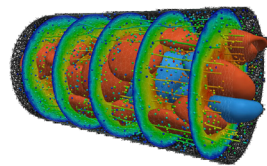
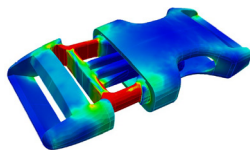


Math to Product 2025

Emerging Technologies in Computational Science for Industry,
Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain



www.m2p2025.com



VIAJES El Corte Inglés
CONGRESOS

Conference secretariat
El Corte Inglés - Congresos
congresos.valencia@viajeseci.es
m2p2025@upv.es

Co-Chairs
Enrique Nadal
Juan José Ródenas
José Manuel Navarro-Jiménez

Simona Perotto
Gianluigi Rozza
Matteo Giacomini





Math to Product 2025

Emerging Technologies in Computational Science for Industry,
Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain



www.m2p2025.com

CONFERENCE CHAIRS

- Enrique Nadal Soriano, I2MB-UPV Spain
- Juan José Rodenas García, I2MB-UPV Spain
- José Manuel Navarro Jiménez, I2MB-UPV Spain
- Prof. Simona Perotto, MOX-Department of Mathematics, Politecnico di Milano, Italy
- Prof. Gianluigi Rozza, SISSA, Italy
- Dr. Matteo Giacomini, Universitat Politècnica de Catalunya/CIMNE, Spain)

ADVISORY COMMITTEE

- Ferdinando Auricchio, *Università di Pavia, Italy*
- Paola Bagnoli, *I.R.C.C.S. Galeazzi Hospital - Sant'Ambrogio, Italy*
- Frédéric Barbaresco, *Thales, France*
- Xavier Bertrand, *AIRBUS, France*
- Stefano Bison, *Assicurazioni Generali, Italy*
- Annalisa Buffa, *EPFL, Switzerland*
- Elias Cueto, *Universidad de Zaragoza, Spain*
- Enrico Deluchi, *PoliHub Milano, Italy*
- Alessandro Della Rocca, *Tenova, Italy*
- Alexandre Ern, *Ecole Nationale des Ponts et Chaussées, France*
- Charbel Farhat, *Stanford University, USA*
- Dirk Hartmann, *Siemens, Germany*
- Antonio Huerta, *Universitat Politècnica de Catalunya, Spain*
- Marta Galvani, *Trenord, Italy*
- Angelo Iollo, *Inria, France*
- Martha Ivanovas, *Intel Ignite, Germany*
- Andrea Lario, *Dofware, Italy*
- Matteo Lombardi, *Scuderia AlphaTauri, Italy*
- Piero Losi, *Pirelli, Italy*



Math to Product 2025

Emerging Technologies in Computational Science for Industry,
Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

- **Yvon Maday**, Sorbonne Université, France
- **Alessandro Maiocchi**, Bracco, Italy
- **Stefania Marconi**, Università di Pavia, Italy
- **Aurelio Mauri**, Micron, Italy
- **Andrea Mazzola**, ATM, Italy
- **Roberto Natalini**, CNR, Italy
- **Carsten Othmer**, Volkswagen, Germany
- **Nicola Parolini**, Politecnico di Milano, Italy
- **Tony Patera**, MIT, USA
- **Benedetto Piccoli**, Rutgers University, USA
- **Laura Anna Ripamonti**, Università degli Studi di Milano, Italy
- **Walter Rocchia**, IIT, Italy
- **Nader Sabbaghian**, 360 Capital Partners, Milano, Italy
- **Wil Schilders**, Eindhoven University of Technology, The Netherlands
- **Ruben Sevilla**, Swansea University, UK
- **Spencer Sherwin**, Imperial College, UK
- **Filippo Spiga**, NVIDIA, UK
- **Harald van Brummelen**, Eindhoven University of Technology, The Netherlands
- **Carlo Urbanet**, Electrolux, Italy
- **Federica Valdenazzi**, Cetena, Italy
- **Simone Vantini**, Politecnico di Milano, Italy
- **Karen Veroy**, Eindhoven University of Technology, The Netherlands
- **Wolfgang Wall**, Technische universität München, Germany
- **Karen Willcox**, University of Texas, USA

CONGRESS SCHEDULE

	WEDNESDAY 4 TH						THURSDAY 5 TH						FRIDAY 6 TH						
	SALÓN ACTOS						SALÓN ACTOS	ROOM 7-8	ROOM 11	ROOM 12	ROOM 13	ROOM 15	SALÓN ACTOS	ROOM 7-8	ROOM 11	ROOM 12	ROOM 13	Room 15	
8:30																			
8:50																			
9:10																			
9:30	OPENNING CEREMONY						IS24	IS33	IS25	IS18	IS28	IS21	IS04	IS20	IS11	IS07	IS17	IS09	
9:45	PLENARY 1																		
10:10																			
10:30	COFFEE BREAK						COFFEE BREAK						COFFEE BREAK						
ROOM	SALÓN ACTOS	ROOM 7-8	ROOM 11	ROOM 12	ROOM 13	ROOM 15	SALÓN ACTOS	ROOM 7-8	ROOM 11	ROOM 12	ROOM 13	ROOM 15	SALÓN ACTOS						
11:00	IS24	IS12	IS14	IS29	IS30	IS05	IS32	IS33	IS25	IS03	IS22	IS06	PLENARY 3						
11:20													CLOSING CEREMONY						
11:40																			
12:00																			
12:20																			
12:40																			
13:00	LUNCH						LUNCH												
14:30	IS24	IS12	IS14	IS13	IS27	IS15	IS32	IS33	IS02	IS31	IS22	IS06							
14:50																			
15:10																			
15:30																			
15:50																			
16:10							ISML	IS08		IS16	IS23								
16:30	BREAK						BREAK												
ROOM	SALÓN DE ACTOS						SALÓN DE ACTOS												
16:40	SPECIAL EVENT						PLENARY 2												
17:25																			
19:00	VISIT VALENCIA						GALA DINNER												
21:00	WELCOME RECEPTION																		



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

PROGRAM

WEDNESDAY, JUNE 4TH

09:30-09:45

OPENNING CEREMONY

09:45-10:30

Salón de Actos: PLENARY 1: FILTERING THE DETAILS: MULTISCALE MODELLING FOR CLEAN AIR, WATER, AND BETTER BATTERIES

Prof. Maria Bruna (University of Oxford-UK)

10:30-11:00

COFFEE BREAK

11:00-13:00

INVITED SESSIONS

11:00-13:00

Salón de Actos-IS24: ADVANCED MODELS AND METHODS TO ENHANCE SUSTAINABILITY

Chairperson: **Rafaelle D'Ambrosio**

Organized by: D. Conte, R. D'Ambrosio, S. Mirabella, S. Perotto, G. Speroni

ID.165

Simulating Stochastic Dynamics in Urban Network Models

Hugo De La Cruz, Mario Muñoz

School of Applied Mathematics. FGV EMAP, Rio De Janeiro, Brazil

ID.156

Stochastic Numerics for Sustainability

Raffaele D'Ambrosio, **Stefano Di Giovacchino**

University of L'Aquila, L'Aquila, Italy

ID.124

Atmospheric Galvanic Corrosion Protection Using Recycled Aluminium Coatings: A Physically Informed Multi-Scale Approach

Stefano Piccardo^(1,2), Keshava Boorgula^(1,2), Ernane De Freitas Martins⁽²⁾, Milan Patel⁽³⁾, Pablo Ordejón⁽²⁾, Tomáš Prošek⁽⁴⁾, Jan Stoulil⁽⁴⁾, Ivan Cole⁽³⁾

⁽¹⁾RMIT Europe, Barcelona, Spain, ⁽²⁾Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC and BIST, Bellaterra, Spain, ⁽³⁾RMIT, Melbourne, Australia, ⁽⁴⁾University of Chemistry and Technology Prague, Prague, Czech Republic

ID.130 **An Interpretable and Transferable Model for Shallow Landslides Combining Spatial Poisson Point Processes and Generalized Additive Models**

Giulia Patanè⁽¹⁾, Teresa Bortolotti⁽¹⁾, Vasil Yordanov⁽¹⁾, Ludovico Giorgio Aldo Biagi⁽¹⁾, Maria Antonia Brovelli⁽¹⁾, Xuan Quang Truong⁽²⁾, Simone Vantini⁽¹⁾

⁽¹⁾Politecnico di Milano, Milano, Italy, ⁽²⁾Vietnam National University, Hanoi, Vietnam

ID.144 **Split Exponential Integrators With Applications To Turing Pattern Formation**

Marco Caliar⁽¹⁾, Fabio Cassini⁽²⁾

⁽¹⁾University of Verona, Verona, Italy, ⁽²⁾Istituto Nazionale di Alta Matematica "Francesco Severi", Roma, Italy

ID.203 **Positive High Order Nonstandard Finite-Difference Methods**
Teo Roldán

Universidad Pública de Navarra, Pamplona, Spain

11:00-13:00

Room 7-8-IS12: SIMULATION-DRIVEN INNOVATION IN THE STRÖMUNGSRAUM® FRAMEWORK: FROM MATHEMATICAL MODELS TO INDUSTRY IMPACT

Chairperson: Markus Geveler

Organized by: Stefan Turek, Markus Geveler

ID.81 **Massively Parallel & Lower Precision Accelerator Techniques As Trends in HPC and Their Realization in FEATFLOW Inside of the StrömungsRaum® Platform (Keynote Lecture)**

Stefan Turek

TU Dortmund University, Dortmund, Germany

ID.67 **Geometric Multigrid Methods On Distributed Non-Conforming Mesh Hierarchies for the Simulation of Steady-State Flows Through Polymer Extrusion Dies**

Peter Zajac, Stefan Turek

Technische Universität Dortmund, Fakultät für Mathematik, Lehrstuhl LSIII, Dortmund, Germany

ID.78 **Automation and Scaling of GPGPU-Accelerated Simulations of Steady-State Flows Through Polymer Extrusion Dies**

Maximilian Esser, Stefan Turek

TU Dortmund University, Dortmund, Germany



Math to Product 2025

Emerging Technologies in Computational Science for Industry,
Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.72

A Time-Parallel Navier-Stokes Solver Using Augmented Lagrangian Acceleration and Space-Time Multigrid Methods

Jonas Dünnebacke, Christoph Lohmann, Stefan Turek

Department of Mathematics, TU Dortmund, Dortmund, Germany

ID.98

Cache Blocking of Repeated Sparse Matrix-Vector Products

Dane Lacey⁽¹⁾, Christie Alappat⁽¹⁾, Florian Lange⁽¹⁾, Georg Hager⁽¹⁾, Holger Fehske^(1,2), Gerhard Wellein^(1,3,4)

⁽¹⁾Erlangen National High Performance Computing Center, Erlangen, Germany,

⁽²⁾Universität Greifswald- Institut für Physik, Greifswald, Germany, ⁽³⁾Department

of Computer Science, Friedrich-Alexander-Universität Erlangen-Nürnberg,

Erlangen, Germany, ⁽⁴⁾Delft Institute of Applied Mathematics, Delft University of Technology, Delft, The Netherlands

