on inflatable structures has yielded significant economic and environmental benefits through its spin-off company Buildair. Founded in 2001, Buildair specializes in large-scale inflatable structures, particularly for the aeronautical sector, with clients including Airbus, Lufthansa, and Saudia Aerospace.

The company has grown to employ **50 staff while creating 15 indirect jobs, generating €11.5 million in revenue between 2018** and **2021.** This growth stems from CIMNE's pioneering computational methods that optimize design and structural integrity of inflatable structures.

Buildair's innovations offer substantial environmental advantages. Their structures **reduce material weight by over 20 times compared to steel equivalents**, decreasing carbon footprints by more than 75%. Energy-efficient features like solar panels and thermal-efficient walls further enhance sustainability.

Beyond commercial applications, these inflatable structures have provided rapid-deployment shelters for humanitarian crises, with UNICEF collaborations showcasing their societal value.

The research behind these developments continues through CIMNE's biennial Conference on Textile Composites and Inflatable Structures, which has attracted over 1,200 participants since its inception in 2003. Recent advancements include the 2021 development of Wind Tunnel software for analysing wind impacts on structures, enabling Buildair to create record-breaking hangar sizes for the aviation industry.

Safeguarding Nuclear Infrastructure Through Advanced Simulation

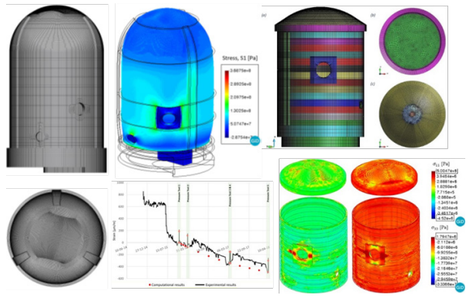
CIMNE's three-decade collaboration with the Ascó-Vandellós Nuclear Association (ANAV) has yielded significant outcomes for nuclear safety and environmental sustainability in Catalonia and Spain.

Through advanced numerical modelling techniques, CIMNE has provided critical assessments that enabled the **extension of operational lifespans for ANAV's nuclear reactors from 2020 to 2030**. This achievement required cutting-edge Finite Element Method (FEM) analysis to evaluate structural integrity, with particular focus on concrete rheology and seismic resilience.

The research directly contributed to Ascó I entering Long Term Operation (LTO) in 2023, with Ascó II and Vandellós II scheduled to follow in 2025 and 2027 respectively. These extensions, verified by the Nuclear Safety Council and International Atomic Energy Agency, have significant environmental implications.

By maintaining operations for the 2020-2023 period, A**NAV prevented approximately 44 million tons of CO_2 emissions, representing 34% of Spain's total CO_2 emissions from electrical generation.** The plants have provided 56% of Catalonia's energy and 10% of Spain's emission-free energy during this period.
The ongoing SPECTRA project, initiated in 2023, represents the latest phase of this collaboration, analysing seismic responses across 15 main buildings at *Vandellós* II using both probabilistic and deterministic methods to ensure structural integrity under various seismic scenarios.

This research has also **preserved 920 jobs at ANAV while generating contracts exceeding €2.4 million for CIMNE**, demonstrating how computational engineering research delivers tangible benefits for safety, sustainability, and economic development.



Jorge Franganillo/Wikimedia Commons

UNESCO Chair

CIMNE Strengthens its UNESCO Chair in Numerical Methods in Engineering by appointing Professor Michael Ortiz

The UNESCO Chair in Numerical Methods in Engineering at CIMNE and the Technical University of Catalonia-Barcelona Tech (UPC) was established in 1989 as the first UNESCO Chair in the world dedicated to advancing numerical methods in engineering. Its mission is to foster international research, education, and technology transfer to address complex engineering challenges, particularly benefiting lower-income countries through knowledge dissemination and capacity building.

In 2024, CIMNE reinforced its commitment to excellence in computational mechanics by appointing Professor Michael Ortiz as the new head of the Chair, effective January 1, 2025. Prof. Ortiz is widely recognized as a pioneer in computational mechanics, with extensive contributions to material modelling, finite element analysis, and multiscale modelling. His leadership marks a significant milestone in the Chair's history, following the legacy of esteemed predecessors, including Prof. O.C. Zienkiewicz and Dr. Jacques Périaux.

As the Chair holder, Prof. Ortiz will focus on cutting-edge research in Quantum Computational Mechanics and data-enhanced simulation—two strategic areas set to expand CIMNE's capabilities and global impact. In addition to his role at CIMNE, he will continue his academic engagement as an Emeritus Professor at the California Institute of Technology (Caltech).

The UNESCO Chair at CIMNE continues to serve as a global hub for collaboration through its extensive network of CIMNE Labs (*Aulas CIMNE*), fostering partnerships with universities and research institutions across Latin America and Europe. The Chair remains dedicated to promoting joint projects in research and training, leveraging international competitive funding and fostering links with scientific communities worldwide.

Through the leadership of Prof. Ortiz, CIMNE strengthens its position at the forefront of numerical methods in engineering, reaffirming its commitment to scientific excellence and global knowledge exchange.

"Prof. Ortiz is the new Head of the UNESCO Chair in Numerical Methods effective January 1, 2025"

Corporate News

CIMNE founder and Senior Researcher Prof Eugenio Oñate Receives Spanish National Research Award 2024

Professor Eugenio Oñate, founder of the International Centre for Numerical Methods in Engineering (CIMNE) and Senior Distinguished Researcher at the centre, has been awarded the prestigious Spanish National Research Award 2024 in the Leonardo Torres Quevedo category. This recognition is one of the highest honours in Spain for scientific research, awarded by the Ministry of Science, Innovation, and Universities.

The Spanish National Research Awards celebrate the scientific excellence of researchers whose work contributes to the progress of society and the strengthening of Spain as a global leader in scientific advancements. The Leonardo Torres Quevedo Award, in particular, highlights individuals who have made significant contributions to the field of engineering.

Prof. Oñate

Professor Oñate has been recognized for his exceptional contributions to computational mechanics and numerical methods. His pioneering work in developing computational techniques for engineering applications has had a transformative impact on the field, influencing industries worldwide.

Born in València (Spain) in 1953, Dr. Oñate's research has focused on the development of numerical methods in the field of structural and fluid dynamics and coupled situations in engineering sciences. He has published 467 articles in JCR-level journals and has over 14,000 citations.

CIMNE's General Director, Prof. Javier Bonet, commended Dr. Oñate and the other awardees for their contributions to advancing science and engineering, highlighting Prof. Oñate's commitment to "excellence in research." In Dr. Bonet's words, this distinction "not only attests to the outstanding scientific career of Prof. Oñate, but to the remarkable impact he has had on young scientific talent".

CIMNE's Director Dr. Javier Bonet Awarded Grand Prize from the Japan Society for Computational Engineering and Science

Dr. Javier Bonet, General Director of CIMNE, has been awarded the prestigious Grand Prize 2023 by the Japan Society for Computational Engineering and Science (JSCES). This accolade recognizes Dr. Bonet's outstanding contributions to computational and numerical methods, particularly in nonlinear solid mechanics. The award ceremony took place at the Kobe International Conference Centre during JSCES' 29th Conference on Computational Engineering and Science in late May 2024. Dr. Bonet delivered a lecture on the latest advances in solid dynamics, highlighting his work on conservation-based formulations.

With over 110 publications and more than 6,000 citations, Dr. Bonet is a leading figure in the field of computational methods. He joined CIMNE as Director in 2022, following a distinguished career at the University of Greenwich and Swansea University.

