

International Centre for NUMERICAL METHODS IN ENGINEERING

ANNUAL REPORT 2020

CIMNE^R



EXCELENCIA
SEVERO
OCHOA

Since 1987

GENERATING KNOWLEDGE AND SOLUTIONS

2020 Annual Report

[ANNUALREPORT2020.CIMNE.COM](https://www.cimne.com/annualreport2020)

GENERATING KNOWLEDGE AND SOLUTIONS

Since 1987

CIMNE^R

CIMNE ANNUAL REPORT 2020

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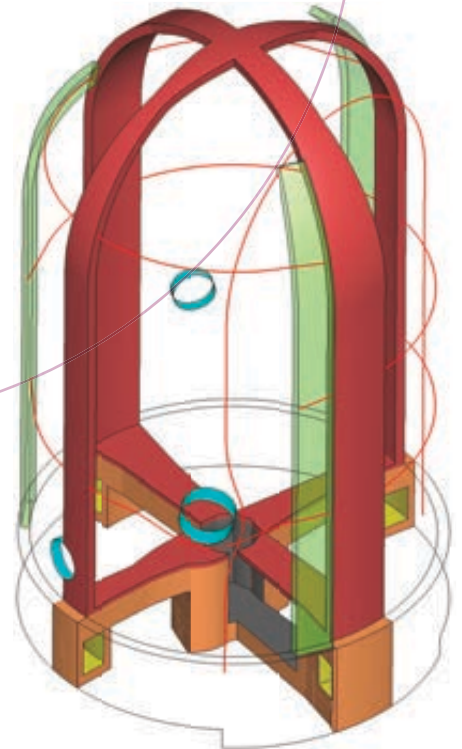
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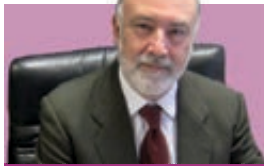
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About **CIMNE**





Director's Letter

Eugenio Oñate (onate@cimne.upc.edu)
Executive Vicepresident and General Director of CIMNE

The International Centre for Numerical Methods in Engineering (CIMNE) was created in April 1987. CIMNE's mission is the development and dissemination of original research in the field of Numerical Methods in Engineering, the education of researchers and the transfer of the research outputs to industry.

CIMNE is a leader as an international centre of excellence in the field of numerical methods (NM) through four main action vectors:

1. Excellence in research on NME for multidisciplinary engineering applications, in terms of scientific outputs and software-based tools.
2. International dimension.
3. Active participation and management in scientific societies.
4. Commitment to technology transfer to industry.

Research at CIMNE focuses 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.

Since 1987 CIMNE has evolved to become a prestigious international research centre on NME. Its research staff (90% of whom are engineers) includes (by December 2020) 23 Full Research Professors, 18 Associate Research Professors, 12 Assistant Research Professors, 24 Postdocs, 10 Staff Scientists, 48 PhD Students, 77 Research Engineers and 42 Administration Staff from 26 countries.

Several researchers of CIMNE are faculty members of the Technical University of Catalonia (UPC) and develop their research duties in CIMNE. These distinguished affiliated researchers play an important role as liaison between researchers at different groups of UPC and CIMNE.

COVID IMPACT

In a situation of a global pandemic, CIMNE activities have been affected. However, the centre has made a strong commitment to teleworking and a notable effort has been made to adapt work meetings, training sessions and congresses to virtual formats. The objective has been to continue advancing in a new and unexplored context.

CIMNE, CENTRE OF EXCELLENCE SEVERO OCHOA

On December 2019 CIMNE was selected as one of the "Centres for Excellence Severo Ochoa" accredited by the Spanish State Research Agency, attached to the Spanish Ministry of Science, Innovation and Universities. The Severo Ochoa Centers are selected on the basis of their excellence on scientific research and technical development activities. This important distinction includes governmental funding to hire some 35 new PhDs and 15 Postdocs for the period 2020-2023. **In 2020, 14 PhDs and 12 Postdoctoral researchers has been hired.**

RESEARCH PRIORITIES AND APPLICATIONS

The priorities of CIMNE for research excellence target **new NM and software to help engineers to better predict, design and optimize systems affecting our lives**, including our environment, our security and safety, and the products we use.

CIMNE research in 2020 has focused in advances on NM that will have an impact on the following four broad application areas that are at the kernel of the activities of CIMNE as a Center for Excellence Severo Ochoa: Construction and Transport, Environment, Functional Materials and Manufacturing Processes.

Some relevant problems where the NMs developed at CIMNE are applied include: structural analysis of constructions and vehicles; safety of structures to hazards; geotechnical engineering and groundwater flow; oil and gas engineering; thermal-mechanical analysis of structures and mechanical systems; indus-

trial forming processes (sheet forming, casting, welding, additive manufacturing, machining, etc.); shape and material optimization; aerodynamics of aircrafts; blast, crashworthiness and impact problems; ship hydrodynamics; analysis of coastal and offshore structures; flow of granular materials in mining and the oil and gas industries, among other applications.

FOCUS OF CIMNE RESEARCH ON TERRITORY AND SUSTAINABILITY

Since December 2017 CIMNE is under the auspices of the Department of Territory and Sustainability (DTES) of the Catalanian Government. This has strengthened the research activities of CIMNE of interest to the civil and environmental engineering sector with a focus on applications to predictive territory management, smart infrastructures, water resources, energy efficiency, transport and mobility and environmental quality.

ORGANIZATION OF RESEARCH

Research in CIMNE is structured in research challenges (RChs) covering several challenging topics applicable to different engineering disciplines. See current CIMNE RChs at the “[Research](#)” section of this report.

Researchers at CIMNE carry out their activity within Research and Technical Development (RTD) Groups managed by a Group Leader. The research activities are coordinated by one or more Principal Investigators (PIs). RTD Groups are gathered in RTD Areas that target fields such as Civil and Environment Engineering, Computational Materials Design and Analysis, Engineering Mechanics and Processes, Innovative Algorithms and HPC Techniques and Transport and Innovation Support and Tech Transfer.

You can visit the CIMNE RTD Areas and Groups at www.cimne.com/research

INTERNATIONAL PRESENCE

CIMNE has established 2 international branches: CIMNE Latin America and CIMNE USA and has also set up an international network of Aulas CIMNE (Joint Labs) with 29 members: 6 in Spain and 23 in Latin America; aulas.cimne.com. The International Association of Aulas CIMNE (AIAC), created by CIMNE in 2015, aims to coordinate and foster the activities on the Aulas CIMNE network (See “[Alliances Section](#)”).

RESEARCH OUTPUTS

In 2020 CIMNE researchers published 110 papers in JCR journals, 85,3% of the papers were published in first quartile journals. Since 1987 CIMNE researchers have published some 2,800 JCR journal papers, 46 text-books, 87 edited books, 276 monographs, 417 RTD reports, 643 technical reports and organized 227 international scientific conferences. CIMNE has 6 patents.

CIMNE scientists are chief editors or associated editors of 6 JCR journals and members of the editorial board of 15 JCR journals.

Since 1987 CIMNE researchers have taken part in 1,765 RTD projects, including 11 projects funded by the European Research Council. In 2020 CIMNE researchers have taken part in 72 RTD projects funded by international (29 projects) and national (43 projects) organizations which have meant funding of 3,40 M€ for CIMNE. In the same period CIMNE had 133 RTD contracts with companies and private organizations amounting some 3,20 M€.

In 2020 CIMNE managed 2 international MSc courses, 2 PhD programs and organized 7 seminars and 4 CIMNE Coffee Talks. In the same year CIMNE research staff supervised 60 PhDs. 13 PhD theses were successfully completed that year.

Research at CIMNE has lead to many software codes that are useful for solving specific problems in each of the engineering areas addressed. The “[CIMNE Products](#)” section of this report lists the main software codes developed at CIMNE.

CITATION RECORDS

By March 2021, CIMNE scientists had an h index of 132 and some 81,300 citations (Source: Google Scholar). Scopus records 663 JCR papers for the period 2015-20. Several CIMNE researchers are ranked in the first positions of the ranking for Mathematics & Interdisciplinary Applications and others of engineering created by Group for the Dissemination of the h Index (further information cimne.com/research-rankings).

By March 2021 the Ranking Web of World Research Centres (research.webometrics.info) reports that 108 CIMNE researchers the 91.000 most cited scientists of Spain best scientists in Spain in terms of citations.

MANAGEMENT OF SCIENTIFIC ORGANIZATIONS

CIMNE is the permanent Secretariat of the following scientific organizations:

- International Association for Computational Mechanics (iacm.info)
- European Community on Computational Methods in Applied Sciences (eccomas.org)
- Spanish Association for Numerical Methods in Engineering (semni.org)
- Pilot Centre of the European Research Community in Flow, Turbulence and Combustion (ercoftac.org)
- Unesco Chair on Numerical Methods in Engineering of UPC (cimne.com/unesco). This is the first UNESCO Chair in the world, created in 1989.

TECHNOLOGY TRANSFER

CIMNE has a vocation for technology transfer. Since 2001 it has launched 20 spin-off companies that market products emanating from CIMNE research. Details are given in Section 3.2 and on cimne.com/spin-offs and www.cimnetecnologia.com.

AWARDS TO CIMNE AND ITS SCIENTISTS

Since 1987 CIMNE and its scientists have received some 75 awards by national and international organizations. The total list of CIMNE Awards, and those granted in 2020, can be seen on page 103 and on cimne.com/awards.

ORGANIZATION OF SCIENTIFIC CONFERENCES

The organization of international scientific conferences and workshops related to the research topics in CIMNE is a relevant part of CIMNE research policy.

Since 1987 the CIMNE Conference Bureau Dpt. has organized some 240 international events. In 2020, due to covid-19 crisis, only two international conferences organized by CIMNE were held. Some 17 international events are planned for the period 2021-2023. Details of future and past events organized by CIMNE can be found in Section 5.2 of this report and in congress.cimne.com.

RTD ALLIANCES

CIMNE is a founding partner of the FLUMEN Institute (www.flumen.upc.edu). On July 2017 CENIT (Centre for

Innovation in Transport, cenit.es) merged its current structure into that of CIMNE, thus broadening the scope of the research activities of CIMNE in the field of transport engineering.

CIMNE has established research alliances with numerous prestigious institutions around the world.

A compilation of the most outstanding collaborations can be found in the “Alliances” section of this report.

DISSEMINATION AND COMMUNICATION STRATEGY

Dissemination and communication tasks at CIMNE involve various activities to bring the research outcomes to the attention of as many people as possible. Frequent use of social media tools are used for this purpose (Facebook, Twitter, etc). The Publications Dpt. (cimne.com/publications) of CIMNE publishes research and technical reports, monographs, text and edited books and software codes. The Aulas CIMNE network is also used for dissemination actions.

SCIPEDIA: CIMNE STRATEGY TOWARDS THE HOLISTIC 4.0 OPEN-ACCESS SCIENCE

In March 2016 CIMNE, via its spin-off company Scipedia SL, launched the innovative web platform Scipedia.com with the aim of providing free publishing and Open Access services to disseminate the results of scientific and technical work.

A SELF-SUSTAINED ORGANIZATION

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 2020 the self-obtained income obtained by CIMNE amounted (in average) to some 85% of its total annual budget. **Details of the sources of CIMNE funding in 2020 and in recent years can be found on page 10.**

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.

Eugenio Oñate

Vicepresident and General Director of CIMNE

CIMNE in Numbers

ACTIVITIES	2020
Postgraduate Studies	4
Conferences	2
Seminars	7
Courses	6
Coffee Talks	4
Publications	116
Books	1
Monographs	5
Research Reports	0
Papers in Journals	110
Spin-off Companies	14
Aulas CIMNE	29
Patents	0 (5)
Contracts with Industry	75 (133)
Competitive Projects	15 (72)
National Projects	7 (43)
EU and international Projects	8 (29)

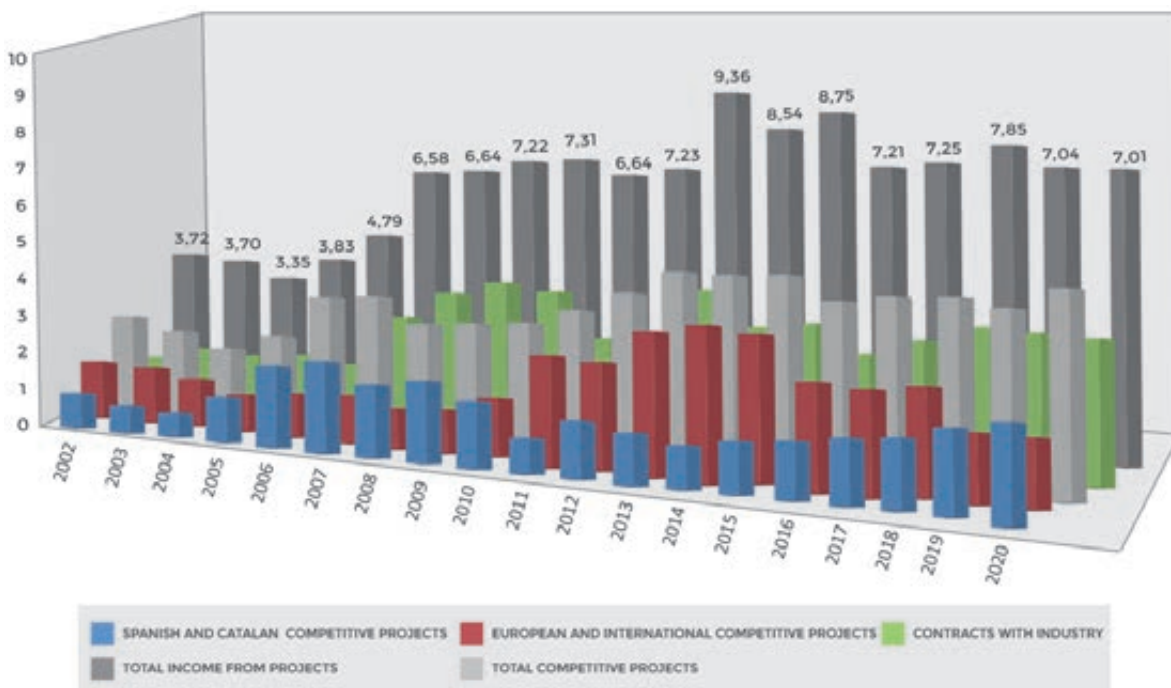
In brackets, the total number of on-going contracts and RTD projects.

STAFF / POSITION TITLE	2020
Management Staff	2
Administration Staff	40
Research Staff	86
Full Research Professors	22
Associate Research Professors	18
Assistant Research Professors	12
Staff Scientists	10
Post Docs	24
Research Engineers	77
Research Students	64
PhD Students	48
Master Students	10
Undergraduate Students	6
TOTAL Staff	269

Income from projects (2002-2020)

in M€

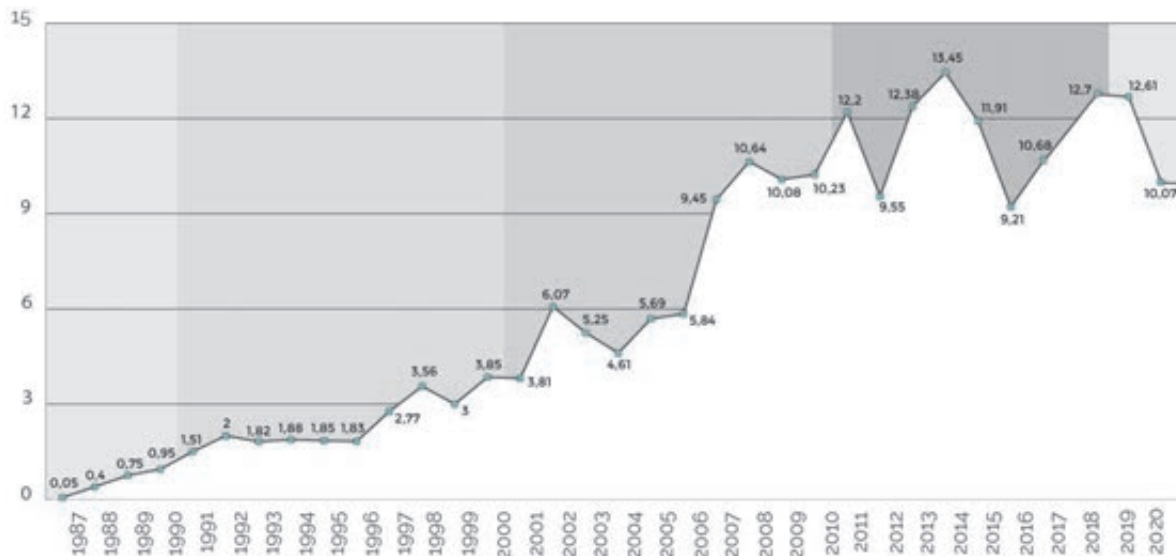
*Data: 23/03/2021 (Pending audit status)



Evolution of Annual income (1987-2020)

in M€

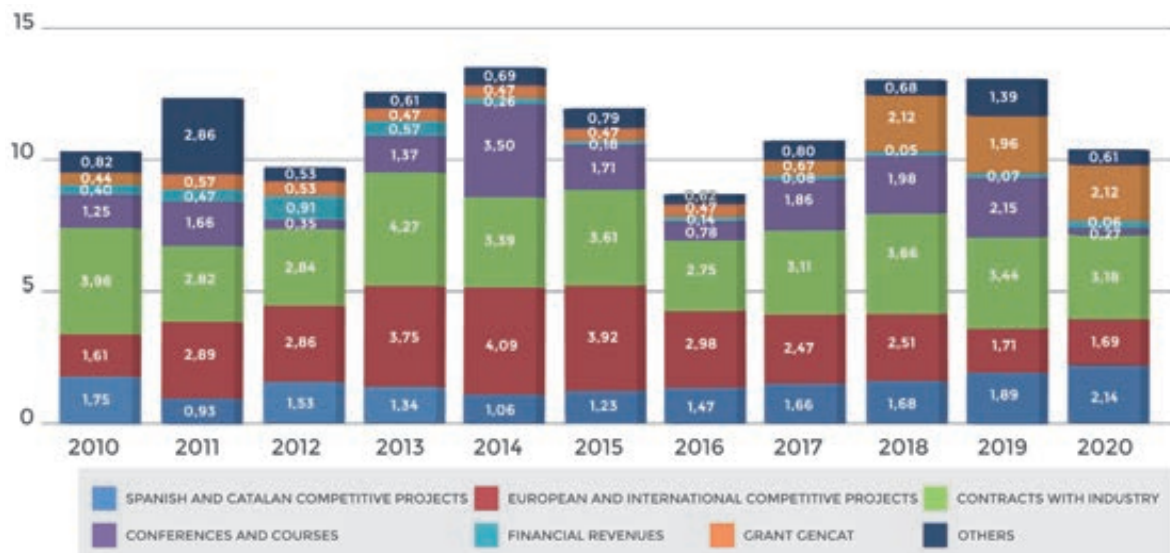
*Data: 23/03/2021 (Pending audit status)



Split of Annual income (2010-2020)

in M€

*Data: 23/03/2021 (Pending audit status)



Governing Bodies

Governing Council

President

Mr. Damià Calvet

President Departament de Territori i Sostenibilitat
(Generalitat de Catalunya)

Representing Catalan Government

Ms. María Matilde Villarroya

Directora General d'Indústria
(Generalitat de Catalunya)

Mr. Isidre Gavín

Secretari d'Infraestructures i Mobilitat
(Generalitat de Catalunya)

Dr. Joan Gómez Pallarès

Director General de Recerca
(Generalitat de Catalunya)

Vice-President

Dr. Eugenio Oñate

Catedràtic (UPC · BarcelonaTech)

Representing UPC · BarcelonaTech

Dr. Francesc Torres

Rector (UPC · BarcelonaTech)

Dr. Luca Pelà

Vicerector of Scientific Policy (UPC · BarcelonaTech)

Dr. Esther Real

Catedràtic (UPC · BarcelonaTech)

Representing UNESCO

Dr. Lluís Ramallo

President of the Spanish Commission of UNESCO

Executive Council

President

Dr. Eugenio Oñate

Catedràtic (UPC ·
BarcelonaTech)

Members

Mr. Xavier Baulies

Departament de
Territori i Sostenibilitat,
Generalitat de Catalunya

Dr. Jordi Berenguer

UPC · BarcelonaTech

Dr. Esteve Codina

UPC · BarcelonaTech

Dr. Pedro Díez

UPC · BarcelonaTech

Dr. Gabriel Bugeda

Catedràtic (UPC ·
BarcelonaTech)

Dr. Antonio Gens

UPC · BarcelonaTech

Dr. Alejandro Josa

UPC · BarcelonaTech

Dr. Juan Miquel

UPC · BarcelonaTech

Dr. Juan Jesús Pérez

UPC · BarcelonaTech

Dr. Estanislau Roca

UPC · BarcelonaTech

Dr. Lluís Rovira

Institució Centres de
Recerca de Catalunya

Ms. Ana Simon

ACCIÓ, Generalitat de
Catalunya

Dr. Cecilia Soriano

UNESCO

Scientific Advisory Council

The Advisory Scientific Council (ASC) of CIMNE is formed by prestigious international researchers in the field of numerical methods in engineering.

Its role is to provide advice and guidance to the Executive and Governing Councils of CIMNE on the scientific policy of CIMNE.

ASC Chaired by:



Prof. PETER WRIGGERS
(President)

Leibniz University
Hannover, Germany

The other members are:



Prof. JAVIER BONET

Greenwich University, UK



Prof. MANUEL CASTELEIRO (†)

A Coruña University,
Spain



Prof. FRANCISCO CHINESTA

ENSAM Paris, France



Prof. LAURA DE LORENZIS

ETH Zurich, Switzerland



Prof. JOSEF EBERHARDSTEINER

Vienna University, Austria



Prof. PÄR JONSEN

Lulea University, Sweden



Prof. MICHAEL KLEIBER

Academy of Sciences,
Poland



Prof. RAINALD LOHNER

George Mason University,
USA



Prof. MANOLIS PAPADRAKAKIS

National Technical Univ.,
Athens, Greece



Prof. UMBERTO PEREGO

Politecnico di Milano,
Italy



Prof. SIMONA PEROTTO

Politecnico di Milano, Italy



Prof. EKEHARD RAMM

Stuttgart University,
Germany



Prof. BERNHARD SCHREFLER

Padova University, Italy



Prof. KAREN VEROY

Eindhoven University,
The Netherlands



Prof. ROLAND WUCHNER

Technical University of
Munich, Germany

Organization Chart

GOVERNING COUNCIL

Chair: Damià Calvet

EXECUTIVE COUNCIL

Chair: Eugenio Oñate

SCIENTIFIC ADVISORY COUNCIL

Chair: Roger Owen (†)

GENERAL DIRECTOR

Eugenio Oñate

SCIENTIFIC DIRECTOR

Pedro Díez

PROJECT DEVELOPMENT DIRECTOR

Fernando Salazar

INSTITUTIONAL RELATIONS DIRECTOR

Gabriel Bugada

MANAGING DIRECTOR

Anna Font

Research and Tech Development (RTD Areas & Groups) Administration

CIVIL AND ENVIRONMENTAL ENGINEERING

Building, Energy and Environment

Leader - Jordi Cipriano

Disaster Risk and Resilience

Leader - Lilitiana Carreño

Geomechanics

Leader - Antonio Gens

Hydrogeology

Leader - Xavier Sánchez Vila

Machine Learning in Civil Engineering

Leader - Fernando Salazar

River Dynamics and Hydrologic Engineering (FLUMEN Institute)

Leader - Ernest Bladé

Structural Mechanics

Leader - Eugenio Oñate

COMPUTATIONAL MATERIALS DESIGN & ANALYSIS

Computational Design & Analysis of Engineering Metamaterials

Leader - Xavier Oliver

Mechanics of Electroactive Materials

Leader - Irene Arias

Soft and Living Material Interfaces

Leader - Marino Arroyo

ENGINEERING MECHANICS AND PROCESSES

Bio-Medical Engineering

Leader - Eduardo Soudah

Fluid Mechanics

Leader - Ramon Codina

Industrial Manufacturing Processes

Leaders - Michele Chiumenti and Miguel Cervera

INNOVATIVE ALGORITHMS AND HPC TECHNIQUES

Credible Data-driven Models

Leader - Pedro Díez

Kratos Multiphysics

Leader - Riccardo Rossi

Innovative Algorithms for Fast Accurate Computing

Leader - Antonio Huerta

Large Scale Scientific Computing

Leader - Santiago Badia

TRANSPORT AREA

Aeronautics

Leader - Jordi Pons

CENIT Group for Innovation in Multimodal Transport

Leader - Sergi Saurí

Naval and Marine Engineering

Leader - Borja Serván

ACCOUNTANCY AND FINANCES

Leader - M^a Carmen Linares

COMMUNICATION

Leader - Laura Bermúdez

CONGRESS BUREAU

Leader - Cristina Vizcaya

HUMAN RESOURCES

Leader - Irene Latorre

POST-GRADUATE TRAINING

Leader - Lelia Zielonka

PROJECT MANAGEMENT

Leader - Sandra Pérez

PUBLICATIONS

Leader - M^aJesús Samper

SYSTEMS

Leader - Miguel Alonso

INNOVATION SUPPORT AND TECHNOLOGY TRANSFER

Information and Communication Technology

Leader - Jordi Jiménez

Pre and Post Processing

Leader - Abel Coll

Valorization of Research and Technology Transfer

Leader - Javier Marcipar

CIMNE Staff

This is the list of all persons who collaborate with CIMNE at December 31st 2020

Research and Technology Development

FULL RESEARCH PROFESSORS

Carmen Andrade
Carlos Agelet de
Saracibar
Eduardo Alonso
Irene Arias
Marino Arroyo
Santiago Badia
Álex H. Barbat
Gabriel Bugeda
Miguel Cervera
Michele Chiumenti
Ramón Codina
Pedro Díez
Julio García
Antonio Gens
Antonio Huerta
Sergio Idelsohn
Alberto Ledesma
Xavier Oliver
Sebastián Olivella
Sergio Oller
Eugenio Oñate
Xavier Sánchez

ASSOCIATE RESEARCH PROFESSORS

Marcos Arroyo
Ernest Bladé
Juan Carlos Cante
Josep M. Carbonell
Liliana Carreño
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Roberto M. Flores
Oriol Lloberas
Jaime E. Martí
Xavier Martínez
José Javier Muñoz
Núria Pinyol
Javier Príncipe
Enrique Romero
Riccardo Rossi
Pavel Ryzhakov
Fernando Salazar
Borja Serván
Francisco Zárate

ASSISTANT RESEARCH PROFESSORS

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Narges Dialami
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Enrique Ortega
Jordi Pons
Marcelo Raschi
Eduardo Soudah

POST DOCS

Jesús Bonilla
Manuel Caicedo
Guillermo Casas
Giacarlo Cicconofri
Ignasi De Pouplana
Daniel A. García
Matteo Giacomini
Juan M. Giménez
Laura González
Joaquín Irazábal
Gerard Laguna
Bàrbara Llacay
Eric Miranda
Lluís Monforte
Alba Muixí
Anna Ramon
David Roca
Roger Ruiz
Mario A. Salgado
Javier San Mauro
Erdem Toprak
Francesc Verdugo
David J. Vicente
Rubén Zorrilla

STAFF SCIENTISTS

Pedro Arnau
Abel Coll
Stoyan Danov
Alessandra Di Mariano
Eloi Gabaldón
José M. González
Javier Mora
Jacques Périaux
Fernando Rastellini
Cecilia Soriano

RESEARCH ENGINEERS

Diego Aguilera
Laura Almunia
Clara Alvarado
Pere Arrom
Ferran Arrufat
Esther Blanco
Alberto Burgos
Jesús Carbajosa
Jordi Carbonell
Marc Carnicero
Miguel Ángel Celigueta
Uxue Chasco
Alexis Cid
Martí Coma
Jesús Conde
André Conde
Cloe Cortés
Eglantina Dani
Maria S. De la Fuente
Gaia Di Carluccio
Maria M. Dolz
Enrique Escolano
Nuria Ferrer
Alessandro Fraccica
Óscar Fruitós
Javi Gárate
Francesc Gasparín
Mohammad R. Hashemi
Fernando Hermosilla
Jordi Jiménez
Joel Jurado
Judith Landinez
Salva Latorre
Sergi Macián
Genís Majoral
África Marrero
Laura Martínez
Josep Mayós
Adrià Melendo
Arisleidy Mesa
Anna Monros

Research and Technology Development

RESEARCH ENGINEERS (cont)

Gerard Mor
Carlos A. Moreira
Marc Núñez
Gonzalo J. Olivares
Eugenio Oñate Hospital
Moisés Ortega
Fermín Otero
Rafael Pacheco
Miguel Pasenau
Domingo Peñalver
Cristian Pérez
Daniel Pérez
Ángel Diego Priegue
Ivan Puig
Brain Junior Ramírez
Anaïs Ramos
Jaume Roca Francisco
Rodero Alfonso
Rodríguez Carlos A. Roig
Jatnna A. Sánchez
Víctor Sande
Marcos Sanz
Pablo Sanz
Núria Sau
Sergi Saurí
Pablo L. Sierra Joaquim
Soler Mercedes Sondon
Javier Soraluze
Fernando A. Sossa
Deniz C. Tanyildiz
Alberto Tena
Pere-Andreu Ubach
Sergio Valero
Ignacio Valero
María Teresa Yubero
Claudio Zinggerling

RESEARCH STUDENTS

PhD Students

Matías Alonso
Ramón Barboza
Irene Berdugo
Davide Besenzon
Álvaro Borrás
José R. Bravo
Fabiola Cavaliere
Alejandro Cornejo
Zulkeefal Dar
Malik Dawi
Irene de Cubas
Arnau Fabra
Mariano T. Fernández
Oriol Frigola
Javier Garrido
Agustina Giuliodori
Rodrigo A. Gómez
Joaquín González
Sthefania Grajales
Benedetto Grillone
Irene Jaqués
Sergio Jiménez
Alexandros Karkoulas
Pieman Khadivipanah
Floencia Lazzari
Luan Malikoski
Edgar A. Martínez
Arash Moaven
Hossein Mohammadi
Laura Moreno
Christina Nasika
Rafael Nazareth
Rafel Perelló
Albert Puigferrat
Saman Rahmani
Iván Rivet
Daniel Ruiz

Gastón Sal
Samra Sarwar
Nathalia Silva
Daniel Tarragó
Riccardo Tosi
Saeed Tourchi
Francesc Turón
Henning Venghaus
Pablo N. Wierna
Massimiliano Zecchetto
Ningning Zhang

Master Students

Sebastián Ares de Parga
Felipe Camprodon
Francesc Contreras
Pau Gabarrell
Julia García
Selene Liverani
Pau Márquez
Jaime Perelló
Blanca Puche
Ricard Sánchez

Undergraduate Students

Cristina Balart
Eduard Escola
Jaime Marín
Raimon Merce
Matyas Rosta
Laura Santos

VISITING SCIENTISTS

CIMNE promotes the visits of academics and researchers from around the world. Visiting Scientists at CIMNE in 2020:

Visiting Scientists

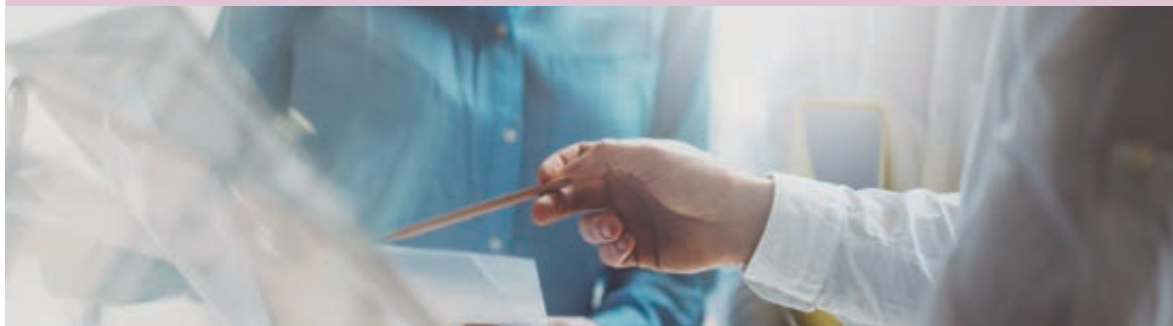
Rainald Löhner
(George Mason University, USA)

Andrea Montanino
(University of Naples Federico II)

Jacques Periaux
(Unesco Professor of Numerical Methods In Engineering)

Ronald Wüchner
(Technical University Munich, Germany)

Administration



GENERAL DIRECTOR

Eugenio Oñate

SCIENTIFIC DIRECTOR

Pedro Díez

PROJECT DEVELOPMENT DIRECTOR

Fernando Salazar

DIRECTOR FOR INSTITUTIONAL RELATIONS

Gabriel Bugada

MANAGING DIRECTOR

Anna Font

Administration staff in CIMNE is formed by highly qualified professionals who address the increasing needs of researchers and scientific personnel in the centre.