11:00-13:00

Room 11-IS14: ADVANCEMENTS IN COMPUTATIONAL MODELING FOR PERSONALIZED DIGITAL TWINS IN HEALTHCARE

Chairperson: Elena Zappa

Organized by: E. Zappa, F. Caforio, E. Karabelas, S. Pagani, F. Regazzon

ID.102

VHEART: A Platform for Fast and Accurate Prediction of Drug Induced Proarrhythmic Risk With Sex Specific Cardiac Emulators

Alberto Zingaro, Paula Dominguez, Caterina Balzotti, Mariano Vazquez

ELEM Biotech S.L., Barcelona, Spain

ID.65

An Integrated Electromechanical-Circulation Model of the Heart and Application To Ventricular Dyssynchrony

Ester Bergantin⁽¹⁾, Federica Caforio⁽²⁾, Simone Pezzuto⁽¹⁾

⁽¹⁾University of Trento, Trento, Italy, ⁽²⁾University of Graz, Graz, Austria

ID.45

Predicting Atrial Fibrillation Inducibility in Personalized Models With Machine Learning

Pascal Maierhofer⁽¹⁾, Patricia Martínez Díaz⁽¹⁾, Eric Invers-Rubio⁽²⁾, Michael Beigl⁽³⁾, Lluís Mont⁽²⁾, Amir Jadidi⁽⁴⁾, Olaf Dössel⁽¹⁾, Axel Loewe⁽¹⁾

⁽¹⁾Institute of Biomedical Engineering, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany, ⁽²⁾Unitat de Fibril·lació Auricular (UFA), Institut Clínic

Cardiovascular (ICCV), Hospital Clínic, Universitat de Barcelona, Barcelona, Spain,

⁽³⁾TECO, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany, ⁽⁴⁾Department of Rhythmology-Electrophysiology, Lucerne Cantonal Hospital, Lucerne, Switzerland

ID.69

Computational Analysis of the Influence of Acute Myocardial Ischemia Maps On Arrhythmogenesis

Alessandra Corda, Stefano Pagani, Christian Vergara

Politecnico di Milano, Milano, Italy

ID.107 **Data-Driven Cardiac Imaging Reconstruction: A PBDW Framework for Cardiac Mechanics**

Francesco Carlo Mantegazza^(1,2), Federica Caforio^(1,2,3), Matthias Gsell⁽³⁾, Elias Karabelas^(1,2)

⁽¹⁾University of Graz, Graz, Austria, ⁽²⁾BioTechMed-Graz, Graz, Austria, ⁽³⁾Medical University of Graz, Graz, Austria

ID.31 **In-Silico Study To Predict In-Hospital Indicators From Wearable-Derived Signals for Cardiovascular and Cardiorespiratory Disease Monitoring**

Bianca Maria Laudenzi, Lucas Omar Muller

University of Trento, Trento, Italy

11:00-13:00

Room 12-IS29: EMERGING TECHNOLOGIES AND APPLICATIONS IN HIGH PERFORMANCE COMPUTING FOR RESEARCH AND INNOVATION

Chairperson: Suzanne Shontz

Organized by: Suzanne M. Shontz

ID.22 **Performance Regression Unit Testing With An Automated Framework, Applied To Julia**

Daniel Sergio Vega Rodriguez⁽¹⁾, Samuel Omlin⁽²⁾, Dimosthenis Pasadakis⁽¹⁾, Olaf Schenk⁽¹⁾

⁽¹⁾Università della Svizzera italiana, Lugano, Switzerland, ⁽²⁾Swiss National Supercomputing Center, Lugano, Switzerland

ID.36 **PTTD: Scalable and Deterministic Parallel Tensor Train Decomposition**

Shiyao Xie⁽¹⁾, Akinori Miura⁽²⁾, Kenji Ono⁽³⁾, Rio Yokota⁽¹⁾

⁽¹⁾Institute of Science Tokyo, Tokyo, Japan, ⁽²⁾NS Solutions Corporation, Tokyo, Japan, ⁽³⁾Research Institute for Information Technology, Kyushu University, Fukuoka, Japan

ID.47 **ParFEMWARP: A Parallel Mesh Warping Algorithm Based On Hybrid Parallel Programming**

Abir Haque, Suzanne Shontz

University of Kansas, Lawrence, United States

ID.62 **Porting ExaHyPE 2 To GPUs**

Mario Wille, Michael Bader

TUM School of Computation, Information and Technology, Garching, Germany



Math to Product 2025

Emerging Technologies in Computational Science for Industry,
Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.210

Parallel Training of Neural Networks: Saving Time, CO₂, and Energy

Rolf Krause⁽¹⁾, Ken Trotti⁽²⁾, Samuel Cruz⁽³⁾, Alena Kopanicakova⁽⁴⁾

⁽¹⁾KAUST, Thuwal, Saudi Arabia, ⁽²⁾USI, Lugano, Switzerland, ⁽³⁾FernUni Schweiz, Brig, Switzerland, ⁽⁴⁾INP Toulouse, Toulouse, France

ID.215

Building Gaussian Process Statistical and Quantitative Learning Framework for Scientific Applications

Sherry Li

Lawrence Berkeley National Lab, Berkeley, United States

11:00-13:00

Room 13-IS30: AI-DRIVEN ADVANCES IN TOPOLOGY OPTIMIZATION AND METAMATERIALS DESIGN

Chairpersons: Ismael Ben-Yelun and Lucia López de Abajo

Organized by: Ismael Ben-Yelun, Alberto Badias, Miguel Ángel Sanz Gómez, José María Benítez, Francisco J. Montans

ID.21

Physics-Based AI-Driven Topology Optimization With Differential FEM Integration

Fariba Ebrahimian⁽¹⁾, Alberto Badias⁽²⁾, Anoop Ebey Thomas⁽³⁾, Francisco Chinesta^(1,3)

⁽¹⁾École nationale supérieure d'Arts et Métiers (ENSAM), PIMM lab, Paris, France, ⁽²⁾Universidad Politécnica de Madrid - ETSIAE, Madrid, France, ⁽³⁾ESI Group, Symbiose 2, 10 Avenue Aristide Briand, 92220, Bagneux, France

ID.51

Graph-Based Machine Learning Approaches for Model Order Reduction

Federico Pichi⁽¹⁾, Beatriz Moya⁽²⁾, Oisín Morrison⁽³⁾, Jan Hesthaven⁽⁴⁾

⁽¹⁾SISSA-International School for Advanced Studies, Trieste, Italy, ⁽²⁾ENSAM-Institute of Technology, Paris, France, ⁽³⁾ECMWF-European Centre for Medium-Range Weather Forecasts, Bonn, Germany, ⁽⁴⁾KIT-Karlsruhe Institute of Technology, Karlsruhe, Germany

ID.136

Mechanostat-Type Effective Density Correction for Carter-Hayes Growth Applied To Topological Optimization and Its PINN-Driven Interpolation

Luis Irastorza Valera, Luis Saucedo Mora

UPM, Madrid, Spain

ID.194

On the Acceleration of the 2-Level Topology Optimization for 3D Problems Considering A Soft Continuity Interface

Marc Bosch-Galera, **Enrique Nadal**, José Manuel Navarro-Jiménez, Rafael Merli-Gisbert, Juan José Ródenas

Universitat Politècnica de València, Valencia, Spain

ID.229

Strategies To Allow for the Use of the 2-Level Topology Optimization in 3D

Antolín Martínez-Martínez⁽¹⁾, Enrique Nadal⁽¹⁾, José Manuel Navarro-Jiménez⁽¹⁾, Rafael Merli-Gisbert⁽¹⁾, Francisco Chinesta⁽²⁾, **Juan José Ródenas⁽¹⁾**

⁽¹⁾Instituto de Ingeniería Mecánica y Biomecánica (I2MB) Universitat Politècnica de Valencia, Valencia, Spain, ⁽²⁾Laboratoire PIMM-ENS Arts et Métiers, Paris, France

ID.74

Topology Optimization of Metamaterials Using A Novel Generative AI Technique

Yanda Chen, Sebastian Rodriguez, Francisco Chinesta

Laboratory PIMM, Arts et Metiers Institute of Technology, CNRS, CNAM, Paris, France)

11:00-13:00

Room 15-IS05: SOLVING INVERSE PROBLEMS WITH DEEP LEARNING

Chairperson: Caterina Millevoi

Organized by: Caterina Millevoi, Massimiliano Ferronato

ID.48

Discovering Partially Known Ordinary Differential Equations: A Case Study On the Cellulose Degradation

Federica Bragone⁽¹⁾, Kateryna Morozovska⁽¹⁾, Tor Laneryd⁽²⁾, Khemraj Shukla⁽³⁾, Stefano Markidis⁽¹⁾

⁽¹⁾KTH Royal Institute of Technology, Stockholm, Sweden, ⁽²⁾Hitachi Energy Research, Västerås, Sweden, ⁽³⁾Brown University, Providence, United States

ID.70

A Novel Machine Learning Framework for Inferring Hidden Dynamics of Model Parameters

Giovanni Ziarelli

Università degli Studi di Milano, Milan, Italy

ID.101

A New Approach Based On Time-Discrete Physics Informed Neural Networks for PDEs

Giovanni Pagano⁽¹⁾, Carmine Valentino⁽²⁾, Dajana Conte⁽¹⁾, Beatrice Paternoster⁽¹⁾, Francesco Colace⁽²⁾

⁽¹⁾Department of Mathematics, University of Salerno, Fisciano, Italy, ⁽²⁾Department of Industrial Engineering, University of Salerno, Fisciano, Italy

ID.119

A CNN-LSTM Approach for Solving An Inverse Problem in Battery Cycling Model

Maria Grazia Quarta⁽¹⁾, Ivonne Sgura⁽¹⁾, Elisa Emanuele⁽²⁾, Jacopo Strada⁽²⁾, Raquel Barreira⁽³⁾, Benedetto Bozzini⁽²⁾

⁽¹⁾Department of Mathematics and Physics, University of Salento, Lecce, Italy, ⁽²⁾Department of Energy, Politecnico di Milano, Milano, Italy, ⁽³⁾Instituto Politécnico de Setúbal, Escola Superior de Tecnologia de Setúbal, Setúbal, Portugal



Math to Product 2025

Emerging Technologies in Computational Science for Industry,
Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.145

Deep Learning Techniques for Indirect X-Ray Imaging of the Sun

Paolo Massa⁽¹⁾, Merve Selcuk-Simsek⁽¹⁾, Simon Felix^(1,2), László István Etesi^(1,2), Ewan Dickson⁽³⁾, Hualin Xiao⁽¹⁾, Francesco Pio Ramunno (1,4), Brandon Panos⁽¹⁾, Säm Krucker (1,5), André Csillaghy⁽¹⁾

⁽¹⁾University of Applied Sciences and Arts Northwestern Switzerland (FHNW), Windisch, Switzerland, ⁽²⁾Ateleris GmbH, Brugg, Switzerland, ⁽³⁾University of Graz, Graz, Austria, ⁽⁴⁾University of Geneva, Geneva, Switzerland, ⁽⁵⁾University of California, Berkeley, United States

ID.162

RELD: Regularization By Latent Diffusion Models for Image Restoration

Pasquale Cascarano

Department of the Arts, Alma Mater Studiorum-University of Bologna, Bologna, Italy