Prof. Bonet

CIMNE Charts Future Course Through Strategic Roadmapping Exercise

CIMNE took a proactive step in shaping its research direction and amplifying its societal impact through a strategic roadmapping exercise held in January 2024. This collaborative event, a first for the Research Centres of Catalonia (CERCA), brought together 110 delegates from public and private industrial sectors, Catalan governmental institutions, CERCA research centres, and CIMNE staff.

The two-day event, held at the Technical University of Catalonia (UPC)'s Campus Nord in Barcelona, was led by CIMNE's Director, Dr. Javier Bonet. It was designed to align CIMNE's medium-term research with the evolving needs of industry and society. Dr. Bonet emphasized the importance of establishing a "two-way communication" path with industry to enhance the impact of CIMNE's research and identify avenues for its application to benefit society.

The roadmapping exercise followed the methodology of Cambridge University's Institute for Manufacturing, emphasizing communication, alignment, and strategic dialogue, using a structured visual framework to convert multidisciplinary ideas into actionable plans. Participants engaged in plenary and group discussions on research trends and drivers, and proposed specific roadmaps to research topics that will add to the centre's stated investigation priorities.

Lluís Rovira, director of CERCA, highlighted the importance of industry involvement in research solutions and emphasized technology transfer as a priority for all Catalan Research Centers. "Research is not about writing papers anymore," he stated, "we need to engage all stakeholders from the very beginning."

The outcomes of the roadmapping exercise, including recommendations on research application areas and long-term ideas, will guide CIMNE's leadership priorities to improve the societal impact of the research carried out at the centre, as stated in the organization's strategic plan. CIMNE's 5-year strategic plan outlines a center-wide research strategy based on UN's Sustainable Development Goals, with particular emphasis on adaptation to climate change, mobility and cities, energy and the environment, industrial processes, and health.

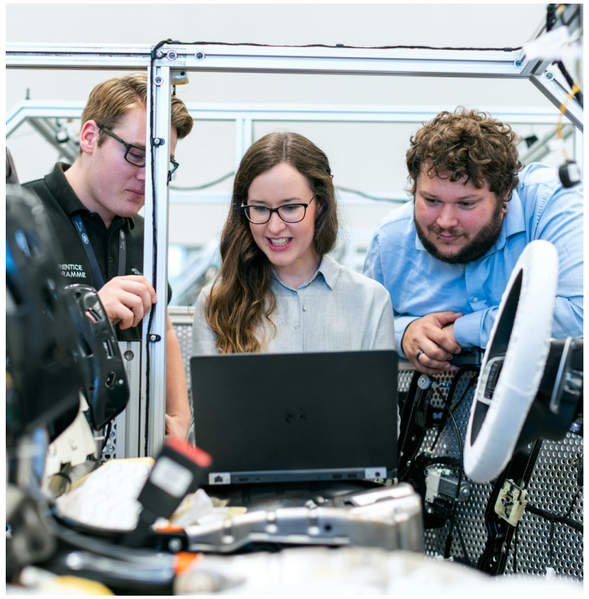
The exercise generated significant insights, including 247 industrial trends and drivers, 176 research challenges, 138 technology transfer alternatives, and several proposed research projects. These results will be integrated into CIMNE's strategic objectives, focusing research efforts on high-impact areas aligned with societal challenges and market needs, and strengthening CIMNE's role as a leading centre in computational modelling technologies.

CIMNE Strengthens Ties with Chinese Aerospace Leader

CIMNE hosted a delegation from Shenyang Aircraft Corporation (SAC), China's oldest aircraft manufacturer, to explore collaboration opportunities. The 15-member SAC delegation, comprised of experts in aircraft design, aerodynamics, and more, engaged with CIMNE's General Director, Prof. Javier Bonet, and cross-cutting researchers. Presentations highlighted CIMNE's expertise in areas like advanced materials, numerical modelling, and fluid mechanics, as presented by Dr. Àlex Ferrer, Dr. Lucia Gratiela Barbu, Dr. Ramon Codina, and Dr. Michele Chiumenti. Jordi Jiménez, head of Technology Transfer, and Dr. Gabriel Bugeda, director of institutional relations, also participated in the partnership event.

CIMNE Partners with SEAT for PhD Researchin Automotive Engineering

CIMNE and SEAT joined forces in a groundbreaking collaboration to offer an innovative PhD Research Opportunity focused on sub-structuring and modular Reduced-Order Models for automotive structural mechanics and dynamics. The project, started in late 2024, aims to revolutionize the automotive design process by developing efficient Reduced-Order Models (ROM) for complex vehicle structures. This partnership will explore the concept of sub-structuring for automotive simulations, dividing vehicles into different modules and representing each with suitable nonintrusive ROMs. The research is expected to significantly reduce computational costs and enhance the analysis of uncertainty in complex structures under extreme loads.



CIMNE Inaugurates New Research Facilities in Lleida

CIMNE officially opened its new research facilities in Lleida's Agrobiotech research park on May 28, 2024. The space, which began operations in 2022, houses CIMNE's Building, Energy, and Environment Innovation Unit (BEE Group), a specialized team focusing on big data and AI solutions for reducing building energy consumption.

The inauguration ceremony was attended by Lleida's mayor Felix Larrosa, CIMNE's director Dr. Javier Bonet, Managing Director Anna Font, and BEE Group leader Dr. Jordi Cipriano, along with other local officials. Dr. Bonet emphasized that the new facilities will enhance BEE Group's ability to develop "tangible solutions" for addressing energy transition challenges through AI and energy management.

The BEE Group, established in 2001, comprises 20 multidisciplinary experts working on various aspects of energy efficiency, including demand-response solutions, user behaviour tools, and energy community management. This expansion reinforces CIMNE's commitment to innovative research and its strategic position in Lleida's growing scientific community.

CIMNE Attends Working Meeting of Research Managers in Catalonia

CIMNE's Project Office team participated in the 12th Meeting of Research Managers of Catalonia on June 6, 2024, at the University of Lleida. Organized by AGAUR, the event focused on "The challenges of research management", and provided a platform for sharing best practices among research project managers. The meeting emphasized adapting to changes in research policies aimed at greater social impact. Sessions covered professional development, emotional well-being, pre-award and post-award management challenges, and the value of research management. The event highlighted the crucial role of project offices in managing competitive, publicly-funded research and fostering innovation in the field.

CIMNE Hosts Young Professionals in Talent Attraction Initiative

In October 2024, the International Centre for Numerical Methods in Engineering (CIMNE) welcomed 20 young professionals to its facilities at the Mediterranean Technology Park in Castelldefels, near Barcelona. The visit was part of the *Innobus* initiative, led by *Innobaix*, aimed at connecting students with innovative organizations in the Barcelona metropolitan area.

During the event, CIMNE staff showcased the centre's research and career opportunities. Jazmín Ríos, tech transfer officer, highlighted CIMNE's role in transforming advanced technology into practical solutions. Human Resources and Project Management representatives presented professional development prospects within the centre's multidisciplinary environment.

Researchers from various groups, including Structural Mechanics and Composites and Advanced Materials, shared insights into ongoing projects and challenges. Javier Piazzese, director of CIMNE's spin-off *Compass Ingeniería y Sistemas*, also contributed to the presentations.

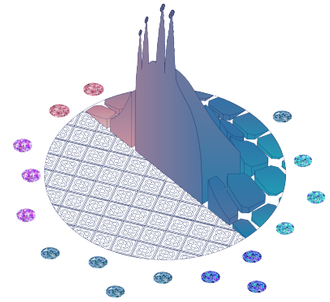
This event aligns with CIMNE's strategy to promote its research, enhance technology transfer, and attract young talent, reinforcing the commitment of the centre to innovation and societal advancement through cutting-edge engineering solutions.