ACCOUNTANCY AND FINANCES

M^a Carmen Linares
(*Head of Unit*)
Katherine J. Brenes ^(*)
Valentín Catalán
Nuria Holgado
Elisabet Laya
Cristina Luque
Irene Martínez
Patricia Rivero ^(*)

COMMUNICATION

Laura Bermúdez

CONGRESS BUREAU

Cristina Vizcaya
(*Head of Unit*)
Sami Amin
Alessio Bazzanella
Gemma Barberillo
Mónica Camanforte
Beatriz Rodríguez
Maria del Mar Santiago
Marcela Silhankova

DIRECTOR SECRETARY

Mercè Alberich
Anna Maria Lozano
Maria Rotger

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Irene Latorre

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Francisco de la Rosa
Alicia Pallarés
Jon Rodríguez
Mahavir Singh

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Lelia Zielonka
(*Head of Unit*)
Cristina Pérez

PUBLICATIONS

M^aJesús Samper
(*Head of Unit*)
Jesús Sánchez

RECEPTION

Jordi López

SYSTEMS

Miguel Alonso
(*Head of Unit*)
José Luis Estragués
Pol González
Aitor Lázaro
Oscar Ruiz

TECHNICAL STAFF

Lisa Jane Grace
Andreu Marí
Javier Tous

TECHNOLOGY TRANSFER

Javier Marcipar
Sergio Otero

^(*) Under training plan

Where we are



Photos: C1 Building at Campus Nord UPC Barcelona

Headquarters



B0 Building at Campus Nord UPC Barcelona

Main premises at UPC

CIMNE's main premises are located at the heart of the North Campus of Universitat Politècnica de Catalunya · BarcelonaTech.

The offices are situated at the C1 Building, adjacent to the Civil Engineering School of UPC and occupy some 1,000 m² of modern office facilities and state of the art equipment with last generation computers linked via a fast intranet and a multicore cluster for parallel computing.

This space, created in 1987, hosts around 90 CIMNE researchers and the main administration offices.

CIMNE-BARCELONA

Campus Nord UPC, C1 Building
C/ Gran Capità, S/N, 08034 Barcelona, Spain
+34 93 401 74 95

B0 Building

In September 2014 CIMNE started the construction of a new building of some 2,000 m² in the North Campus of the Universitat Politècnica de Catalunya · BarcelonaTech.

The B0 building, that also hosts the Flumen Institute, was completed by the end of 2015. Several CIMNE researchers moved to the new facilities during the first months of 2016. This new building is equipped with modern experimental facilities for model scale testing of river dynamic and hydraulic problems and it also provides work areas for researchers at the graduate level (master, doctoral and postdocs) and for senior researchers from CIMNE and UPC · BarcelonaTech.

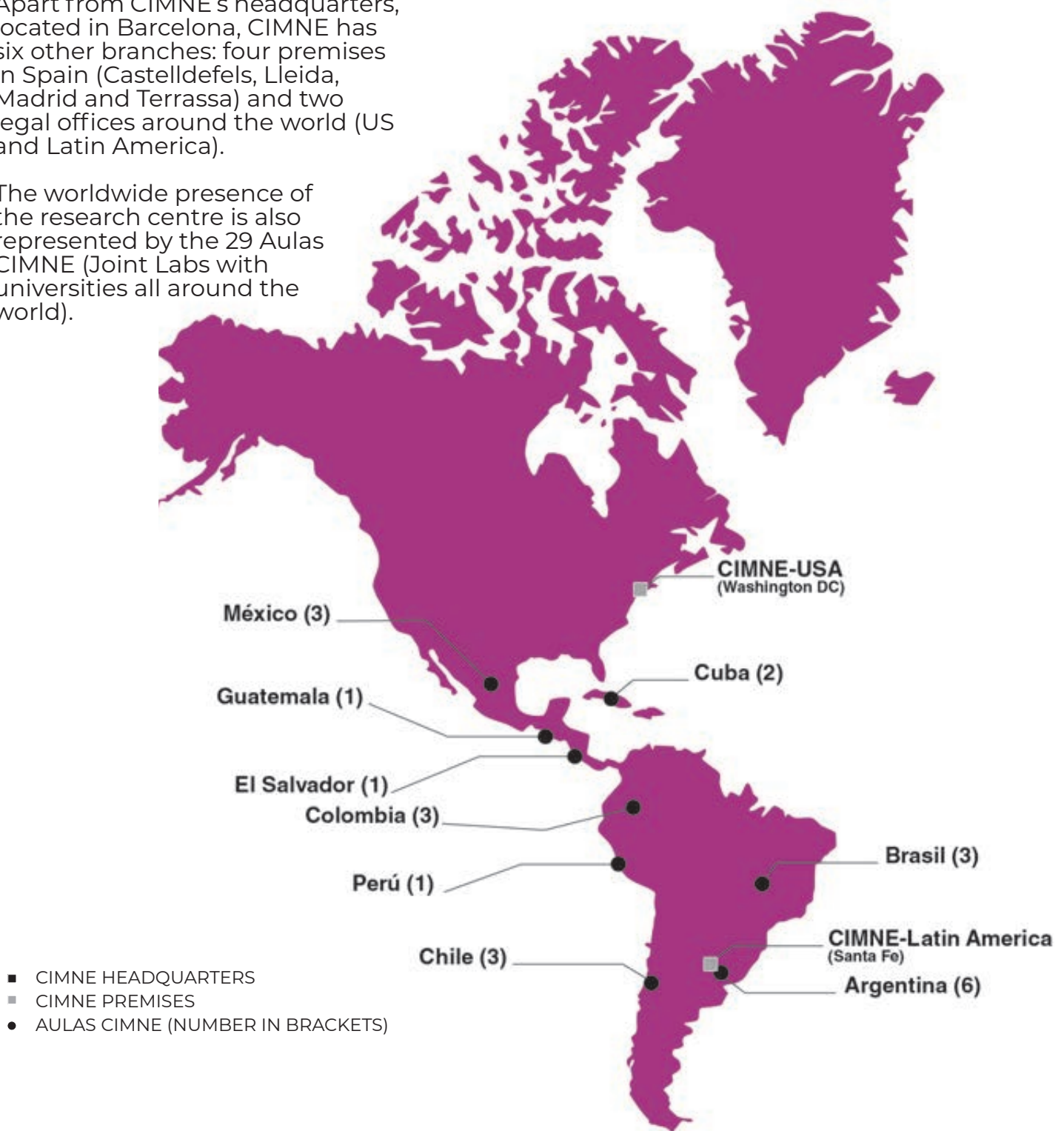
CIMNE-B0

Campus Nord UPC, B0 Building
C/ Gran Capità, S/N, 08034 Barcelona, Spain
+34 93 401 09 50

CIMNE Premises

Apart from CIMNE's headquarters, located in Barcelona, CIMNE has six other branches: four premises in Spain (Castelldefels, Lleida, Madrid and Terrassa) and two legal offices around the world (US and Latin America).

The worldwide presence of the research centre is also represented by the 29 Aulas CIMNE (Joint Labs with universities all around the world).





Premises in Spain



CIMNE - Terrassa

CIMNE offices in Terrassa (Barcelona, Spain) opened in 2001. The premises cover an area of 150m² and house part of the department of Building Energy and Environment Group (BeeGroup).

Director: J. Cipriano

Address

Campus de Terrassa UPC
Edifici GAIA (TR14)
C/ Rambla Sant Nebridi, 22
08222 Terrassa (Barcelona), Spain
+34 93 789 91 69



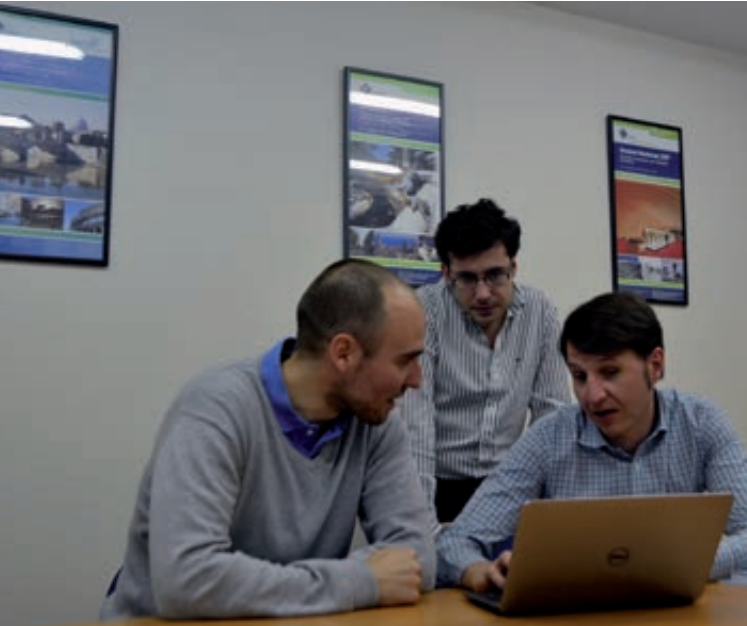
CIMNE - Castelldefels

CIMNE's headquarters in the city of Castelldefels (Barcelona, Spain) were inaugurated on October 15th 2008. The facilities are located in the building CIMNE-C3 of the Mediterranean Technology Park of the UPC, and occupy 1,500m² in a new building constructed in collaboration with the UPC. The premises are shared with the Technical School of Castelldefels.

Director: J. Mora

Address

Campus del Baix Llobregat UPC
CIMNE Building C3
C/ Esteve Terradas, 5
08860 Castelldefels, Barcelona, Spain
+34 93 413 41 86



CIMNE - Madrid

CIMNE - MADRID started its activities in September 2007 and on May 2008 CIMNE opened its premises located in the centre of the city (150m²). The main goal of CIMNE Madrid is to build a strong research team in Madrid and foster the links between CIMNE, the Central Government of Spain, the Technical University of Madrid (UPM) and partner companies and research centres based in Madrid.

Director: F. Salazar

Address

Paseo General Martínez Campos, 41, 9º
28010 Madrid, Spain
Tel. +34 91 319 13 59



CIMNE - Lleida

CIMNE's premises in Lleida are located at the Eurotrading building, besides the Cappont Campus of the University of Lleida (UdL). The 130 m² office is surrounded by more than 30 companies from different sectors in the same building and the proximity to the University of Lleida gives CIMNE Lleida a strategic position.

Director: J. Cripiano

Address

Eurotrading Building

Pere de Cabrera, 16, 2G
25002 Lleida

Tel: +34 873 991 354 / +34 873 991 737

International Branches

CIMNE-USA (Washington DC, USA)

CIMNE-USA is an educational and scientific research organization, affiliated with the International Centre for Numerical Methods in Engineering (CIMNE).

The objective of CIMNE-USA is leading scientific research and development projects supported by government, foundations and industry sources.

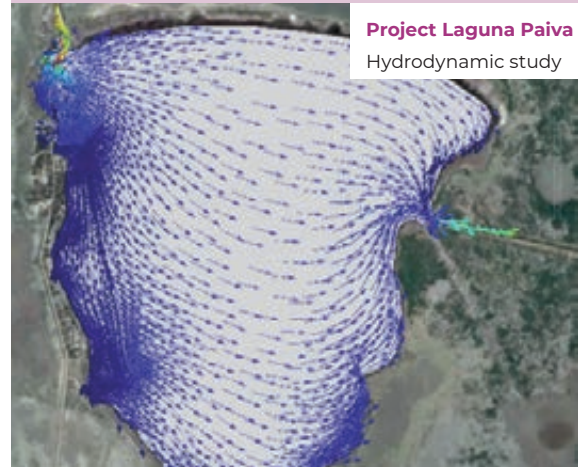
The branch also carries out educational activities related to advanced numerical methods. It participates in national and international conferences and symposia and works jointly with Aulas CIMNE, in cooperation with US and international universities. CIMNE-USA also supports visiting scientists.



Dr. David Cranmer (on the left side photo), CIMNE US Acting Executive Director, is a senior scientist at the National Institute of Standards and Technology (NIST) and advisor of many US companies. Mr. Varadaraju (Raju) Gandikota (on the right side photo) is CIMNE USA Scientific Director.



CIMNE-Latin America (Santa Fe, Argentina)



Project Laguna Paiva
Hydrodynamic study

CIMNE is represented in Latin America by the CIMNE Iberoamérica Foundation (CIMNE Iber).

CIMNE Iber is located at the city of Salta in Argentina. It was created in 2020 with strong support from the University of Salta and other local academic organizations in the region. It is also supported by the CIMNE Classroom in University of Salta.

The director of CIMNE Iber is Prof. Sergio Oller, a Full Research Professor at CIMNE for over 25 years.

CIMNE Iber aims to developing and disseminating research activities in the field of numerical methods in engineering in cooperation with CIMNE and other academic organizations. It has also a strong vocation for supporting industry in the development of innovative solutions.

CIMNE Iber will also play an important role in fostering and coordinating the activities of the CIMNE Classroom Network in the Latin American region.



TOTAL: **29** AULAS CIMNE

Argentina ●●●●●●

Brazil ●●●

Chile ●●●

Colombia ●●●

Cuba ●●

El Salvador ●

Guatemala ●

Mexico ●●●

Peru ●

Spain ●●●●●●

Aulas CIMNE

Aulas CIMNE are physical spaces (Joint Labs) for cooperation in education, research and technological development (RTD) activities created jointly by CIMNE and one or several universities.

The 29 Aulas CIMNE promote educational and training activities at graduate and postgraduate level and development of RTD projects in cooperation with companies around the world.

AULA FICH – CIMNE (Argentina)**Universidad Nacional del Litoral**Director: Gerardo FranckCreated on: October 2002Activity: Applications of numerical methods to problems related to water resources, mechanical and computer engineering.**AULA ITBA – CIMNE (Argentina)****Instituto Tecnológico de Buenos Aires**Director: Sebastián d'HersCreated on: April 2015Activity: Application development of numerical methods in the field of mechanical, naval, petroleum, chemical, electronics, electrical, industrial engineering and bioengineering.**AULA IUA – CIMNE (Argentina)****Instituto Universitario Aeronáutico**Director: Carlos SaccoCreated on: September 2002Activity: Applications of numerical methods to problems related to fluid mechanics, structures, heat transfer, etc.**AULA UNER – CIMNE (Argentina)****Universidad Nacional de Entre Ríos**Director: José Di PaoloCreated on: March 2013Activity: Applications of numerical methods to problems related to Bioengineering.**AULA UNSA – CIMNE (Argentina)****Universidad Nacional de Salta**Director: Liz NallimCreated on: April 2008Activity: Development of computer models for application in civil engineering.**AULA UNT – CIMNE (Argentina)****Universidad Nacional de Tucumán**Director: Guillermo EtseCreated on: November 2002Activity: Development of computational models of bridges (degradation and repair mechanisms).**AULA FEMEC – CIMNE (Brazil)****Universidad Federal de Uberlândia**Director: Gilmar GuimarãesCreated on: April 2004Activity: Forming process applications, structural design and biomechanics.**AULA IFSP – CIMNE (Brazil)****Instituto Federal de Educação, Ciência e Tecnologia de São Paulo**Director: Clayton dos SantosCreated on: July 2009Activity: Applications of numerical methods in engineering problems in forming processes, solid mechanics and biomechanics.**AULA ISF – CIMNE (Brazil)****Instituto Federal de Educação, Ciência e Tecnologia de Goiás**Director: Écio NavesCreated on: October 2018Activity: Applications of numerical methods in engineering problems.**AULA DIMEC – CIMNE (Chile)****Universidad Técnica Federico Santa María**Director: Franco PerazzoCreated on: March 2004Activity: Numerical methods in mechanical engineering. Development of numerical methods without mesh. Applications in Engineering.**AULA FIULS (Chile)****Universidad La Serena**Director: Jaime CampbellCreated on: 2019Activity: Applications of numerical methods to problems in Engineering.**AULA PUCV (Chile)****Pontificia Universidad Católica de Valparaíso**Director: Juan Carlos VielmaCreated on: October 2017Activity: Numerical Methods for the evaluation of seismic vulnerability of structures, dynamic response of non-linear structures and pre-seismic reinforcement techniques.**AULA UNC – CIMNE (Colombia)****Universidad Nacional de Colombia**Director: Jairo Andrés ParedesCreated on: June 2005Activity: Numerical methods applied to civil engineering.**AULA UNIMAR – CIMNE (Colombia)****Universidad Mariana de Colombia**Director: Jorge Hernan López MeloCreated on: May 2018Activity: Structural analysis.

AULA UNIANDES – CIMNE (Colombia)**Universidad de los Andes**Director: René MeziatCreated on: January 2003Activity: Teaching and research in numerical methods, optimization, variational principles and computational mechanics.**AULA UCI – CIMNE (Cuba)****Universidad de las Ciencias Informáticas**Director: Jorge GulínCreated on: October 2015Activity: Development of computational models and tools with application in high performance computation.**AULA UCLV – CIMNE (Cuba)****Centro de Investigación de métodos computacionales y numéricos en la ingeniería. Universidad Central de las Villas**Director: Carlos RecareyCreated on: July 2003Activity: Modelling and analysis of structures and grounds to the application of numerical methods.**AULA UCA – CIMNE (El Salvador)****Universidad Centroamericana "José Simeón Cañas" UCA**Director: Mauricio PohlCreated on: February 2010Activity: Civil eng. applications and multi objective optimization and applications.**AULA UMG – CIMNE (Guatemala)****Universidad Mariano Gálvez**Director: Rolando TorresCreated on: February 2011Activity: Development of computer models for application in civil engineering.**AULA CIMAT – CIMNE (Mexico)****Centro de Investigaciones en Matemáticas**Director: Salvador BotelloCreated on: June 2006Activity: Applied mathematics, numerical methods, engineering and statistical analysis.**AULA UGTO – CIMNE (Mexico)****Universidad de Guanajuato**Director: Gerardo ValdésCreated on: January 2002Activity: Civil engineering applications and multi objective optimization and applications.**AULA MORELIA – CIMNE (Mexico)****Universidad Michoacana de San Nicolás de Hidalgo**Director: Francisco DomínguezCreated on: October 2015Activity: Civil, mechanic and electric engineering.**AULA PUCP – CIMNE (Peru)****Universidad Católica de Perú**Director: Rosendo FrancoCreated on: April 2009Activity: Modelling and analysis of structures and grounds to the application of numerical methods.**AULA ESEIAAT – CIMNE (Spain)****UPC - BarcelonaTech Terrassa**Directors: Roberto Flores; Óscar FruitósCreated on: April 2007Activity: Industrial and aeronautical engineering**AULA EEBE – CIMNE (Spain)****Escuela Técnica de Ingeniería Industrial**Director: Daniel Di CapuaCreated on: July 2001Activity: Development of numerical methods in industrial and civil engineering.**AULA ETSINO – CIMNE (Spain)****Universidad Politécnica De Cartagena**Director: José GutiérrezCreated on: May 2018Activity: Development of numerical naval engineering.**AULA FNB – CIMNE (Spain)****Facultad de Náutica de Barcelona**Director: Julio GarcíaCreated on: March 2002Activity: Applications of numerical methods to problems related to marine engineering.**AULA UPM – CIMNE (Spain)****Universidad Politécnica de Madrid (UPM)**Director: Rafael Morán; Miguel Ángel ToledoCreated on: May 2010Activity: Applications of numerical methods in civil engineering.**AULA ETS Ingenieros Industriales UPM – CIMNE (Spain)****Universidad Politécnica de Madrid (UPM)**Director: Jorge RodríguezCreated in: February 2021Activity: Development and applications of numerical methods in engineering



Research

CIMNE, Centre of Excellence Severo Ochoa



The International Centre for Numerical Methods in Engineering received the Severo Ochoa accreditation in December 2019. CIMNE became thus one of the six “Centre for Excellence Severo Ochoa” accredited by the Spanish State Research Agency (attached to the Spanish Ministry of Science, Innovation and Universities).

With this action, the Ministry of Science, Innovation and Universities aims to promote high-impact research carried out in the R&D centres of Spain.

CIMNE has reinforced and reorganized its current research activities in order to contribute to overcome Four Scientific Challenges of high impact to the welfare of citizens:

Severo Ochoa Centres stand out both for the international notoriety of the scientific contributions they make, and for their innovative capacity and their intense relationship with the business sector. They are also world reference centres capable of attracting international talent.

Research Challenges & Goals

4 Research Challenges (*)

(*) These challenges are aligned with the research and technical development (RTD) priorities of European Commission (EC) H2020 priorities and the Plan Estatal de Investigación Científica y Técnica y de Innovación 2017-2020.



RCh1. CONSTRUCTION & TRANSPORT:

The enhanced design of buildings and constructions, transport infrastructure and vehicles.

RCh2. ENVIRONMENT, ENERGY & SECURITY: A more environmentally-friendly and safer planet.

RCh3. MANUFACTURING:

A more competitive industrial sector.

RCh4. MATERIALS:

The development of new materials with functional properties for engineering applications.

RCh1 - CONSTRUCTION & TRANSPORT

Enhanced design of buildings, constructions, transport infrastructure and vehicles.

RCh 1.1. NEW NM FOR ANALYSIS OF CONSTRUCTIONS WITH NEW MATERIALS

Design and construction of new sustainable, safer and affordable buildings and infrastructures.

RCh 1.2. NEW NM FOR ANALYSIS OF CONSTRUCTIONS WITH NEW MATERIAL

Design of new aircrafts with improved features, such as reduced energy consumption and environmental impact, and increased safety of air transport.

RCh 1.3. NEW NM FOR ENHANCED DESIGN OF SHIPS AND MARINE STRUCTURES WITH IMPROVED PERFORMANCE AND ENVIRONMENTAL FEATURES

Design and construction of environmentally friendly and faster ships that can meet the challenges of the maritime transport.

RCh2 - ENVIRONMENT, ENERGY & SECURITY

Towards a more environmental-friendly and safer planet.

RCh 2.1. NM FOR ENVIRONMENTAL BIOTECHNOLOGY

New Numerical Methods for:

- Wetlands for wastewater treatment;
- Water bodies, the atmosphere, animals & lands.
- Surface reactive barriers for reducing the risk of organic compounds to human and ecosystems

RCh 2.2. ADVANCED NM FOR THE PREDICTIVE IMPACT OF HAZARDS ON THE BUILT INFRASTRUCTURE AND THE ENVIRONMENT

Development of NM, fed with information from satellites, drones and monitoring devices at the small scale, processed via Big Data techniques, for studying:

- The effect of water hazards on constructions and landscape.
- The effect of earthquakes on the built environment
- The motion of pedestrians in hazards.
- Air pollution in cities.
- The effect of explosions and fire on structures.
- The creep-like motion and evolution of landslides.
- The vulnerability and resilience of transport networks in hazards.

RCh3 - MANUFACTURING

Numerical Methods for the predictive design of forming manufacturing processes to achieve affordable final products made of metallic and polymer-based materials with the desired functionalities.

- **Applications:** additive manufacturing, sheet stamping, casting, welding, forging, machining, rolling and extrusion, etc.

RCh4 - MATERIALS

Numerical Methods (NM) for analysis and predictive design of multifunctional architected materials.

Development of new materials with functional properties for engineering applications:

- In photonics and acoustics for attenuating selected ranges of frequencies
- To produce ultra-light materials with desired mechanical properties
- Nonlinear metamaterials exhibiting extreme shock absorbing and restitution capacities
- Biological active meta-materials (organ-on-a-chip devices)



RTD Areas and Groups

RTD AREAS AND GROUPS			
CIVIL AND ENVIRONMENT ENGINEERING		COMPUTATIONAL MATERIALS DESIGN & ANALYSIS	
BUILDING, ENERGY AND ENVIRONMENT PI: Jordi Cipriano	MACHINE LEARNING IN CIVIL ENGINEERING PI: Fernando Salazar	COMPUTATIONAL DESIGN & ANALYSIS OF ENGINEERING METAMATERIALS PI: Xavier Oliver	
DISASTER RISK AND RESILIENCE PI: Liliana Carreño	RIVER DYNAMICS AND HYDROLOGIC ENGINEERING (FLUMEN INSTITUTE) PI: Ernest Bladé	MECHANICS OF ELECTROACTIVE MATERIALS PI: Irene Arias	
GEOMECHANICS PI: Antonio Gens	STRUCTURAL MECHANICS PI: Eugenio Oñate	SOFT AND LIVING MATERIAL INTERFACES PI: Marino Arroyo	
HYDROGEOLOGY PI: Xavier Sànchez-Vila			
ENGINEERING MECHANICS AND PROCESSES		INNOVATION SUPPORT AND TECHNOLOGY TRANSFER	
BIO-MEDICAL ENGINEERING PI: Eduardo Soudah		INFORMATION AND COMMUNICATION TECHNOLOGY PI: Jordi Jiménez	
FLUID MECHANICS PI: Ramon Codina		PRE AND POST PROCESSING PI: Abel Coll	
INDUSTRIAL MANUFACTURING PROCESSES PI: Michele Chiumenti and Miguel Cervera		VALORIZATION OF RESEARCH AND TECHNOLOGY TRANSFER PI: Javier Marcipar	
INNOVATIVE ALGORITHMS AND HPC TECHNIQUES		TRANSPORT	
CREDIBLE DATA-DRIVEN MODELS PI: Pedro Díez		AERONAUTICS PI: Jordi Pons	
KRATOS MULTIPHYSICS PI: Riccardo Rossi		CENIT - INNOVATION IN TRANSPORT PI: Sergi Saurí	
INNOVATIVE ALGORITHMS FOR FAST ACCURATE COMPUTING PI: Antonio Huerta		NAVAL AND MARINE ENGINEERING PI: Borja Serván	
LARGE SCALE SCIENTIFIC COMPUTING PI: Santiago Badia			

Building, Energy and Environment

The Building Energy and Environment Group (BEE Group) is an autonomous department of the International Centre for Numerical Methods in Engineering (CIMNE) involving over 15 researchers (Physics, Engineering, ICT, Environmental Science and Statistics specialists). It was founded in 2001 and has two main offices, one in the GAIA building of the UPC Campus in Terrassa and the other in the EUROTRADE building in Lleida.