13:00-14:30

LUNCH

14:30-16:30

INVITED SESSIONS

14:30-16:30

Salón de Actos-IS24: ADVANCED MODELS AND METHODS TO ENHANCE SUSTAINABILITY

Chairperson: Dajana Conte

Organized by: D. Conte, R. D'Ambrosio, S. Mirabella, S. Perotto, G. Speroni

ID.223

A New Semi-Analytical Algorithm for Weakly and Strongly Singular Integrals in 3D Elastodynamic Energetic Boundary Element Method

Luciano Coppolino, Luca Desiderio

University of Messina, Messina, Italy

ID.224

Matrix-Oriented Discretisation of Phase-Field and High-Order Diffusion Problems and Applications in Battery Modeling

Massimo Frittelli, Maria Chiara D'Autilia, Ivonne Sgura

University of Salento, Lecce, Italy

ID.155

Low Rank Adaptive Computation and Optimization of Dominant Eigenvalues of Specific Physical Systems

Carmela Scalone

University of L'Aquila, L'Aquila, Italy

WEDNESDAY 4TH

ID.149 **Efficient Solution of PDEs Models for Battery and Vegetation Modeling**

Dajana Conte⁽¹⁾, Francesco Giannino⁽²⁾, Samira Iscaro⁽¹⁾, Giovanni Pagano⁽¹⁾, Beatrice Paternoster⁽¹⁾

⁽¹⁾Department of Mathematics, University of Salerno, Salerno, Italy, ⁽²⁾Department of Agriculture, University of Naples, Naples, Italy

ID.225 **Scheduling Solutions for Autonomous Systems: From Drones To Adaptive Greenhouses**

Patrizia Bagnerini⁽¹⁾, Mauro Gaggero⁽²⁾

⁽¹⁾University of Genoa, Genoa, Italy, ⁽²⁾National Research Council of Italy, Genoa, Italy

ID.178 **A Computational Framework for Assessing the Impact of Crop Diversification in Europe Under Future Climate Scenarios.**

Marianna Cerasuolo⁽¹⁾, Roberta Farina⁽²⁾, Silvia Vanino⁽²⁾

⁽¹⁾University of Sussex, Brighton, United Kingdom, ⁽²⁾Council for Agricultural Research and Economics, Rome, Italy

14:30-16:30

Room 7-8-IS12: SIMULATION-DRIVEN INNOVATION IN THE STRÖMUNGSRAUM® FRAMEWORK: FROM MATHEMATICAL MODELS TO INDUSTRY IMPACT

Chairperson: Stefan Turek

Organized by: Stefan Turek, Markus Geveler

ID.108 **Parallel Implementation of Two-Level Nonlinear Schwarz Domain Decomposition Methods**

Kyrrill Ho⁽¹⁾, Axel Klawonn^(1,2), Martin Lanser^(1,2)

⁽¹⁾Center for Data and Simulation Science, University of Cologne, Cologne, Germany, ⁽²⁾Department of Mathematics and Computer Science, University of Cologne, Cologne, Germany

ID.68 **Scalable Overlapping Schwarz Preconditioners for Fluid Problems**

Stephan Köhler, Oliver Rheinbach

Technische Universität Bergakademie Freiberg, 09599, Germany

ID.167 **A Unified Multiphysics Framework for Multi-Region Coupling**

Heba Alkafri^(1,2), Constantin Habes⁽³⁾, Mohammed Elwardi Fadel⁽³⁾, Steffen Hess⁽⁴⁾, Steven B. Beale⁽⁴⁾, Shidong Zhang⁽⁴⁾, Hrvoje Jasak⁽⁵⁾, **Holger Marschall⁽³⁾**

⁽¹⁾IANUS Simulation GmbH, Darmstadt, Germany, ⁽²⁾Technical University of Darmstadt, Darmstadt, Germany, ⁽³⁾Technische Universität Darmstadt, Darmstadt, Germany, ⁽⁴⁾Forschungszentrum Jülich GmbH, Jülich, Germany, ⁽⁵⁾University of Cambridge, Cambridge, United Kingdom



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.75 New Horizons in CAE: Advanced Modeling, Cloud-Native HPC Simulations and AI-Assistants for Comprehensive Pump Innovation (Part 1)

Markus Geveler⁽¹⁾, Mikael Tekneyan⁽²⁾, Vibhav Singhal⁽¹⁾

⁽¹⁾IANUS Simulation GmbH, Dortmund, Germany, ⁽²⁾NETZSCH Pumpen und Systeme GmbH, Waldkraiburg, Germany

ID.120 New Horizons in CAE: Advanced Modeling, Cloud-Native HPC Simulations and AI-Assistants for Comprehensive Pump Innovation (Part 2)

Mikael Tekneyan⁽¹⁾, Somnath Bankar⁽¹⁾, Markus Geveler⁽²⁾, Vibhav Singal⁽²⁾

⁽¹⁾NETZSCH Pumpen & Systeme GmbH, Waldkraiburg, Germany, ⁽²⁾IANUS Simulation GmbH, Dortmund, Germany

ID.76 New Horizons in CAE: Advanced Modeling, Cloud-Native HPC Simulations and AI-Assistants for Comprehensive Pump Innovation (Part 3)

Markus Geveler⁽¹⁾, Mikael Tekneyan⁽²⁾, Vibhav Singhal⁽¹⁾

⁽¹⁾IANUS Simulation GmbH, Dortmund, Germany, ⁽²⁾NETZSCH Pumpen & Systeme GmbH, Waldkraiburg, Germany

14:30-16:10

Room 11-IS14: ADVANCEMENTS IN COMPUTATIONAL MODELING FOR PERSONALIZED DIGITAL TWINS IN HEALTHCARE

Chairperson: Elias Karabelas

Organized by: E. Zappone, F. Caforio, E. Karabelas, S. Pagani, F. Regazzoni

ID.190 Computational Model of Hemodynamics and Pharmacokinetics in Stented Arteries With Restenosis

Anna M. Ranno⁽¹⁾, Felix Vogt⁽²⁾, Kevin Linka⁽³⁾, Marek Behr⁽¹⁾

⁽¹⁾Chair for Computational Analysis of Technical Systems, RWTH Aachen University, Aachen, Germany, ⁽²⁾Department of Internal Medicine I-Cardiology, Angiology and Intensive Care Medicine, Uniklinik RWTH Aachen, Aachen, Germany, ⁽³⁾Institute for Continuum and Material Mechanics, Hamburg University of Technology, Hamburg, Germany

ID.35 Model Correction and Parameter Estimation Via Population Data

Corrie James^(1,2), Muriel Boulakia⁽²⁾, Damiano Lombardi⁽¹⁾

⁽¹⁾Inria, Paris, France, ⁽²⁾Université de Versailles Saint-Quentin-en-Yvelines, Versailles, France

ID.141 **Automated Structural Analysis of Vertebrae Using Semantic Segmentation and Numerical Methods**

Blai Gandia Vañó⁽¹⁾, Jose Manuel Navarro Jimenez⁽¹⁾, Estanislao Arana⁽²⁾, Enrique Nadal Soriano⁽¹⁾, Juan José Ródenas García⁽¹⁾

⁽¹⁾Universitat Politècnica de València, València, Spain, ⁽²⁾Dpto. Radiología, Fundación Instituto Valenciano de Oncología, València, Spai

ID.232 **Predicting Birth-Related Trauma Using Reduced Order Models and Machine Learning**

William Snyder⁽¹⁾, Mostafa Zakeri⁽¹⁾, Traian Iliescu⁽²⁾, Justin Krometis⁽²⁾, **Raffaella De Vita**⁽¹⁾

⁽¹⁾STRETCH Lab, Department of Mechanical Engineering, Virginia Tech, Blacksburg, United States, ⁽²⁾Department of Mathematics, Virginia Tech, Blacksburg, United States

ID.233 **Modeling of Cardiac Fibers as Liquid Crystals**

Nicolás Barnaf⁽¹⁾, Axel Osses⁽²⁾

⁽¹⁾Pontificia Universidad Católica de Chile, Santiago de Chile, Chile

⁽²⁾Universidad de Chile, Santiago de Chile, Chile

15:10-16:30

Room 12-IS13: HIGH PERFORMANCE COMPUTING IN RESEARCH AND INDUSTRY

Chairperson: Sohel Sebastian Herff

Organized by: Sohel Herff, Johan Hoffman, Andreas Lintermann, Makoto Tsubokura, Mariano Vázquez

ID.151 **Deep Learning for Turbulence Closure Modelling On Unstructured Grids With Differentiable Turbulence**

Francisco Alcántara-Ávila⁽¹⁾, Amal Sebastian⁽²⁾, Chenyang Huang⁽²⁾, Ricardo Vinuesa⁽¹⁾, Venkat Viswanathan⁽²⁾

⁽¹⁾FLOW, Engineering Mechanics, KTH Royal Institute of Technology, Stockholm, Sweden, Stockholm, Sweden, ⁽²⁾Department of Aerospace Engineering, University of Michigan, Ann Arbor, 48109, MI, USA, Ann Arbor, United States

ID.172 **A Psuedo-One-Sided Direct Forcing Immersed Boundary Method Using A Virtual Solid Approach**

Rahul Bale^(1,2), Makoto Tsubokura⁽¹⁾

⁽¹⁾RIKEN Center for Computational Science, Kobe, Japan, ⁽²⁾Kobe University, Kobe, Japan



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.173 Performance Evaluation of A CFD Code Implemented Using Matrix Product State

Junya Onishi⁽¹⁾, Ayato Takii⁽²⁾, Sangwon Kim⁽¹⁾, Younghwa Cho⁽³⁾, Makoto Tsubokura^(1,2)

⁽¹⁾RIKEN, Kobe, Japan, ⁽²⁾Kobe University, Kobe, Japan, ⁽³⁾Hokkaido University, Sapporo, Japan

ID.189 HPC-Enabled Reactor Core-Scale Modelling of a Loss of Flow Accident Transient in A Prismatic High Temperature Gas-Cooled Reactor

Bo Liu, Wei Wang, Charles Moulinec, Stefano Rolfo
STFC Daresbury Laboratory, Warrington, United Kingdom

14:30-15:10

Room 13-IS30: AI-DRIVEN ADVANCES IN TOPOLOGY OPTIMIZATION AND METAMATERIALS DESIGN

Chairpersons: Lucia López de Abajo and Ismael Ben-Yelun

Organized by: Ismael Ben-Yelun, Alberto Badías, Miguel Ángel Sanz Gómez, José María Benítez, Francisco J. Montans

ID.230 Rank-Reduction Autoencoders for Forward and Inverse Topology Optimization Problems

I. Ben-Yelun⁽¹⁾, M. El Fallaki Idrissi⁽²⁾, J. Mounayer⁽²⁾, S. Rodriguez⁽²⁾, C. Ghnatios⁽³⁾, F. Chinesta^(2,4)

⁽¹⁾E.T.S. de Ingeniería Aeronáutica y del Espacio, Universidad Politécnica de Madrid, Madrid, Spain, ⁽²⁾ENSAM Institute of Technology PIMM, Paris, France, ⁽³⁾University of North Florida, Jacksonville, United States, ⁽⁴⁾ESI/Keysight Chair CNRS@CREATE, Singapore

ID.231 Towards Learning-Based Topology Optimization

L. López-De-Abajo, A. Badías, M.A. Sanz-Gómez, J.M. Benítez, F.J. Montáns (E.T.S. de Ingeniería Aeronáutica y del Espacio, Universidad Politécnica de Madrid, Madrid, Spain)