CIMNE Joins other CERCA Centres to Strengthen Technological Transfer in Argentina

Representatives from CIMNE's Technology Transfer Office, along with other tech transfer specialists from the CERCA system centres, engaged in a strategic visit to Buenos Aires and Santa Fe, Argentina, in December 2024. The mission, featuring CIMNE's Tech Transfer Director Jordi Jiménez and CIMNE *Tecnología* Director Javier Marcipar, aimed to foster international relations and knowledge transfer between Latin America and Catalonia. Meetings were held with institutions like the National University of Litoral (UNL), CONICET, and the National Technological University (UTN), exploring collaborations in AI, bioeconomy, and sustainability. The initiative, supported by the CERCA VESHI KTT grant, seeks to extend the international reach of CERCA centres.

CIMNE's General Director Keynote at SPHERIC 2025

CIMNE's General Director, Prof. Javier Bonet, presented a keynote address at the SPHERIC World Conference in Barcelona (June 17-19, 2025). The presentation, entitled *Stabilised SPH formulations in large strain solid mechanics*, focused on advanced computational methods for simulating material behaviour under extreme conditions. SPHERIC is a key international forum for experts in smoothed particle hydrodynamics (SPH). Prof. Bonet's lecture highlighted recent advances in SPH and their potential applications in diverse engineering challenges.



CIMNE and Saudi Aramco Technologies Company Forge Partnership

CIMNE has signed a development agreement with Saudi Aramco Technologies Company (SATC) to advance the field of fibre reinforced polymer (FRP) rebars. The project, led by Dr. Xavier Martinez from CIMNE's *Aeronautical, Marine, Automotive and Energy Engineering* research cluster, aims to develop and test prototypes of FRP rebars partially or fully composed of hydrocarbon-based materials.

This collaboration follows CIMNE's commitment to applying its expertise directly to industry needs. The agreement encompasses additional research on the properties of a selected rebar, production of the rebar, and the structural design of a footbridge for future installation and monitoring at SATC's facilities.

The project has the potential to uphold construction materials, combining CIMNE's research prowess with SATC's industry leadership in energy, transport, and materials solutions. This partnership will demonstrate the practical application of CIMNE's cutting-edge research in real-world scenarios.

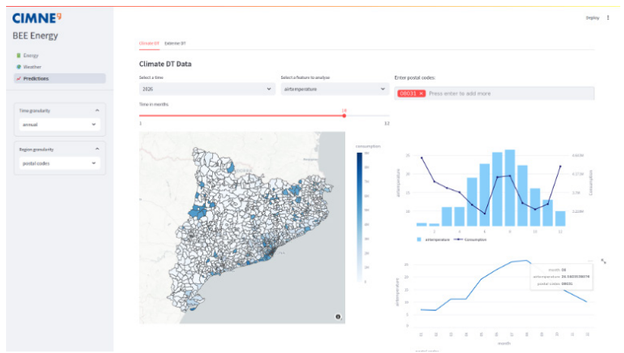
Scientific and Tech Transfer News

CIMNE Advances Energy Forecasting with Innovative Machine Learning Model

CIMNE has launched an advanced machine learning model to predict electricity demand in Catalonia. This tool tackles climate change and electrification challenges within the EU's Destination Earth initiative, an ambitious project aiming to create a digital twin of the Earth. With households contributing 27.4% to the EU's 2021 energy use and buildings nearly 70%, alongside a 61% annual growth in electric vehicle sales from 2016-2021, this model provides better solutions for accurate energy forecasting. This is especially critical in Catalonia, where authorities plan to shift to a decentralized, renewable energy system amid rising extreme weather events.

Led by Dr. Gerard Mor of CIMNE's BEE Group, the model uses the XGBoost algorithm on a Dask cluster, offering a scalable, unified approach. It draws on ERA5 Land climate data, Datadis energy records, INE socioeconomic stats, Esios pricing, and INSPIRE building data, incorporating Heating and Cooling Degree Days for precision. The model provides short-term forecasts for extreme weather and projections to 2026, supported by a Plotly-Streamlit visualization platform for stakeholders. This work advances a digital twin of Catalonia's energy network, aiding its renewable transition.

CIMNE has been selected as a partner for the Destination Earth initiative, a programme by the European Commission to develop a highly accurate digital model of the Earth on a global scale to aid Europe's "green transformation". By combining real-time observations with previous data pools, experts are developing a highly-accurate replica of complex Earth systems, giving special attention to extreme weather events and the effects of climate change.



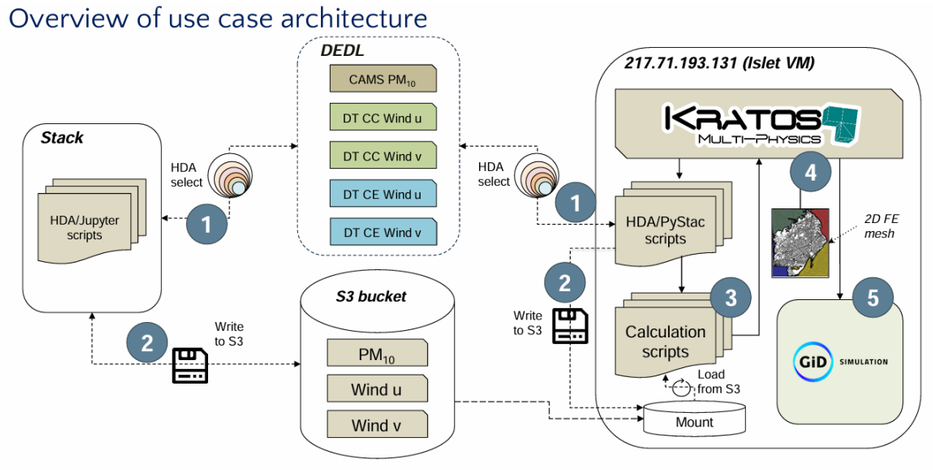
CIMNE Unveils Air Quality and Energy Demand Models for Destination Earth at User Exchange Workshop

CIMNE researchers showcased two advanced prediction models at the 3rd User Exchange Workshop of the Destination Earth initiative, held on October 23, 2024, in Darmstadt, Germany. Hosted by EUMETSAT, with ESA and ECMWF as co-organizers, the event spotlighted CIMNE's work on the European Commission-funded project to build a digital twin of Earth.

Dr. Ignasi de Pouplana and Laurence Sigler presented a micro-scale air pollution model for Barcelona, using the project's "Data Lake" to monitor street-level air quality. By integrating federated data, the model tracks dust particles under 10 microns, using CIMNE's Kratos Multiphysics and GiD platform for high-definition outputs with public health applications. Rooted in the PIKSEL project—developed with the Catalan Government—this tool aids environmental analysis.

In a second case, Dr. Gerard Mor and Miriam Méndez introduced a machine learning model to predict peak electricity demand in Catalonia during extreme climate events. Developed within CIMNE's Building, Energy and Environment unit, it combines environmental and socioeconomic data to forecast consumption by postcode. This scalable solution, also powered by Kratos and GiD, supports energy planning and can extend to other regions.

Both models demonstrate the computational capabilities of Destination Earth's repository, advancing Europe's "green transformation." CIMNE's role in this initiative underscores its expertise in modelling Earth systems, with a focus on climate change, blending data for precision.



CIMNE Experts Enhance Shipbuilding with Advanced Composite Technologies

The FIBRE4YARDS project, led by Dr. Xavier Martínez, has set a new benchmark in the maritime industry by integrating cutting-edge composite technologies into shipbuilding. This ambitious initiative, funded under the European Union's Horizon 2020 program, was recognized with the prestigious *JEC Composites Innovation Award* 2025 in the Maritime Transportation & Shipbuilding category, underscoring its transformative impact.