BEE Group scouts the science world looking for knowledge and inspiration. Developing better building energy management by improving precision, providing faster response, setting up adaptive and predictive control and making buildings more responsive to users' requirements and wishes.

Making energy data more useful to professionals and companies by reducing cost and increasing applicability and reliability through Big Data Analytics, personalized energy services and adaptive visual interfaces and mobile applications.

BEE Group collaborates with national and international leading research centers and public and private companies to develop research projects related with energy, buildings and the environment.

Research

Demand response in buildings. PI: Gerard Mor

Development of technologies to maximize impact of more efficient electricity consumption, optimize use of renewable at the same scale for use when demand does peak. The solutions take data driven models to manage user behavior according to energy generation through monitoring, analysis and validation of Demand Response algorithms.

Energy empowerment and user behavior.

PI: Stoyan Danov

Development of data driven user behavior models with the aim of defining the occupancy and user activity pattern to improve the quality of information provision to empower citizens to participate more actively in their energy expenses.

Big Data analytics for energy efficiency in buildings. PI: Jordi Carbonell

Development of data driven models to get insights of the energy performance of huge amounts of buildings in real operation conditions: energy simulation, energy management practices, web services and monitoring devices in real buildings.

Bio-digesters. PI: Jaime Martí

Knowledge transfer since 2001 on design, implementation, installation and monitoring of domestic and industrial bio-digesters, adapted to simple technologies in cold climates, especially in the Andean region.

nZEBs and Energy positive living.

PI: Jordi Cipriano

Working actively to promote energy positive buildings and energy communities. BEE Group develops methodologies and technologies to facilitate the local energy transition at building and neighborhood levels.

Staff

Jordi Cipriano
(Leader)
Jordi Carbonell
Francesc Contreras

Stoyan Danov
Eloi Gabaldón
Benedetto Grillone

Gerard Laguna
Florescia Lazzari
Selene Liverani

Jaime E. Martí
Edgar Alexis
Martínez

Josep Mayós
Gerard Mor
Daniel Pérez

On-going RTD Projects

BIGG - Building Information aGGregation, harmonization and analytics platform
EC - H2020 - SC3-Secure, clean & efficient energy
Coordinator: REALDOLMEN NV - 01/12/2020 - 30/11/2023

EN-TRACK - Energy Efficiency Performance-Tracking Platform for Benchmarking Savings and Investments in Buildings
EC - H2020 - SC3-Secure, clean & efficient energy
Coordinator: CIMNE - 01/11/2020 - 31/10/2023

EKATE - Gestión de Energía Eléctrica Fotovoltaica y Autoconsumo Compartido en la zona transfronteriza Francia-España, utilizando tecnología "Blockchain" e "Internet of Things (IoT)"
EC - Interreg POCTEFA
Coordinator: ESTIA - 01/01/2018 - 31/05/2022

FEM IOT - Valorització de les dades de la IoT (P2)
GENCAT - Activitats Emergents
Coordinator: CIMNE - 31/12/2019 - 28/02/2022

FLEXCoop - Democratizing energy markets through the introduction of innovative flexibility-based demand response tools and novel business and market models for energy cooperatives
EC - H2020 (2014-2020)
Coordinator: Fraunhofer - 01/10/2017 - 31/01/2021

GAVIUS - From reactive to proactive public administrations
EC - UIA Initiative
Coordinator: Ajuntament de Gavà
01/09/2019 - 31/08/2022

PIPLATES - Plataforma de Predicció Territorial
GENCAT - Tecnologies Digitals Avançades
Coordinator: CIMNE - 01/07/2020 - 30/06/2022

SENSEI - Smart Energy Services Integrating the Multiple Benefits from Improving the Energy Efficiency of the European Building Stock
EC - H2020 - SC3-Secure, clean & efficient energy
Coordinator: IEECP - 01/09/2019 - 31/08/2022

Sim4Blocks - Simulation Supported Real Time Energy Management in Building Blocks
EC - H2020 - SC3-Secure, clean & efficient energy
Coordinator: ZAFH - 01/04/2016 - 31/09/2020

Collaboration agreements

PNB: Programa Nacional de Biodigestores en Ecuador: Design and Scale-up of Climate Resilient Waste Management and Energy Capture Technologies in Small and Medium Livestock Farms.
Duration: 2018-2020

Technology transfer

The BEE Group collaborates with national and international companies and institutions since 2001, a long journey with some 50 national and international RTD projects that has carried on a trade to emerge two new business "Start-ups": Inergy (created in 2012) and Beedata Analytics (created in 2017).

beedata

inergy
R&D Gasol Címic Energy, SL

Further information at "Spin-off Companies" section at page 85.

Disaster Risk and Resilience

The Disaster Risk and Resilience Group (DRR Group) focuses on the development of prospective models to estimate possible economic and human losses caused by events with a natural and anthropogenic origin. This includes the development of multi-hazard catastrophe risk models at different scales and the use of a multidisciplinary and comprehensive framework that considers socio-economic and lack of resilience indicators.

Current global agendas encourage countries, regions, and cities to manage disaster risk and design climate change adaptation strategies. For that, risk assessments with probabilistic approaches and the development and application of indicators about resilience and disaster risk management provide valuable information to monitor progress in a quantitative manner.

The objective of the DRR Group is to provide approaches, tools, and frameworks to be used in comprehensive risk assessments aiming to have a more resilient society.

The DRR Group has collaborated with several multi-lateral organizations and has been actively engaged in research, consulting, and capacity building activities in different world regions.

Research

Disaster risk assessments at different scales

PI: Liliana Carreño

Risk assessment with a comprehensive approach considering socio-economic and lack of resilience indicators. Development of tools for effective disaster risk management. These tools provide results for risk reduction, emergency attention and support different disaster risk management activities (Marulanda et al. 2020).

Development of indicators for disaster risk evaluation, resilience and disaster risk management. **PI: Liliana Carreño**

Global agendas encourage countries, regions, and cities to maintain efforts to reduce their disaster risk and improve their resilience. The development of indicators to perform such evaluations and perform progress monitoring helps communicate and apply an informed decision-making process (Lantada et al. 2020, Marulanda et al 2020).

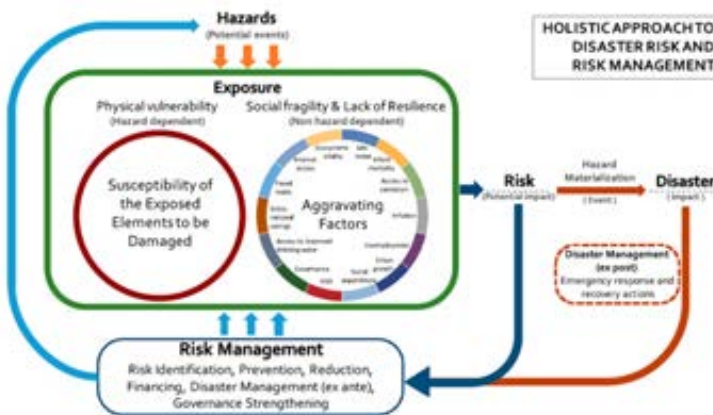
Integration of catastrophe models with financial instruments. **PI: Mario A. Salgado**

Probabilistic catastrophe models provide required data for the structuring and design of financial protection strategies. The calibration and validation procedures for different components of the model, index selection, and customization of the models to fit the characteristics of portfolios impact the pricing and reliability of financial protection instruments.

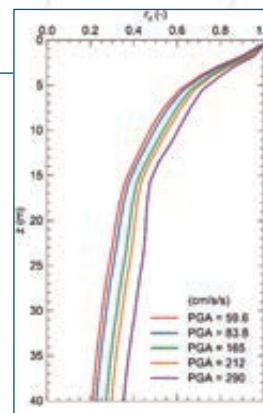
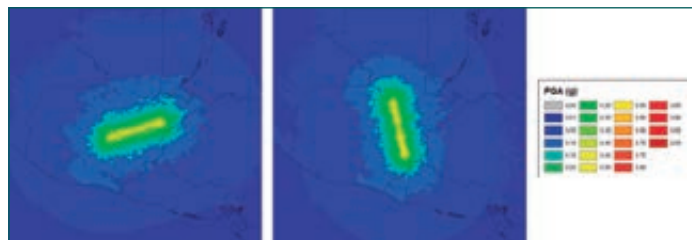
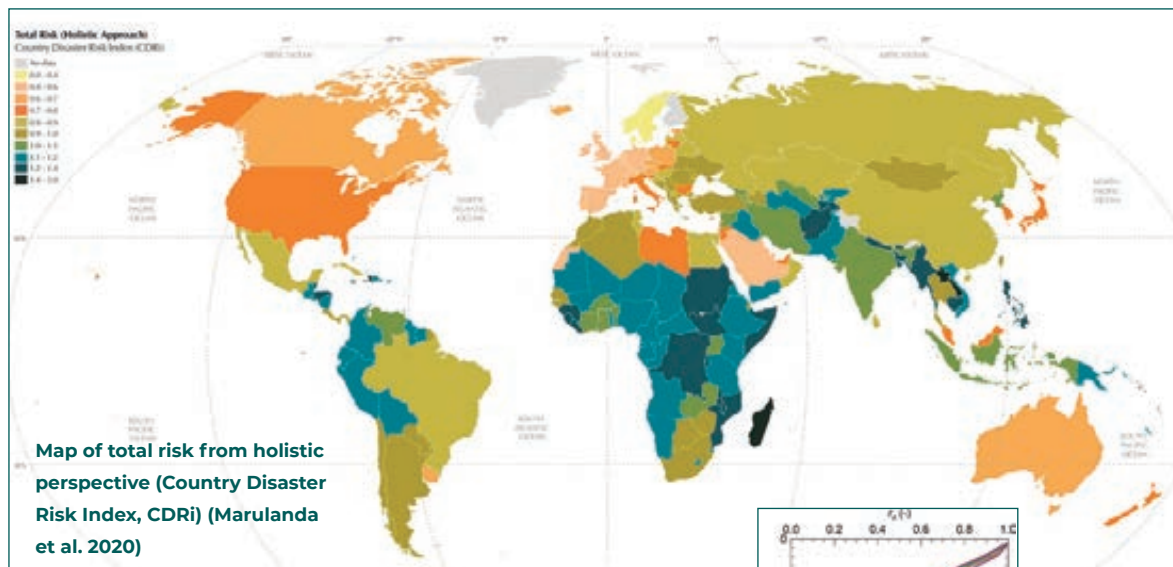
Probabilistic Seismic Hazard Analysis.

PI: Mario A. Salgado

Integration of the liquefaction analysis within the probabilistic seismic hazard framework. Typically, liquefaction analyses are performed for the maximum considered earthquake which selection tends to be highly subjective and does not provide a lot of information about its occurrence frequency. The use of an event-based approach to estimate the liquefaction hazard allows having a more comprehensive description of the problem and is very useful in environments where two or more seismic sources contribute to the overall hazard level.



Conceptual framework of the holistic approach to disaster risk (Marulanda et al., 2020)



On-going RTD Projects

UKRI GCRF HUB - Urban Disaster Risk Hub
UKRI - Interdisciplinary Research Hubs
Coordinator: FLACSO
01/03/2019 - 31/08/2020

Collaboration agreements

Cálculo para la reevaluación de los espectros de piso de los edificios de control y auxiliar de la C.N. de Vandellòs II, mediante la modelización de los edificios, ANAV.

Staff

M. Liliana Carreño (Leader)
Álex H. Barbat
Sthefania Grajales
Sergio Oller
Brain Junior Ramírez
Mario Andrés Salgado

Geomechanics

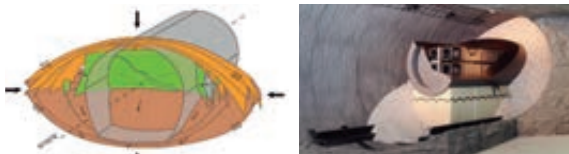
The research work of the Geomechanics Group focuses on the contribution to fundamental understanding and modelling of soil and rock behavior, the development of advanced computational tools and testing techniques at laboratory scale and the participation in applied engineering projects.

Achieving a proper balance among these aspects has been a permanent objective of the group over the years.

The research of the group and the developed software are a reference in the analysis of coupled thermal, hydraulic, mechanical and chemical processes in porous media applied to the analysis and design of underground structures (tunnels, foundations, geo-reservoirs, etc), earth and rockfill dams and fluid-soil-structure interaction problems.

Research

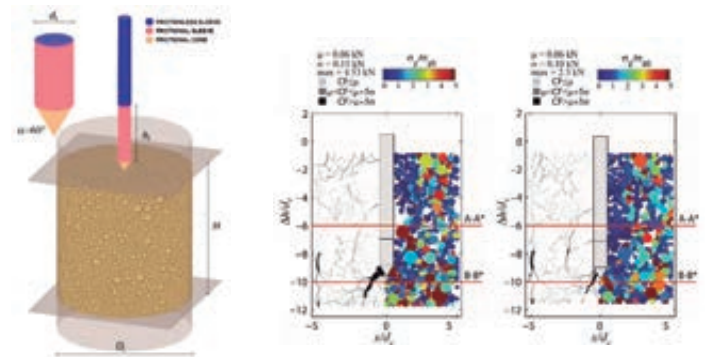
- Coupled multi-physical analyses of porous media. Application to radioactive waste disposal. **PIs:** **Sebastià Olivella** and **Antonio Gens**.



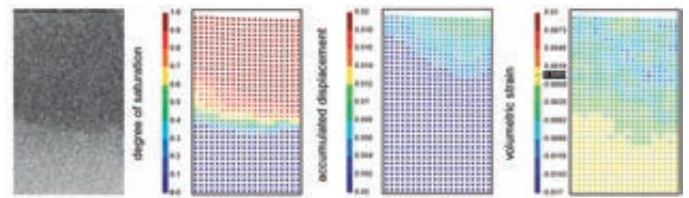
- Numerical analysis of large-scale infrastructure projects. **PI:** **Antonio Gens**



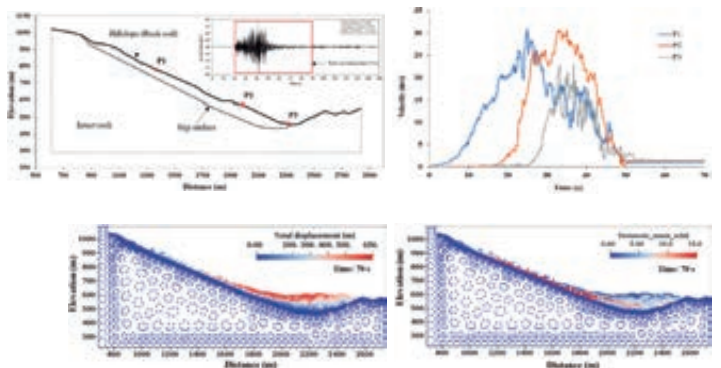
- DEM and PFEM modelling of penetration problems in Geomechanics. **PIs:** **Marcos Arroyo** and **Antonio**



- Advance image analysis techniques for laboratory experiments in soils including large displacements and deformations. Measurements of degree of saturation based on infrared-images. **PI:** **Núria M. Pinyol**.

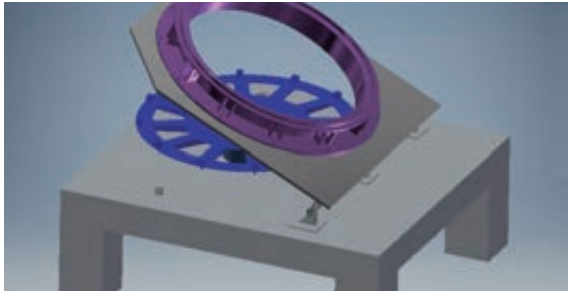


- Thermal-hydro-mechanical large deformation problems in porous media. Development of a Material Point Method open source code. **PI:** **Núria M. Pinyol**.



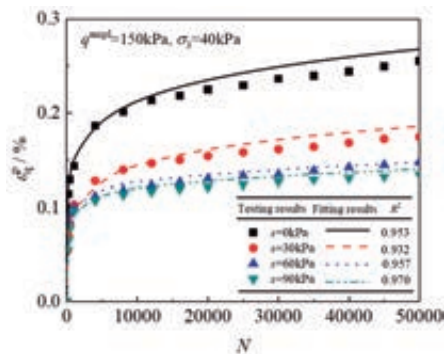
- Thermal accelerated seismic-induced landslides.
- MPM modelling of flow-landslides.





Design and construction of a geotechnical drum centrifuge for evaluating physical models subjected to large displacements and deformations.

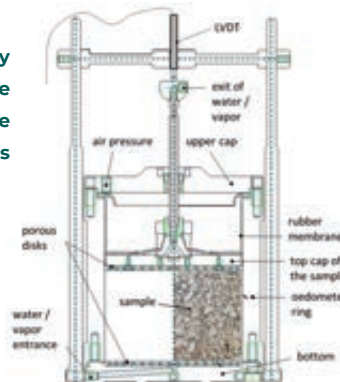
- Unsaturated Soil Mechanics. Experimental and theoretical advances. Application to embankments, dams and radioactive waste disposal. **PI: Eduardo Alonso.**



Comparison of measured deviatoric deformations in high number cyclic triaxial tests of unsaturated compacted samples and model predictions

- Rockfill Mechanics. Particle breakage. Relative humidity effect. DEM modelling. **PI: Eduardo Alonso.**

Relative Humidity controlled device for testing coarse granular aggregates



- Multi-scale experiments and analyses of geomaterials. **PIs: Enrique Romero and Laura González Blanco.**
- Multi-physics experiments and modelling of geomaterials. **PIs: Enrique Romero and Laura González Blanco.**
- Cracking in desiccating soils. **PIs: Alberto Ledesma and Pere Prat.**
- Crystal Growth in sulphated soils and rocks. Swelling and structure interaction. **PI: Anna Ramon.**

Ongoing projects

EURAD - European Joint Programme on Radioactive Waste Management

H2020 (2014-2020) - EURATOM

Coordinator: AALTO

01/06/2019 - 31/05/2024

ANHY_RISK - Risk prediction and safe design in anhydritic rocks

MCIU - Retos Investigación

Coordinator: CIMNE

01/09/2019 - 31/08/2022

SiM - Soil in Motion

MCIU - Retos Investigación

Coordinator: CIMNE

01/01/2019 - 31/12/2022

Staff

Antonio Gens (**Leader**)

Matías Alonso

Clara Alvarado

Marcos Arroyo

Ramón Barboza

Gaia Di Carluccio

Alessandra Di Mariano

Laura González

Irene Jaqués

Peiman Khadivipناه

Sebastià Olivella

Judith Landinez

Laura Martinez

Arisleidy Mesa

Luis Monforte

Núria M. Pinyol

Ivan Puig

Anna Ramon

Enrique E. Romero

Jatnna A. Sánchez

Núria Sau

Fernando A. Sossa

Daniel Tarragó

Erdem Toprak

María Teresa Yubero

Hydrogeology

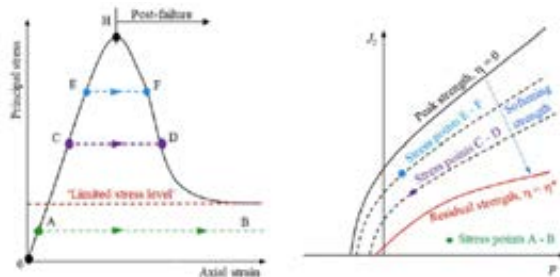
The Hydrogeology Research Group conducts research and knowledge transfer to society in the fields of subsurface hydrology and bio-geochemistry. The Group works on the characterization of permeable media by hydraulic data, hydrochemical and environmental isotope. Applications include groundwater resources, aquifer management, saltwater intrusion, managed aquifer recharge, and transport of pathogenic microorganisms in the subsurface.

The methods span several scales, from the pore to regional aquifers, strongly based on quantitative methods, with the use of numerical modeling of flow and mass transport including bio catalysed chemical reactions. Emphasis is placed on process understanding, based on experimental efforts at the laboratory and the field, leading to model conceptualization of complex phenomena in the field of Water Resources that need to be addressed by new computing tools.

Research

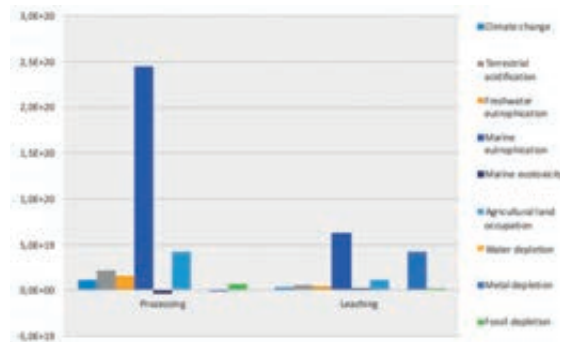
- **Analysis and implementation of coupled THM models for soils and rocks in the numerical modelling software CODE_BRIGHT. PI: Alfonso Rodríguez-Dono**

This study provides a general numerical approach for predicting longitudinal deformation profiles using a coupled ViscoElastic-ViscoPlastic Strain-Softening (VEVPSS) model.



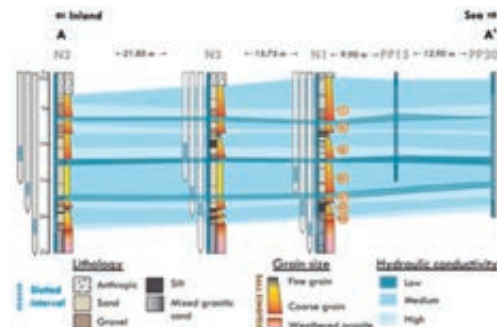
- **Environmental life cycle assessment for large-scale gold mining. PI: Alfonso Rodríguez-Dono**

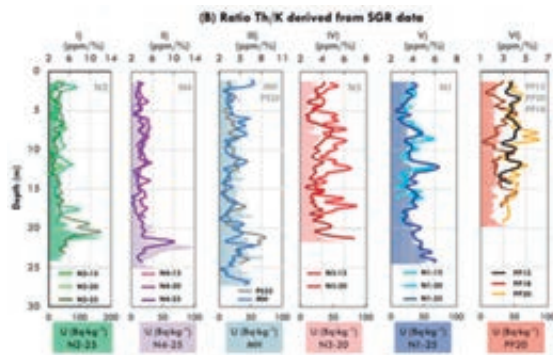
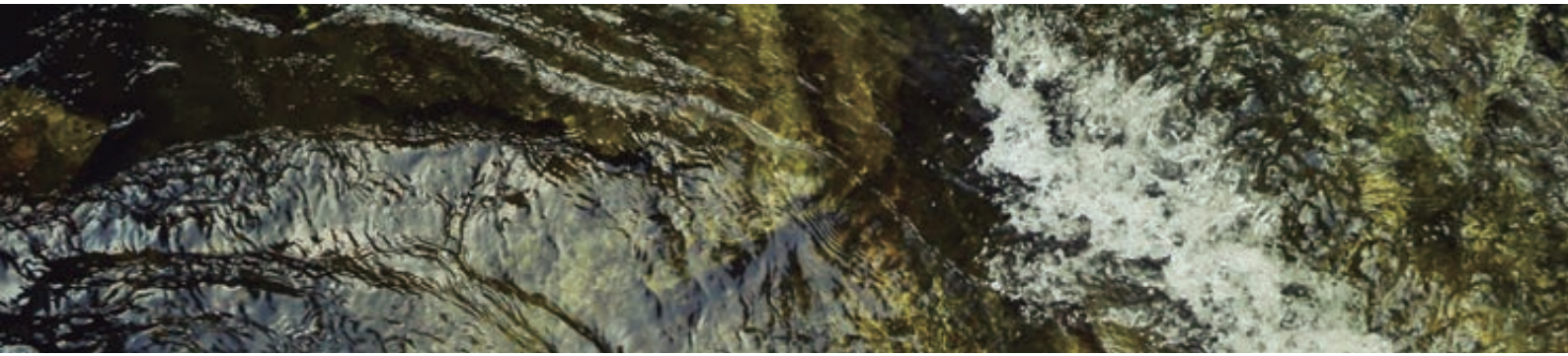
Using the life cycle assessment (LCA) software SimaPro, an assessment focused on large scale gold mining by heap leaching has been made, identifying that the processes that have the worst effects on the environment resulted to be processing, mainly, and leaching in second place.



- **Analysis of the controlling factors of seawater intrusion (SWI) in alluvial coastal aquifers and their coupling with submarine groundwater discharge (SGD). PI: Laura Martínez.**

This investigation provides a framework for the coupled study of seawater intrusion and submarine groundwater discharge in alluvial coastal aquifers. It is based on a multidisciplinary and multiscale characterization and monitoring of an alluvial aquifer located at the mouth of a representative stream of the Maresme hydrological system.





Staff

Xavier Sánchez-Vila (Leader)

Marc Carnicero

Malik Dawi

Daniel Fernández-García

Núria Ferrer

Daniel A. García

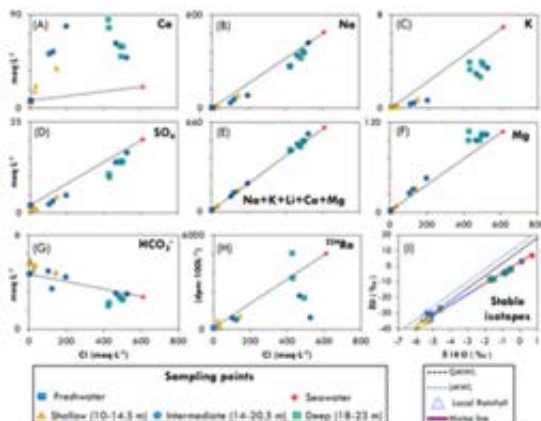
Laura Martínez

Alfonso Rodríguez

Joaquín Soler

Collaboration agreements

- Análisis de información hidrogeológica para la evaluación del efecto barrera en el TAV Tramo Trinidad-Montcada, UTE Línea 2, 2020.
- Prestación de consultoría general, medio ambiente, energía y exportación, Amphos 21 Consulting Chile, 2020.



Machine Learning in Civil Engineering

The main objective of the group is to solve complex engineering problems by applying machine learning techniques with data obtained from sensors and numerical models. The main area of activity is the field of hydraulic works: dams, spillways and water supply networks. However, these same techniques have been applied in the analysis of geomaterials such as railway ballast or landslides.

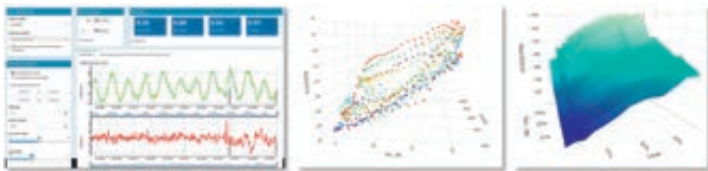
The group has a strong background in the use of machine learning techniques in health monitoring of dams for anomaly detection and predictive maintenance. At present, we are developing methodologies for the efficient quantification of uncertainty in complex problems, combining machine learning and advanced numerical methods. The group has a clear practical approach, and includes among its capabilities the development of customized user interfaces.

New areas of application for machine learning techniques include water quality prediction and wastewater disinfection through advanced tertiary treatments.

Research

Research activities involving Machine Learning techniques:

- **Machine Learning (ML) for dam safety assessment:** Development of methodologies and software for analysis of dam monitoring data, including generation of ML predictive models and their interpretation, with the final objective of supporting decision making in dam safety.



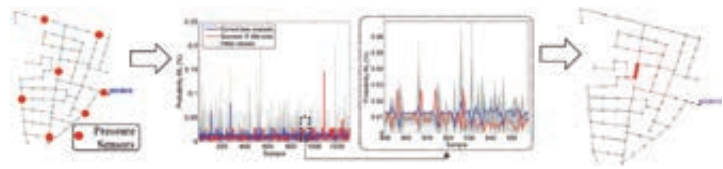
Software for dam safety assessment through ML: screenshots of PREDATOR/SOLDIER application

- **New computational tools for reliability-based dam safety assessment:** Use of ML models to support FEM analysis to predict dam response including uncertainty and risk analysis.



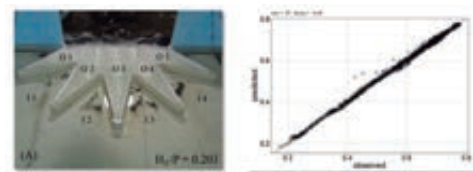
Anomaly detection in dams: example of monitoring network (left) and numerical model to simulate anomalous events (right)

- **Leakage management in Water Distribution Networks (WDN):** Development of data-driven classification models based on pressure monitoring data, combining ML techniques and graph theory for leakage detection and location.

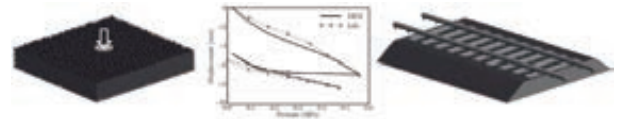


Leakage location in WDN through ML: pressure sensors location (left), probability analysis through classification ML model (center) and map visualization of leak location results

- **Analysis of hydraulic structures:** Analysis of the hydraulic performance of dam spillways and bottom outlets combining numerical methods (PFEM, Free-Surface) and ML techniques.