15:10-16:30

Room 13-IS27: MESH HANDLING TECHNIQUES: MATHEMATICAL INSIGHTS AND ENGINEERING INNOVATIONS

Chairperson: Nicola Ferro

Organized by: N. Ferro, E. Temellini, S. Perotto

ID.86 Advanced Meshing Techniques for Two-Phase Flow Simulations in Polymer Injection Molding

Blanca Ferrer Fabón, Marek Behr

Chair for Computational Analysis of Technical Systems (CATS), RWTH Aachen University, Aachen, Germany

ID.205 **Fluid-Structure Interaction in Plastics Extrusion Dies Using Adaptive Space-Time Finite Elements**

Oliver Wege⁽¹⁾, Norbert Hosters⁽¹⁾, Jana Sasse⁽²⁾, Christian Hopmann⁽²⁾, Marek Behr⁽¹⁾

⁽¹⁾Chair for Computational Analysis of Technical Systems (CATS), Center for Simulation and Data Science (JARA-CSD), RWTH Aachen University, 52056 Aachen, Germany, ⁽²⁾Institute for Plastics Processing (IKV) at RWTH Aachen University, 52056 Aachen, Germany

ID.158 **A Space-Time Adaptive Strategy for High Reynolds Number Flows**

Erika Temellini, Nicola Ferro, Simona Perotto

Politecnico di Milano, Milano, Italy

ID.93 **Accuracy Enhancement in Immersed Boundary Finite Element Methods Using R-, H-, and R-H Mesh Adaptations**

Saman Rahmani⁽¹⁾, Joan Baiges⁽²⁾, Javier Principe⁽³⁾

⁽¹⁾Centro Internacional de Métodos Numéricos en la Ingeniería (CIMNE), Edificio C1, Campus Norte UPC, 08034, Barcelona, Spain, ⁽²⁾Universitat Politècnica de Catalunya (UPC), Edificio C1, Campus Norte UPC, 08034, Barcelona, Spain, ⁽³⁾Universitat Politècnica de Catalunya (UPC), Edificio A, Campus Diagonal Besòs UPC, 08019, Barcelona, Spain

14:30-15:10

Room 15-IS05: SOLVING INVERSE PROBLEMS WITH DEEP LEARNING

Chairperson: Caterina Millevoi

Organized by: Caterina Millevoi, Massimiliano Ferronato

ID.180 **Solving Forward and Inverse Problems in Nonlinear Prostatic Biomechanics: Stiffness Estimation Using Physics-Informed Neural Networks (PINN)**

María Ferrón Vivó, Enrique Nadal Soriano, Santiago Gregori Verdú, Jose Manuel Navarro Jimenez, María José Rupérez Moreno

Universitat Politècnica de València, Valencia, Spain

ID.148 **Qualitative Study of Stochastic Optimization Methods Via Backward Error Analysis**

Stefano Di Giovacchino⁽¹⁾, Desmond J. Higham⁽²⁾, Konstantinos C. Zygalakis⁽²⁾

⁽¹⁾University of L'Aquila, L'Aquila, Italy, ⁽²⁾University of Edinburgh, Edinburgh, United Kingdom



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

WEDNESDAY 4TH

15:10-16:30

Room 15-IS15: INVERSE PROBLEMS IN DIGITAL TWINS: OPTIMAL DESIGN OF EXPERIMENTS, UNCERTAINTY QUANTIFICATION AND REAL-WORLD APPLICATIONS

Chairperson: Marco Mattuschka

Organized by: Marco Mattuschka, Sebastian Brandstaeter, Max Von Danwitz, Alexander Popp

ID.56

Optimal Experimental Design for the Transport of Contaminants

Marco Mattuschka⁽¹⁾, Max Von Danwitz⁽¹⁾, Alexander Popp (2.1)

⁽¹⁾German Aerospace Center (DLR), Institute for the Protection of Terrestrial Infrastructures, Sankt Augustin, Germany, ⁽²⁾University of the Bundeswehr Munich, Institute for Mathematics and Computer-Based Simulations (IMCS), Neubiberg, Germany

ID.88

Physics-Informed Machine Learning for Inverse Problems in Condition Monitoring

Max Von Danwitz⁽¹⁾, Philip Franz⁽¹⁾, Philipp Knechtges⁽²⁾, Alexander Popp^(1,3)

⁽¹⁾German Aerospace Center (DLR), Institute for the Protection of Terrestrial Infrastructures, Sankt Augustin, Germany, ⁽²⁾German Aerospace Center (DLR), Institute for Software Technology, Sankt Augustin, Germany, ⁽³⁾University of the Bundeswehr Munich, Institute for Mathematics and Computer-Based Simulations (IMCS), Neubiberg, Germany

ID.g1

Using Reduced Order Model With Stochastic Closure To Estimate and Predict Unsteady Flows

Florian Regnault⁽¹⁾, Valentin Resseguier⁽²⁾, Giovanni Stabile⁽³⁾, Merveille Talla⁽²⁾, Chloé Caville⁽¹⁾, Alexis Valls (1.4), Philippe Barbet⁽¹⁾

⁽¹⁾Insights, Scalian DS, Rennes, France, ⁽²⁾INRAE, OPAALE, Rennes, France, ⁽³⁾Sant'Anna School of Advanced Studies, Pisa, Italy, ⁽⁴⁾Inria, Bordeaux, France

ID.221

Indirect Contact Force Estimation in Railway Pantographs Using Digital Twin and Kalman Filtering

Guillem Vallet, Jaime Gil, Santiago Gregori, Ana Maria Pedrosa, Manuel Tur
Institute of mechanical engineering and biomechanics, Universitat Politècnica de València, Valencia, Spain

16:30-16:40

BREAK

16:40-17:25

Salón de Actos: SPECIAL EVENT: THE M2P PATH: FROM ACADEMIA TO INDUSTRY

Chair: Mr. Eugenio Mallol Sanchis

- Prof. Francisco Chinesta, École Nationale Supérieure d'Arts et Métiers (ENSAM), Paris
- Dr. Dirk Hartmann, Siemens Industry Software GmbH, Munich, Germany

19:00-21:00**VISIT VALENCIA**

Meet with a local guide at **19:00 h at the Plaza de la Virgen** of Valencia (by the fountain) for a walking tour of the historic city center.

How to get from the UPV to Plaza de la Virgen:

Tram line 4 from UPV (Conference Venue) to Pont de Fusta stop. **TRAM MAP**

From Pont de Fusta to Plaza de la Virgen there are 6 minutes walking. **SEE MAP**

We'll take a walking tour through the Valencia historic city center, to visit the city's most emblematic monuments, such as the Cathedral, the Basilica of the Virgin, Paz Street or Palacio del Marqués de Dos Aguas (outdoor only).

The visit will finish at 21:00 in the Welcome Reception location (Palacio de la Exposición).

21:00-22:30**WELCOME RECEPTION**

Salón Noble Palacio de la Exposición (C/ Galicia 3, Valencia)

To present the corresponding ticket will be madatory



THURSDAY, JUNE 5TH

08:30-10:30 INVITED SESSIONS

09:10-10:30

Salón de Actos-IS24: ADVANCED MODELS AND METHODS TO ENHANCE SUSTAINABILITY

Chairperson: Simona Perotto

Organized by: D. Conte, R. D'Ambrosio, S. Mirabella, S. Perotto, G. Speroni

ID.200

CFD-Based Analysis of Crop Transpiration Dynamics for Optimizing Humidity Control in Small-Scale Vertical Farming Systems

Susanna Mirabella⁽¹⁾, Nicola Ferro⁽¹⁾, Cecilia Stanghellini⁽²⁾, Ep Heuvelink⁽³⁾, Matteo Matteucci⁽⁴⁾, Simona Perotto⁽¹⁾

⁽¹⁾Politecnico di Milano-MOX, Milano, Italy, ⁽²⁾Wageningen University and Research, Greenhouse Horticulture and Flower Bulbs Unit, Wageningen, The Netherlands, ⁽³⁾Wageningen University and Research, Horticulture and Product Physiology, Wageningen, The Netherlands, ⁽⁴⁾Politecnico di Milano Department of Electronics, Information and Bioengineering, Milano, Italy

ID.211

Hyperspectral Imaging Application for Chemical Compounds Detection in A Vertical Farming Production

Aleksander Dabek⁽¹⁾, Susanna Mirabella⁽¹⁾, Simone Cinquemani⁽¹⁾, Matteo Matteucci⁽¹⁾, Simona Perotto⁽¹⁾, Giacomo Cocetta⁽²⁾

⁽¹⁾Politecnico di Milano, Milano, Italy, ⁽²⁾University of Milan, Milano, Italy

ID.177

Advanced Models and Numerical Methods to Enhance Sustainability in Soilless Cultivations

Giacomo Speroni, Nicolò Mondini, Nicola Ferro, Simona Perotto

Politecnico di Milano, MOX, Milano, Italy

ID.170

Modeling Auxin Distribution in Plant Roots: A Homogenization-Based Approach

Nicolò Mondini⁽¹⁾, Francesco Magni⁽²⁾, Valentina Pederzoli⁽¹⁾, Nicola Ferro⁽¹⁾, Daniele Avitabile⁽³⁾, Simona Perotto⁽¹⁾

⁽¹⁾Politecnico di Milano, Milan, Italy, ⁽²⁾SISSA, Trieste, Italy, ⁽³⁾Vrije Universiteit Amsterdam, Amsterdam, The Netherlands



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

08:30-10:30

Room 7-8-IS33: FROM SURROGATE MODELS TO LEARNING IN MULTI-PHYSICS, MULTI-SCALE, MULTI-DISCIPLINARY OPTIMISATION

Chairperson: Matteo Giacomini

Organized by: Matteo Giacomini, Antonio Huerta

ID.116

Surrogate Modeling of Parametric PDEs Using Graph-Instructed Neural Networks (**Keynote Lecture**)

Sandra Pieraccini, Francesco Della Santa, Maria Strazzullo

Politecnico di Torino, Torino, Italy

ID.115

Surrogate Models With Gradient-Informed Neural Networks: Addressing Data Scarcity and Knowledge Gaps

Filippo Aglietti^(1,2), Francesco Della Santa⁽¹⁾, Andrea Piano⁽¹⁾, Virginia Aglietti⁽³⁾

⁽¹⁾*Politecnico di Torino, Torino, Italy*, ⁽²⁾*Dumarey Automotive Italia S.p.A., Torino, Italy*, ⁽³⁾*Independent Researcher, Lucca, Italy*

ID.100

Training sampling variations in non-intrusive data-driven surrogate models for coupled viscous flow and transport

Roberto Machado Velho, Adriano M. A. Côrtes, Gabriel F. Barros, Fernando A. Rochinha, Alvaro L. G. A. Coutinho

Federal University of Rio de Janeiro, Rio De Janeiro, Brazil

ID.97

Hidden Heat-Sources Estimation in Real-Time With A Deep Kalman Filter

Erik Chinellato, Marco Dell'Orto, Fabio Marcuzzi, Laura Rinaldi

University of Padova-Department of Mathematics, Padova, Italy

ID.213

Shape-Informed Operator Learning for Non-Intrusive Mesh-Free Surrogate Models

Francesco Regazzoni⁽¹⁾, Davide Carrara⁽¹⁾, Marc Hirschvogel⁽¹⁾, Stefano Pagani⁽¹⁾, Simone Pezzuto⁽²⁾, Alfio Quarteroni (1,3), Linying Zhang⁽⁴⁾