Launched in 2021, FIBRE4YARDS aimed to modernize European shipyards through the "Shipyard 4.0" concept. The project developed automated manufacturing processes and modular construction techniques using fiber-reinforced polymers (FRPs). Traditionally limited to small vessels, FRPs are now being adapted for larger ships, thanks to innovative technologies such as robotic additive manufacturing, UV-cured pultrusion, and adaptable moulds. These advancements enable more efficient production, reduced costs, and enhanced environmental sustainability.

As part of the FIBRE4YARDS project, international experts created a digital twin of a shipyard, integrating real-time data from advanced sensors to optimize production and maintenance processes. This digitalization improves quality assurance while minimizing waste and shortening development cycles.

The project brought together 13 partners from six European countries under the purview of CIMNE, showcasing the power of collaboration in addressing industry challenges. By reducing reliance on semi-artisanal methods and introducing scalable solutions, FIBRE4YARDS has strengthened Europe's competitiveness in shipbuilding while promoting greener practices.

The *JEC Innovation Award*, granted by the world's leading organization in Composite Materials, highlights the project's success in redefining maritime construction. As Dr. Martínez noted, these achievements pave the way for a "more sustainable and technologically advanced future for shipyards" worldwide.

CIMNE's BEE Group Advances Data-Driven and Community-Based Energy Solutions

CIMNE's Building, Energy and Environment (BEE) Group is contributing to sustainable energy solutions in Barcelona through two distinct projects focused on minimizing the effects of energy poverty and climate change.

One key initiative is the EKATE+ project, which promotes the development of renewable energy communities in the cross-border between Spain, Andorra, and France. By facilitating access to sustainable energy sources and fostering community ownership, EKATE+ aims to reduce reliance on traditional energy grids and lower energy costs for residents. This project empowers communities to generate and manage their own clean energy, contributing to a more resilient and equitable energy system.

Complementing this effort, the BEE Group has developed the Energy Vulnerability Map as part of the Climate Ready Barcelona initiative. This tool, designed by Dr. Gerard Mor, integrates open data, artificial intelligence, and simulation models to assess the impact of heatwaves at the building level across the city. By identifying the areas most vulnerable to climate change and energy poverty, the map informs municipal policies aimed at adaptation and mitigation. The map allows the city to direct resources to the most vulnerable, ensuring targeted support for energy efficiency improvements, climate shelters, and other essential services.

Through EKATE+ and the Energy Vulnerability Map, CIMNE's BEE Group is working in creating sustainable energy communities and using data-driven approaches to address energy poverty and climate change challenges in urban environments.

CIMNE's Innovation Unit in Transport works with authorities in Turkey and Fiji for Sustainable Transport Solutions

CIMNE's Innovation Unit in Transport (CENIT) has significantly advanced sustainable urban planning in 2024, spearheading transformative projects in both Ankara and Fiji. These initiatives are spearheaded by CENIT's expertise in developing and implementing innovative transport solutions tailored to diverse urban environments.

In Ankara, CENIT led the "SMART Ankara" project, aimed at creating a sustainable and integrated transportation system for Turkey's capital. The project focuses on optimizing public transport networks, promoting active mobility, and reducing traffic congestion through data-driven strategies and advanced technologies. By analysing mobility patterns and leveraging smart city concepts, CENIT is helping Ankara transition towards a more efficient, accessible, and environmentally friendly urban environment.

Simultaneously, CIMNE has been instrumental in Fiji, conducting a study on "Route Prioritization for Phasing in of Electric Buses." This project, funded by the Global Green Growth Institute (GGGI), identified the most suitable routes for electric bus implementation. Through a meticulous Multi-Criteria Analysis (MCA), Experts at CENIT assessed various factors, including operational feasibility, environmental impact, and economic viability. The study provides a roadmap for Fiji's transition to electric public transport, supporting the nation's commitment to reducing fossil fuel consumption and achieving its climate goals. The project also explored innovative solutions, such as retrofitting existing buses for rural routes, to address unique challenges within the Fijian context.

These projects are part of CENIT's portfolio and expertise in developing sustainable urban planning strategies. Experts at the unit combine data analysis, innovative technologies, and collaborative approaches to empowering cities worldwide to create more liveable, resilient, and environmentally responsible urban spaces.

Two CIMNE Researchers Participate in Study to Evaluate Bone Health in Women with Long-Term Remission of Cushing's Syndrome

Dr. Agustina Giuliodori and Dr. Eduardo Soudah from CIMNE's Research Cluster in Computational Mechanics in Medical Engineering and Living Matter co-authored a novel study that provided valuable insights into bone-related mechanical properties in women with long-term remission of Cushing's syndrome (CS). Published in 2024, the research employs advanced computational modelling to assess the lingering impact of hypercortisolism on bone strength and fracture risk.

Cushing's syndrome, a disorder caused by prolonged exposure to high cortisol levels, is known to significantly affect bone health, increasing the risk of osteoporosis and fractures. While remission restores many physiological functions, its long-term effects on bone mechanical properties remain underexplored. The study aimed to bridge this knowledge gap using quantitative computed tomography (QCT) combined with Finite Element Analysis (FEA), a computational technique that simulates mechanical stress and strain in bone structures.

The research included 32 women with Cushing's syndrome in long-term remission, matched with 32 healthy controls of similar age, body mass index, and menopausal status. The team applied QCT imaging to analyse volumetric bone mineral density (vBMD), cortical thickness, and buckling ratio at the femoral neck. The reconstructed 3D bone models were then subjected to FEA simulations to estimate strain and stress distributions under a standardized fall scenario.
Key findings indicate that despite remission, women with a history of Cushing's syndrome exhibited compromised bone mechanical properties. Specifically, their femoral necks showed higher stress and strain values, suggesting an increased susceptibility to fractures compared to healthy controls. Additionally, trabecular vBMD was significantly lower in the CS group, while the cortical bone structure exhibited greater instability. These findings highlight that conventional bone density measurements, such as Dual-Energy X-ray Absorptiometry (DXA), may underestimate the actual fracture risk in these patients.

The study relied on advanced imaging and computational techniques in evaluating bone health beyond traditional assessments, underscoring the relevance of such techniques. Authors hope this study will improve diagnostic tools and targeted interventions to prevent fractures in CS patients, even years after achieving remission.

New Computational Tool Enhances Prediction of Rain Erosion in Wind Turbine Blades

Dr. Sergio R. Idelsohn, from CIMNE's Solid and Fluid Simulation for Industrial Processes Research Cluster, and Dr. Eugenio Oñate, from the Structural and Particle Mechanics Research Cluster, introduced a novel computational tool for fast and accurate prediction of rain erosion in wind turbine blades. Published in 2024, this research, co-authored with Dr. Juan M. Giménez, provides a breakthrough in understanding and mitigating the effects of environmental wear on renewable energy infrastructure.

Wind turbine blades are highly vulnerable to environmental degradation, particularly from rain erosion, which significantly affects efficiency and durability. This problem is especially critical for offshore wind farms and high-precipitation areas, where sustained exposure to droplet impacts leads to material fatigue and surface deterioration. Traditional methods for assessing rain erosion rely on time-intensive simulations or costly experimental setups, limiting their practical application for predictive maintenance and design optimization.

To address this challenge, the study proposes a computational tool that integrates Pseudo-Direct Numerical Simulations (P-DNS) with machine learning techniques. P-DNS is used to generate high-fidelity datasets capturing the impact of raindrops on turbine blade sections under different operational conditions. These datasets train a machine learning model that predicts impact patterns and damage evolution based on meteorological data and turbine operation parameters.