Spillway hydraulic performance: example of geometry (left) and relationship between observed and predicted values from ML models of discharge capacity



•Smart optimization of industrial processes: Support and optimization of rotational metal deformation design processes. Use of FEM-based Digital Twin framework combined with ML classification techniques.



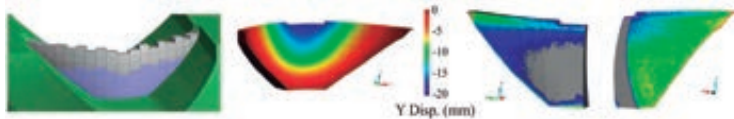
Metal-forming processes analysis: industrial equipment (left) and GUI for process parametrization (right)

•Water quality and water treatment techniques: Application of ML models for the prediction of water quality status in water bodies and assessment of advanced water pollutant removal treatments.

•Development of calibration utilities: Calibration of Discrete Element Method (DEM) parameters combining high performance numerical calculation with ML.

Research activities involving Numerical Methods:

•Thermo-mechanical behavior of concrete dams: Simulation of concrete dam behavior during construction and operation stages integrating high-detailed thermo-mechanical loads.



Concrete dam modelling: construction stage simulation (left), displacements field (center) and stresses field (right)

•Design of wedge shaped block spillways: CFD simulation through Eulerian FEM modelling and block stability simulation through DEM modelling.

•Industrial design of dam fuse gates: Fluid-solid interaction simulations through PFEM+DEM modelling to calculate the following processes: discharge flow for different gate positions, gate falling velocity and gate-wall impact force.

•CFD analysis of hydraulic structures: Highly convergent spillways, stilling basin and drainage systems modelling.

•Analysis of railway track behavior: Simulation of railway infrastructures against climate change actions and evaluation of railway ballast response through DEM model.

•Numerical modelling of WDN: Development of numerical models for leakage simulation through advanced pressure-driven solvers.

On-going RTD Projects

ACROPOLIS - CIAsificación de balsas frente al Riesgo POTencial combinando GIS y Machine Learning

MCIU - Retos Colaboración

Coordinator: IDP - 01/07/2020 - 31/12/2022

COFRE - Diseño Industrial de una COMpuerta Fusible REcuperable para la mejora de la Seguridad Hidrológica de las Presas

MCIU - Retos Colaboración: Proyectos I+D

Coordinator: VEMSA - 01/07/2018 - 30/06/2021

HIRMA - Desarrollo y validación de una aplicación para la determinación del hidrograma de rotura de presas de materiales sueltos

MEIC - Retos Colaboración: Proyectos I+D

Coordinator: INCLAM - 01/09/2016 - 31/12/2020

PABLO - Prototipo de Aliviadero de BLOques en forma de cuña

MCIU - Retos Colaboración: Proyectos I+D

Coordinator: PREHORQUI - 01/07/2018 - 30/06/2021

SMILER - Sistema basado en Machine Learning para la Reducción de pérdidas en redes de distribución de agua

MCIU - Retos Colaboración: Proyectos I+D

Coordinator: INCLAM - 01/07/2018 - 31/12/2020

TRISTAN - New computational Tools for Reliability-based dam SafeTy Assessment

MCIU - Retos Investigación

Coordinator: CIMNE - 01/01/2019 - 31/12/2021

Staff

Fernando Salazar
(Leader)

André Conde

Joaquín Irazábal

Javier San Mauro

Nathalia Silva

David J. Vicente

Railway infrastructure simulation: ballast behavior simulation (left), calibration analysis (center) and railway infrastructure simulation (right)

River Dynamics and Hydrologic Engineering (Flumen Institute)

The FLUMEN Institute is the outcome of merging the FLUMEN RTD group existing since 2005 at the School of Civil Engineering of UPC - BarcelonaTech and CIMNE, bringing together the numerical and experimental expertise of FLUMEN RTD group in hydraulics with the broad experience of CIMNE on numerical methods, computer simulation and integration of decision support systems.

The objectives of FLUMEN are the promotion of RTD and technology transfer activities in the field of River Dynamics and Hydrologic Engineering.

FLUMEN is an Academic Research Institute affiliated with the Technical University of Catalonia (UPC · BarcelonaTech) and CIMNE. FLUMEN was founded by the Government of Catalonia (Generalitat de Catalunya) through the order ECO/305/2012 on October 3rd (DOGC October 17th) and it is an interdisciplinary research group (SGR 1139).

The FLUMEN Institute is actively engaged in research activities, consulting, training and technology transfer in relation to hydrology and river dynamics. When first established in the 1980's the experience of the Flumen Research Group was incorporated.

These activities have been developed and perpetuated inside the framework provided by the School of Civil Engineering of Barcelona, and the Department of Civil and Environmental Engineering of UPC.



Research

• River hydrodynamics:



- Settlements and land use concerning flood risks
- Solid transport and river geomorphology
- Transport of non reactive substances
- River rehabilitation
- Preservation and rehabilitation of wetlands



• Urban hydrology:



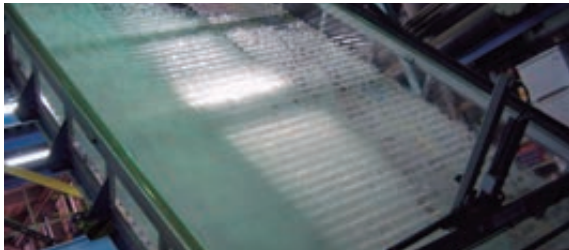
- Urban drainage: sewer network/surface runoff. Inlets
- Pollutant load in urban hydrology
- Flood risks in urban areas

• Reservoir dynamics:



- Thermal and hydrodynamic behaviour
- Sediment and nutrients dynamics
- Reservoir impact on river dynamics. Corrective measures

• Dam hydraulics:



- New designs for spill-flows
- Spills over crest

• Irrigation canals exploitation:



- Automatic control algorithms
- Control structure and lateral storage

• Flow-soil-structure interaction:

- New numerical methods based on the integration particles technique with discrete element methods and finite elements
- Stability and safety of structures under hydraulic influences (water)

Staff

Ernest Bladé (Leader)

Josep Dolz

Gonzalo Olivares

Anaïs Ramos

Marcos Sanz



Structural Mechanics

The objective of the Structural Mechanics Group is the development of innovative numerical methods for analysis of structures of standard materials (metallic materials and concrete), as well as structures incorporating new materials such as composites and hybrid materials.

The numerical methods developed by the group include the finite element method (FEM) and a number of particle-based computational techniques, such as the discrete element method (DEM) and the particle finite element method (PFEM), among others.

Research

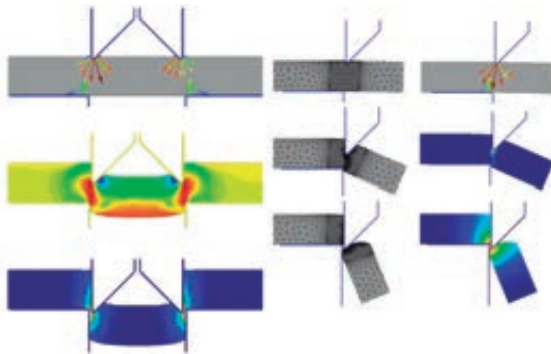
- **Particle Finite Element Method (PFEM)** for multi-disciplinary coupled problems in engineering. **PIs:** A. Franci and E. Oñate.



- **Finite element methods (FEM)** for nonlinear analysis of solids and structures with standard and composite materials. **PIs:** X Martínez, F. Rastellini and E. Oñate.

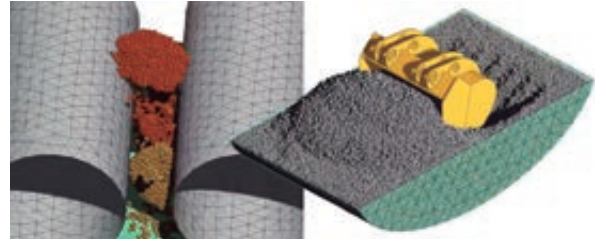
- **Innovative interface elements** for modelling discontinuities in solids. **PI:** I. de Pouplana.

- **Particle Finite Element Method (PFEM)** for multi-disciplinary problems in solid mechanics. **PIs:** J.M. Carbonell and E. Oñate.



- **Discrete element methods (DEM)** for analysis of non-cohesive and cohesive materials.

PIs: M.A. Celigueta and E. Oñate.



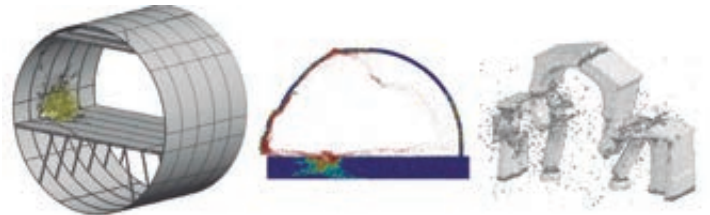
- **Coupling** of DEM, FEM and PFEM procedures.

PIs: M.A. Celigueta, G. Casas and I. Pouplana.



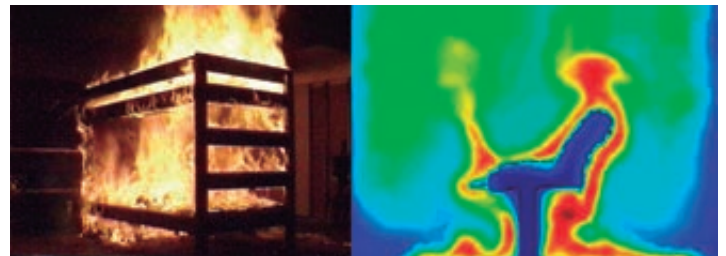
- **Finite elements** for analysis of plates and shells.

PIs: E. Oñate, F. Rastellini and J.M. González.

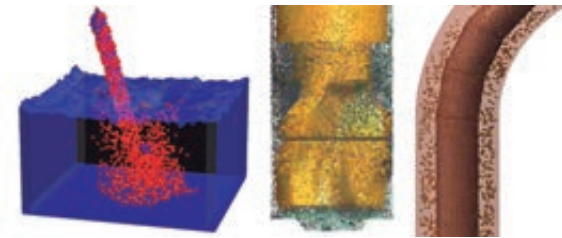


- **Innovative fatigue models** accounting for coupled damage and plasticity effects for analysis of structures under high, medium and low cycling loads with the FEM. **PIs:** L. Barbu and E. Oñate.

- **Modelling and simulation** of the melting and burning of objects in fire. **PIs:** J. Martí and E. Oñate.



- **Particle-based methods** for analysis of particulate flows. **PIs: S. Idelsohn, E. Oñate and G. Casas**



- **Numerical methods** for accurate and fast solution of problems in continuum and structural mechanics. **PIs: E. Oñate and I. de Pouplana.**

Staff

Eugenio Oñate (Leader)	Xavier Martínez
Diego Aguilera	Javier Mora
Ferran Arrufat	Rafael Nazareth
Lucía Barbu	Fermín Otero
Josep Maria Carbonell	Ignasi de Pouplana
Guillermo Casas	Albert Puigferrat
Alejandro Cornejo	Fernando Rastellini
Daniel Di Capua	Pavel Ryzhakov
Miguel Ángel Celigueta	Pablo L. Sierra
Àlex Ferrer	Francesc Turón
Roberto M. Flores	Pere Andreu Ubach
Alessandro Franci	Ignacio Valero
Juan Marcelo Giménez	Francisco Zárate
Joaquín González	Massimiliano Zecchetto
José Manuel González	
Mohammad R. Hashemi	
Fernando Hermosilla	
Sergio Idelsohn	
Sergio Jiménez	
Salvador Latorre	
Julio Martí	

On-going RTD Projects

Add2Man - Design tool for optimal performance in Additive Manufacturing
 AGAUR- Producte
 Coordinator: CIMNE – 23/07/2020 - 22/01/2022

AVINT - Estratègies de mecanitzat i predicció de la rugositat per a una integritat superficial òptima
 ACCIÓ - Comunitat RIS3CAT Industries del Futur
 Coordinator: CTM – 01/01/2018 - 20/03/2021

ACASIAS - Advanced Concepts for Aero-Structures with Integrated Antennas and Sensors
 EC - H2020
 Coordinator: NLR – 01/06/2017 - 31/05/2021

ADaMANT - Marco Computacional para la Fabricación Aditiva de Componentes de Aleaciones de Titanio
 MCIU - Proyectos de I+D (Excelencia)
 Coordinator: CIMNE – 01/01/2018 - 31/12/2020

ALTERNATE - Assessment on Alternative Aviation Fuels Development
 EC - H2020 - SC4-Smart, green & integrated transport
 Coordinator: UPM – 01/01/2020 - 31/12/2022

AMADEUS - Advanced Multi-scale moDEling of coupled mass transport for improving water management in fuel cells
 MCIU - Proyecto de Generación de Conocimiento
 01/01/2019 - 31/12/2021

BIMIoTICa - Digitalización de los Procesos de Prevención de Riesgos Laborales en el Sector de la Construcción
 MCIU - Retos Colaboración: Proyectos I+D
 Coordinator: COMSA – 01/07/2018 - 31/12/2020

COFRE - COMpuerta Fusible REcuperable para la mejora de la Seguridad Hidrológica de las Presas
 MCIU - Retos Colaboración: Proyectos I+D
 Coordinator: Ventilación, estructuras y montaje metálicos, SL – 01/07/2018 - 30/06/2021

COMET-K1 -Modeling and simulation of laser-controlled process and manufacturing techniques (VII-2.06)
 FFG - COMET
 Coordinator: PCCL 01/01/2021 - 31/12/2024

Development of particle-based computational methods for predicting sand production and sand flow in oil wells. Exxon Mobil (Houston, USA)
 PIs: M.A. Celigueta and E. Oñate – 2019-2021

Development of finite element methods for analysis and design of new polymer fiber reinforced rebars for the building and construction sector - Saudi Aramco.
PIs: X. Martinez and E. Oñate - 2019-2022

EMUSIC - Efficient Manufacturing for Aerospace Components USING Additive Manufacturing, Net Shape HIP and Investment Casting - EC - H2020 (2014-2020)

Coordinator: Univ. Birmingham - 01/04/2016 - 31/03/2019

Espigó Infable-MMSC - Validation of inflatable breakwaters design for the intelligent protection of sandy beaches against erosion

AGAUR - Producte

Coordinator: CIMNE - 01/05/2019 - 01/02/2021

EUIN PRO-COAST - Arenales de protección y restauración de costas

MCIU - Europa Investigación

Coordinator: CIMNE - 01/06/2019 - 31/05/2021

Fatigue4Light - Fatigue modelling and fast testing methodologies to optimize part design and to boost lightweight materials deployment in chassis parts

H2020 - SC4-Smart, green & integrated transport

Coordinator: CIMNE - 01/02/2021 - 31/01/2024

FIBREGY - Development, engineering, production and life-cycle management of improved FIBRE-based material solutions

H2020 - Leadership in enabling & industrial technologies

Coordinator: CIMNE - 01/01/2021 - 31/12/2023

FIBRE4YARDS - FIBRE composite manufacturing technologies FOR the automation and modular construction in shipYARDS

EC- H2020 - SC4-Smart, green & integrated transport

Coordinator: CIMNE - 01/01/2021 - 31/12/2023

FIBRESHIP - Engineering, production and life-cycle management for massive application of FIBRE-based materials in large-length SHIPs

EC - H2020 (2014-2020)

Coordinator: TSI - 01/06/2017 - 31/05/2020

HAMELIN - Herramientas para adecuar y mejorar la gestión de plagas de insectos / Outils pour adapter et améliorer la gestion d'invasions d'insectes

EC - Interreg POCTEFA

Coordinator: CIMNE - 01/01/2019 - 31/01/2022

HIRMA - Desarrollo y validación de una aplicación para la determinación del hidrograma de rotura de presas de materiales sueltos, a partir de la configuración geomecánica particular

MEIC - Retos Colaboración: Proyectos I+D

Coordinator: INCLAM - 01/09/2016 - 31/12/2020

LIGHT3D - Technologies de Làser i altra Llum (BASE3D)

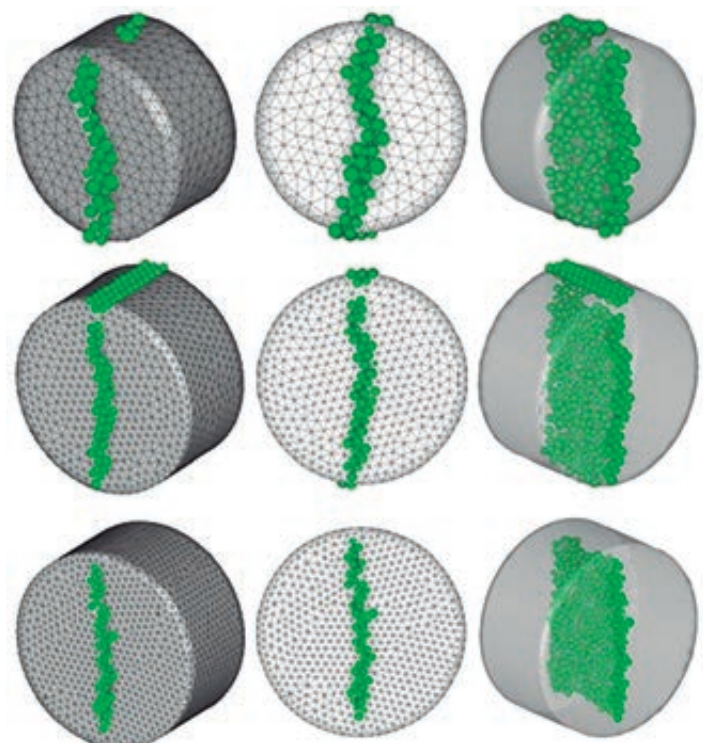
GENCAT - Activitats Emergents

Coordinator: Fundació CIM - 31/12/2019 - 31/12/2022

MATHEGRAM - Multiscale analysis of thermomechanical behaviour of granular materials

EC - H2020 - Coordinator: USUR - UNIS

01/01/2019 - 31/12/2022



METACOUSTIC - Computational design and prototyping of acoustic metamaterials for target ambient noise reduction - EC - H2020 (2014-2020)

Coordinator: CIMNE - 01/11/2019-30/04/2021

METAMAT - Computational design of acoustic and mechanical metamaterials - MCIU - Proyectos de I+D

Coordinator: CIMNE - 01/01/2018 - 31/12/2020

Multiscale analysis of thermomechanical behaviour of granular materials

EC - MSCA-Marie Skłodowska-Curie Actions, H2020

PI: F. Zárte - 2019-2022

OPTIPRO - Sistema inteligente de optimización de procesos de deformación de metal por rotación mediante simulación avanzada

MCIU - Retos Colaboración - 01/07/2020 - 30/06/2023

PABLO - Prototipo de Aliviadero de BLOques en forma de cuña

MCIU - Retos Colaboración: Proyectos I+D

Coordinator: PREHORQUI - 01/07/2018- 30/06/2021

PARAFLUIDS - Un Método Numérico Multi-Escala para Fluidos con Partículas

MCIU - Retos Investigación - 01/06/2020 - 31/05/2023

PRECISE - Numerical methods for PREdicting the behaviour of Civil StructurEs under water natural hazards

MCIU - Retos Investigación: Proyectos de I+D+i

Coordinator: CIMNE - 01/01/2018 - 31/12/2020

PRO2 - Ecosistema d'R+D+i per la implementació i adopció de la Fabricació Additiva /Impressió 3D a fabricació de productes industrials i als processos industrials de producció

ACCIÓ - Comunitat RIS3CAT Llabor3D

Coordinator: LEITAT - 01/01/2018 - 20/03/2021

PS BRIDGE - Desarrollo de un puente liviano, modular y portable con vigas Tensairity

MCIU - Retos Colaboración: Proyectos I+D

Coordinator: PSTEC - 01/07/2018 - 30/06/2020

SMILER -Desarrollo de un Sistema basado en Machine Learning para la Reducción de pérdidas en redes de distribución de agua

MCIU - Retos Colaboración: Proyectos I+D

Coordinator: INCLAM - 01/07/2018 - 31/12/2020

PIPLATES - Plataforma de Predicció Territorial

GENCAT - Technologies Digitals Avançades (TDA)

Coordinator: CIMNE - 01/01/2020 - 30/06/2022

TRANSPORT - Ecosistema d'R+D+i per la implementació i adopció de la Fabricació Additiva/Impressió 3D a la indústria del transport

ACCIÓ - Comunitat RIS3CAT Llabor3D

Coordinator: CIMNE - 01/01/2018 - 31/12/2020

TRISTAN - New computational Tools for Reliability-based dam SafeTy Assessment

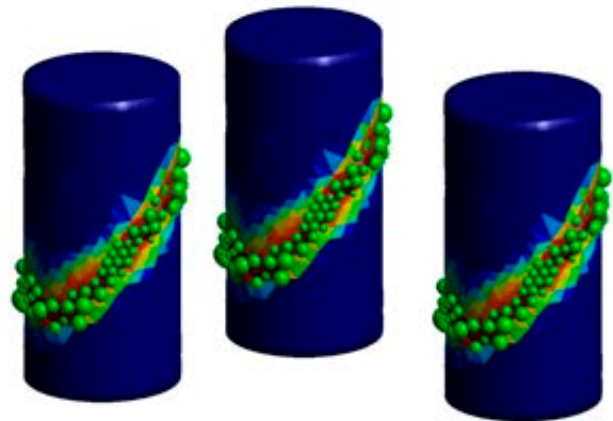
MCIU - Retos Investigación

Coordinator: CIMNE - 01/01/2019 - 31/12/2021

UKRI GCRF HUB - Urban Disaster Risk Hub

UKRI - Interdisciplinary Research Hubs

Coordinator: FLACSO - 01/03/2019 - 31/08/2020



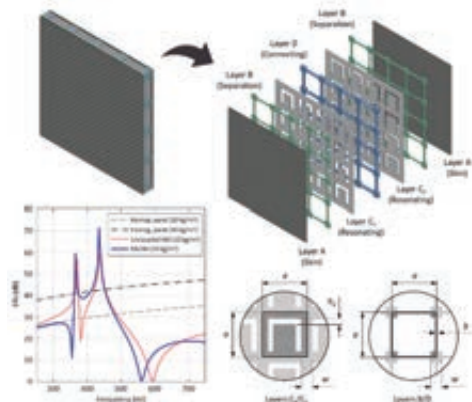
Computational Design & Analysis of Engineering Materials and Meta-materials

The mission of the **Computational Design & Analysis of Engineering Metamaterials** group is the development of new computational tools for designing metamaterials with extreme acoustic, mechanical and electro-magnetic properties, focusing engineering applications.

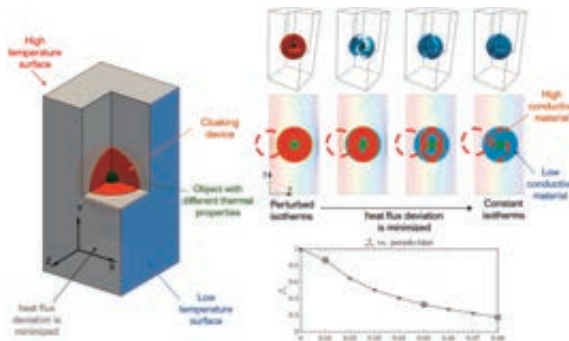
Research

• Computational Design of Engineering Metamaterials

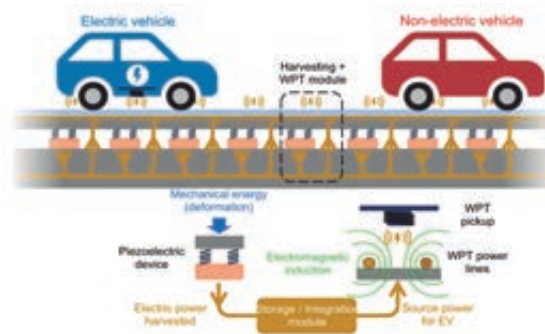
- **METACOUSTIC**: Development of new acoustic meta-materials (panels-liner)s for customized acoustic insulation.



- **VARTOP**: New methods for topology optimization in structural and thermal problems using variational-based techniques. Development of new mechanical meta-materials for shock absorbing.



- **WPTE**: Design of new electromagnetic meta-materials for wireless power transfer (WPT) to be applied to energy exchange between fuel-powered and electrical vehicles.



• High Performance Model Order Reduction methods (HPR-FE2) for industrial multiscale material modelling and design

- **HPR-FE2 PLUGIN**: New high-efficiency methods for taking multiscale model order to daily-live industrial applications.



Staff

Xavier Oliver (Leader)
Juan Carlos Cante
Oriol Lloberas-Valls
Álex Nuñez
Marcelo Raschi

David Roca
Gastón Sal-Anglada
Pablo Wierna
Daniel Yago

On-going RTD Projects

METACOUSTIC - Computational design and prototyping of acoustic metamaterials for target ambient noise reduction

EC - H2020 - Coordinator: CIMNE - 01/11/2019-30/04/2021

METAMAT - Computational design of acoustic and mechanical metamaterials - MCIU - Proyectos de I+D
Coordinator: CIMNE - 01/01/2018 - 31/12/2020

Mechanics of Electroactive Materials

This group will develop theoretical and computational models to quantify flexoelectricity in solids, focusing on continuum models but also exploring multiscale aspects, in tight collaboration with experiments.

The research group explores the effects of strain gradients on the physics of dielectrics, identifying fundamental manifestations and identifying the underlying engineering principles for a new generation of electromechanical metamaterials.

Research

- **Theoretical framework of flexoelectricity.** Develop a comprehensive theoretical framework for flexoelectricity in infinitesimal and finite deformation, establishing the precise connections between the different families of formulations, their physical interpretation and the physical meaning of the corresponding set of high-order boundary conditions.

PIs: D. Codony, H. Mohammadi, I. Arias.

- **Efficient numerical solution of high-order general electromechanics problems:** Development of advanced discretization methods, including immersed B-splines and C0 penalty, for the efficient solution of the 4th-order PDE system arising in flexoelectricity in general geometries, material and electrode configurations. **PI:** Irene Arias.

- **Reduced theories of flexoelectric beams and shells:** Development of reduced theories for non-linear flexoelectric beams and non-linear shells to gain understanding of the physics and aid the design of new devices.

PIs: P. Gupta, D. Millán, I. Arias.

- **Flexoelectricity from first principles:** Development of electronic structure calculations of flexoelectric systems to establish a precise connection with continuum models both guiding the development of enriched models accounting for nanoscale effects and finite surface effects and characterizing continuum model parameters. **PIs:** D. Codony, M. Dingle, I. Arias in collaboration with P. Suryanarayana.

- **Fundamental manifestation of flexoelectricity in torsion mechanics:** New methods to mobilize flexoelectricity under torsion to provide understanding about the fundamental physics and flexoelectricity characterization tools. **PIs:** Irene Arias, A. Mocci, A. Abdollahi.

- **Fundamental manifestation of flexoelectricity in strain and electric field singularities:** Cracks, ferroelectric domain walls, creasing, AFM: Exploration of the physics of flexoelectricity in situations where large strain or electric field gradients develop. **PIs:** A. Abdollahi, J. Barceló-Mercader, H. Mohammadi, I. Arias

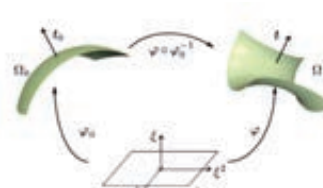
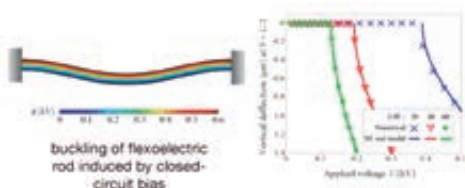
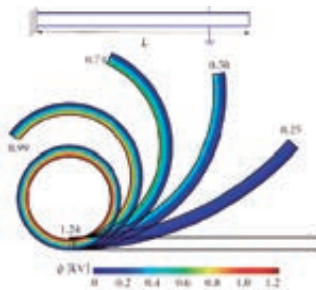
- **Design and characterization of flexoelectric devices and metamaterials:** Development of new concepts for the design of effectively piezoelectric metamaterials and devices from non-piezoelectric components. **PIs:** Irene Arias, A. Mocci, D. Codony, P. Gupta.

- **Theoretical and computational modeling of flexo-photovoltaics:** Development of a theoretical and computational framework for the simulation of flexo-photovoltaics aiming at the design and optimization of a new family of solar-cells. **PIs:** Irene Arias, Amir Abdollahi.

Staff

Irene Arias (Leader)

Hossein Mohammadi

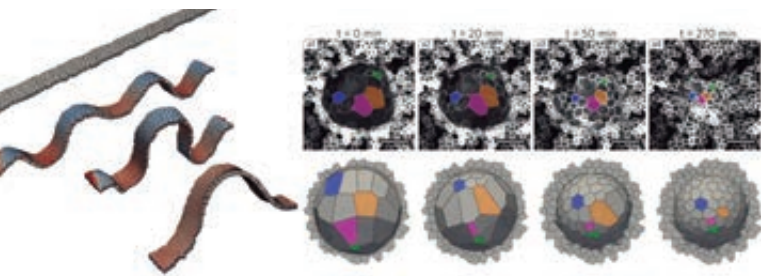


Soft and Living Material Interfaces

The group develops theoretical and computational models for the mechanobiology biological interfaces, cells and tissues, with the goal of quantitatively understanding these systems, rationally manipulating active living materials and engineering new bionic materials.