⁽¹⁾*MOX, Department of Mathematics, Politecnico di Milano, Milano, Italy*, ⁽²⁾*Università degli Studi di Trento, Trento, Italy*, ⁽³⁾*Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland*, ⁽⁴⁾*School of Aeronautic Science and Engineering, Beihang University, Beijing, China, Beijing, China*

THURSDAY 5TH

08:30-10:30

Room 11-IS25: ENABLING DIGITAL TWIN TECHNOLOGIES IN COMPUTATIONAL SCIENCE AND ENGINEERING

Chairperson: Diana Manveluan-Scroot

Organized by: Diana Manvelyan-Stroot, Yevgeniya Filanova

ID.46

Mathematical Innovations As Catalysts for Scalable Digital Twin Technologies (Keynote Lecture)

Dirk Hartmann

Siemens Industry Software GmbH, Munich, Germany

ID.208

Parametric Reduced Order Modelling of the Thermal Behaviour of Power Electronic Modules

Juan Angelo Vargas Fajardo⁽¹⁾, **Pietro Botazzoli**⁽²⁾, Catharina Czech⁽³⁾, Diana Manvelyan⁽³⁾

⁽¹⁾TUM, Munich, Germany, ⁽²⁾Siemens AG, Erlangen, Germany, ⁽³⁾Siemens AG, Munich, Germany

ID.52

Well-Conditioned Snapshot Data Generation for Operator Inference

Henrik Rosenberger⁽¹⁾, Benjamin Sanderse⁽¹⁾, Giovanni Stabile⁽²⁾

⁽¹⁾Centrum Wiskunde & Informatica, Amsterdam, The Netherlands, ⁽²⁾Sant'Anna School of Advanced Studies, Pisa, Italy

ID.126

Reduced-Order Modeling of Contact Problems Using Operator Inference and Substructuring

Yevgeniya Filanova^(1,2), Diana Manvelyan⁽³⁾, Igor Pontes Duff⁽²⁾, Peter Benner^(2,1)

⁽¹⁾Otto-von-Guericke University, Magdeburg, Germany, ⁽²⁾Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg, Germany, ⁽³⁾Siemens AG, München, Germany

ID.140

Advances in Reduced Order Modelling - Toward the Digital Twin

Riccardo Rossi, Marco Zuñiga, Sebastian Ares De Parga, Ruben Zorrilla, Joaquin Hernandez, Nicolas Sibuet

CIMNE/UPC, Barcelona, Spain



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

08:30-10:30

Room 12-IS18: UNCERTAINTY QUANTIFICATION IN COMPUTATIONAL MODELS: ENHANCING PREDICTIVE ACCURACY AND DESIGN

Chairperson: Joakim Beck

Organized by: Joakim Beck, Ben Mansour Dia

ID.137

Bayesian Inference of Earthquake Histories Using In-Situ Chlorine-36 Measurements

Joakim Beck⁽¹⁾, Gerald Roberts⁽²⁾

⁽¹⁾King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia, ⁽²⁾Birkbeck, University of London, London, United Kingdom

ID.111

Advanced Uncertainty Quantification for Transport in Porous Media Using Physics Informed Neural Operators

Cedric G Fraces

Stanford University, Stanford, United States

ID.54

Price Formation in Mean Field Games: A Monotonicity-Based Numerical Approach

Yeva Gevorgyan, Diogo Gomes

KAUST, Thuwal, Saudi Arabia

ID.193

Lagrangian Relaxation for Continuous-Time Optimal Control of Coupled Hydrothermal Power Systems Including Storage Capacity and A Cascade of Hydropower Systems With Time Delays

Eliza Rezvanova

KAUST, Thuwal, Saudi Arabia

ID.198

Validating Deep Learning Models: Tools and Insights for Industrial Applications

Miguel Sanchez-Dominguez⁽¹⁾, Lucas Lacasa⁽²⁾, Javier De Vicente (1,3), Eusebio Valero (1,3), Gonzalo Rubio (1,3)

⁽¹⁾ETSIAE-UPM—School of Aeronautics, Universidad Politécnica de Madrid, Spain, ⁽²⁾Institute for Cross-Disciplinary Physics and Complex Systems (IFISC), CSIC-UIB, Palma De Mallorca, Spain, ⁽³⁾Center for Computational Simulation, Universidad Politécnica de Madrid, Spain

ID.20

Multi-Index Stochastic Collocation for Pdes with Imperfect Solvers

Benjamin M. Kent⁽¹⁾, Lorenzo Tamellini⁽¹⁾, Matteo Giacomini⁽²⁾, Antonio Huerta⁽³⁾

⁽¹⁾CNR-IMATI, Pavia, Italy, ⁽²⁾Universitat Politècnica de Catalunya-CIMNE, Barcelona, Spain, ⁽³⁾Universitat Politècnica de Catalunya, Barcelona, Spain

08:30-10:30

Room 13-IS28: RECENT ADVANCES IN NUMERICAL METHODS FOR COMPLEX CFD SIMULATIONS

Chairpersons: Gianluigi Rozza and Federico Pichi

Organized by: Federico Pichi, Michele Girfoglio, Gianluigi Rozza

ID.39

Large Eddy Simulation Reduced Order Models (LES-ROMs) for Turbulent Flows

Traian Iliescu

Virginia Tech, Blacksburg, United States

ID.118

Modeling Root-Water Uptake: A 3D-1D Virtual Element Approach

Stefano Berrone⁽¹⁾, Stefano Ferraris⁽²⁾, Denise Grappein⁽¹⁾, Gioana Teora⁽¹⁾, Fabio Vicini⁽¹⁾

⁽¹⁾Politecnico di Torino, Italy, ⁽²⁾Politecnico di Torino e Università di Torino, Italy

ID.134

Enhancing Surrogate CFD Simulations for Digital Twins By Combining Model Order Reduction and Scientific Machine Learning

Gianluigi Rozza

SISSA mathLab, Trieste, Italy

ID.195

The Three-Dimensional Extension of the Volume of Fluid-Machine Learning Method

Moreno Pintore, Bruno Després

Sorbonne University, Paris, France

ID.207

Hierarchical Model Reduction in CFD: the Latest Developments in Stokes and Navier-Stokes Applications

Simona Perotto⁽¹⁾, Erika Temellini⁽¹⁾, Francesco Ballarin⁽²⁾, Tomas Chacon Rebollo⁽³⁾

⁽¹⁾Politecnico di Milano, Italy, ⁽²⁾Università Cattolica del Sacro Cuore, Brescia, Italy,

⁽³⁾Universidad de Sevilla, Spain

ID.216

Recent Advances in Modeling Hypersonic Flows With Stabilized Finite Elements

Artem Korobenko⁽¹⁾, Craig Johansen⁽¹⁾, David Codoni⁽²⁾, Rahul Verma⁽¹⁾

⁽¹⁾University of Calgary, Calgary, Canada, ⁽²⁾Stanford University, Stanford, United States



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

THURSDAY 5TH

09:10-10:30

Room 15-IS21: RECENT TRENDS IN OPENFOAM-BASED NUMERICAL MODELS FOR REAL WORLD APPLICATIONS

Chairperson: Nicola Parolini

Organized by: Michele Girfoglio, Nicola Parolini, Gianluigi Rozza

ID.85

Towards An OpenFOAM-Based Framework for Meshless Simulation

Mohammed Elwardi Fadel⁽¹⁾, Holger Marschall^(1,2)

⁽¹⁾TU Darmstadt, Darmstadt, Germany, ⁽²⁾IANUS Simulation GmbH, Darmstadt, Germany

ID.99

Free-Surface Simulations of Polymer Mixing Processes Using OpenFOAM

Emilia Capuano

Politecnico di Milano, Milano, Italy

ID.168

A New Experimental-Numerical Approach for Wind Interaction Design of Permeable Façades

Marcello Catania, Giulia Pomaranzi, Paolo Schito, Alberto Zasso

Politecnico di Milano, Milano, Italy

ID.220

Overcoming Mesh-Induced Limitations in Finite Volume Solvers: Advancing Accuracy With the Face-Centered Approach

Matteo Giacomini^(1,2), Antonio Huerta^(1,2)

⁽¹⁾Universitat Politècnica de Catalunya, Barcelona, Spain, ⁽²⁾Centre Internacional de Mètodes Numèrics en Enginyeria, Barcelona, Spain

10:30-11:00

COFFEE BREAK

11:00-13:00

INVITED SESSIONS

11:00-13:00

Salón de actos-IS32: ADVANCED STRUCTURAL MODELLING FOR THE AEROSPACE INDUSTRY

Chairperson: Leonardo Leonetti

Organized by: Leonardo Leonetti, Laura Galuppi, Domenico Magisano, Giovanni Zucco, Marco Morandini

ID.90

A Versatile Approach for Multiscale Structural Analysis Using the Empirical Interscale Finite Element Method (Keynote Lecture)

Joaquín A. Hernández^(1,2), Eduardo Soudah^(1,3)

⁽¹⁾CIMNE, Barcelona, Spain, ⁽²⁾UPC, TERRASSA, Spain, ⁽³⁾University of Valladolid, Valladolid, Spain

ID.50 **Predicting Macroscopic Pyrolysis-Induced Deformations in Polymer Composites**

Marco Riva⁽¹⁾, Marco Morandini⁽¹⁾, Alessandro Airoidi⁽¹⁾, Lorenzo Cavalli⁽²⁾

⁽¹⁾Politecnico di Milano, Milan, Italy, ⁽²⁾Petroceramics S.p.A., Stezzano, Italy

ID.122 **Programming the Energy Landscape of 3D-Printed Kresling Origami Via Crease Geometry and Viscosity**

Samantha Mora⁽¹⁾, Nicola Pugno^(1,2), Diego Misseroni⁽¹⁾

⁽¹⁾University of Trento, Trento, Italy, ⁽²⁾Queen Mary University, London, UK

ID.159 **Analytical Modelling of the Thermal Problem in Multi-Layered Structural Composites for Fenestration of Low-E Orbiting Stations**

Laura Galuppi⁽¹⁾, Gianni Royer-Carfagni^(1,2), Ali Haydar⁽¹⁾

⁽¹⁾University of Parma, Department of Engineering for Industrial Systems and Technologies, Parma, Italy, ⁽²⁾Construction Technologies Institute-Italian National Research Council, Milan, Italy

ID.188 **Advantages of Suppressing Bending in Composite Laminate Pressure Vessels for Space Applications**

Shahrzad Daghighi, Giovanni Zucco

University of Limerick, Limerick, Ireland

11:00-13:00

Room 7-8-IS33: FROM SURROGATE MODELS TO LEARNING IN MULTI-PHYSICS, MULTI-SCALE, MULTI-DISCIPLINARY OPTIMISATION

Chairperson: Matteo Giacomini

Organized by: Matteo Giacomini, Antonio Huerta

ID.206 **Physics-Based Local Surrogate Models for Parametric PDEs Via Overlapping Domain Decomposition**