The tool's efficiency was demonstrated by simulating the long-term erosion behaviour of a 5 MW wind turbine blade. By analysing different environmental scenarios—offshore, coastal, and inland—the researchers assessed variations in damage rates depending on location, coating material, and blade thickness. The model successfully estimated erosion accumulation over years of operation in a matter of minutes, offering a significant advancement over conventional prediction techniques.

Key findings reveal that blade erosion is heavily influenced by material composition and exposure conditions. Results indicated that coatings with higher fatigue resistance significantly extend blade lifespan, while thinner coatings deteriorate rapidly under harsh weather conditions. Additionally, offshore wind turbines were found to be at greater risk of early erosion compared to those in inland environments due to more intense rainfall and higher wind speeds. This study uses data-driven predictive maintenance in the wind energy sector.

Using identification of erosion-prone areas, the computational tool developed by Dr. Idelsohn, Dr. Oñate, and their colleagues provides an invaluable resource for turbine manufacturers and operators, supporting optimized maintenance schedules and enhancing the reliability of wind power systems.

Satellite-Based Monitoring Expands Understanding of Soil-Structure Interaction in Tunnelling Projects

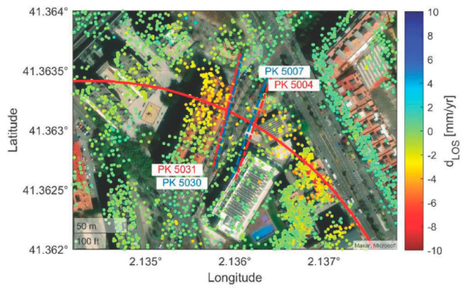
A study co-authored by Dr. Alessandra Di Mariano and Dr. Antonio Gens, both from CIMNE's Geomechanics and Hydrogeology Research Cluster, provides new insights into the response of buildings to underground construction. The manuscript, published in 2024, focuses on a case study from the Barcelona Metro expansion, comparing conventional displacement monitoring methods with advanced satellite-based techniques.

Tunnelling in urban environments presents significant challenges, particularly in areas with mixed geological conditions and dense infrastructure. Predicting soil-structure interaction (SSI) during tunnel excavation remains a critical concern for engineers, as it influences ground stability and the integrity of nearby buildings. This research analysed the construction of a tunnel below a residential complex in Barcelona, assessing how different measurement techniques capture ground and structural movements.

The study compared traditional optical surveying methods with multi-temporal Interferometric Synthetic Aperture Radar (MT-InSAR) analyses, derived from high-resolution satellite images. The MT-InSAR technique, which processes data from synthetic aperture radar (SAR) satellites, provides a broad and continuous dataset of ground displacements, complementing ground-based monitoring methods.

Key findings revealed that MT-InSAR results closely matched conventional monitoring data, particularly for settlement patterns along the tunnel alignment and building displacements. However, minor discrepancies were observed, attributed to phase unwrapping errors in the satellite data and differences in point positioning relative to the tunnel centerline. Despite these limitations, MT-InSAR proved to be a valuable tool for enhancing monitoring strategies, offering an extensive spatial and temporal dataset that reduces reliance on labor-intensive ground surveys.

Satellite-based techniques are becoming usual in geotechnical engineering. These tools allow engineers to improve the accuracy of tunnel-induced settlement predictions, enhancing risk-management and improving safety of urban tunnelling projects. The findings of this international study support the adoption of MT-InSAR as a complementary tool in large-scale infrastructure projects, helping to safeguard existing buildings and optimize excavation processes.



CIMNE Researchers Develop Advanced Model to Predict Failure in 3D-Printed Components

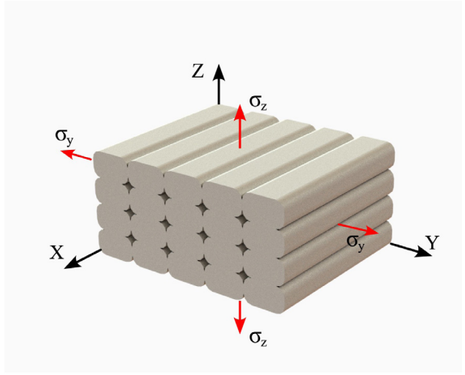
Researchers at CIMNE have developed a novel Mechanism-Based (MB) damage material model to predict the failure of components produced through Fused Filament Fabrication (FFF), a significant development in Additive Manufacturing. The study, published in Composites Part B in 2024, addresses the challenges of understanding the mechanical behaviour and failure mechanisms of 3D-printed parts, which are increasingly used in industries ranging from aerospace to healthcare.

The research team, composed of doctors Iván Rivet, Narges Dialami, Miguel Cervera, and Michele Chiumenti, focused on the orthotropic properties of FFF components—materials that exhibit different mechanical properties in separate directions due to their layered structure. The study introduces a Mechanism-Based damage criterion that distinguishes between various failure modes, such as filament rupture, layer decohesion, and fibre kinking, which are influenced by the printing patterns used during the manufacturing process.

To validate their model, the team conducted experimental tests, including three-point bending and door-handle tests, on 3D-printed specimens made from ABS and PLA materials. The results showed that the MB criterion not only accurately predicted the failure locations but also matched the experimental force-displacement curves more closely than the TW criterion. This is particularly important for industries where the reliability of 3D-printed parts is critical.

The study also introduced a Mechanism-Based cracking model, which requires only two parameters to predict the brittle or ductile failure of FFF components. This model was successfully calibrated using experimental data, further enhancing its potential for practical applications.

The findings of this research have significant implications for the additive manufacturing industry, offering a more accurate tool for predicting the failure of 3D-printed components under complex loading conditions. This could lead to improved design and manufacturing processes, ultimately enhancing the reliability and performance of 3D-printed parts in real-world applications.



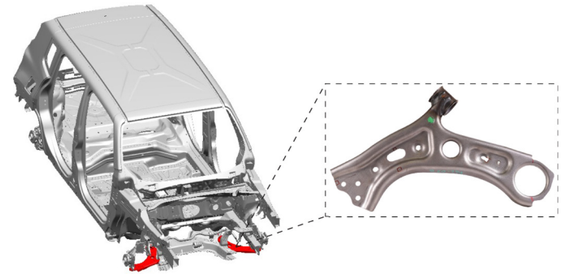
Advanced Numerical Framework Enhances Virtual Fatigue Testing for Automotive Components

Researchers from CIMNE have developed a cutting-edge numerical framework for virtual fatigue testing of metallic structures, specifically targeting automotive components. The study, published in *Engineering Structures* in 2024 as part of the *Fatigue4light* project, focuses on the fatigue assessment of a light-duty vehicle's lower control arm (LCA), a critical component in the vehicle's suspension system. The research was conducted by L.A. Gonçalves Junior, S. Jiménez, A. Cornejo, and L.G. Barbu, all affiliated with CIMNE's "Aeronautical, Marine, Automotive, and Energy Engineering" Research Cluster.

The framework leverages an isotropic damage-based high-cycle fatigue (HCF) constitutive model, combined with an advanced time-strategy algorithm to enhance computational efficiency. This approach allows for high-fidelity simulations that accurately predict the onset and propagation of fatigue cracks in metallic components, significantly reducing the need for extensive physical testing. The model was validated through two durability tests on the LCA, demonstrating its ability to replicate experimental results with high precision.

The study introduces a novel methodology for calibrating material parameters, converting average stress data from S-N curves into localized material point information. This ensures consistency with the model's stress measures, which are computed at the material point level. The framework was applied to simulate both general operational loads and specific stress concentrations near welding seams, accurately predicting crack locations and morphologies observed in experimental tests.