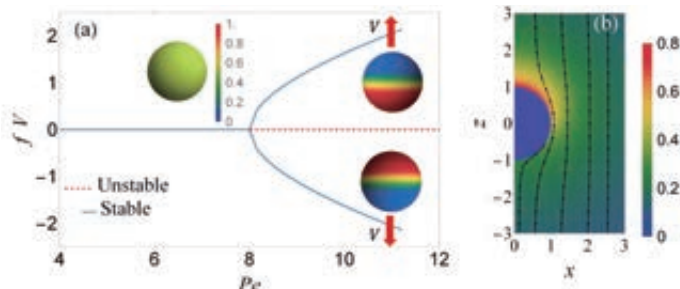
Research

- **Mechanics of Epithelial materials:** Development of theoretical and computational models to understand and rationally manipulate epithelial materials in-vivo and in bio-hybrid devices. **PI: Marino Arroyo**

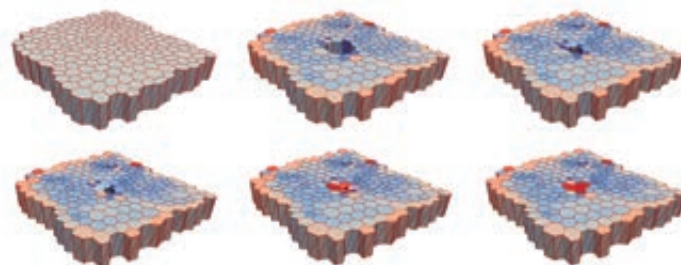


- **Mechanics of the cell envelope:** Development of theoretical and computational models to understand and quantify the mechanics of the cell envelope, and to develop biomimetic multifunctional systems based on the engineering principles of the cell envelope. **PI: Marino Arroyo**

- **Motility of cells and of artificial bio-inspired systems:** Development of theoretical and computational models to understand cell motility and to understand and conceive mechanisms for bio-inspired motile artificial systems. **PI: Marino Arroyo.**



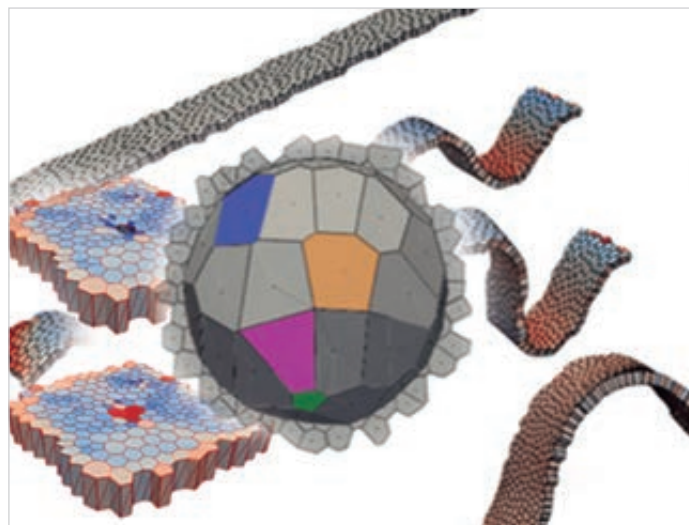
- **High-performance finite element library for interfacial problems:** Development of a high-performance finite element parallel library to model Multiphysics interfacial problems. **PI: Marino Arroyo**
- **Analysis of cell and tissue dynamics:** Modelling of regulation of cell contractility and intercalation during morphogenesis. Development of specific finite element and vertex models. **PI: José Muñoz**



- **Control and optimisation in organism locomotion:** design of optimisation and control numerical algorithms for understanding locomotion patterns of microorganism. **PI: José Muñoz.**

Staff

Marino Arroyo (Leader)
Giancarlo Cicconofri
Jose Muñoz



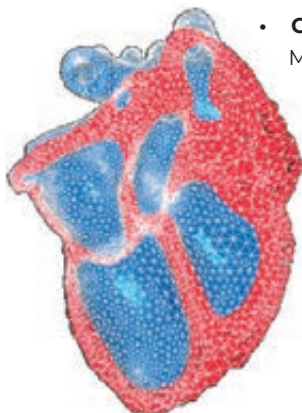
Bio-Medical Engineering

The main objective of the group is to solve complex biomedical engineering problems by applying numerical models, machine learning techniques and virtual and augmented reality models.

The Biomedical Engineering (BME) group offers software solutions to automatically transform medical imaging to create a 3D digital twins of the patients to help diagnostics, to virtually try treatments, and to automatically design optimal braces and devices. One of the main areas of activity of the BME group is the field of personalized cardiovascular devices. For medical companies and physicians who need to improve their personalized designs, BME brings innovative tools based on our numerical simulation technology to better design cardiovascular medical devices during the pre-prototype stage. We aim at making patient care more personalized and secured. The group has a strong background in the cardiovascular, dental and respiratory areas.

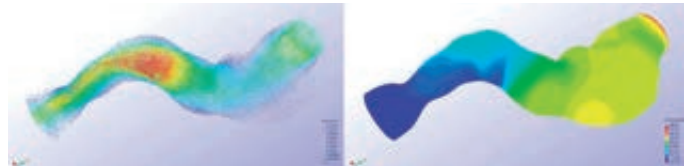
At present, we are developing Augmented & Virtual reality methodologies for improving the healthcare system. We are applying augmented reality techniques for breast and liver surgeries. We have developed an API to couple Unity and KRATOS frameworks. This API is able to provide augmented real simulations. The group has a clear practical approach, and includes among its capabilities the development of customized user medical interfaces.

Research



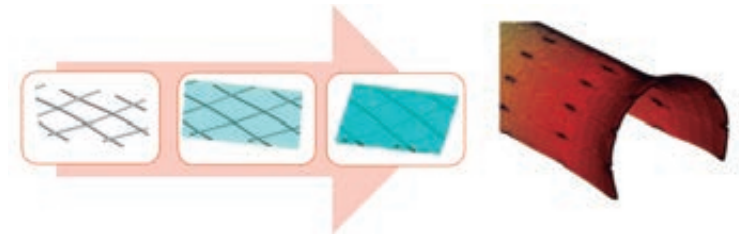
- **Cardiovascular Research:** Methods to simulate blood flow simulation for different cardiovascular pathologies as Abdominal Aneurysm, Aorta coarctation and dissection, etc. Full scale cardiovascular models: 0D-1D-3D. **PI: E.Soudah.**

- **Artificial Intelligence Methods:** Combination of numerical simulations with machine learning techniques for different pathologies.

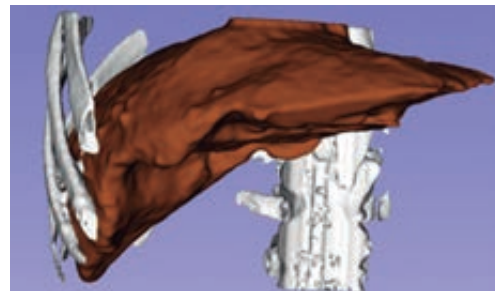


- **Medical Device R&D:** Medical devices for medical companies and physicians to improve their personalized designs. Innovative tools based on our numerical simulation technology to better design medical devices during the pre-prototype stage.

PIs: E. Soudah and J. A. Hernández.



- **Respiratory System:** New solution for Obstructive Sleep Apnea treatment (OSAS). **PI: E. Soudah.**

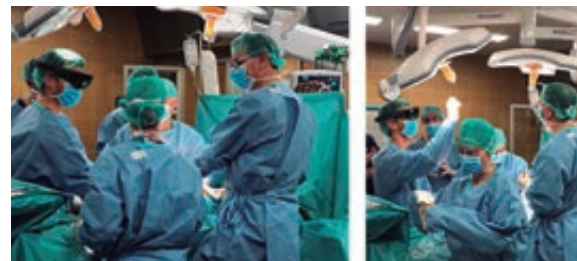
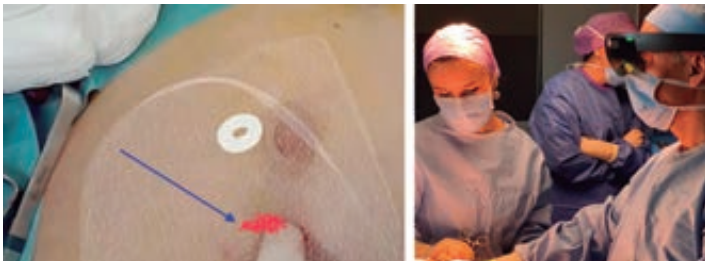


- **Image Processing & Modelling:** Software solutions to automatically transform medical imaging to create a 3D digital models to help diagnostics, to virtually try treatments, and to automatically design optimal devices. **PI: E. Soudah.**

- **BIM & TIC Applications:** Mobile applications and virtual scenarios for teaching and training anatomy, anesthesia and cardiovascular pathologies for medical/resident students and continuous training of the healthcare system. BIM environment for hospitals. **PI: E. Soudah.**



- **Augmented and Virtual Reality:** Interactive surgical communication platform based on augmented reality technology for clinical remote assistance in real time. **PI: E. Soudah.**



On-going RTD Projects

ANACONDA - ANCD Brain®, micro-catéter de acceso distal para trombectomías cerebrales y tratamiento del accidente cerebrovascular isquémico agudo

MCIU - Proyectos de I+D

Coordinator: ANACONDA BIOMED S.L

01/01/2018-31/12/2020

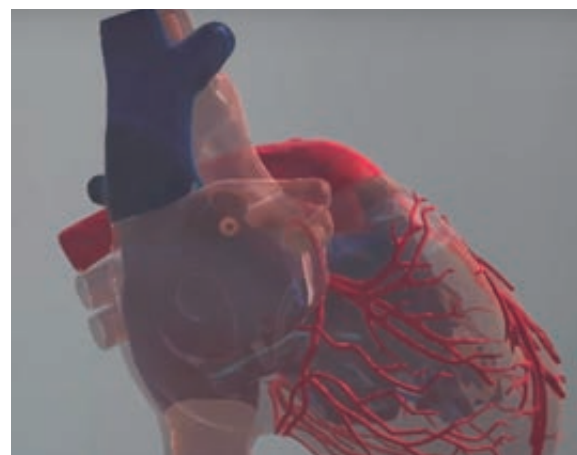
Staff

Eduardo Soudah (Leader)

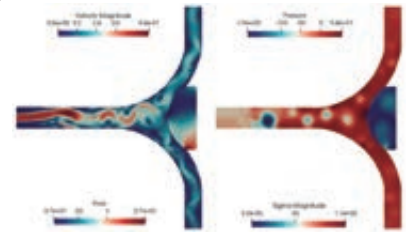
Óscar de Coss

Agustina Giuliodori

Joaquín A. Hernández



Fluid Mechanics

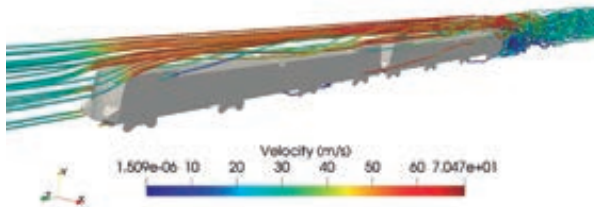


The Fluid Mechanics Group focuses on the development of mathematical models and numerical methods for the solution of a wide range of problems in engineering and other applied sciences involving external and internal flows.

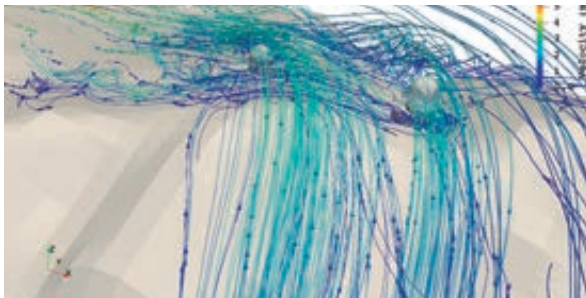
Applications include, among others, high speed compressible flows, turbulent flows, shallow water flows, flow in porous media, aero-acoustics, wave propagation, viscoelastic fluids, bio-flows and many multidisciplinary coupled problems involving fluids, such as magneto-hydro-dynamics, fluid-structure interaction, and thermal flows.

Research

- **Stabilized finite element methods for problems** involving waves, viscoelastic flows, compressible flows, shallow water flows, magneto-hydro-dynamics, approximation of eigenvalues, finite strain solid dynamics and structural elements. **PI: R. Codina**



- **Efficient time integration schemes**, including algebraic fractional step schemes for incompressible flows, adaptive time integration schemes and accuracy enhancement using artificial neural networks. **PI: R. Codina**



- **Reduced order models in fluid mechanics (ROM).** Development of POD and adaptivity/Artificial-Neural-Network based reduced order models, with special emphasis on stabilization issues. **PIs: R. Codina and S. Idelsohn**

- **Acoustic analogies in incompressible flows.** Direct numerical simulation of sound, aero-acoustics in time dependent domains. With applications to the simulation of railway generated sound.

PI: R. Codina and J. Baiges

- **Topology optimization in fluid-structure interaction.** Finite strain cases which require a special treatment, and incompressible and nearly incompressible materials. **PIs: R. Codina and J. Baiges**



- **Numerical simulation of Additive manufacturing processes.** H-adaptive methodologies, high performance computing and large scale parallelization. Application to metallic materials, plastics and concrete. **PI: Ramon Codina**

On-going projects

TOP-FSI - Topology Optimization of structures subject to fluid structure interaction

MCIU - Retos Investigación

Coordinator: CIMNE - 01/01/2019 - 31/12/2021

Staff

Ramon Codina (Leader)

Joan Baiges

Zulkeefal Dar

Arnau Fabra

Laura Moreno

Iván Rivet

Industrial Manufacturing Processes

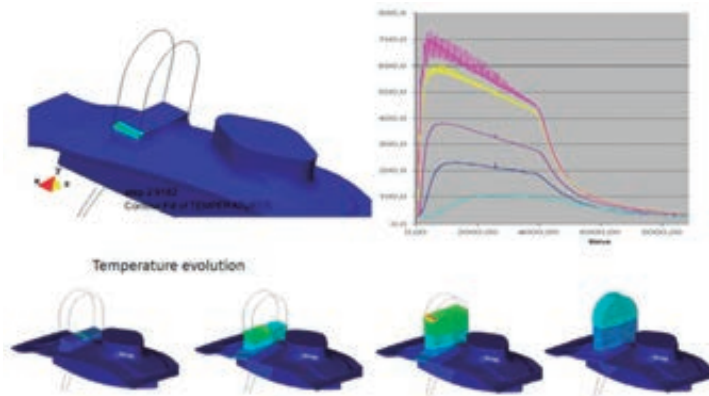
Since 1998, the Industrial Manufacturing Processes Group develops computational tools for thermo-mechanical modeling and advanced non-linear analysis tools.

The outcomes are generally implemented in COMET, a Finite Element based framework for the solution of engineering problems in both academic and industrial environments.

COMET includes multiple classical and advanced elements formulations as well as a wide constitutive law library (viscoelasto-plasticity, small and large strain plasticity, damage models, etc).

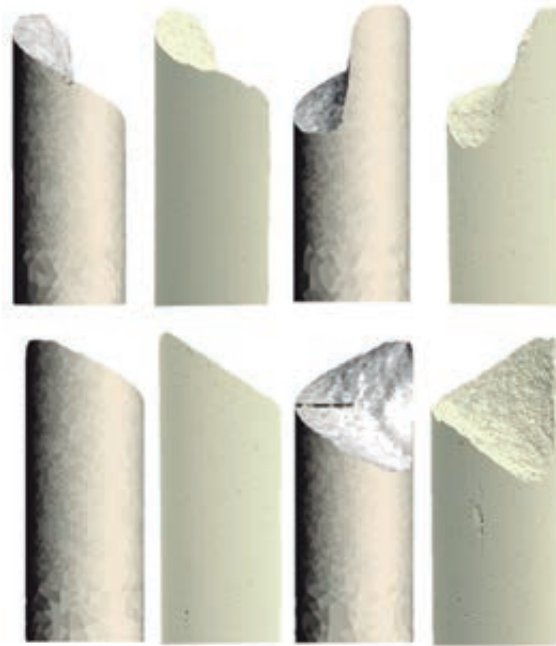
Research

- **Advanced Manufacturing Processes:** Additive Manufacturing, Friction Stir Welding, Electron Beam Welding, Shaped Metal Deposition, Casting processes and Metal Forming.



- **Constitutive Modeling and Computational Failure Mechanics.** New constitutive models appropriate for mechanical and civil engineering materials. These include isotropic and orthotropic plasticity models appropriate for metallic and polymeric industrial parts and components and damage models for civil engineering structures.

PIs: M.Cervera and M. Chiumenti



On-going projects

ADaMANT - Marco Computacional para la Fabricación Aditiva de Componentes de Aleaciones de Titanio

MCIU - Proyectos de I+D (Excelencia)

Coordinator: CIMNE

01/01/2018 - 31/12/2020

Add2Man - Design tool for optimal performance in Additive Manufacturing

EC - AGAUR - Producte

Coordinator: CIMNE

23/07/2020 - 22/01/2022

AVINT - Estratègies de mecanitzat i predicció de la rugositat per a una integritat superficial òptima (RIS-3CAT Industries del Futur)

ACCIÓ - Projectes col·laboratius recerca industrial i/o innovació

Coordinator: CTM

01/01/2018 - 20/03/2021

CityFlows - Decision-support system for pro-active crowd management of crowded urban spaces

EC-H2020-SC4-Smart, green & integrated transport

Coordinator: AMS Institute

01/01/2020 - 31/12/2021

FLOWCALOP - Flowforming Process Calibration Via Cloud Optimization

EC - H2020

Coordinator: Industrias Puigjaner, SA

15/02/2019 - 15/02/2020

KYKLOS 4.0 - An Advanced Circular and Agile Manufacturing Ecosystem based on rapid reconfigurable manufacturing process and individualized consumer preferences - EC - H2020

Coordinator: TECNALIA

01/01/2020 - 31/12/2023

LIGHT3D - Technologies de Làser i altra Llum (BASE3D)

GENCAT - Agrupacions en tecnologies emergents 2018

Coordinator: Fundació CIM - 31/12/2019 - 31/12/2022

OPTIPRO - Sistema inteligente de optimización de procesos de deformación de metal por rotación mediante simulación avanzada

MCIU - Retos Colaboración

Coordinator: Industrias Puigjaner, SA

01/07/2020 - 30/06/2023

PRO2 - Impressió 3D a fabricació de productes industrials i als processos industrials de producció (Comunitat RIS3CAT Llabor3D)

ACCIÓ - Projectes col·laboratius recerca industrial i/o innovació

Coordinator: LEITAT

01/01/2018 - 20/03/2021

TRANSPORT - Impressió 3D a la indústria del transport (Comunitat RIS3CAT Llabor3D)

ACCIÓ - Projectes col·laboratius recerca industrial i/o innovació

Coordinator: CIMNE

01/01/2018 - 20/03/2021

Staff

Miguel Cervera (Leader)

Michele Chiumenti (Leader)

Carlos Agelet de Saracibar

Gabriel Barbat

Manuel Caicedo

Jesús Conde

Narges Dialami

Óscar Fruitós

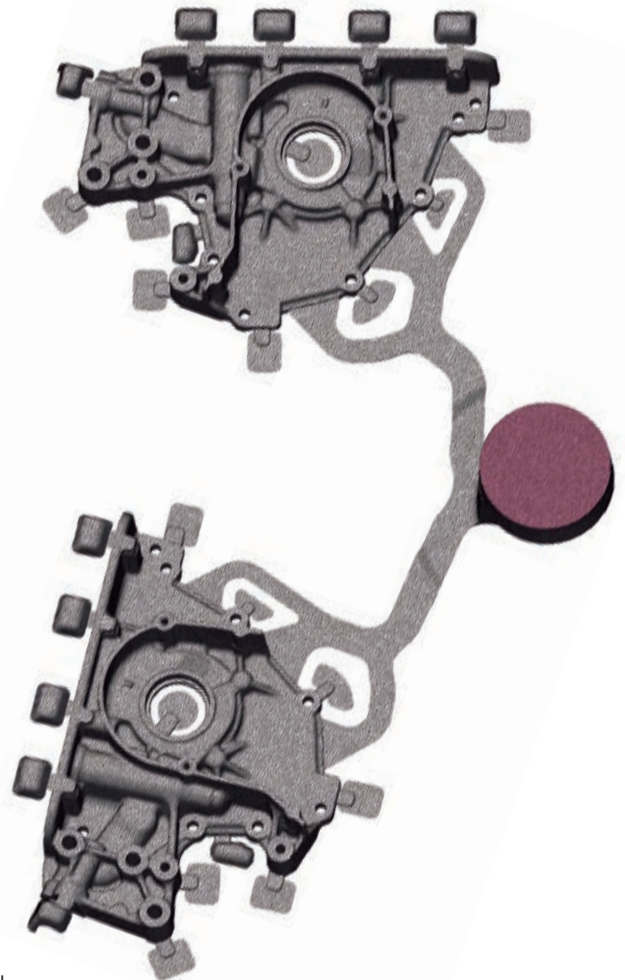
Pau Gabarrell

Carlos A. Moreira

Saman Rahmani

Iván Rivet

Ricard Sánchez



Credible Data-driven Models

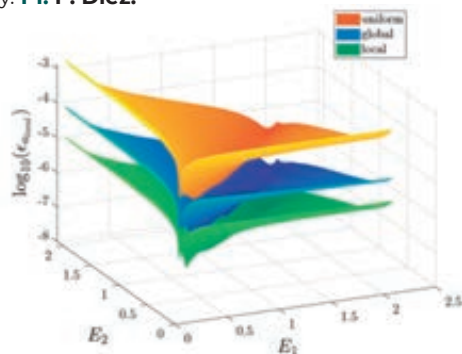
The group aims at developing, implementing and analyzing models and methods accounting for their credibility, and assimilating data into the model. The credibility concept embraces three underlying ideas: control of the numerical accuracy (Verification), monitor the pertinence of the model (Validation) and account for the aleatoric nature of the systems analyzed (Uncertainty Quantification).

The data assimilation strategies are incorporating into the models the information contained in data from sensors, observations and other models. This is complementary to the Validation phase (via parameter identification) and strongly related to the Uncertainty Quantification.

The group has a proven track record in applying these tools and methods to diverse disciplines in applied sciences and engineering. In particular, some of the current active projects and research lines pertain to the field of Automotive Engineering, Geophysical Modelling, and Biomechanics (biometamaterials).

Research

- **Error assessment and adaptivity.** Development, analysis and implementation of numerical tools for assessing the error in solutions produced by Finite Element and Reduced Order Models. Mesh and model adaptivity to monitor the numerical accuracy. **PI: P. Díez.**



- **Data-driven Geophysical Modeling.** High-fidelity models of large-scale geophysical phenomena in the earth crust. Data assimilation and model updating. Bayesian approaches to inverse problems. **PI: S. Zlotnik.**

- **Data-driven Biomechanical Modeling.** Modeling and simulation of biomechanical devices and bio-systems. Computational design of metamaterials for health care applications. **PI: A. García-González.**



- **Reduced-Order Models and Surrogate Models.** Intrusive and nonintrusive Reduced Order Models, using different numerical strategies accompanied by error control. Special insight in Proper Generalized Decomposition (PGD) and Proper Orthogonal Decomposition (POD). **PI: P. Díez.**

On-going RTD Projects

ProTechTion - Industrial decision-making on complex production technologies supported by simulation-based engineering

EC - MSCA - Marie Skłodowska - Curie actions

Coordinator: CIMNE - 01/03/2018 - 28/02/2022

Staff

Pedro Díez (**Leader**)

Fabiola Cavaliere

Mariano Tomás Fernández

Alexandros Karkoulas

Luan Malikoski

Arash Moaven

Alba Muixí

Christina Nasika

Sergio Zlotnik

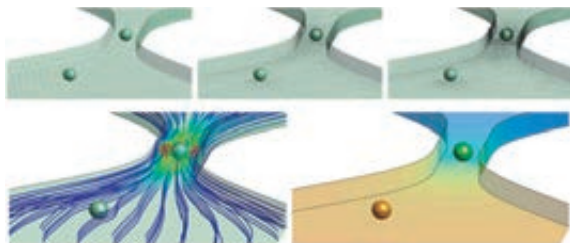
Innovative Algorithms for Fast Accurate Computing

Fast and accurate solution of computationally-demanding engineering problems is critical in daily industrial practice. Indeed, efficient strategies are needed to compute multiple queries of complex multi-physics and multi-disciplinary problems arising in parametric studies such as flow control, shape design and optimization, real-time monitoring of manufacturing processes and inverse analysis in medical imaging.

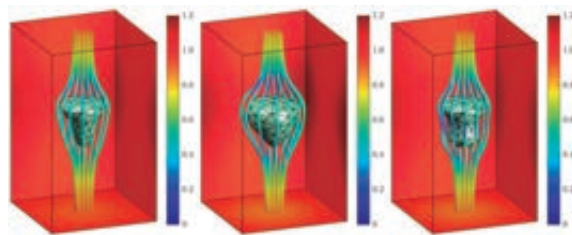
To contribute to these challenges the group exercises a comprehensive approach in the area of computational science and engineering, in order to develop new mathematical models and numerical methods to predict and quantify science and engineering problems. This implies combining concepts, methods and models of an interdisciplinary nature that include various disciplines such as mechanics, mathematics and computer science, among others.

Research

- **High-fidelity simulations of complex phenomena.** Development of high-order approximations (in particular, hybridizable discontinuous Galerkin) with exact geometric description (via NURBS-enhanced FEM) of engineering problems. **PIs: A. Huerta and M. Giacomini.**
- **Robust low-order solvers for large-scale problems.** Development of innovative finite volume strategies and integration in open-source libraries for fast computation of industrial problems. **PIs: A. Huerta and M. Giacomini.**



- **Reduced-order models for parametric studies.** Development of surrogate models (via proper generalized decomposition) for real-time solution of parametric problems. **PIs: A. Huerta and M. Giacomini.**



- **Credibility of computational engineering solutions.** Development of certification techniques for reliable simulations with goal-oriented error control and adaptivity. **PI: A. Huerta.**

- **Open-source solutions for industrial problems.** Development of open-source software and application to fluid, solid, electromagnetics and multi-physics problems of industrial interest. **PIs: A. Huerta and M. Giacomini.**

On-going projects

ProTechTion - Industrial decision-making on complex production technologies supported by simulation-based engineering

EC - MSCA - Marie Skłodowska-Curie actions

Coordinator: CIMNE

01/03/2018 - 28/02/2022

Staff

Antonio Huerta (Leader)

Álvaro Borràs

M. Giacomini

Rafel Perelló

Kratos Multiphysics

The Kratos Multiphysics group aims at the development of a global purpose research code integrating state-of-the art capabilities in multiple fields, with the explicit goal of allowing the simulation of complex multiphysics problems.

The group aims at the exploitation of High Performance Computing capabilities to be employed for the simulation of realistic engineering problems. This goal will be achieved both by the development of new solution technologies and by exploring the integration of models from different areas, thus making the research intrinsically transversal.

The research will foster open source developments and collaboration with groups located at different locations and working in different areas. It will also contribute to the integration of different technologies within a single, unified, workflow with the goal of enriching the solution capabilities of the Kratos framework.

Research

- **Development of CFD models and other FEM technologies, including model order Reduction-**

Development of new solver capabilities within Kratos, and as a tools for the development of projects. This includes in particular the improvement of the existing capabilities for the solution of “embedded” CFD problems and the development of new real-time interactive solvers based on ROM.

- **Uncertainty Quantification (UQ) and Optimization Under Uncertainties (OUU):**

Uncertainty Quantification studies the characterization and the reduction of uncertainties in problems where some variables of the system are not exactly known. Optimization Under Uncertainties aims at solving optimization problems by considering the aforementioned uncertainties in the objective function, constraints or parameters of the problem.

On-going projects

AMADEUS - Advanced Multi-scAle moDEling of coupled mass transport for improving water management in fuel cells

MCIU - Proyectos de I+D: Generación de Conocimiento

Coordinator: CIMNE

01/01/2019 - 31/12/2021

ExaQute - EXAscale Quantification of Uncertainties for Technology and Science Simulation

EC - H2020 (2014-2020)

Coordinator: CIMNE

01/06/2018 - 31/05/2021

EdgeTwins HPC - Bringing Digital Twins to the Edge for mass Industry 4.0 applications

EC - H2020 (2014-2020)- SC7-Secure societies

Coordinator: CIMNE

01/06/2020 - 30/11/2021

HIRMA - Desarrollo y Validación de una Aplicación para la Determinación del Hidrograma de Rotura de Presas de Materiales Suelos, a Partir de la Configuración Geomecánica Particular

MEIC - Retos Colaboración: Proyectos I+D

01/09/2016 - 31/12/2020

PRECISE - Numerical methods for PREdicting the behaviour of CIVil StructurEs under water natural hazards

MCIU - Retos Investigación: Proyectos de I+D+i

Coordinator: CIMNE

01/01/2018 - 31/12/2020

Staff

Riccardo Rossi (Leader)

Sebastian Ares

Raúl Bravo

Uxue Chasco

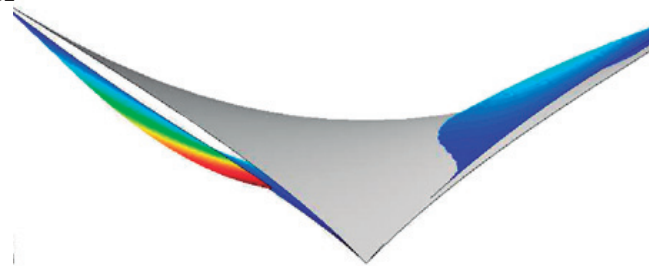
Pau Márquez

Marc Nuñez

Carlos Roig

Riccardo Tosi

Rubén Zorrilla



Large-scale Scientific Computing

The large scale scientific computing group develops advanced numerical methods for the simulation of problems governed by PDES, e.g., solid and fluid mechanics and electromagnetics, together with the design and implementation of scalable solvers for the arising linear systems.