Matteo Giacomini^(1,2), Ben J. Evans⁽³⁾, Marco Discacciati⁽³⁾

⁽¹⁾Laboratori de Càlcul Numèric (LaCàN), E.T.S. de Ingeniería de Caminos, Canales y Puertos, Universitat Politècnica de Catalunya, Barcelona, Spain, ⁽²⁾Centre Internacional de Mètodes Numèrics en Enginyeria (CIMNE), Barcelona, Spain, ⁽³⁾Department of Mathematical Sciences, Loughborough University, Loughborough, United Kingdom

ID.103 **Deep Learning-Based Surrogate Models for Parameter Identification in Multi-Physics Porous Media Simulations**

Caterina Millevoi, Claudia Zoccarato, Massimiliano Ferronato

University of Padova, Padova, Italy



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.146

Deep Reinforcement Learning for Industrial Optimization: Applications in Water Distribution, Fluid Catalytic Cracking and Battery Management Systems

Anas Belfadil⁽¹⁾, David Modesto⁽¹⁾, Carlos Cano Domingo⁽²⁾

⁽¹⁾Barcelona supercomputing center, Barcelona, Spain, ⁽²⁾Universitat Politècnica de Catalunya, Barcelona, Spain

ID.83

Multiobjective Optimization With Discrete Meta-Variables: the Case of Building Energy Refurbishment

Kevin Taurines⁽¹⁾, Rodolphe Le Riche⁽²⁾, Renaud Chicoisne⁽¹⁾, Boris Brangeon⁽³⁾

⁽¹⁾CNRS LIMOS, Aubière, France, ⁽²⁾CNRS LIMOS, Saint-Etienne, France, ⁽³⁾SAS TIPEE, Lagord, France

ID.96

Data-Informed Uncertainty Quantification for Laser-Based Powder Bed Fusion Additive Manufacturing By Multi-Fidelity Surrogate Modeling

Mihaela Chiappetta⁽¹⁾, Chiara Piazzola⁽²⁾, Lorenzo Tamellini⁽³⁾, Alessandro Reali^(1,3), Ferdinando Auricchio^(1,3,4), Massimo Carraturo⁽¹⁾

⁽¹⁾University of Pavia, Pavia, Italy, ⁽²⁾Technical University of Munich, Munich, Germany, ⁽³⁾CNR-Institute for Applied Mathematics and Information Technologies, Pavia, Italy, ⁽⁴⁾Fondazione IRCCS Policlinico San Matteo, Pavia, Italy

ID.28

Multi-Output Multilevel Best Linear Unbiased Estimators Via Semidefinite Programming

Matteo Croci^(1,2), Karen E. Willcox⁽³⁾, Stephen J. Wright⁽⁴⁾

⁽¹⁾BCAM, Basque Center for Applied Mathematics, Bilbao, Spain, ⁽²⁾Ikerbasque, Bilbao, Spain, ⁽³⁾Oden Institute for Computational Engineering and Sciences, University of Texas at Austin, Austin, United States, ⁽⁴⁾University of Wisconsin-Madison, Madison, United States

11:00-12:00

Room 11-IS25: ENABLING DIGITAL TWIN TECHNOLOGIES IN COMPUTATIONAL SCIENCE AND ENGINEERING

Chairperson: Yevgeniya Filanova

Organized by: Diana Manvelyan, Yevgeniya Filanova

ID.150

Bayesian Estimation of A Lumped Network Model for A Building's Thermal Digital Twin

Zhijian Wang, Idoia Cortes Garcia, Stein Stoter, Clemens Verhoosel

Technology University of Eindhoven, Eindhoven, The Netherlands

ID.105

PDE-Constrained Deep Kernel Learning for High-Dimensional

Weihao Yan⁽¹⁾, Christoph Brune⁽¹⁾, Mengwu Guo⁽²⁾

⁽¹⁾University of Twente, Enschede, The Netherlands, ⁽²⁾Lund University, Lund, Sweden

ID.30

Learning Stochastic Reduced Order Models From Data: A Nonintrusive Approach

Melina Freitag⁽¹⁾, Jan Martin Nicolaus^(1,2), Martin Redmann⁽²⁾

⁽¹⁾University of Potsdam, Potsdam, Germany, ⁽²⁾Martin-Luther-University Halle-Wittenberg, Halle, Germany

12:00-13:00

Room 11-1500: CONTRIBUTED SESSION

Chairperson: Juan José Ródenas

Organized by: José Manuel Navarro-Jiménez, Enrique Nadal, Juan José Rodenas

ID.66

Machine Learning Approaches for CO2 Geological Storage Monitoring and Repeatability of Acquisition

Manon Sarrouilhe^(1,2), Hélène Barucco^(1,2), Henri Calandra^(2,3), Stefano Frambati^(2,3)

⁽¹⁾Inria, Bordeaux, France, ⁽²⁾EPC Makutu, Pau, France, ⁽³⁾TotalEnergies, Pau, France

ID.182

Hybrid Machine Learning Reduced Order Models for the Analysis, Enhancement and Interpolation of Fluid Mechanics Databases

Guillermo Enrique Barragán Montalvo⁽¹⁾, Arindam Sengupta⁽¹⁾, Ashton
lan Hetherington⁽¹⁾, Santos Rodrigo Abadía-Heredia⁽¹⁾, Jesús Garicano-
Mena^(1,2) Soledad Le Clairche Martínez^(1,2)

⁽¹⁾Universidad Politécnica de Madrid, Madrid, Spain, ⁽²⁾Center for Computational Simulation (CCS), Boadilla del Monte, Spain

ID.186

High Order Singular Value Decomposition To Improve Deep Learning Predictions: A Short Guide

Arindam Sengupta, Santos Rodrigo Abadia-Heredia, Ashton Ian Hetherington, Jose Miquel Perez, Soledad Le Clairche

ETSI Aeronáutica y del Espacio, Universidad Politécnica de Madrid, Madrid, Spain

11:40-13:00

Room 12-Is03: NUMERICAL METHODS FOR WIND ENERGY AERODYNAMICS

Chairpersons: Sergio G. Horcas, Esteban Ferrer and Jose I. Rojas

Organized by: Sergio G. Horcas, Esteban Ferrer, Jose I. Rojas

ID.25

First steps towards optimization of turbine blade efficiency via flow control: characterization of unsteadiness

Adeline Montlaur⁽¹⁾, Santiago Arias⁽¹⁾, Sergio G. Horcas⁽²⁾, Jose I. Rojas⁽¹⁾

⁽¹⁾Universitat Politècnica de Catalunya (UPC), Castelldefels, Spain, ⁽²⁾Universitat Politècnica de Catalunya, Terrassa, Spain



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.196

Optimizing Airfoil Design With Deep Reinforcement Learning

David Ramos Archilla⁽¹⁾, Nicolás Becerra Zúñiga⁽¹⁾, Gonzalo Rubio Calzado^(1,2), Eusebio Valero Sánchez^(1,2)

⁽¹⁾ETSIAE-UPM—School of Aeronautics, Universidad Politécnica de Madrid, Madrid, Spain, ⁽²⁾Center for Computational Simulation, Universidad Politécnica de Madrid, Campus de Montegancedo, Madrid, Spain

ID.17

OFFturb, A High-Order Numerical Solver for Offshore Wind Turbine Simulations

Esteban Ferrer, Oscar Mariño, David Huergo, Abbas Ballout, Eduardo Jané, Gonzalo Rubio, Gerasimos Ntoukas

Universidad Politécnica de Madrid, Spain

ID.104

Influence of Numerical Simulation Parameters On the Design of A Horizontal Axis Wind Turbine Rotor

Benjamin Maximiliano Fuentes Ortega^(1,2), David Roca^(1,2), Juan Carlos Cante^(1,2), Jose Ignacio Rojas⁽³⁾, Sergio Gonzalez Horcas⁽²⁾

⁽¹⁾Centre Internacional de Metodes Numerics en Enginyeria (CIMNE), Barcelona, Spain, ⁽²⁾Escola Superior d'Enginyeries Industrial Aeroespacial i Audiovisuals de Terrassa ESEIAAT, Universitat Politècnica de Catalunya-BarcelonaTech (UPC), Barcelona, Spain, ⁽³⁾Dept. of Physics-Division of Aerospace Eng., Universitat Politècnica de Catalunya (UPC), Barcelona, Spain

11:00-13:00

Room 13-IS22: CHALLENGES AND INNOVATIVE SOLUTIONS IN OPTIMIZATION AND DATA-DRIVEN APPROACHES FOR INDUSTRIAL AND REAL-WORLD PROBLEMS

Chairperson: Elena Govi

Organized by: Pasquale Cascarano, Elena Govi, Francesco Mezzadri

ID.27

Deep Initial Guess for Accelerated Reconstruction of Sparse-View CT Acquisitions

Davide Evangelista, Elena Morotti, Elena Loli Piccolomini

University of Bologna, Bologna, Italy

ID.29

An Inexact Optimization Framework for Non-Convex Bilevel Optimization

Danilo Pezzi, Silvia Bonettini, Giorgia Franchini, Marco Prato

University of Modena and Reggio Emilia, Modena, Italy

ID.55

GreenNAS: A Green Approach To the Hyperparameters Tuning in Deep Learning

Giorgia Franchini

UNIMORE, Modena, Italy

ID.59 Smart Design of Thermoplastic Vulcanizate Products: Linking Process To Performance Via Machine Learning

Hector Lobato⁽¹⁾, Ignacio Trojaola⁽²⁾, Felipe Garitaonandia⁽¹⁾, Jon Haitz Badiola⁽¹⁾, Aizeti Burgoa⁽¹⁾

⁽¹⁾Leartiker, Markina-Xemein, Spain, ⁽²⁾Ikerlan, Arrasate/mondragon, Spain

ID.89 Deep Image Segmentation: Variational Approaches Interact With Deep Image Prior

Alessandro Benfenati⁽¹⁾, Giorgia Franchini⁽²⁾, Federica Porta⁽²⁾

⁽¹⁾University of Milan, Milan, Italy, ⁽²⁾University of Modena and Reggio Emilia, Modena, Italy

ID.147 Deformation in Large Plates: Exploring Optimal Support Conditions With Isogeometric Analysis

Alexander Luther

Fraunhofer Institute for Large Structures in Production Engineering IGP, Rostock, Germany

11:00-13:00

Room 15-IS06: APPLICATIONS OF ADAPTIVE MESH REFINEMENT

Chairperson: Sandro Elswijker

Organized by: Lukas Dreyer, Sandro Elswijker

ID.217 Tree-Based Adaptive Mesh Refinement for Cartesian Grid Applications (Keynote Lecture)

Donna Calhoun⁽¹⁾, Carsten Burstedde⁽²⁾, Jonathan Snively⁽³⁾, Matthew Zettergren⁽³⁾, Scott Aiton⁽¹⁾

⁽¹⁾Boise State University, Boise, United States, ⁽²⁾University of Bonn, Germany, ⁽³⁾Embry Riddle Aeronautic University, Daytona, United States

ID.63 Data Compression for Geophysical Data

Adrian Kolb, Siegfried Müller

RWTH Aachen University, Aachen, Germany

ID.58 Exploring Data Using Adaptive Multiresolution Datastructures

David Knapp

Deutsches Zentrum für Luft- und Raumfahrt e.V., Köln, Germany

ID.64 Space-Filling Curve AMR for Solving Arbitrary PDEs On Hybrid Adaptive Meshes

Lukas Dreyer^(1,2)