The results highlight the framework's potential to support engineering decision-making processes by providing reliable virtual fatigue testing tools. This advancement is particularly valuable for the automotive industry, where lightweight design and durability are critical for meeting environmental regulations and improving vehicle efficiency.



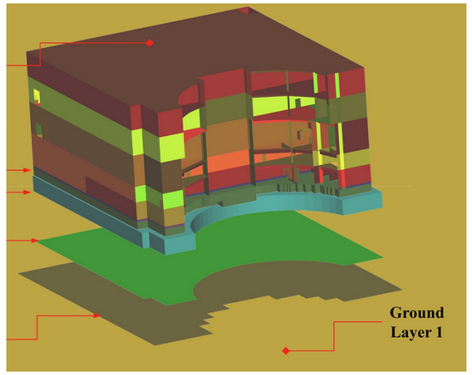
New Methodology Upholds Seismic Safety Analysis for Nuclear Structures

Researchers at CIMNE have developed an advanced nonlinear soil-structure interaction (SSI) methodology for the seismic analysis of nuclear structures. The study, published in the *Bulletin of Earthquake Engineering* in 2024, focuses on the dynamic response of a nuclear reinforced concrete structure subjected to Beyond Design Basis Earthquakes (BDBE). The research was conducted by J.M. González, A.H. Barbat, F. Rastellini, J. Ramírez, and C. Escudero, all affiliated with CIMNE's "Structural and Particle Mechanics" Research Cluster, along with Y.F. Vargas-Alzate and L.G. Pujades.

The proposed methodology integrates a detailed 3D finite element model (FEM) of both the nuclear structure and the underlying soil, considering the nonlinear effects of sliding and rocking at the soil-structure interface. The study highlights the importance of accurately modelling these interactions, especially for safety-related nuclear structures, where seismic performance is critical. The research also introduces an innovative approach to spectral matching, ensuring that the seismic ground motions applied at the bedrock level produce accurate surface responses in the FEM model.

The numerical model was validated through a series of simulations, comparing three different soil-structure contact hypotheses: fixed-base, fixed-contact, and sliding-rocking contact. The results demonstrate that the sliding-rocking contact hypothesis significantly reduces peak spectral accelerations (PSA) at the foundation and roof levels, highlighting the importance of considering nonlinearities in SSI analysis. The study also incorporates a statistical approach to account for uncertainties in soil properties, providing a more robust assessment of the structural response under seismic loading.

The findings have important implications for the design and safety assessment of nuclear structures, particularly in regions prone to strong earthquakes. By accurately capturing the effects of soil-structure interaction, the proposed methodology can help engineers better predict the seismic performance of nuclear facilities, ultimately enhancing their safety and reliability.



CIMNE Researchers Publish Critical Review on XR and Construction Safety

Researchers Dr Felipe Muñoz-La Rivera, Dr Javier Mora-Serrano, and Prof Eugenio Oñate from CIMNE's Structural and Particle Mechanics research cluster published a novel paper titled *A Critical Review of How Extended Reality (XR) has Addressed Key Factors Influencing Safety on Construction Projects (fSCPs) in the journal Archives of Computational Methods in Engineering*.

This comprehensive review examines the role of Extended Reality (XR) technologies—encompassing Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR)—in improving safety outcomes on construction sites.

The study highlights how XR tools have been employed to address critical safety challenges in construction, such as hazard identification, worker training, and real-time risk management. By synthesizing findings from various applications, the authors provide a detailed evaluation of XR's effectiveness in mitigating risks and enhancing safety protocols. The paper also identifies gaps in current research and offers recommendations for future developments in XR technology to better integrate it into safety practices.

The Structural and Particle Mechanics research cluster, where the authors are based, specializes in developing innovative numerical methods like the Finite Element Method (FEM) and particle-based techniques. These methods are applied across sectors, including civil engineering, to address complex problems such as multi-physics interactions and structural safety.

(a)

(b)

(c)

(d)

Enhancing Semiconductor Simulations: New Insights on Formulations and Solvers

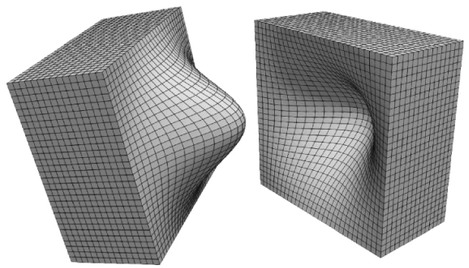
A paper titled *A comparison of formulations and non-linear solvers for computational modeling of semiconductor devices* was published in the journal *Computational Mechanics*, featuring contributions from CIMNE researcher Dr. Irene Arias. The study, which became available online in early 2024, presents a comprehensive analysis of various formulations and non-linear solvers used in semiconductor device modelling.

The research team, led by Sergi Pérez-Escudero and including David Codony, Irene Arias, and Sonia Fernández-Méndez, focused on comparing different approaches to solve the complex equations governing semiconductor behaviour. Their work is particularly significant in the field of computational mechanics, as it aims to improve the efficiency and accuracy of simulations used in the design and optimization of electronic devices.

To validate their methods, the authors conducted numerical experiments on semiconductor components such as p-n junctions and MOSFET devices, which are pivotal in modern electronics. These tests demonstrated how the proposed techniques could enhance the accuracy and efficiency of semiconductor simulations, offering potential benefits for device design and optimization.

Dr. Irene Arias, affiliated with CIMNE's Mechanics of Advanced Materials and Metamaterials Research Cluster, brought her expertise in computational methods to the project. The study's findings are expected to have far-reaching implications for the semiconductor industry, potentially leading to more efficient design processes and improved device performance.

The study's findings offer valuable insights into the effectiveness of various formulations and non-linear solvers for semiconductor device modelling. By comparing different approaches, the research team provided a comprehensive analysis that could potentially streamline the simulation process for semiconductor devices.
bility.



Publications

In 2024, CIMNE research clusters and innovation units produced **202 publications** in areas ranging from Offshore Wind Security to Ground-Level Ozone Prevention. More than **75%** appeared in **Q1 journals** and **over 60%** were available under **open access**.

Selected publications

Empirical Interscale Finite Element Method (EIFEM) for modeling heterogeneous structures via localized hyperreduction
Hernandez J.A., Giuliodori A., Soudah E.
DOI: 10.1016/j.cma.2023.116492

A shifted boundary method based on extension operators
Zorrilla R., Rossi R., Scovazzi G., Canuto C., Rodriguez-Ferran A.
DOI: 10.1016/j.cma.2024.116782

Dynamic and modal analysis of nearly incompressible structures with stabilised displacement-volumetric strain formulations
Zorrilla R., Rossi R., Codina R.
DOI: 10.1016/j.cma.2024.117382

Finite-data nonparametric frequency response evaluation without leakage
Markovsky I., Ossareh H.
DOI: 10.1016/j.automatica.2023.111351

Sound transmission loss enhancement through triple-peak coupled resonances acoustic metamaterials
Sal-Anglada G., Yago D., Cante J., Oliver J., Roca D.
DOI: 10.1016/j.ijmecsci.2023.108951

Formulation and Implicit Numerical Integration of a Kinematic Hardening Model for Unsaturated Soils
Monforte L., Rouainia M.
DOI: 10.1002/nag.3878

Topology optimization of flexoelectric metamaterials with apparent piezoelectricity
Greco F., Codony D., Mohammadi H., Fernandez-Mendez S., Arias I.
DOI: 10.1016/j.jmps.2023.105477