Research

- **Uncertainty quantification.** Development and analysis of multilevel Monte Carlo methods for stochastic partial differential equations, discretisation of PDEs on stochastic domains.

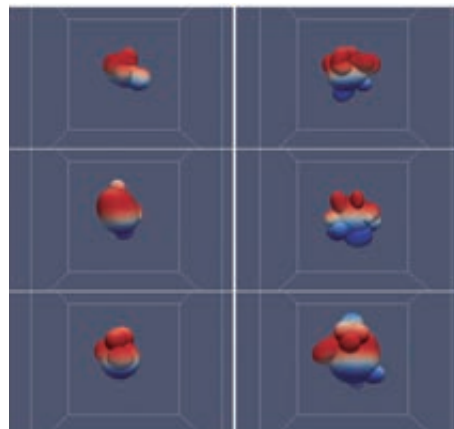
PIs: J. Hampton and J. Principe.

- **Unfitted finite element methods and discretisations:** Design of robust finite element schemes on embedded meshes, adaptive embedded methods on tree meshes, applications to moving geometries and interfaces.

PIs: S. Badia, E. Miranda and F. Verdugo.

- **Open source scientific software:** Design of advanced mathematical software, e.g., using novel programming languages and programming paradigms, scalable implementations on distributed memory machines.

PIs: S. Badia and F. Verdugo.



On-going RTD Projects

CompMam (Europ.Ex) - Towards Computational Methods for Metal Additive Manufacturing
MCIU - Acciones de Dinamización «Europa Excelencia»
Coordinator: CIMNE - 01/12/2018 - 31/12/2020

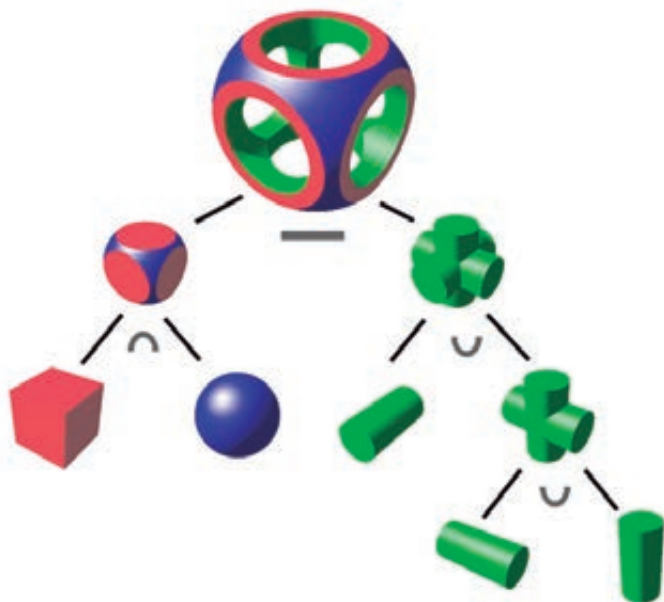
EUROFUSION - Implementation of activities described in the Roadmap to Fusion during Horizon 2020 through a Joint programme of the members of the EUROfusion consortium
EC - H2020 (2014-2020)
Coordinator: MPG - 01/01/2014 - 31/12/2022

ExaQute - EXAscale Quantification of Uncertainties for Technology and Science Simulation
EC - H2020 (2014-2020)
Coordinator: CIMNE - 01/06/2018 - 31/05/2021

SOFAST - Marco de optimización estocástica para el diseño estructural de aeronaves A Stochastic Optimization Framework for Aircraft STRUCTURAL design
MCIU - Retos Investigación
Coordinator: CIMNE - 01/01/2019 - 31/12/2021

Staff

Santiago Badia (Leader)	Eric Miranda
Jesús Bonilla	Víctor Sande
Jerrad Harris Hampton	Francesc Verdugo
Javier Príncipe	



Aeronautics

The Aeronautics group develops new and challenging projects in the aeronautical field, optimization and data modelling, as well as fuel cells.

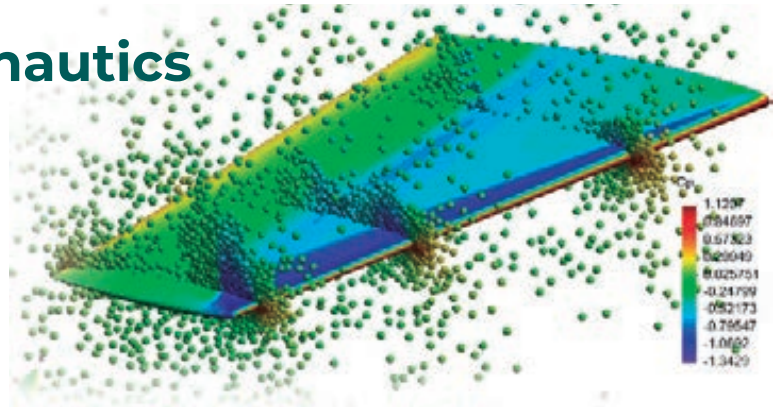
The group deals with research in computational fluid dynamics, fluid structure interaction with Particle Finite Element Methods and thin membrane structures, optimization and machine learning, and fuel cells technology and also collaborates with other CIMNE groups in Composites materials analysis or IT technology applied to sensing and data management.

Research

- **FEM and meshless methods for aerodynamics analysis and drag reduction in aeronautics.** This research line is oriented to develop, implement and apply meshless methods in aeronautical and engineering applications. **PIs: J. Pons-Prats and E. Ortega**
- **Fluid-Structure Interaction and aeroelastic problems.** This research line is intended to develop methods for FSI problems in aeronautical and civil engineering. Emphasis is placed on fast (low-fidelity/surrogate) solution methods suitable for practical applications. **PIs: E. Ortega, R. Flores, J. Pons-Prats and O. Frigola.**
- **Optimization algorithms for robust optimal design, shape optimization and material design in aeronautics.** This research line is oriented to develop, implement and apply meshless methods in aeronautical and engineering applications. **PIs: G. Bugada and J. Pons-Prats**

Staff

Jordi Pons-Prats (Leader)
 Martí Coma
 Roberto M. Flores
 Jacques Périaux
 Enrique Ortega



On-going RTD Projects

ALTERNATE - Assessment on Alternative Aviation Fuels Development

EC- H2020 - SC4-Smart, green & integrated transport

Coordinator: UPM - 01/01/2020 - 31/12/2022

AVINT - Estratègies de mecanitzat i predicció de la rugositat per a una integritat superficial òptima

ACCIÓ - RIS3CAT

Coordinator: CTM - 01/07/2017 - 20/03/2021

CityFlows -Decision-support system for pro-active crowd management of crowded urban spaces

EC- H2020 - SC4-Smart, green & integrated transport

Coordinator: AMS Institute - 01/01/2020 - 31/12/2021

ExaQute - EXAScale Quantification of Uncertainties for Technology and Science Simulation

EC- H2020 - Future & emerging technologies

Coordinator: CIMNE - 01/06/2018 - 31/05/2021

FIBRESHIP - Engineering, production and life-cycle management for massive application of FIBRE-based materials in large-length SHIPs

EC - H2020 (2014-2020)

Coordinator: TSI - 01/06/2017 - 31/05/2020

GAVIUS - Gavius: from reactive to proactive public administrations

EC - 4th Call for Proposals (2019)

Coordinator: Ajuntament de Gavà

01/09/2019 - 31/08/2022

ICARE – International Cooperation in Aviation Research - EC-H2020 (2014-2020)

Coordinator: ERDYN – 01/10/2017 - 31/03/2020

CENIT- Innovation in Multimodal Transport

CENIT's main activity is the knowledge generation related to transport, from logistics and mobility, to its transmission to society through research, training and technology transfer.

- **Transport economics.** Financing of public transport, cost-benefit analysis and pricing strategies.
- **Urban Freight Distribution.** Assessment of the impact of e-commerce on urban mobility and strategies for optimizing the delivery.
- **Green transport.** Environmental impact of several transportation modes and developing strategies and measures to reduce the impacts. The analysis has been focused mainly on port and urban freight sectors.

Staff

Sergi Saurí (Leader)

Pere Arrom

Esther Blanco

Felipe Camprodon

Cloe Cortés

Eglantina Dani

Irene De Cubas

Javier Garrido

Julia García de la Santa

Francesc Gasparín

Lisa Grace

África Marrero

Genis Majoral

Moisés Ortega

Domingo Peñalver

Blanca Puche

Jaume Roca

Francisco Rodero

Pablo Sanz

Kristi Shalla

On-going RTD Projects

CityFlows -Decision-support system for pro-active crowd management of crowded urban spaces

EC- H2020 - SC4-Smart, green & integrated transport

Coordinator: AMS Institute

01/01/2020 - 31/12/2021

EnerNETMob - Mediterranean Interregional Electromobility Networks for intermodal and interurban low carbon transport systems

EC - MED Programme 2014-2020

Coordinator: REGPEL

01/02/2018 - 31/01/2022

LASH FIRE - Legislation Assessment addressing Safety Hazards of Fire and Innovations in Ro-ro ship Environments – EC - H2020 (2014-2020)

Coordinator: RISE

01/05/2019 - 30/04/2023

REG4SSEA - Regulation strategies to promote sustainable transport through Short Sea Shipping

MINECO - Retos Investigación: Proyectos de I+D+i

Coordinator: CIMNE

30/12/2016 - 31/12/2020

SMUD - Shared micro depots for urban pickup and delivery

EC - H2020 - SC4-Smart, green & integrated transport

Coordinator: Fraunhofer

01/01/2020 - 31/12/2020



Naval and Marine Engineering

CIMNE has a large experience in conducting RTD projects in naval and marine engineering.

The main activities in these fields are related to the development and application of computational methods and computer aided design and verification tools on the following topics:

- Hydrodynamic analysis of vessels / optimum shape design methods for ships.
- Ship structures / composite materials / fluid-structure interaction effects.
- Offshore structures / fluid-structure interaction effects.
- Environmental problems in naval and marine engineering.
- Multidisciplinary problems in naval and marine engineering.
- Decision support systems in naval and marine engineering / wireless sensor networks / artificial intelligence technology.

Research

- **Development of technology for the massive application of composite materials in large marine structures.** The objective of this line is the development of computational tools to enable the design and assessment of large FRP marine structures.
- **Hydrodynamic analysis of vessels.** The current objective of this line is the development and application of advanced computational tools for the analysis and optimization of ship hulls.

- **Ship structures / fluid-structure interaction.** The current objective of this line is the development and application of advanced computational tools for the direct analysis of ship structures (including structural health monitoring solutions).

On-going RTD Projects

FIBRESHIP - Engineering, production and life-cycle management for massive application of FIBRE-based materials in large-length SHIPS

EC - H2020 (2014-2020)

Coordinator: TSI - 01/06/2017 - 31/05/2020

NICE-SHIP - Development of new Lagrangian computational methods for ice-ship interaction problems

ONR - NICOP

Coordinator: CIMNE - 30/09/2016 - 01/10/2019

STM Validation Project

INEA - CEF Programme 2014-2020

Coordinator: Swedish Maritime Administration
01/01/2015 - 30/06/2019

Staff

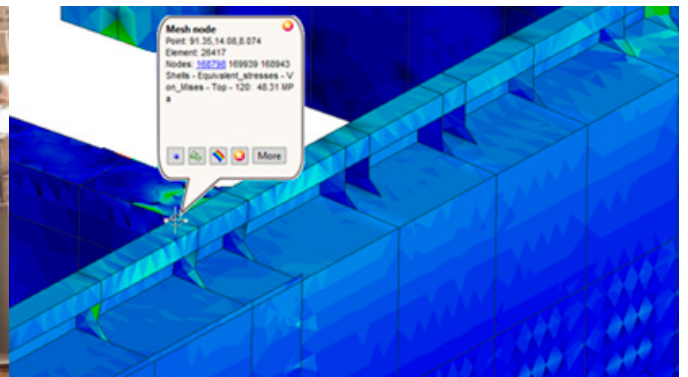
Borja Serván (Leader)

Irene Berdugo

Miguel Calpe

Jonathan Colom

Rafael Pacheco



Information and Communication Technology

The Information and Communication Technology Group of CIMNE specializes in research, development and innovation of new and disruptive technologies, applicable to multiple engineering areas.

The group activities aim to improve simulation tools, smart embedded systems, Artificial Intelligence (AI), IOT devices and GIS in order to develop Decision Support Systems (DSS), Prediction Systems and Cyber Physical Systems (CPS) for advancing knowledge and technology in engineering and applied sciences for different sectors: Industry5.0, SmartCities, Environment, Building, Transport, Health, etc.

Research

Computation and Information Technologies

(PI: J. Jiménez)

- IOT Technologies
- AI Technologies (ML, DL, TinyML)
- Blockchain
- GIS Technologies & Simulations
- Computer Vision
- DSS/EWS/CPS/ Monitoring Platforms Development
- Biomedical Signal Processing
- Web/App Development
- Proactive Communications Tools
- Water

Staff

Jordi Jiménez (Leader)	Javier Mora
Pedro A. Arnau	Cristian Pérez
Laura Almunia	Ángel Diego Priegue
Alberto Burgos	Javier Soraluze
Alexis Cid	Alberto Tena
Eduard Escola	Sergio Valero
Sergi Macian	Claudio M. Zinggerling
Andreu Marí	

Ongoing projects

LIFE4MEDECA - Support for the preparation of Emission Control Areas in the Mediterranean Sea
EC - LIFE (2014-2020)

Coordinator: Autorità di Sistema Portuale del Mar Tirreno Centro Settentrionale
01/01/2021 - 31/12/2023

CityFlows - Decision-support system for pro-active crowd management of crowded urban spaces

EC - H2020 - SC4-Smart, green & integrated transport
Coordinator: AMS Institute - 01/01/2020 - 31/12/2021

GAVIUS - From reactive to proactive public administrations

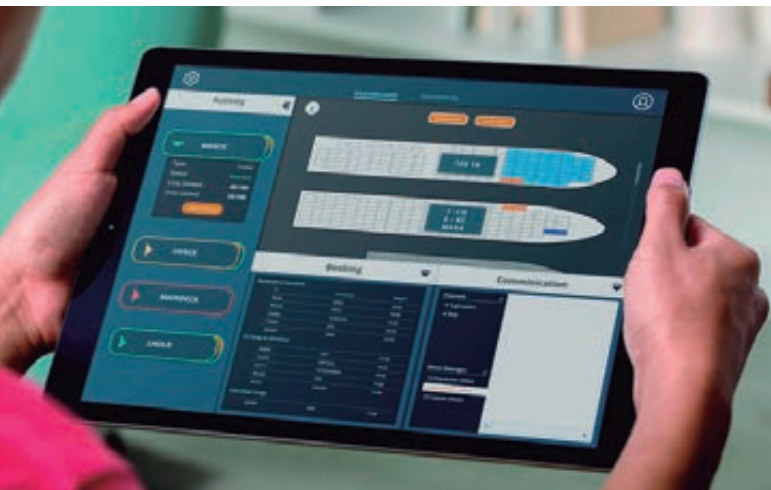
EC - UIA Initiative - **Coordinator:** Ajuntament de Gavà
01/09/2019 - 31/08/2022

LASH FIRE - Legislation Assessment addressing Safety Hazards of Fire and Innovations in Ro-ro ship Environments

EC - H2020 - SC4 - Smart, green & integrated transport
Coordinator: RISE
01/09/2019 - 31/08/2023

COOSW - Transnational cooperation in Lab validation for SWAC, WEC and COOL STEAM devices harnessing the ocean energy

EC - ERA - NETS
Coordinator: CIMNE - 01/06/2019 - 31/05/2022





HAMELIN - Herramientas para adecuar y mejorar la gestión de plagas de insectos

EC- Interreg/POCTEFA

Coordinator: CIMNE

01/01/2019 - 31/01/2022

EnerNETMob - Mediterranean Interregional Electromobility Networks for intermodal and interurban low carbon transport systems

EC - MED Programme 2014-2020

Coordinator: REGPEL

01/02/2018 - 31/01/2022

EUIN COAST - Preparación de la Propuesta HEU "COAST - Citizen Science for Global Coast Environmental"

MCIU - Europa Investigación

Coordinator: CIMNE - 01/11/2020 - 31/10/2022

PAVIRE - Plataforma TIC para la Gestión del Estado del Pavimento y su influencia en el consumo con información cruzada del tipo de conducción

MCIU - Retos Colaboración: Proyectos I+D

Coordinator: COMSA - 01/07/2018 - 30/06/2021

BIMIoTICa - Digitalización de los Procesos de Prevención de Riesgos Laborales en el Sector de la Construcción

MCIU - Retos Colaboración: Proyectos I+D

Coordinator: COMSA - 01/07/2018 - 31/12/2020

GNLBlockchain - Implementación de un prototipo pre-industrial de ultracongelación utilizando GNL y desarrollo de herramientas de trazabilidad mediante el concepto Blockchain

MCIU - Retos Colaboración: Proyectos I+D

Coordinator: E4EFFICIENCY - 01/07/2018 - 01/07/2018

APoEmA - Aigua potable per a emplaçaments aïllats

AGAUR - Producte

Coordinator: CIMNE

23/07/2020 - 22/01/2022

PIPLATES - Plataforma de Predicció Territorial

GENCAT - Technologies Digitals Avançades (TDA)

Coordinator: CIMNE

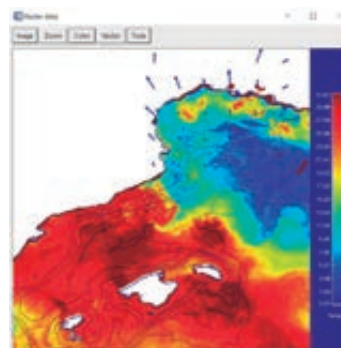
01/07/2020 - 30/06/2022

Valorització de les dades de la IoT (Agrupació FEM IOT)

GENCAT - Activitats Emergents

Coordinator: CIMNE

31/12/2019 - 28/02/2022



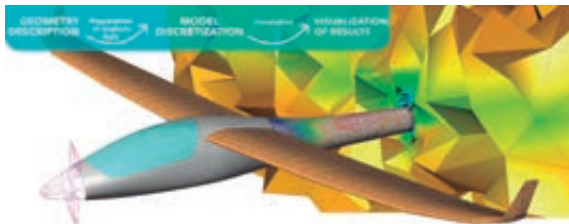
Pre and Post-Processing

The Pre and Postprocessing Group works on the development of advanced methods for efficient generation of data for numerical simulations and visualization of computational results. This group holds the development team of the commercial pre and postprocessing environment GiD, which is a universal pre and post-processor for numerical simulations.

Research

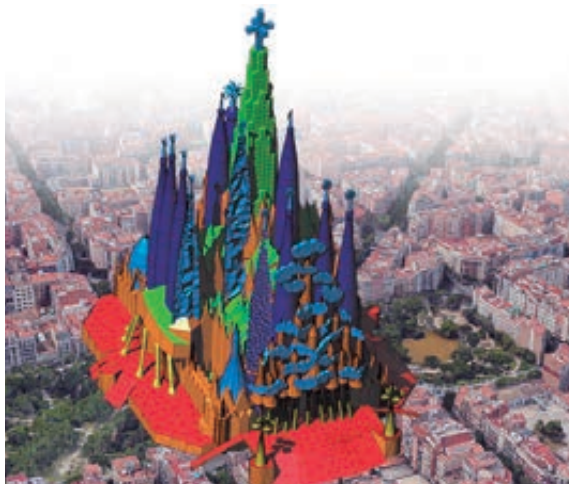
• Computational Geometry. PI: E. Escolano

Computer Aided Design (CAD) tools development to cover numerical simulation tools.



• Mesh Generation. PI: A. Coll

Development and improvement of mesh generation tools for numerical simulations, covering the needs of all CIMNE groups devoted to numerical simulations, as well as the GiD users.



• Postprocessing for numerical simulations. PI: M. Pasenau

Development of advanced postprocessing techniques for numerical simulations, specially for cases of huge distributed results focused on High Performance Computing (HPC) architectures.

• Advanced visualization. PI: M. Pasenau

Advanced 3d visualization techniques adapted for numerical simulations, considering very big models and sets of results, as well as remote solutions to allow the use of light devices (mobile) for visualizing simulations adapted to cloud architectures.

• Software architecture. PI: A. Melendo

Design of Graphical User Interface (GUI) for simulation software, and customization of solvers to be integrated in GiD pre and postprocessing platform. Adaptation of cloud architectures to cover the needs of simulation software, and implementation of a new platform for simulations based on Software as a Service (Saas) business model paradigm.

On-going RTD Projects

ACASIAS - Advanced Concepts for Aero-Structures with Integrated Antennas and Sensors

EC - H2020 (2014-2020)

Coordinator: NLR - 01/06/2017 - 31/05/2021

CityFlows - Decision-support system for pro-active crowd management of crowded urban spaces

EC - H2020 (2014-2020)

Coordinator: AMS Institute - 01/01/2020 - 31/12/2021

Staff

Abel Coll (Leader)

Enrique Escolano

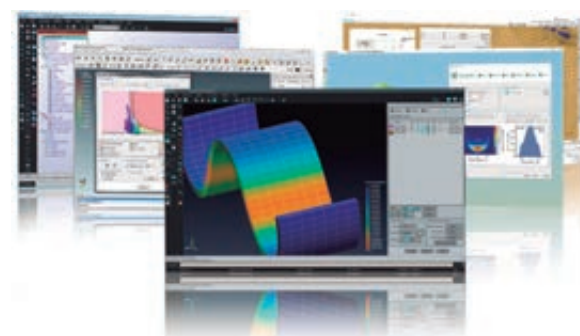
Javier Gárate

Adrià Melendo

Anna Monros

Miguel Pasenau

Laura Santos



Valorization of Research and Technology Transfer

The Valorization of Research and Technology Transfer Group focuses on the development and implementation of innovative procedures for transforming the outputs of RTD activities of CIMNE into useful prototypes and products of practical interest and their subsequent transfer to industry.

The Valorization of Research and Technology Transfer group mission is to transfer technology in its broadest sense, by helping to identify and by putting together all the key players in the entire value chain of technology, from the creators to distributors in the market. Two main tools are used by CIMNE for the technology transfer: Technology License agreements and creation and shareholding in spin-offs.

Staff

Javier Marcipar (Leader) Sergio Otero

New technologies under valorization process during year 2020

- **Smart Water:** IOT device to measure water consumption from home, clubs, hotels application. Smart water is an easy-to-install, non-invasive water consumption sensor system that allows the user to track and visualize their water consumption. It allows to become aware to make a more responsible consumption at a particular level and to generate data (big data) to obtain quantitative information at a macro level, in order to take better decisions and generate more efficient consumption strategies and policies.



- **Applications of inflatable technologies to support formworks of large sizes in sewers, dams and galleries.**

The application of large scale inflatable elements covered with special protection material to allow the projection of concrete over the structure.

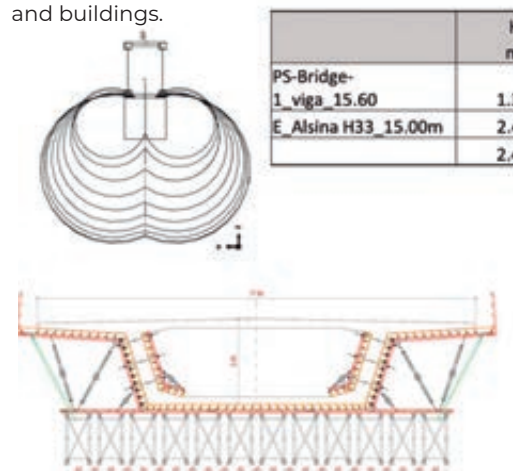
This new technique may drastically reduce the needed to construct formworks, which are very demanding of heavy materials, human and heavy machinery resources.



- **Applications of Tensairity technology to increase portable capability of formworks for bridges.**

The use of Tensairity technology developed for the Ultra-lightweight bridges can help to reduce the amount of steel needed in large formworks.

It is expected to reduce about 3 times the need of heavy steel frames, reducing time and resources needed to set-up large formworks in roads, bridge and buildings.



- **Applications of IOT, Digital Signage and Smart Communications to support operations and maintenance in municipalities and public spaces.**

Use of IOT technologies to improve the interaction of different physical elements in the municipalities with the citizens and maintenance staff.

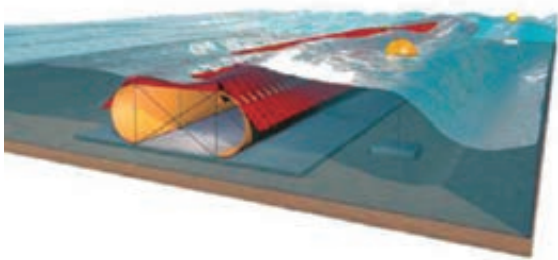
The system is based into the application of smart intelligent signages connected to a smart information management system. Allowing users to access required information just approaching their mobile phones to the signages.



- **Inflatable Breakwaters for sand beach protection.**

Existing solutions are based into Rigid Transversal breakwaters, that decrease the incipient wave height to reduce the These solutions are permanent unless they are not needed all the time, and it is an obstacle for natural refreshment of seawater, causing another important impact into the environment.

Main advantage of the new inflatable breakwaters is that they can be deployed only during storms and deflated otherwise. At the same time reducing the affection to the flora and fauna.



Highlighted technologies in the market licensed to spin-off companies



PS-Bridge (Market by PSTECH – Ultra-lightweight bridge for rapid deployment that solves current logistical needs in less than 5 hours)



Large Scale Inflatable Structures (Market by Buildair – Conceived as a membrane-strapanchorage system to ensure the stability and functionality requirements in front of the external and internal actions)

Research Rankings

Webometrics Ranking

Recently, the **16th edition of Webometrics Ranking of Spanish researchers** and researchers working in Spanish Institutions (Spain) according to their Google Scholar Citations public profiles (<http://www.webometrics.info>) has been published.

This edition data was collected during the second week of March 2021. The list includes the top **91.000 profiles ranked by h-index** in decreasing order and then by the total number of citations.

Eugenio Oñate, professor of the School of Civil Engineering of UPC, is in the position 372th of the ranking with an h-index of h=75 and 25.983 citations.

There are **108 CIMNE researchers listed in Webometrics, three of them among the 1.000 first positions:**

- Prof. Eugenio Oñate (372th position)
- Prof. Antonio Gens (458th position)
- Prof. Eduardo Alonso (898th position)

This list ranks Prof. Eugenio Oñate, director of CIMNE, as the highest cited researcher of Universitat Politècnica de Catalunya · BarcelonaTech (UPC).

Webcindario Ranking

Another reference website in research ranking is Webcindario (<https://grupodih.info/>). In February 2021, it has updated its yearly list about prizes, women researchers and its ranking list by provinces.