⁽¹⁾German Aerospace Center (DLR), Cologne, Germany, ⁽²⁾Leibniz University, Hannover, Germany



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.106

Scda: A Minimal, Serial-Equivalent Format for Parallel I/O and Its Applications

Tim Griesbach, Carsten Burstedde

Institute for Numerical Simulation, University of Bonn, Bonn, Germany

13:00-14:30

LUNCH

14:30-16:30

INVITED SESSIONS

14:30-15:50

Salón de actos-IS32: ADVANCED STRUCTURAL MODELLING FOR THE AEROSPACE INDUSTRY

Chairperson: Leonardo Leonetti

Organized by: Leonardo Leonetti, Laura Galuppi, Domenico Magisano, Giovanni Zucco, Marco Morandini

ID.181

Effective large rotation isogeometric shell models for alternating stiff/soft laminates (Keynote Lecture)

Leonardo Leonetti, Domenico Magisano, Giovanni Garcea

Unical, Rende, Italy

ID.201

Machine Learning Models for Efficient Fatigue Life Prediction in Aircraft Design

Ángel Ladrón⁽¹⁾, Javier Rozalén⁽²⁾, Fernando R. Sánchez⁽²⁾, Lucas Lacasa⁽³⁾, Eusebio Valero^(1,4), Gonzalo Rubio^(1,4)

⁽¹⁾ETSIAE-UPM—School of Aeronautics, Universidad Politécnica de Madrid, Plaza Cardenal Cisneros 3, E-28040, Madrid, Spain, ⁽²⁾Airbus Defence & Space, Fatigue & Damage Tolerance, Getafe, Spain, ⁽³⁾Institute for Cross-Disciplinary Physics and Complex Systems (IFISC), CSIC-UIB, Palma De Mallorca, Spain, ⁽⁴⁾Center for Computational Simulation, Universidad Politécnica de Madrid, Campus de Montegancedo, Boadilla del Monte, 28660, Madrid, Spain

ID.82

An Enrgy Stable Discontinuous Galerkin Discretisation for the Damped Intrinsic Beam Equations

Shivam Sundriyal, Christian Bleffert, Lukas Dreyer, Melven Röhrig-Zöllner
German Aerospace Center, Köln, Germany

15:50-16:30

Salón de actos-ISML: MATLAB - WOULD YOU TRUST YOUR AI MODEL WITH YOUR LIFE? RESEARCH VS. REALITY IN AI

Chairperson: Enrique Nadal Soriano

Organized by: Lucas Garcia (Product Manager for AI at Mathworks)

THURSDAY 5TH

14:30-15:30

Room 7-8-IS33: FROM SURROGATE MODELS TO LEARNING IN MULTI-PHYSICS, MULTI-SCALE, MULTI-DISCIPLINARY OPTIMISATION

Chairperson: Matteo Giacomini

Organized by: Matteo Giacomini, Antonio Huerta

ID.183

High-Resolution 2-Level Structural Topology Optimization Through An Iterative Stiffness Projection Algorithm

José Manuel Navarro-Jiménez, Antolin Martínez-Martínez, Rafael Merli, Enrique Nadal, Juan José Ródenas

Universitat Politècnica de València, València, Spain

ID.133

Two-Level Topology Optimization With Improved Inter-Cell Continuity

Rafael Merli, Antolin Martínez-Martínez, Juan José Ródenas, Marc Bosch, José Manuel Navarro, José Albelda

Universitat Politècnica de València, Valencia, Spain

ID.33

From Low To High, and To Low Again: Challenges in Soft Robotics Modeling

Gianmarco Mengaldo

National University of Singapore, Singapore

15:30-16:30

Room 7-8-IS08: PROXY APPLICATION DEVELOPMENT: DISCRETE MATHEMATICS-INDUSTRIAL SYNERGIES TO MEET SUSTAINABILITY CHALLENGES AND FOSTER INNOVATION

Chairperson: Stefano Frambati

Organized by: Hélène Barucq, Henri Calandra, Stefano Frambati, Jean-Pierre Vilotte

ID.19

SharC: An Arcane Based Proxy Application for Porous Media Flow Simulations

Raphaël Gayno⁽¹⁾, Stéphane De Chaisemartin⁽¹⁾, Guillaume Enchéry⁽¹⁾, Jean-Marc Gratien⁽¹⁾, Aboul Karim Mohamed El Maaroufi⁽¹⁾, Xavier Tunc⁽¹⁾, Soleiman Yousefi⁽¹⁾, Anthony Michel⁽¹⁾, Thomas Guignon⁽¹⁾, Gilles Grospellier⁽²⁾, Benoît Lelandais⁽²⁾, Alexandre L'Heritier⁽²⁾, Sylvain Desroziers⁽³⁾, Pascal Havé⁽⁴⁾

⁽¹⁾IFP Energies Nouvelles, Rueil Malmaison, France, ⁽²⁾CEA-DAM, Bruyères-Le-Châtel, France, ⁽³⁾Michelin (previously IFPEN), Clermont-Ferrand, France, ⁽⁴⁾Nuant (previously IFPEN), Rueil Malmaison, France

ID.143 **Hybrid Differentiable/Deep Learning Flow Solver for Reacting Flow Control**

Nguyen Anh Khoa Doan

Delft University of Technology, Delft, The Netherlands

ID.184 **Reduced-Order Modeling With An Optimized Progress Variable for A Hydrogen Flame**

Grégoire Corlù⁽¹⁾, Kamila Zdybal⁽²⁾, Xu Wen⁽³⁾, Lukas Berger⁽⁴⁾, Heinz Pitsch⁽⁴⁾, Alessandro Parente⁽¹⁾

⁽¹⁾Université Libre de Bruxelles-Aero-Thermo-Mechanics (ATM), Brussels, Belgium, ⁽²⁾EMPA-Swiss Federal Laboratories for Materials Science and Technology, Zurich, Switzerland, ⁽³⁾University of Science and Technology of China-State Key Laboratory of Fire Science, Hefei, China, ⁽⁴⁾RWTH Aachen University-Institute for Combustion Technology, Aachen, Germany

ID.222 **Invariant Risk Minimization in RANS Turbulence Modelling**

Richard Dwight

TU Delft, Delft, The Netherlands

14:30-15:50

Room 12-IS31: FROM QUANTUM OPEN SYSTEMS TO QUANTUM COMPUTING

Chairperson: Antonio Falcó

Organized by: Alberto Acevedo, Antonio Falcó, Miguel Ángel García March

ID.138 **An Algebraic Probability Approach To Quantum Computing**

Antonio Falcó⁽¹⁾, Hermann Mathies⁽²⁾

⁽¹⁾Universidad CEU Cardenal Herrera, Elche, Spain, ⁽²⁾Universidad Cische Universität Braunschweig, Braunschweig, Germany

ID.139 **Quantum Algorithms for Fluid Dynamics: Exploring Block Encoding and Amplitude Amplification**

Alessandro Andrea Zecchi⁽¹⁾, Claudio Massimiliano Sanavio⁽²⁾, Simona Perotto⁽¹⁾, Sauro Succi⁽²⁾

⁽¹⁾Politecnico di Milano, Milano, Italy, ⁽²⁾Fondazione Istituto Italiano di Tecnologia, Roma, Italy

ID.219 **A Mathematical Approach To the Grover-Rudolph Quantum Algorithm**

Daniela Falcó Pomares^(1,2)

⁽¹⁾Universidad de Salamanca, Salamanca, Spain, ⁽²⁾Universidad CEU Cardenal Herrera, Elche, Spain



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.160

Effectiveness of Dynamical Decoupling On Quantum Random Telegraph Noise

Andreu Anglés-Castillo

Universitat de València, València, Spain

14:30-15:10

Room 13-IS22: CHALLENGES AND INNOVATIVE SOLUTIONS IN OPTIMIZATION AND DATA-DRIVEN APPROACHES FOR INDUSTRIAL AND REAL-WORLD PROBLEMS

Chairperson: Francesco Mezzadri

Organized by: Pasquale Cascarano, Elena Govi, Francesco Mezzadri

ID.153

Enhancing Stent Design Through Multiphysics Topology Optimization

Nicola Ferro⁽¹⁾, Francesco Mezzadri⁽²⁾, Dario Carbonaro⁽³⁾, Giuseppe De Nisco⁽³⁾, Diego Gallo⁽³⁾, Elena Torta⁽³⁾, Umberto Morbiducci⁽³⁾, Claudio Chiastra⁽³⁾, Simona Perotto⁽¹⁾

⁽¹⁾Politecnico di Milano, Milano, Italy, ⁽²⁾University of Modena and Reggio Emilia, Modena, Italy, ⁽³⁾Politecnico di Torino, Torino, Italy

ID.214

Data Driven Multi-Frame Pose Tracking for Robotic Welding and Assembly: A Preliminary Investigation

Daniele Bernardini⁽¹⁾, Boyoung An⁽¹⁾, Suraj Deshini⁽¹⁾, Arturo Maiani^(1,2), Lukas Dirnberger⁽³⁾

⁽¹⁾Cognivix, Pescara, Italy, ⁽²⁾Università di Roma La Sapienza, Roma, Italy, ⁽³⁾Technical University of Munich, Munich, Germany

15:10-15:50

Room 13-IS19: MECHANISTIC CARDIAC DIGITAL TWINS AND VIRTUAL COHORTS FOR INDUSTRIAL THERAPY DESIGN AND CLINICAL APPLICATIONS

Chairperson: Gernot Plank

Organized by: G. Plank, B. Rodríguez

ID.79

Generating Cardiac Digital Twins At Scale: A Workflow for Automated Anatomical and Functional Twinning

Karli Gillette^(1,2,3), Elena Zappone^(2,3), Thomas Grandits^(4,5), Zorica Ristic⁽²⁾, Matthias Gsell⁽²⁾, Christoph Augustin⁽²⁾, Simone Pezzuto^(6,5), Gernot Plank^(2,3)

⁽¹⁾The University of Utah, Salt Lake City, United States, ⁽²⁾Medical University of Graz, Graz, Austria, ⁽³⁾BioTechMed-Graz, Graz, Austria, ⁽⁴⁾University of Graz, Graz, Austria, ⁽⁵⁾Università della Svizzera italiana, Lugano, Switzerland, ⁽⁶⁾University of Trento, Trento, Italy

THURSDAY 5TH

ID.129 Computational Insights Into Conduction System Pacing: Mechanisms, Stimulation Strategies, and Electrophysiological Responses

Mohammadreza Kariman

Medical University Graz, Graz, Austria

15:50-16:30

Room 13-IS16: FROM INFLAMMATION TO INNOVATION: MECHANOBIOLOGICAL BIOPHYSICAL COMPUTATIONAL MODELING FOR THE DEVELOPMENT OF NEXT-GENERATION THERAPIES

Chairperson: Claudio Conci

Organized by: Claudio Conci, Matteo Vicini, Leonardo Cherubin

ID.121 Macrophages on-chip investigation to calibrate an early inflammatory phase model of bone fracture healing

Edoardo Borgiani⁽¹⁾, Gabriele Nasello⁽¹⁾, Liesbet Geris^(1,2)

⁽¹⁾KU Leuven, Leuven, Belgium, ⁽²⁾University of Liege, Liege, Belgium

ID.128 Understanding and modeling the mechanobiology of breast cancer progression