An unfitted high-order HDG method for two-fluid Stokes flow with exact NURBS geometries
Piccardo S., Giacomini M., Huerta A.
DOI: 10.1016/j.jcp.2024.113143

Active interfacial degradation/deposition of an elastic matrix by a fluid inclusion: Theory and pattern formation
Cicconofri G., Blanco P., Vilanova G., Saez P., Arroyo M.
DOI: 10.1016/j.jmps.2024.105773

Modelling a gas injection experiment incorporating embedded fractures and heterogeneous material properties
Rodriguez-Dono A., Zhou Y., Olivella S., Gens A.
DOI: 10.1016/j.gete.2024.100552

A Review of Technologies and Challenges for Integrated Modeling Analysis
Sigler L., Ubach P.-A., Mora J., Onate E.
DOI: 10.1007/s11831-024-10187-3

Definition of a beam-like reduced order model element by means of a mixed dimensional coupling
Turon F., Otero F., Ferrer A., Martinez X.
DOI: 10.1016/j.compstruc.2024.107466

CECM: A continuous empirical cubature method with application to the dimensional hyperreduction of parameterized finite element models
Hernandez J.A., Bravo J.R., Ares de Parga S.
DOI: 10.1016/j.cma.2023.116552

Adjoint-based optimal control of contractile elastic bodies. Application to limbless locomotion on frictional substrates
Bijalwan A., Munoz J.J.
DOI: 10.1016/j.cma.2023.116697

PhD Theses

Eighteen PhD students successfully defended their dissertation at CIMNE in 2024. We welcomed new doctors across the board, with research topics ranging from fluid flow study in Geomaterials to Transport Planning for Autonomous Vehicles.

Theses defended in 2024

Constitutive models for unsaturated soils. A thermodynamic approach
Alcoverro, Jordi
Advisor: Gens, A.

A micromechanical investigation of pile set-up effect in sands
Lei, Jiangtao
Advisor: Arroyo, M.

Multi-scale hydro-mechanical and gas transport characterisation of granular bentonite
Zeng, Hao
Advisor: Gonzalez, L.

Multiphase fluid flow in heterogeneous / anisotropic deformable geomaterials
Zhou, Yunfeng
Advisor: Olivella, S.

Numerical modelling of non-Newtonian shallow flows
Sanz-Ramos, Marcos
Advisor: Blade, E.

Evaluation of potential hazard due to off-stream reservoir failure using Machine Learning techniques
Silva-Cancino, Nathalia
Advisors: Blade, E., Salazar, F.

Development of a unified fatigue constitutive model: from high to low cycle regime
Jimenez, Sergio
Advisor: Oñate, E.

Numerical approximation of thin structures using stabilized mixed formulations for Infinitesimal and Finite Strain theories, including Fluid-Structure Interaction problem applications
Aguirre, Alejandro
Advisor: Codina, R.

Aerodynamic shape optimization under uncertainties using embedded methods and adjoint technique
Nuñez, Marc
Advisor: Rossi, R

Numerical optimisation of worm locomotion on frictional substrates
Bijalwan, Ashutosh
Advisor: Muñoz, J.

Continuous-discrete numerical modeling of the thermomechanical behavior of granular media supported by experimental campaign
Rangel, Rafael López
Advisor: Franci, A.

Computational analysis and design of metamaterial-based panels for high-performance acoustic applications
Sal Anglada, Gaston
Advisor: Oliver, X.

A novel computational homogenization theory for multilayered plates: the multiscale 2D+ approach
Wierna, Pablo
Advisor: Oliver, X.

Low-order face-based approaches for incompressible computational fluid dynamics
Malikoski Vieira, Luan
Advisors: Huerta, A.; Giacomini, M.; *Sevilla, R.*

A face-centred finite volume solver for viscous laminar incompressible flows using OpenFOAM
Cortellessa, Davide
Advisors: Huerta, A.; Giacomini, M.

Development of multiscale reduced-order models for the analysis of medical devices
Giuliodori, Agustina
Advisor: Soudah, E.

Transport Planning Strategies in the Context of Autonomous Vehicles
Sarwar, Samra
Advisor: Saurí, S.

The Impacts of Main Trends on the Port Sector. Evolution towards a New Generation of Green and Digital Ports
Garrido, Francisco Javier
Advisor: Saurí, S.

CIMNE Labs

The **CIMNE Labs Network** (*Red de Aulas CIMNE*) is a matrix of international cutting-edge research labs associated with CIMNE, leveraging cooperation in education and research and technological development (RTD) in the field of numerical methods in engineering. Each lab is created through a collaboration agreement between CIMNE and a hosting institution, and are locally managed by esteemed professors in fields ranging from materials science to structural mechanics.

There are currently 32 CIMNE Labs in 10 countries.

5 Argentina	5 Spain	5 Mexico	5 Colombia	4 Brazil
3 Chile	1 Peru	2 Cuba	1 El Salvador	1 Guatemala

The International Network of CIMNE Labs

The International Network of CIMNE Labs is a non-governmental, non-profit organization bringing together CIMNE Labs around the globe. The network promotes continuous education, interdisciplinary collaboration, and exchange programs for researchers and students. It also supports the development of emerging knowledge areas, enhancing global expertise and positioning itself as a reference in numerical methods for engineering.

Red Aulas CIMNE

Looking ahead

Although the activity of **CIMNE Labs** is currently split between Spain and Latin America, the centre is committed to replicating this collaboration formula through Europe, expanding innovation opportunities with top research institutions across the continent. This strategy, called out in CIMNE's Strategic Plan, will strengthen innovation and training efforts with institutions with which CIMNE already has close ties, like the Swansea University (Wales), the University of Pavia (Italy), TU Braunschweing (Germany), or the Technical University of Athens (Greece).

CIMNE Congress Bureau

The CIMNE Congress Bureau is a globally-recognized entity specializing in the management of highly-specialized conferences, events, and associations. With decades of expertise, it provides tailored solutions for technical and administrative needs, ensuring seamless event execution. Trusted by leading global organizations in numerical methods and computational engineering, it combines personalized service with innovative tools to deliver proven results at a reasonable cost.

Top Conferences 2024

SIAM Conference on Uncertainty Quantification (UQ24)
27 February–1 March | *Trieste, Italy*

9th European Congress on Computational Methods in Applied Sciences and Engineering
3-7 June | *Lisbon, Portugal*

13th Spanish Conference on Dams
June 17 – 20 | *Barcelona, Spain*

7th International Conference on Geotechnical and Geophysical Site Characterization
June 18-21 | *Barcelona, Spain*

2024 in Numbers

9	4,986	4,118
conferences	attendees	contributions

Some of Our Clients

The CIMNE Congress Bureau has a long-standing collaboration with some of the world's leading institutions in the field of numerical methods and computational engineering, including:

The European Community on Computational Methods in Applied Sciences

The International Association for Computational Mechanics

Spanish Society of Computational Mechanics and Engineering

Society for Industrial and Applied Mathematics

Management of Scientific Associations

Fostering Global Engineering Excellence

CIMNE's Congress Bureau has established itself as a global leader in the management of scientific associations in the fields of numerical methods and computational engineering. With decades of experience and a deep understanding of the academic landscape, CIMNE has developed unparalleled expertise in organizing high-level scientific conferences, managing complex international networks, and facilitating knowledge exchange among researchers worldwide. Currently, CIMNE holds the permanent secretariat for several prestigious scientific societies, a testament to its ability to provide comprehensive administrative support, strategic guidance, and innovative solutions for the global scientific and engineering community. This unique position allows CIMNE to foster collaboration, drive scientific progress, and maintain its status as a key player in the advancement of computational engineering and related disciplines.