The following list is a summary of the CIMNE researchers that appear in the one made by DIH Group / Webcindario:

Mathematics, Interdisciplinary Applications

Four CIMNE researchers are the top positions in this rank:

- Oñate, Eugenio (Fh: 1,42)
- Codina, Ramon (Fh: 1,06)
- Huerta, Antonio (Fh: 1)
- Idelsohn, Sergio (Fh: 0,94)

Engineering, Civil

- Barbat, Alex (Fh: 0,83)

Engineering, Geological

Two CIMNE researchers lead this rank:

- Gens, Antonio (Fh: 1,34);
- Alonso, Eduardo (Fh: 1,06);

Engineering, Multidisciplinary

- Agelet, Carlos (Fh: 0,95)



RANKING OF CIMNE SCIENTISTS IN SPAIN

RANK	RESEARCHER	H-INDEX	CITATIONS
372	Eugenio Oñate	75	25983
458	Antonio Gens	71	21652
898	Eduardo Alonso	60	18785
1317	Antonio Huerta	54	11610
1329	Ramón Codina	54	10518
1619	Miguel Cervera	51	8397
1772	Javier Xavier Oliver	49	13549
1790	Sergio Idelsohn	49	10695
2207	Alex H Barbat	46	8508
2691	Sergio Oller	43	9261
3390	Marino Arroyo	40	5563
3772	Enrique Romero	38	6911
4356	Sebastià Olivella	36	6033
4560	Michele Chiumenti	36	3736
5197	Alfredo Huespe	34	3943
5643	Santiago Badia	33	3596
8358	Carlos Agelet de Saracibar	28	2464
9244	Melba Navarro	26	4415
9515	Riccardo Rossi	26	2564
9635	Pedro Díez	26	2320
11356	Xavier Martínez	24	1907
12518	José Sarrate	23	1454
12673	Antonio Rodríguez Ferran	22	3018
12924	Luca Pelà	22	2051
14458	Javier Principe	21	1413
14885	Martha Liliana Carreño	20	2574
15237	Gabriel Bugada	20	1671
16202	Julio García	19	2161
18645	Jaime Martí	18	1022
19705	Juan Carlos Cante	17	1125
23226	Narges Dialami	15	885
25947	Pavel Ryzhakov	14	600
26035	Alberto F Martín	14	583
26887	Fernando Salazar	13	889
27239	Julio Marti	13	742
29362	Oriol Lloberas Valls	12	744

RANK	RESEARCHER	H-INDEX	CITATIONS
32265	Rafael Morán	11	549
32286	Antonia Larese	11	546
33241	Mario A Salgado	11	408
33767	Sergi Sauri	11	349
34400	Marcelo Raschi	10	807
35392	Antonio R Marí	10	424
35549	Borja Serván	10	403
35816	Javier Mora	10	377
36118	Roubin Emmanuel	10	350
36714	Francesc Verdugo	10	299
36798	Ernesto Castillo	10	291
37473	Miguel Ángel Celigueta	9	838
37586	Pedro Arnau	9	636
37610	Jerrad Hampton	9	614
57809	Marcos Sanz	5	67
59476	David J Vicente	4	142
59554	Emilio Salsi	4	131
59631	Eric Neiva	4	123
59642	Miquel Santasusana	4	122
59810	Jordi Carbonell	4	110
60334	Alba Hierro	4	87
60470	Guillermo Casas	4	83
60948	David Roca	4	72
61721	Marina Arbat Bofill	4	60
62818	Ilaria Iaconeta	4	48
65464	Jesús Bonilla	3	77
65692	Nelson Lafontaine	3	65
66339	Claudio Zinggerling	3	48
66562	Ignasi de Pouplana	3	45
66838	Marc Olm	3	41
68359	Barbara Llacay	3	29
68898	Javier Marcipar	3	26
71854	André Conde	2	41
72288	Alejandro Cornejo	2	30
74024	Rubén Zorrilla	2	16
80662	Daniel Pérez	1	5
80662	Miguel Ángel Celigueta	1	5
82011	Arnab Samaddar	1	3
84409	Sergio Jiménez	1	1

(WEBOMETRICS.INFO)

Publications

CIMNE publishes books, journals, monographs, scientific reports and educational software on the theory and applications of numerical methods in engineering and applied science. The publications of CIMNE can be visited and ordered via Internet on the website books.cimne.com. Most publications can be freely downloaded from the web. We list below the publications of CIMNE in 2020.

NUMBER OF CIMNE PUBLICATIONS (1987-2020)

Edited books	87
Text books	46
Research reports	417
Technical reports	643
Monographs	276
Papers in journals (since 2009)	998

Books

Oller S.H; Nallim L.G. *Estática y resistencia de materiales*, CIMNE, L151, 366pp, 2020.

Journals



Archives of Computational Methods in Engineering. **Editors:** Kleiber M., Oñate E. Springer, 2020. Journal Impact Factor (2019): 6.730; 5 Year Impact Factor (2019): 7.351



Revista Internacional de Métodos Numéricos para Cálculo y Diseño en Ingeniería. Editors: Oñate E., Idelsohn S.R., Scipedia, 2020. Journal Impact Factor (2019): 0.338. H-Index: 8

Monographs

In 2020 CIMNE researchers have published **5 monographs:**

Aguar R. , Cagua B., J. Pilatasig. *Pushover con Aco-plamiento de CEINCI-LAB y OpenSees*, MIS77, pp.184, CIMNE, 2020.

Mataix V., Oñate E., Rossi R. *Innovative mathematical and numerical models for studying the deformation of shells during industrial forming processes with the Finite Element Method*, M190, CIMNE, pp.374, 2020.

Roca D., Cante J.C., Lloberas O, Oliver X. *Numerical tools for computational design of acoustic metamaterials*, M191, CIMNE, pp.70, 2020.

Ugel R. D. , Pujades L. G. , Guerrero N. L. , Herrera R. I. *Análisis sismo-resistente de edificios mixtos de acero y hormigón armado*, MIS78, CIMNE, pp.172, 2020.

Zorrilla R., Oñate E., Rossi R. *Towards the Virtual Wind Tunnel for civil engineering applications*, M189, CIMNE, pp.213, 2020.

Papers in Journals

In 2020 CIMNE researchers have published **110 papers in JCR Journals. 85,3% of the papers were published in Q1 journals:**

Further info and DOIs available on cimne.com/papers2020

Andrade C. *Initial steps of corrosion and oxide characteristics*, Structural Concrete, vol: 21, issue: 5, 1710-1719, 2020.

Andrade C. *Electrochemical methods for on-site corrosion detection*, Structural Concrete, vol: 21, issue: 4, 1385-1395, 2020.

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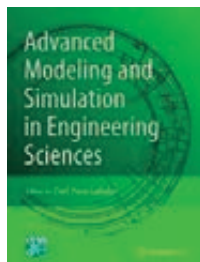
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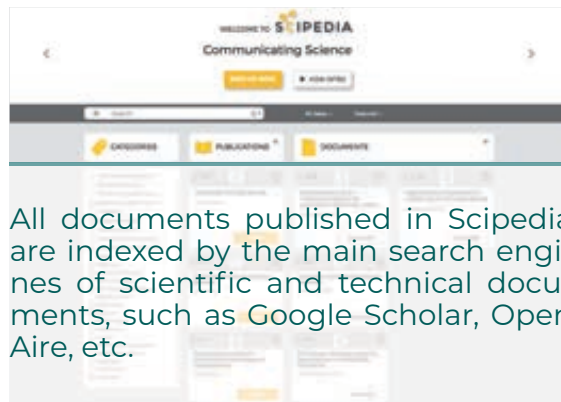
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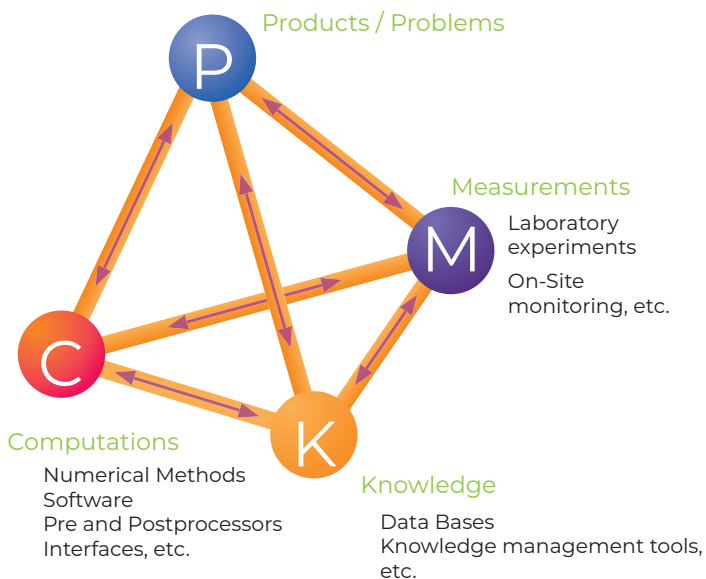
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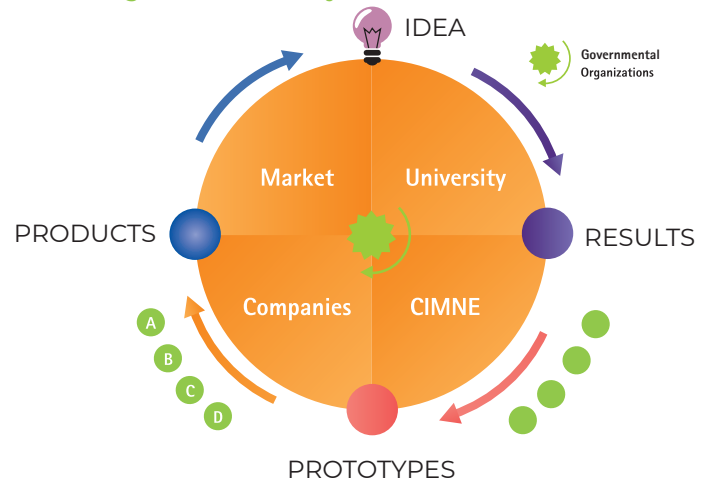
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The mission and activity of CIMNE can be explained through the so-called Cycle of Ideas:



Ideas (scientific advances) usually originate in university environments, where many professionals study, investigate and discover new areas of knowledge. The idea matures until it produces tangible results (thesis, papers, computer programs, physical devices, etc.) that have to be filed and protected. **Results** evolve until they reach the level of a prototype (a software code, a system, a device, etc.). The transit of a result to a prototype demands an organization, efficient and capable staff and resources. What is desirable is that the idea follows its route on specialized institutions, adjacent to the university, such as CIMNE, with the mission of transforming knowledge into tangible things (prototypes). The **prototype** develops into a product within a company. The cycle follows with the marketing of the **product** and ends up with the reinvestment of part of the revenues in the development of new ideas.

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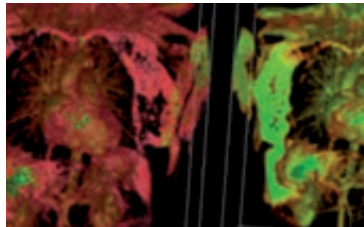
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Customizable web application that creates virtual communities where users can communicate and share. Developed and marketed by CIMNE since 2009. ✱ fraktalis.com

EDUCATIONAL SOFTWARE



Educational software for interactive learning about structural design and finite element method. Developed and marketed by CIMNE.

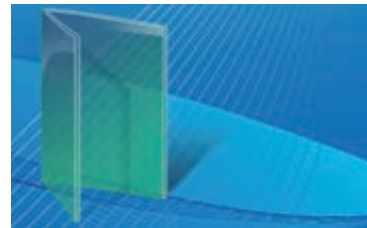
✱ cimne.com/educational

LHINGS



Cloud platform to provide access and links to all kind of things and let users management, share and interaction with them. Developed and marketed by Lyncos SL and CIMNE. ✱ lhings.com

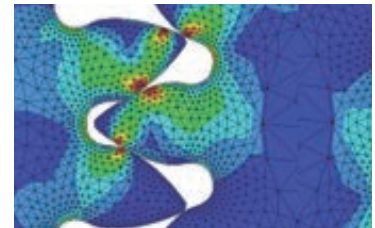
SIGPRO



Integrated software platform for the management of the research and financial activities and reports in RTD projects. Developed by CIMNE.

✱ cimne.com/sigpro

MAT-FEM



Educational program in MATLAB for introduction to the finite element method for analysis of structures and field problems. Developed by CIMNE.

✱ cimne.com/mat-fem

SCIPEDIA



Web platform for free publishing and open access of scientific publications. Developed by Scipedia, S.L. in cooperation with CIMNE. Marketed by Scipedia, S.L. since 2016.

✱ scipedia.com

DECISION SUPPORT SYSTEMS

BEACHING



Information system for management of tourism activities in beach areas. Developed by CIMNE and marketed by TAOC SA since 2011.

✱ beaching.com

RMOP



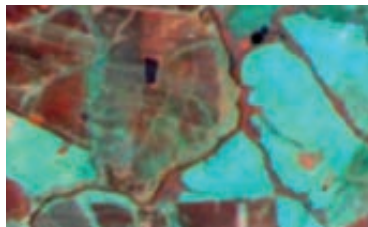
Integrated platform for robust multiobjective optimization in engineering.

Developed by CIMNE.

✱ tts.cimne.com/RMOP

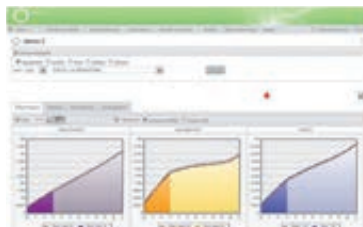
DECISION SUPPORT SYSTEMS

GIS+



Web-based interactive Geographic Information System.
Developed by CIMNE.

SIE



Information system for management of energy consumption in public buildings and municipalities. Developed by CIMNE. Marketed since 2005 by Gassó Auditores SL and CIMNE. [✱ inergybcn.com](http://www.inergybcn.com)

ROEM



Information system for assessment of the environmental quality in reservoirs and lakes.
Developed by CIMNE.

E-TESTING



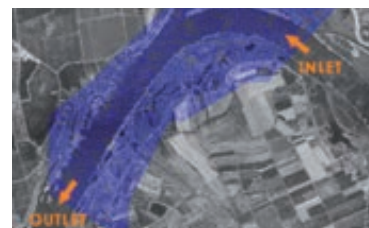
Web-based platform for e-management of experimental tests.
Developed by CIMNE and Applus.

FLOOD



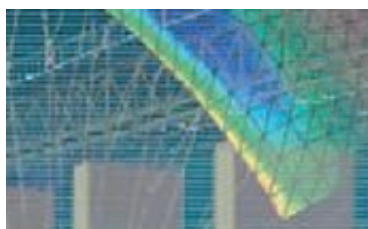
Artificial neuronal network package. Developed by CIMNE.
[✱ cimne.com/flood](http://www.cimne.com/flood)

RAMFLOOD



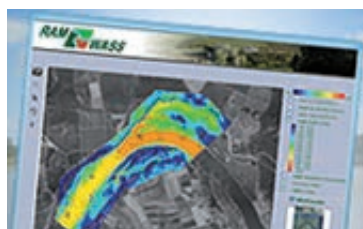
Decision support system for risk assessment and managing of floods.
Developed by CIMNE and Flumen.
[✱ www2.cimne.com/ramflood](http://www2.cimne.com/ramflood)

WSNP



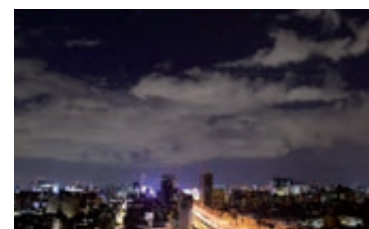
An integrated platform for e-monitoring using wireless sensor network technology.
Developed by CIMNE.
[✱ www2.cimne.com/wsnp](http://www2.cimne.com/wsnp)

RAMWASS



Decision support tool for the risk assessment and management of environmental and human-induced hazards on the water/sediment/soil system in fluvial ecosystems. Developed by CIMNE.
[✱ www.cimne.com/ramwass](http://www.cimne.com/ramwass)

BEE DATA

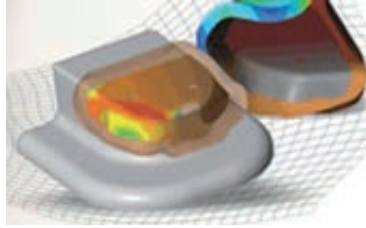


Open source BiG Data Analytics platform for deep analysis of massive data coming from smart metering infrastructure of utility companies. Developed by CIMNE and marketed by Inergy.
[✱ beedataanalytics.com](http://www.beedataanalytics.com)

SIMULATION SOFTWARE FOR INDUSTRIAL PROCESSES

WELDPACK

Welding processes software.
Developed by CIMNE.

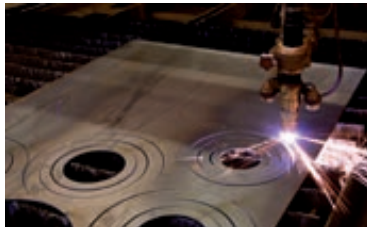
STAMPACK

Software for sheet metal forming processes. Developed by Quantech ATZ, SA and CIMNE. Marketed by Quantech ATZ, SA since 1999.

✚ stampack.com

CLICK2CAST

Software for fast simulation of casting processes. Developed by Quantech ATZ in cooperation with CIMNE. Marketed by Altair since 2015.

SCUT

Software able to simulate cutting processes for the metal manufacturing industry.
Developed by CIMNE.

ADD2MAN

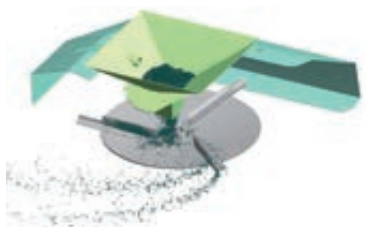
Additive manufacturing processes software. Developed by CIMNE in cooperation with Eurecat.

FORGEPACK

Forging manufacturing processes software. Developed by CIMNE.

MACHPACK

Software able to simulate machining manufacturing processes.
Developed by CIMNE.

SPREADDEM

Simulation software for the study of the particle flow on centrifugal fertilizer spreaders. Developed and marketed by CIMNE.

✚ cimne.com/spreaddem

SIMULATION SOFTWARE FOR MULTIPHYSICS

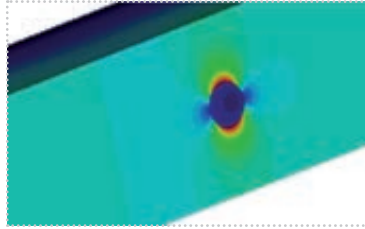
KRATOS



Object-oriented software platform for the development and application of finite element codes for multidisciplinary applications. Developed by CIMNE.

✳ cimne.com/kratos

ERMES



Computational electromagnetics using advanced finite element methods.

Developed by CIMNE.

✳ tts.cimne.com/ermes

PFIRE



Analysis of propagation of fire and its effect on the burning and melting of objects.

Developed by CIMNE.

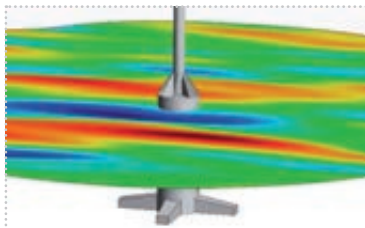
SIMULATION SOFTWARE FOR FLUID DYNAMICS

TDYN



Finite element code for analysis of a wide range of multi-physics problems in engineering and applied science. Developed by Compass Ingeniería y Sistemas, SA. and CIMNE. Marketed by Compass since 2003. ✳ compassis.com

SEAFEM



Hydrodynamics and seakeeping analysis of ships and marine structures. App for wind tower generators in the sea. Developed by Compass Ingeniería y Sistemas, SA. and CIMNE. Marketed by Compass since 2011. ✳ compassis.com

PFLOW



Analysis of fluid dynamics and fluid-structure-soil-thermal interaction problems into the Particle Finite Element Method (PFEM). Developed by CIMNE.

✳ cimne.com/pfem

PARACHUTES

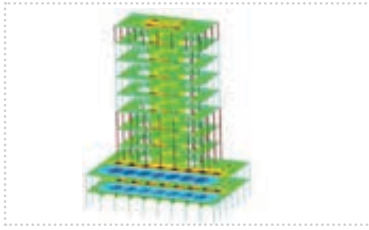


Computer program for the fast simulation of parachute-payload systems. Developed and marketed by CIMNE since 2016.

✳ cimne.com/parachutes

SIMULATION SOFTWARE FOR STRUCTURAL ENGINEERING

RAMSERIES

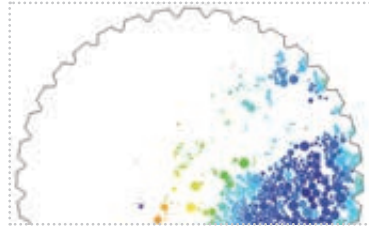


Finite element code for analysis of structures in engineering and architecture. Developed by Compass Ingeniería y Sistemas, SA. and CIMNE.

Marketed by Compass since 2003.

✱ www.compassis.com

DEMPACK



Analysis of granular systems and multifractal problems in geomechanics and industrial processes using discrete and finite element methods. Developed by CIMNE.

✱ cimne.com/dem

COMET



Finite element code for non linear analysis of thermomechanical problems in solid and structural mechanics accounting for frictional contact situations. Developed by CIMNE.

✱ cimne.com/comet

BIOMECHANICS & HEALTH

HEALTH APP



App to control eating disorders. Developed by HealthApp in cooperation with CIMNE. Marketed by HealthApp SL since 2014.

✱ bcnhealthapp.com

BODYGID



Multiscale representation and analysis of the human body. Developed by CIMNE.

✱ cimne.com/bodygid

VISIT CIMNE PRODUCTS AT
CIMNE.COM/PRODUCTS

Spin-off companies



SOLUCIONES INTEGRALES DE FORMACIÓN Y GESTIÓN STRUCTURALIA, SA

Created in 2001

* **structuralia.com**

Training and consulting activities in the civil engineering via Internet. It was sold in 2011 to KAPLAN (The Washington Post Group).



COMPASS INGENIERÍA Y SISTEMAS, SA

Created in 2002

* **compassis.com**

It develops commercial activities related to numerical methods in engineering, with emphasis on civil, naval and maritime engineering. CIMNE owns 24% of COMPASS.



QUANTECH ATZ

Created in 1996

* **quantech.es**

Development and marketing of simulation software for production processes.

CIMNE TECNOLOGÍA, SAU

Created in 2011

* **cimnetecnologia.com**

CIMNE Tecnología SAU is managed by an administration committee chaired by Mr. Ferran Falcó, Secretary General of the Ministry for Territory and Sustainability of the Generalitat de Catalunya. The Director General of the company is Mr. Javier Marcipar, Director of the Group for Valorization of Research and Technology Transfer of CIMNE.

COMPANIES WITH PARTICIPATION OF CIMNE TECNOLOGIA SAU:



BUILDAIR INGENIERÍA Y ARQUITECTURA, SA

Created in 2001

* **buildair.com**

Inflatable structures for engineering and architecture applications.

CIMNE Tecnología SA owns 3,76% of Buildair.



BEEDATA ANALYTICS, SL

Created in 2017

* **beedataanalytics.com**

ICT services based on mass analytical data treatment to users and business intelligence for companies and institutions. CIMNE Tecnología owns 36,35% of Beedata Analytics, SL.



COMPUTATIONAL AND INFORMATION TECHNOLOGIES, SA

Created in 2012

* **citechsa.com**

Computational methods and information technology systems in engineering. 100% owned by CIMNE Tecnología SA.

**FRESH WATER NATURE, SL**

Created in 2013

* **freshwaturnature.com**

Solutions for obtaining fresh water from desalination and destillation of waste water.

The company is 92,99% owned by CIMNE Tecnología SA.

**RSM GASSÓ CIMNE ENERGY, SL**

Created in 2012

* **inergybcn.com**

Advanced engineering energy services. CIMNE Tecnología, SA. owns 100% of Inergy.

**INLOC ROBOTICS, SL**

Created in 2014

* **inlocrobotics.com**

Positioning and navigation solutions for mobile robots in buried environments. CIMNE Tecnología owns 6,19% of INLOC Robotics since October 2015.

**LYNCOS TECHNOLOGIES, SL**

Created in 2012

* **lhings.com**

Software and systems for the Internet of Things.

CIMNE Tecnología SA owns 4,77% of Lyncos Technologies, SL.

**PORTABLE MULTIMEDIA SOLUTIONS, SL**

Created in 2013

* **portablemultimediasolutions.com**

Mobile pavilions with multimedia technology for leisure, sport and events. 22,6% owned by CIMNE Tecnología SA.

**PNEUMATIC STRUCTURES TECHNOLOGIES, SL**

Created in 2015

* **ps-technologies.com**

Pneumatic structures for a wide range of engineering problems. 9,5% owned by CIMNE Tecnología SA.

**OKTICS ATZ, SL**

Created in 2019

* **okobusiness.com**

Digital Signance Technologies and products.

CIMNE Tecnología, SA owns the 24,5% of OKTICS ATZ SA.

**SCIPEDIA, SL**

Created in 2015

* **scipedia.com**

Free publishing and open access for scientific publications. CIMNE Tecnología owns 16,67% of Scipedia, SL.



VISIT

CIMNE COMPANIES AT

CIMNE.COM/COMPANIES

Alliances

CIMNE, leader in research on computational engineering, has established relevant alliances with international institutions and companies since its creation in 1987.



CIMNE host of UNESCO Chair of Numerical Methods in Engineering Since 1989.

Prof. Olgierd Zienkiewicz was UNESCO Chair until his death (2009).

Secretariat of SEMNI
Since 1989



Pilot Center of
ERCOTAC in Spain
Since 1989



Secretariat of ECCOMAS
Since 1992

Secretariat of IACM
1994 - 2016



Partner of FLUMEN
Since 2012



Creation of AIAC
Since 2015

Unesco Chair in Numerical Methods in Engineering

UNESCO and UPC · BarcelonaTech reached an agreement to create the first UNESCO chair in the world in 1989: the UNESCO Chair of Numerical Methods in Engineering.



Dr. Jacques Périaux

The main mission of the Chair is to promote the development, dissemination and application of numerical methods in engineering at an international level, through education, research and technology transfer, with the aim of contributing to the solution of complex problems in lower-income countries.

Prof. O. C. Zienkiewicz held the UNESCO Chair since its creation in 1989 until his death on January 2nd, 2009. Since 2009 Dr. Jacques Périaux is the Chairholder of the Unesco Chair of Numerical Methods in Engineering. He is a recognized expert in the field of numerical methods applied to aerospace engineering.

Dr. Périaux contributions have resulted in a significant increase in the RTD activities of CIMNE in the aerospace sector, in particular with academic organizations and industry in China, the organization of numerous training courses, exchanges with leading scientists worldwide and several RTD projects at an international level.

It is important to note that computational methods are especially useful in resource-limited countries because they enhance the ability of people to predict outcomes and optimize solutions before committing resources to specific investments.

An important UNESCO Chair activity over the years has been the creation of a series of “Aulas CIMNE” (CIMNE Classrooms), physical spaces of collaboration with other research groups in universities and research centers located mainly in Latin America and Europe. All nodes in the network connected to each other are using, transforming and broadcasting knowledge generated in CIMNE over the last thirty years.

Both the people and the knowledge generated by the network members easily circulate within the network. “Aulas CIMNE” is now a growing network of centers of excellence in research and training in the field of numerical methods.

A priority in the network is the promotion of joint projects in research and training using international competitive funds and existing programs that target specific local needs. Links with scientific groups and other organizations established locally are also actively encouraged. The network is the seed for creating other expected nodes in countries of Africa and Asia.

Dr. Cecilia Soriano is the coordinator of the UNESCO Chair of Numerical Methods in Engineering.



FLUMEN Institute



In 2012, the Government of Catalunya created the FLUMEN Institute for River Dynamics and Hydrologic Engineering as a partnership between CIMNE and UPC · BarcelonaTech.

FLUMEN Institute is the outcome of merging the prestigious Flumen RTD group existing since 2005 at the School of Civil Engineering of UPC · BarcelonaTech and CIMNE, bringing together the numerical and experimental expertise of Flumen RTD group in hydraulics with the broad experience of CIMNE on numerical methods, computer simulation and integration of decision support systems.

The objectives of FLUMEN are the promotion of RTD and technology transfer activities in the field of river dynamics and hydrologic engineering. The Flumen Institute is directed by Prof. Ernest Bladé.



FLUMEN Premises



Flumen Institute is located at the B0 Building in the North Campus of UPC · BarcelonaTech since 2016. The building is equipped with modern experimental facilities for model scale testing of river dynamic and hydraulic problems. It also provides work areas for researchers at the graduate level (masters, doctoral and postdoc) and for senior researchers from CIMNE and UPC · BarcelonaTech.



Unió Europea
Fons europeu
de desenvolupament regional
Una manera de fer Europa

SEMNI

Sociedad Española de Métodos Numéricos en Ingeniería

Since 1989 CIMNE supports the activities of the Spanish Association for Numerical Methods in Engineering (SEMNI).

SEMNI

The basic aims of SEMNI are the organization and coordination of all activities related to numerical methods in engineering in Spain and being the Spanish representative in the International Association for Computational Mechanics (IACM).

SEMNI is linked to similar associations in other countries, such as the European Community on Computational Methods in Applied Sciences (ECCOMAS), the International Association for Computational Mechanics (IACM), the Groupe pour l'Avancement des Méthodes Numériques de l'Ingénieur in France, the United States Association for Computational Mechanics in the United States, and the Asociación Argentina de Mécanica Computacional, among others.

The headquarters and the secretariat of SEMNI are based in CIMNE. Currently, SEMNI has over 400 members worldwide. Some of the main activities of SEMNI include the organization of technical workshops and the organization of the Spanish Conference on Numerical Methods in Engineering, held every two years.

SEMNI will organize the congress CMN 2022 (Congress on Numerical Methods in Engineering) on September 12-14, 2022, in the city of Las Palmas de Gran Canaria (Spain).





European Community on Computational Methods in Applied Sciences

ECCOMAS is a scientific organization founded in 1992. It groups European associations with interests in the development and application of computational methods in applied sciences and technology. The ECCOMAS Secretariat is located at CIMNE.

The mission of ECCOMAS is to promote joint efforts of European universities, research institutes and industries which are active in the broad field of numerical methods and computer simulation in Engineering and Applied Sciences (i.e. Computational Solid and Structural Mechanics, Fluid Dynamics, Acoustics, Electromagnetics, Physics, Chemistry, Applied Mathematics, and Scientific Computing), to address critical societal and technological issues with particular emphasis on multidisciplinary applications and disseminate innovative research.

The three main scientific events that ECCOMAS organizes every four years are the ECCOMAS Congress, the ECCOMAS Conference on Computational Solid and Structural Mechanics (ECCM) and the ECCOMAS Conference on Computational Fluid Dynamics (ECFD). They attract approximately 5,000 participants in total.