Scientific Associations Managed by CIMNE

International Association for Computational Mechanics (IACM)

IACM is a global organization advancing computational mechanics, fostering collaboration and innovation. Strongly linked to CIMNE since its 1981 inception, CIMNE held IACM's permanent secretariat from 1994 to 2016, reflecting their shared commitment to the field's growth and excellence.

European Community on Computational Methods in Applied Sciences (ECCOMAS)

ECCOMAS is a leading scientific organization in numerical methods, founded in 1993. It groups different European associations with interests in the development and applications of computational methods in science and technology, promoting world-leading events in the field. CIMNE has led the secretariat of ECCOMAS since its founding.

Spanish Society of Numerical Methods in Engineering (SEMNI)

SEMNI emerged in 1989 with the aim of bringing together researchers, professionals, companies, and institutions interested in the development and practical applications of numerical methods. The society organises periodic conferences and events, and promotes awards recognizing young talent. CIMNE has led the secretariat of SEMNI since its inception.

International Association of CIMNE Labs (AIAC)

CIMNE manages the secretariat of AIAC, promoting spaces for scientific exchange and bringing together top researchers from more than 10 countries and over 30 institutions. The secretariat ensures AIAC can fulfil its goals of research, education, innovation, and dissemination.

Awards

The 11 awards received by CIMNE experts and projects with the centre's participation in 2024 testify to the scientific talent of our community and the commitment of CIMNE to innovating to the benefit of society.

Awards to People

Oñate, Eugenio
Spanish National Research Award (Engineering and Architecture)
Spanish Ministry for Science

Bonet, Javier
Grand Prize
Japan Society for Computational Engineering and Science

Carreño, Martha Liliana
Landmark Article Award
International Society for Integrated Disaster Risk Management, 2024

Martí, Jaime
Best Oral Presentation
IWA World Conference on Anaerobic Digestion

Asensio, Jaume
Best final thesis
CampusLab mode
UPC Sostenible

Gens, Antonio
Overseas Prize Award
Institution of Civil Engineers, UK
Honorary Member
Mexican Society of Geotechnical Engineering

Otero, Fermín
Martínez, Xavier
Teaching Quality Award
UPC Social Council

Markovsky, Ivan
Outstanding Paper award
Control Systems *Magazine*

Awards to Projects

Fibre4Yards
JEC Innovation Award 2025
JEC Composites

Dissemination

Dissemination of science, innovation, and technology transfer is at the heart of CIMNE. These efforts appeal not only to existing audiences — whether specialised or generic — but serve as a catalyst to reach new pools of young talent and potential collaborators, as well as industry and community leaders, and constituents. CIMNE believes in communication as a warranty of transparency, a way of highlighting the societal impact of its research, and an avenue for trusted, open dialogue with society.

Communication Highlights of 2024

7
Coffee Talks

Casual events to discuss ongoing and exploratory research, best practices, and state-of-the-art reviews related to CIMNE's disciplines.

13
Seminars

Presentations on innovative research and high-impact scientific challenges, specially by external contributors.

Virtually all Coffee Talks and Seminars are openly available online

365+
Social Media Posts

Across different platforms, highlighting CIMNE's activities, research, and impact on society.

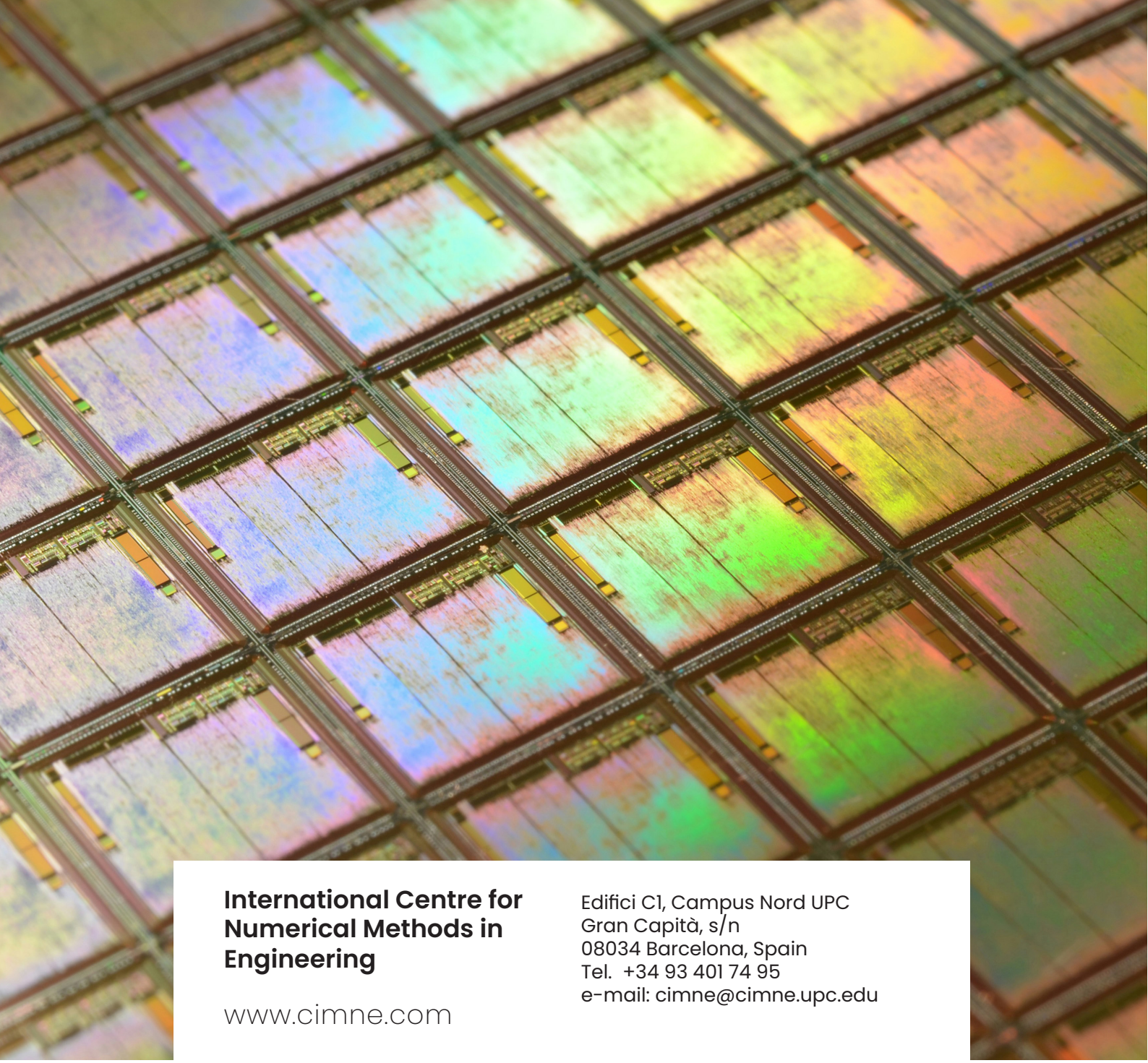
New BlueSky Profile

CIMNE launched a Bluesky account in 2024 to align with industry trends and engage with diverse and emerging audiences.

CIMNE Alert System

In 2024, CIMNE launched an "Alert System" to promote transparency and accountability. Open to all, this platform allows individuals to share suggestions, report issues or voice concerns anonymously or with their identity. The service is accessible 24/7 through any device with Internet connection, and supports English, Catalan, and Spanish. The New Alert System underscores CIMNE's commitment to fostering a safe and ethical environment by providing a straightforward way to communicate and address any misconduct or irregularities effectively.

The service is available here:
https://cimne.com/alert-system/



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