The ECCOMAS Congress is addressed to scientists and engineers both in and outside Europe. Its main objective is to provide a forum for presentation and discussion of state-of-the-art in scientific computing applied to engineering, with emphasis on basic methodologies, scientific development and industrial applications. It also includes invited lectures,

Special Technological Sessions (STS), contributed papers from Academy and Industry and organized Minisymposia. Proceedings of the ECCOMAS Congresses are widely disseminated in Europe.

1st virtual edition of the WWCM Congress in Computational Mechanics & ECCOMAS Congress

The WWCM Congress in Computational Mechanics & ECCOMAS Congress, that took place from January 11th to 15th, 2021, had to be celebrated virtually for the first time in its history, due to the COVID-19 crisis. However, the edition has gathered more than 3000 participants from 30 countries and its organizers make a positive balance: "Nearly 150 sessions were held! Together with the 2500 questions and comments posted on the different talks, they have been the source of rich and inspiring scientific debates". More than 280 symposia have been celebrated during this edition which counted with more than 2500 contributors.

These series of ECCOMAS global meetings are complemented with more focused thematic conferences on state-of-the-art topics in computational sciences and engineering.



International Association for Computational Mechanics

The International Association for Computational Mechanics (IACM) was founded in 1981 and, since then, it has been strongly connected to CIMNE.

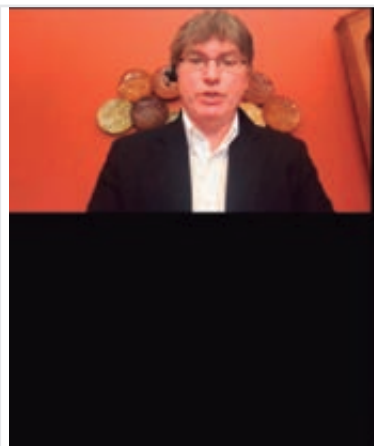
The goal of IACM is the promotion of advances in computational mechanics in a wide sense. IACM defines computational mechanics as the development and application of numerical methods and digital computers to solve problems in engineering and applied sciences with the objectives of understanding and harnessing the resources of nature.

Computational Solid Mechanics (CSM) and Computational Fluid Dynamics (CFD) are at the core of IACM activity. Subjects such as thermodynamics, electromagnetics, rigid body mechanics, control systems and some aspects of particle physics fall naturally within the scope of the IACM. Indeed providing a common forum for discussion, education and research information transfer between the diverse disciplines represented is the main raison d'être of IACM.

IACM Awards 2020

The 14th World Congress in Computational Mechanics & ECCOMAS Congress took from January 11th to 15th, 2021. During the Opening Session, IACM prizes were awarded. In this edition, CIMNE scientists Prof. Marino Arroyo and Prof. Irene Arias were awarded the IACM Fellow Award. Prof. Xavier Oliver received the Gauss-Newton Medal, the highest award given by IACM. It honors individuals who have made outstanding, sustained contributions in the field of computational mechanics over periods representing substantial portions of their professional careers.

IACM publishes a periodic bulletin and supports Special Interest Conferences, IACM Symposia and courses in various fields of computational mechanics.



X. Oliver, Awardee 2020

Prof. Oliver's research has focused on numerical modeling and computational design of engineering materials, development of the strong discontinuity approach for computational fracture mechanics, simulation of industrial manufacturing processes (with a focus on powder metallurgy and machining processes), contact mechanics for frictional materials, and most recently in acoustic metamaterials.

He is an active participant in several associations including serving as President of the Spanish Association for Numerical Methods in Engineering (SEMNI), as a member of the General Assembly of ECCOMAS, and for the last ten years as a member of the General Council of IACM.

Prof. Xavier Oliver, Technical University of Catalonia





European Research Community on Flow, Turbulence and Combustion

The ERCOFTAC network was founded in 1987. It is promoted by several European aerospace companies and it groups together more than 60 research centers and companies working primarily in the numerical simulation of fluid mechanics problems in engineering.

Since 1989, CIMNE is a Pilot Centre of ERCOFTAC in Spain.

CIMNE, acting as Pilot Centre, has organized a number of activities, including, among others, the 8th European Turbulence Workshop (Barcelona 2000), the Europe-Russia Workshop (Barcelona 2006), the 3rd Workshop on Research in Turbulence (Seville 2008), the 5th Workshop on Research in Turbulence (Tarragona 2010) and ERCOFTAC Spring Festival (Terrassa 2014).

CIMNE has coordinated the FP7 E-Caero projects 1 and 2 (E-CAERO: European Collaborative Dissemination of Aeronautical research and applications, 2009-2013 and 2014-2017).

Both projects aim to promote joint activities of different scientific associations in the aeronautic field in Europe. ERCOFTAC is a partner in both projects.





International Association of Aulas CIMNE

The International Association of Aulas CIMNE (AIAC) is a non-governmental non-profit civil organization with the objective of fostering the advances of numerical methods in a common academic space: the Aulas CIMNE (Joint Labs). Aulas CIMNE are the basis for cooperation in scientific, technological and training among its members, aiming to achieve social and economic improvements in society.

Mission

To contribute to the development, strengthening and consolidation in:

- Training, by promoting and organizing courses of interest to its members.
- Scientific and technological research, including the processes of innovation, adaptation and technology transfer in strategic areas.
- The use of numerical methods in engineering as a tool to help developing countries.

The interaction of the members of the Association with the society at large, by disseminating scientific and technological advances that drive progress.

AIAC members benefit from:

- Continuous education, enhancing the set of high-level human resources of Aulas CIMNE and the Network and by the competitive advantage of installed capacity in the regions.
- The development of multi- and inter-disciplinary activities in areas of basic research, applied research and experimental developments.
- Exchange programs for teachers, researchers, students and academic and innovation managers.
- Research and development programs in emerging knowledge areas, related to new professional profiles identified as strategic.

AIAC's vision

To promote a common project and create a network of experts from around the world, which results in the international benchmark in the field of numerical methods in engineering.

AIAC intends to encompass an international environment in which scientists, technical staff and engineers can benefit directly from CIMNE's tools (developed or in development), international collaborations, participation in projects, exchange of information and industry technology transfer, among others.



Dissemination

Knowledge transfer is of vital importance for CIMNE, which invests great efforts in training and education addressed to its research staff as well as to graduates and professionals from schools of engineering and universities in applied sciences.

CIMNE regularly organises seminars, coffee talks, courses and post-graduate studies related to the theory and application of numerical methods in engineering. It has also developed a web environment for distance learning education via Internet.

The research centre plays also an important role as event organizer in the field of computational engineering. In the following pages, a summary of the conferences organized by CIMNE Congress Bureau during 2020 can be found (most of them have to be cancelled, postponed or carried out due to COVID-19 crisis). The agenda of congresses and conferences that will take place during 2021, it is also included.

Training

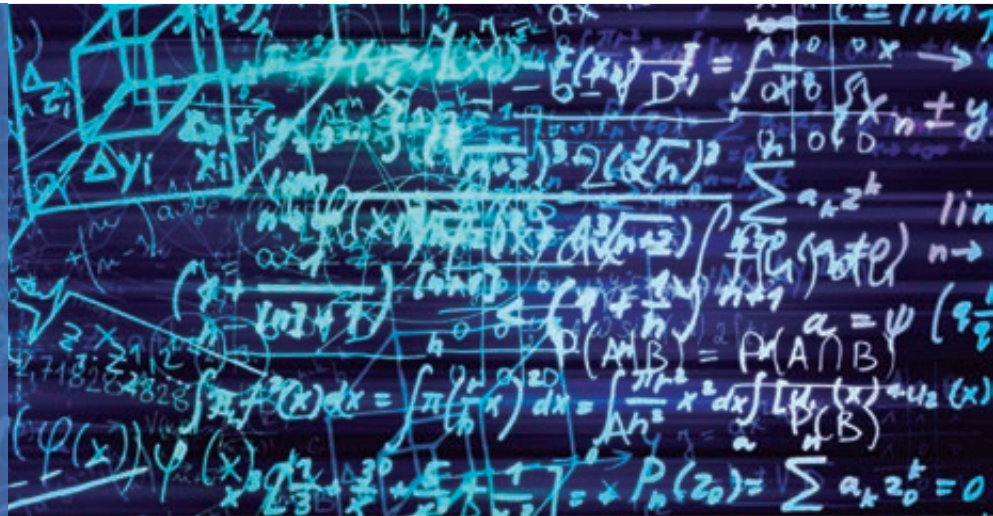
 POST-GRADUATE STUDIES

 COURSES

 SEMINARS

 COFFEE TALKS

 CONFERENCES



Post-graduate Studies

CIMNE supports the organization of the following postgraduate degrees awarded by the UPC · BarcelonaTech.

Master Degrees

Master on Numerical Methods in Engineering

Duration: 2 academic years, 120 ECTS

cimne.com/mumni

Master of Science on Computational Mechanics

Duration: 2 academic years, 120 ECTS

cimne.com/mcm

Doctoral Degrees

PhD Degree in Civil Engineering

Duration: PhD studies, 3 years period

cimne.com/phd-civil

PhD Degree in Structural Analysis

Duration: PhD studies, 3 years period

cimne.com/phd-structural

Courses

CIMNE is also been organizing courses and workshops related to its field of expertise:

Ibercursos

Online courses held in 2020:

- Initiation (English)
- Advanced courses (only in Spanish):
 - Dam breaks
 - Water quality
 - Hydraulic works
 - Sediment transport

Severo Ochoa (SO) Seminars at CIMNE in 2020

7
SO seminars

260
attendees

6/7
in virtual
format



Available
online

Towards statistically steady CFD

Riccardo Rossi; CIMNE / UPC, Barcelona (Spain)
– 26/2/2020

Reduced Order Models and the Variational Multi-scale method for flow problems

Ramon Codina; CIMNE / UPC, Barcelona (Spain)
– 6/5/2020

A (subjective) review on Computational Glacier Dynamics

Juan Pedro Roldan-Blasco; CNRS/IGE, Grenoble
(France) – 17/6/2020

Reduced-order and surrogate models for automotive research: parametric design and Uncertainty Quantification

Pedro Díez; CIMNE/UPC, Barcelona (Spain) –
1/7/2020

Structural performance and numerical assessment of polymeric AM components fabricated by Fused Filament Fabrication (FFF)

Michele Chiumenti; CIMNE/UPC, Barcelona
(Spain) – 4/11/2020

Disaster risk assessment

Liliana Carreño; CIMNE/UPC, Barcelona (Spain)
– 18/11/2020

Artificial Intelligence for optimised operation of building energy systems. Projects: REFER, SIM4BLOCKS

Jordi Cipriano and Gerard Mor; CIMNE, Lleida
(Spain) – 2/12/2020

Severo Ochoa (SO) Coffee Talks at CIMNE in 2020

4
Coffee talks

75
attendees

2/4
in virtual
format


Available
online

Sensitivity analysis of embedded bodies using the adjoint method and applied to airfoil optimization for the full-potential equation

Marc Núñez; CIMNE / CIMNE/UPC, Terrassa (Spain) – 22/1/2020

How can the art be a value for the engineering?

Constanza Delgado, Tatiana Núñez, Constanza Jofré and Rafael Vera; Pontificia Universidad Católica de Valparaíso, Valparaíso (Chile) – 19/2/2020

GiD user licences: New cloud system

Javi Gárate, CIMNE, Barcelona (Spain) – 14/10/2020

The Port of Barcelona of the future: Port Vision 2040

Javier Garrido, CIMNE (CENIT), Barcelona (Spain) – 25/11/2020

Conferences organized by CIMNE in 2020

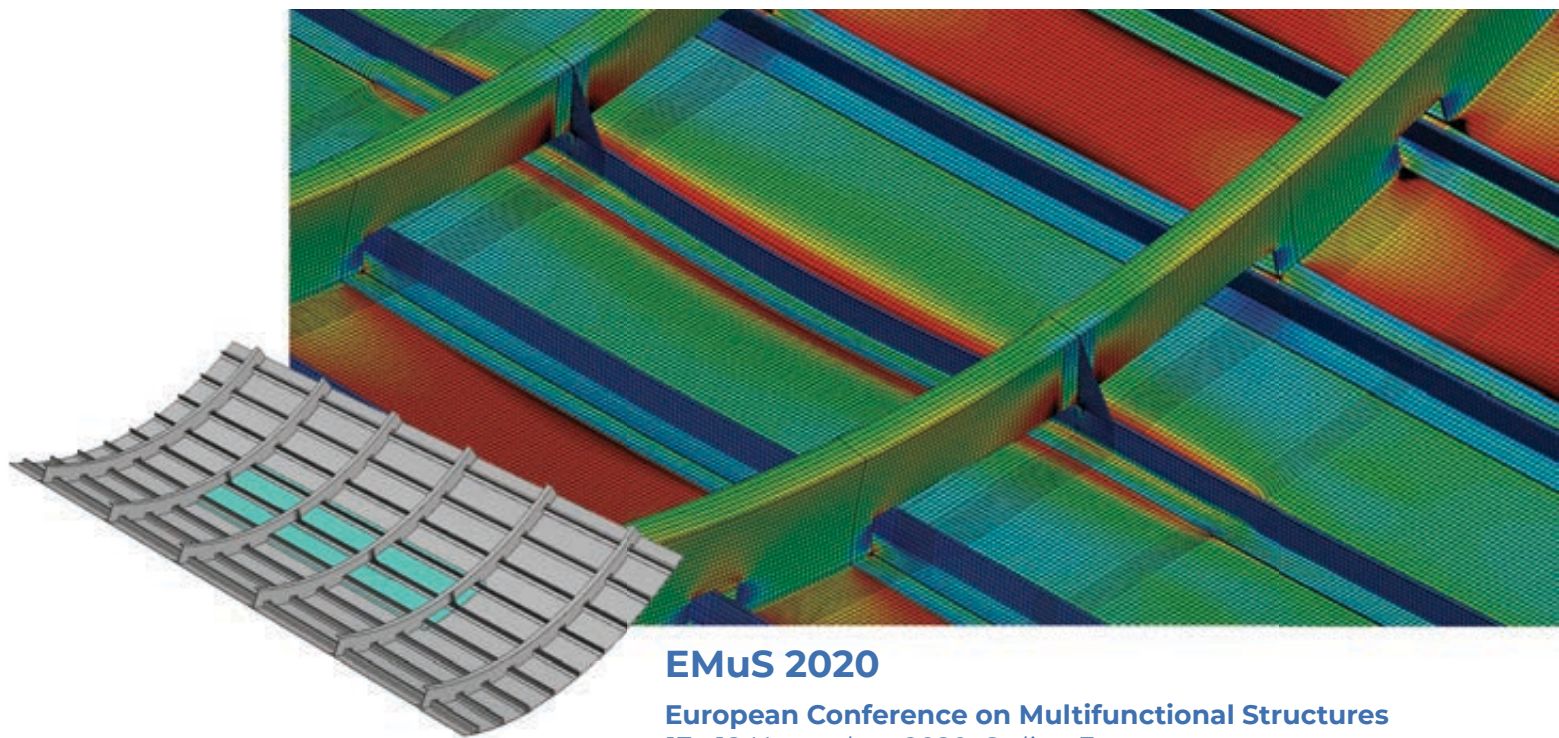


DBMC 2020

**15th International Conference
on Durability of Building
Materials and Components**

*20 - 23 October 2020,
Barcelona, Spain*

Number of participants: 412



EMuS 2020

European Conference on Multifunctional Structures

17 - 18 November, 2020, Online Event

Number of participants: 46

Upcoming conferences organized by CIMNE in 2021



WWCM 2021

World Congress on
Computational Mechanics &
ECCOMAS 2020
11 - 15 January 2021, Virtual
Conference



MARINE 2021

IX International Conference
on Computational Methods in
Marine Engineering
2-4 June, 2021, Edinburgh,
Scotland, UK



CSAI 2021

Computational Science and
AI in Industry
7 - 9 June 2021, Trondheim,
Norway



COUPLED 2021

IX International Conference
on Coupled Problems in
Science and Engineering
13-16 June, 2021, Chia Laguna,
South Sardinia, Italy



ADMOS 2021

International Conference
on Adaptive Modeling and
Simulation
21-23 June 2021, Gothenburg,
Sweden



Sim-AM 2021

International Conference
on Adaptive Modeling and
Simulation
1 - 3 September, 2021, Online
Format



COMPLAS 2021

XVI International Conference
on Computational Plasticity
7-10 September 2021,
Barcelona, Spain



STRUCTURAL MEMBRANES 2021

X International Conference
on Textile Composites and
Inflatable Structures
13-15 September 2021, Munich,
Germany



M2P

Math 2 Product
15 - 17 September, 2021, Vietri
sul Mare, Salerno, Italy



XII Jornadas Españolas de Presas - SPANCOLD 2021

Last week September 2021,
Gran Canaria



COMPOSITES 2021

12th International Conference
on Structural Analysis of
Historical Constructions
29 September - 1 October
2021, Barcelona, Spain



SAHC 2021

12th International Conference
on Structural Analysis of
Historical Constructions
29 September - 1 October
2021, Barcelona, Spain



PARTICLES 2021

VII International Conference on
Particle-Based Methods
4-6 October, 2021, Hamburg,
Germany

PARTICLES COURSE 2021

Short Course on Particle-Based
Methods in Engineering and Applied
Science
2-3 October, 2021, Hamburg, Germany



Draft programme of conferences organized by CIMNE in 2022

ECCOMAS CONGRESS 2022

5 - 9 June 2022
Oslo, Norway

BARCELONA IABMAS 2022

11th International Conference on Bridge
Maintenance, Safety and Management
11 - 15 July 2022
Barcelona, Spain

CMN 2022

Congress on Numerical Methods in
Engineering
12 - 14 September 2022,
Las Palmas de Gran Canaria, Spain

SLOPE SYMPOSIUM

X National Symposium on Unstable Slopes
13 - 16 September, 2022
Granada, Spain

Awards

Chronology of the prizes awarded to CIMNE

Below we briefly review some of the awards granted to the research centre along its history.

SPECIAL MENTION TO THE CIUTAT DE BARCELONA AWARD 1999

Special Mention to the Ciutat de Barcelona Award 1999 in the category of Technological Research for the work carried out by Drs. P. Roca, M. Cervera and E. Oñate on the modelling and structural analysis of the Barcelona Cathedral.

NARCÍS DE MONTURIOL PLATE AWARD TO THE SCIENTIFIC AND TECHNOLOGICAL MERIT 1999

In 1999 the Generalitat de Catalunya granted to CIMNE the Narcís de Monturiol Plate Award for Scientific and Technological Merit:

- For its contribution to the development of new methods for analysis and design for products and processes in engineering.
- For fostering the cooperation between industry and university research groups.
- For the organization of training activities and the promotion of science and technology at an international level.

2002 IST PRIZE TO THE BEST PRODUCT OF THE INFORMATION SOCIETY TECHNOLOGIES, EUROPEAN COMMISSION (EC)

The EC granted the IST Award to the pre/post processor system GiD (www.gidhome.com) developed at CIMNE.

CIUTAT DE BARCELONA 2002 AWARD IN TECHNOLOGICAL RESEARCH

On February 11th, 2003, the Ciutat de Barcelona Award in Technological Research was awarded to the CIMNE research team formed by Eugenio Oñate, Ramon Ribó, Enrique Escolano, Miquel Pasenau and Jorge Suit Pérez.

The prize recognized the development of the pre/postprocessor GID

AWARD DURAN I FARRELL FOR RESEARCH AND TECHNOLOGY UNIVERSITAT POLITÈCNICA DE CATALUNYA, 2004

The Award was delivered to CIMNE scientists Dr. Oñate and Dr. García for their work entitled: "Development of a new finite element code for the hydrodynamic study of vessels. Applications to the design of sailing ships for the America's Cup race".

CUBAN NATIONAL PRIZE 2016 TO THE SCIENTIFIC RESEARCH RESULT BY THE CUBAN ACADEMY OF SCIENCES

This award is a recognition of the research work entitled "Development of advanced technologies for the generation and packaging of particles focused on the methods of discrete elements".

The research was carried out by the Central University "Las Villas" of Cuba (UCLV) and the CIMNE within the Aula UCLV-CIMNE. It also involved the collaboration of the universities of Leuven (KU Leuven, Belgium), and Brasilia (UnB, Brazil), as well as foreign and local institutions.

FIMA 'TECHNICAL NOVELTY' AWARD 2018

The Centrifugal Spreading Simulation Software, SpreadDEM, developed by CIMNE, has been awarded by the 40th International Fair of Agricultural Machinery (FIMA) with the "Technical Novelty" award in the category of "Agricultural Management Solution". With this award, the Fair recognizes the companies that present devices and systems with direct application in agriculture and rural areas, which bring remarkable innovation to the sector.



Awards and honours to CIMNE Scientists in 2020

Below we list the most highlighted recognition and awards granted to CIMNE scientists during the year 2020.



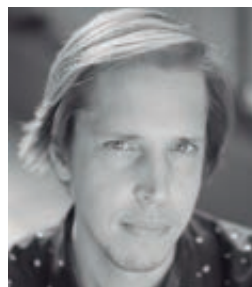
IRENE ARIAS

IACM Fellow Award
International
Association for
Computational
Mechanics (IACM)



MARINO ARROYO

IACM Fellow Award
International
Association for
Computational
Mechanics (IACM)



CARLES ESTRUCH

IABSE Early Career
Prize
International Association
for Bridge and Structural
Engineering (IABSE)



ANTONIO GENS

Doctor Honoris Causa
Technical University of
Civil Engineering of
Bucharest



XAVIER OLIVER

Gauss-Newton Medal
International
Association on
Computational
Mechanics (IACM)



EUGENIO OÑATE

Ritz-Galerkin Medal
European Community
on Computational
Methods in Applied
Sciences (ECCOMAS)



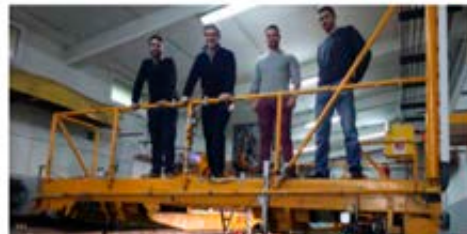
XAVIER SÀNCHEZ-VILA

Henry Darcy Medal
European Geosciences
Union

CIMNE in the media 2020



CIMNE'S PROJECTS RELATED TO THE INTERNET OF THINGS, 3D PRINTING, BLOCKCHAIN AND NAVAL ENGINEERING HAVE FOCUSED THE INTEREST OF THE LOCAL AND NATIONAL MEDIA. IMAGES BELOW SHOWS SOME OF THE MEDIA CLIPPING IN 2020.



3D Printing & Design
ADDITIVE MANUFACTURING

IMPRESORAS 3D AUTOMATIZACIÓN Y AERONÁUTICA COMERCIO E INDUSTRIA SALUD Y MEDICINA INVESTIGACIÓN Y DISEÑO EVENTO

INVESTIGACIÓN Y DISEÑO

Proyecto BASE 3D: para la investigación de nuevas tecnologías de impresión 3D
14/04/2020

El CIM UPC agrupa a centros de investigación de toda Cataluña para potenciar la I+D+i en nuevos campos emergentes de la impresión 3D. El CIM UPC presentó sus estrategias en un Kick Off el pasado viernes 6 de marzo y la previsión es de ejecutar proyectos por valor de 3,7 M€.

CIM UPC, entidad perteneciente a la Universidad Politécnica de Catalunya, lidera la agrupación en tecnologías emergentes BASE3D, que reúne a los centros de investigación más prestigiosos de Cataluña cuya actividad es potenciar la I+D+i en impresión 3D. El pasado viernes 6 de marzo se presentó el proyecto en un online Kick Off, en las instalaciones del CIM UPC donde se pudieron conocer los objetivos y las destacadas vías de trabajo de la agrupación BASE3D con los principales grupos de investigación en fabricación aditiva, aliados en el proyecto.

Con un presupuesto de 3,7 M€, BASE3D tiene como objetivo afrontar los principales retos actuales de las tecnologías de fabricación aditiva, entre los cuales se encuentran la formación de nuevos materiales y multifuncionales, la optimización de la tecnología para la obtención de piezas funcionales, los acabados y postprocesados, el incremento de la productividad, etc. El resultado del proyecto incrementará el TRL (Índice Technology Readiness Level o escala de madurez de la madurez de la tecnología antes de llegar al mercado) de cada una de las tecnologías propuestas creando un importante impacto en sectores como la industria tradicional, la industria alimentaria, el sector biomédico y el sector de la construcción.

La actuación se enmarca dentro del programa de tecnologías emergentes que ha emprendido la Generalitat de Catalunya a través de su estrategia RIS3CAT, y que impulsa el desarrollo de nuevas actividades emergentes basadas en tecnologías o procesos innovadores, disruptivos y que buscan por objetivos abrir nuevos mercados o transformar los que ya existen. Su meta

Profesionales Hoy

ALQUILER ARQUITECTURA RECICLAJE ENERGÍA NAVAL JARDINERÍA MINERÍA OBRA CIVIL

MERCADO PROTAGONISTAS ACREDITADOS NOVEDADES EMPRESAS A FONDO

INICIO > EMPRESAS > El CIM UPC presenta una agrupación de empresas punteras para la investigación de nuevas tecnologías de impresión 3D

El CIM UPC presenta una agrupación de empresas punteras para la investigación de nuevas tecnologías de impresión 3D

INICIO > EMPRESAS > El CIM UPC presenta una agrupación de empresas punteras para la investigación de nuevas tecnologías de impresión 3D

El CIM UPC presenta una agrupación de empresas punteras para la investigación de nuevas tecnologías de impresión 3D

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El CIM UPC presenta una agrupación de empresas punteras para la investigación de nuevas tecnologías de impresión 3D

SMARTGRIDSINFO

Todo sobre Redes Eléctricas Inteligentes

INICIO SMART GRIDS GENERACIÓN TRANSPORTE / DISTRIBUCIÓN CONSUMO ALMACENAMIENTO

Inicio > Smart Grid > El proyecto EKATE desarrollará sistemas de intercambio energético con I

El proyecto EKATE desarrollará sistemas de intercambio energético con blockchain e IoT

Publicado: 30/04/2020



La **Universidad del País Vasco** participa en el proyecto EKATE, que se ha puesto en marcha recientemente y tendrá una duración de 30 meses. Gracias a la cooperación transfronteriza, el proyecto trabajará en el desarrollo de sistemas eficaces de gestión del intercambio energético para instalaciones fotovoltaicas de **autoconsumo** colectivo a través de las tecnologías **blockchain** e **IoT**.



Diseño numérico, impresión 3D, pruebas hidrostáticas y un barco pesquero: así de práctica es la formación en Ingeniería Naval

12 de mayo de 2020



Diseño numérico, impresión 3D, pruebas hidrostáticas y un barco pesquero: así de práctica es la formación en Ingeniería Naval

@2020 IN TWEETS / TOP TWEETS



CIMNE carries out an intensive activity through social media, with special attention to Twitter, where the centre has more than 1.600 followers. Below we highlight some of the 2020 tweets to explain CIMNE's activities through the networks.

JANUARY'20



Congrats to the Full Research Professor at @cimne Antonio Gens for his #HonorisCausa by the Technical University of Civil Engineering of Bucharest

FEBRUARY'20



Congrats to Prof. Xavier Oliver @la_UPC @cimne, winner of the Gauss-Newton Medal of the @IACM_Community!

MARCH'20



Investigadors del @cimne simulen el flux del virus després d'esternudar
@EscolaCaminsUPC @la_UPC @gencat @biocat_cat @SOMM_alliance @AgEIves #COVID19

APRIL'20



L'equip de @CIMNETIC planifica, junt a la spin-off del @cimne #OKTICS, noves propostes R+D i el llançament exprés de dos nous productes @okosmartframe #COVID19

MAY'20



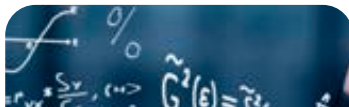
A la reunió de seguiment d'avui del consorci del projecte TRANSPORT (#LLAVOR3D), cofinançat per @accio_cat i #fonsUECat i liderat per @cimne, s'ha analitzat l'afectació de la #COVID19

JUNE'20



****ONLINE**** 17 June at 12 noon, @cimne #SeveroOchoaSeminar: "A (subjective) review on Computational Glacier Dynamics", by Juan Pedro Roldán-Blasco, #phdstudent at @IGE_Grenoble

JULY'20



Today, at 12 noon, #Online #severochoaseminar by @pedrodiezmejia entitled: "Reduced-order and surrogate models for automotive research: parametric design and Uncertainty Quantification".

AUGUST'20



HAMELIN project starts a pilot test in #deltebre

SEPTEMBER'20



3rd call New PhD and Postdoc opportunities at @cimne funded by #SeveroOchoa

OCTOBER'20



Today is #DRRday and Liliana Carreño, leader of Disaster Risk&Resilience group of @cimne explains what is a "disaster risk" and what can do scientists, society and governments to avoid it

NOVEMBER'20



Prof. Eugenio Oñate (@DirectorCIMNE) has been awarded the #ECCOMAS Ritz-Galerkin Medal 2020 #computationalmethods

DECEMBER'20



Brindis @cimne @ferranfalco: "El @cimne està orientat a resultats i sap navegar amb rigor i perseverància"

**International Centre for
Numerical Methods in
Engineering**

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