Claudio Conci, Alberto Bocconi, Giovanni Buccioli, Leonardo Cherubin, Srijan Chakraborty, Giulia Lodola, Giada Mainieri, Chiara Martinelli, Emanuela Jacchetti, Matteo Vicini, Manuela T. Raimondi

Department of Chemistry, Materials and Chemical Engineering "G. Natta" Politecnico di Milano, Milano, Italy)

14:30-15:50

Room 15-IS06: APPLICATIONS OF ADAPTIVE MESH REFINEMENT

Chairperson: Sandro Elswijker

Organized by: Lukas Dreyer, Sandro Elswijker

ID.112 Scalable Overset Computation Between A Forest-Of-Octrees and An Arbitrary

Distributed Parallel Mesh

Hannes Brandt

University of Bonn, Bonn, Germany

ID.125 Introducing Space Filling Multilevel Curves Into Tree-Based Adaptive Mesh Refinement

Sandro Elswijker^(1,2)

⁽¹⁾German Aerspace Center, Cologne, Germany, ⁽²⁾University of Bonn, Bonn, Germany



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.87

An Adaptive Dynamical Core for Earth System Modeling

Benedict Gbeihe

University of Cologne, Cologne, Germany

ID.117

P4est: A Software Library for Extreme-Scale Adaptive Mesh Refinement

Carsten Burstedde

University of Bonn, Germany

15:50-16:30

Room 15-IS23: INDUSTRIAL APPLICATIONS OF NUMERICAL COMPUTING AND DIGITAL TWINS

Chairperson: Lucia Royo Pascual

Organized by: L. Royo-Pascual, A. Labarías, J. Monzón, C. Alfaro

ID.34

Real-Time Predictive Modeling of A Jet Ejector Cycle With Integrating Empirical Maps for Two-Phase Flow

José Galindo Lucas, José Ramón Serrano Cruz, Vicente Dolz Ruiz, Paulina Iljaszewicz

Universitat Politècnica de València, Valencia, Spain

ID.171

Physics-Based Reduced Order Model for Hydrogen Injection Into Natural Gas Pipelines

Carlos Montañés, Jaime Milla, Leyre Pardo, Antonio Gómez

Nabladot, S.L., Zaragoza, Spain

16:30-16:40

BREAK

16:40-17:25

Salón de Actos: PLENARY 2: MIXED-INITIATIVE ENGINEERING DESIGN: TOWARDS A MORE-THAN-HUMAN DESIGN PROCESS

Prof. Dr. Ing. Stefanie Elgeti

Institute of Lightweight Design and Structural Biomechanics (ILSB) at the Vienna University of Technology-TU Wien

19:00-23:00

Departure at 19:00 h from the UPV (Conference Venue) Gate L by bus to the Albufera Area for the Gala Dinner. **SEE MAP**

On our way, we will see the **City of Arts and Sciences**, a symbol of modernist Valencia. Work of the Valencian architect Santiago Calatrava, several of its buildings have become icons in the city. It is a scientific and cultural leisure complex covering around two kilometres of the former riverbed of the river Turia.

We will leave the city heading south to reach the lake located in the Albufera Natural Park.

THURSDAY 5TH

The name "**Albufera**" comes from the Arabic "al-buhayra," meaning "small sea." The Albufera of Valencia is a Natural Park located at 10 km from Valencia. It is a collection of lakes, rice paddies, and swamps that make up the park. The most well-known and famous part of the Albufera is its lake, as it is the most important part. Within the Natural Park, we can find the famous Valencian barraca (typical house).

We will enjoy a boat ride (approximately 30 minutes) until we reach the restaurant where the Gala Dinner will be held.

21:00 h Gala Dinner at Nou Racó Restaurant.

After the Dinner, return to Valencia by bus..



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

FRIDAY, JUNE 6TH

08:30-10:30 INVITED SESSIONS

08:30-10:30

Salón de Actos-ISO4: POLYTOPAL METHODS AND APPLICATIONS: A NEMESIS MINI-SYMPOSIUM

Chairperson: Alexandros Skouras

Organized by: Paola F. Antonietti, Lourenço Beirão Da Veiga, Daniele A. Di Pietro, Jérôme Droniou

ID.26

Discretization of Maxwell'S Equations On Riemannian Manifolds

Jérôme Droniou⁽¹⁾, **Marien Hanot**⁽²⁾, Todd Oliynyk⁽³⁾

⁽¹⁾IMAG, Univ. Montpellier, CNRS, Montpellier, France, ⁽²⁾Univ. Lille, INRIA, Lille, France, ⁽³⁾School of Mathematics, Monash University, Monash, Australia

ID.41

Numerical Analysis of A Mixed-Dimensional Poromechanical Model With Frictionless Contact At Matrix-Fracture Interfaces

Francesco Bonaldi⁽¹⁾, Jérôme Droniou⁽²⁾, Roland Masson⁽³⁾

⁽¹⁾Université de Perpignan Via Domitia, Perpignan, France, ⁽²⁾Université de Montpellier, Montpellier, France, ⁽³⁾Université Côte d'Azur, Nice, France

ID.113

A New Look at the Hp Version of the Virtual Element Method

Silvia Bertoluzza

CNR-IMATI, Pavia, Italy

ID.174

A High-Order Solver for Acoustic and Aero-Acoustics Applications

Nicola Parolini

MOX, Dipartimento di Matematica, Politecnico di Milano, Italy

ID.185

Hybrid High-Order Methods With Hybrid Pressure and Improved Turbulence Modelling Capabilities

Lorenzo Alessio Botti, **Francesco Carlo Massa**

University of Bergamo, Dalmine, Italy

ID.73

Recent Advances in Stabilization-Free Virtual Elements

Stefano Berrone⁽¹⁾, Andrea Borio⁽¹⁾, Davide Fassino⁽¹⁾, **Francesca Marcon**⁽¹⁾, David Mora⁽²⁾

⁽¹⁾Politecnico di Torino, Torino, Italy, ⁽²⁾Universidad del Bio-Bio, Concepcion, Chile

08:30-10:30

Room 7-8-IS2o: OPTIMAL CONTROL STRATEGIES IN INDUSTRIAL APPLICATIONS

Chairperson: José Muñoz

Organized by: Jose J. Muñoz, Peter Betsch

ID.57

Discretization of Dirac Structures With Applications To Port-Hamiltonian Systems and Optimal Control Problems

Juan Manuel López Medel⁽¹⁾, David Martín De Diego⁽¹⁾, María Barbero Liñán⁽²⁾

⁽¹⁾*Instituto de Ciencias Matemáticas (CSIC-UAM-UC3M-UCM), Madrid, Spain,* ⁽²⁾*Universidad Politécnica de Madrid, Madrid, Spain*

ID.49

Optimal Control of Slender Soft Robot Locomotion

Jose J J Munoz⁽¹⁾, Bijalwan Bijalwan⁽²⁾, Michael Krieg⁽³⁾, Aleksandra Pidde⁽³⁾

⁽¹⁾*Universitat Politècnica de Catalunya, Barcelona, Spain,* ⁽²⁾*Centre Internacional de Mètodes Numèrics en Enginyeria, Barcelona, Spain,* ⁽³⁾*Institut de Ciències Fotòniques, Castelldefels, Spain*

ID.92

On the Consistency of the Boundary Conditions for the Adjoint Variables in Optimal Control Problems With Free End Time and Final Constraints

Wolfgang Steiner⁽¹⁾, Philipp Eichmeir^(1,2), Karin Nachbagauer⁽¹⁾

⁽¹⁾*University of Applied Sciences Upper Austria, Wels, Austria,* ⁽²⁾*Vienna University of Technology, Institute of Mechanics and Mechatronics, Vienna, Austria*

ID.157

Showcase of An Optimal Control Problem in Robotics for Integrating the System Matrices From A Multibody Simulation Code To Generate Adjoint Gradients for Optimization

Karin Nachbagauer^(1,2), Philipp Zallinger⁽¹⁾, Lukas Buchner (1,3), Roman Froschauer⁽¹⁾

⁽¹⁾*University of Applied Sciences Upper Austria, Wels, Austria,* ⁽²⁾*Institute for Advanced Study, Technical University of Munich, Garching, Germany,* ⁽³⁾*LIT CPS Lab, Johannes Kepler University, Linz, Austria*

ID.199

Adjoint Gradient Computation for An Extremal Value of A System Output for the Minimization of A Maximum

Philipp Zallinger⁽¹⁾, Daniel Lichtenegger⁽²⁾, Philipp Eichmeir (1,3), Wolfgang Steiner⁽¹⁾, Karin Nachbagauer (1,4)

⁽¹⁾*University of Applied Sciences Upper Austria, Wels, Austria,* ⁽²⁾*TUM School of Engineering & Design, Department of Mechanical Engineering, Chair of Applied Mechanics, Munich Institute of Robotics and Machine Intelligence (MIRMI), Technical University of Munich, Garching, Germany,* ⁽³⁾*Institute of Mechanics and Mechatronics, Division of Process Control and Automation, Vienna University of Technology, Vienna, Austria,* ⁽⁴⁾*Institute for Advanced Study, Technical University of Munich, Garching, Germany*



Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

ID.228 PDE-Constrained Optimization Using Homogenization for Topology Optimization and Phase-Field Fracture Mechanics
Gerard Villalta I Quintana, Fermin Otero Gruer, Alex Ferrer Ferre
CIMNE, Barcelona, Spain

08:30-10:30

Room 11-IS11: EU-MATHS-IN-MATHEMATICS FOR INNOVATION: SUCCESS STORIES AND SUPPORT FOR EUROPEAN INDUSTRIES

Chairpersons: Matthias Ehrhardt and Manel Cruz

Organized by: M. Ehrhardt, M.B. Cruz

ID.95 EU-MATHS-IN OpenDesk: A European One-Stop Shop for Researchers and Entrepreneurs (**Keynote Lecture**)
Manuel B. Cruz
Polytechnic Institute of Porto, Portugal and EU-MATHS-IN, Oporto, Portugal

ID.227 Mathematical Modelling of diffusive filaments: from active colloids to microplastic fibre pollutant release dynamics
Panayiota Katsamba
The Cyprus Institute, Nicosia, Cyprus

ID.110 Unsupervised method for decoding ion fusion in inorganic crystalline solid electrolytes
Henry Andres Cortes Paez⁽¹⁾, Mauricio Rincon Bonilla⁽¹⁾, Elena Akhmatskaya^(1,2)
⁽¹⁾Basque Center for Applied Mathematics, Bilbao, Spain, ⁽²⁾IKERBASQUE-Basque Foundation for Science, Bilbao, Spain

ID.16 Driving Innovation for Sustainable Silicon Production: Case Studies From the SisAl Pilot Project
Dolores Gómez^(1,2)
⁽¹⁾Universidade de Santiago de Compostela, Spain, ⁽²⁾Galician Centre for Mathematical Research and Technology (CITMAga), Santiago de Compostela, Spain

ID.15 Perovskites Solar Cells: Modeling, Analysis and Simulations
Patricio Farrell
Weierstrass Institute Berlin, Germany

FRIDAY, JUNE 6TH

08:50-10:30

Room 12-IS07: ARTIFICIAL INTELLIGENCE FOR ACCELERATED STUDY OF COMPLEX ENGINEERING AND PHYSICAL SYSTEMS

Chairperson: Massimiliano Lupo Pasini

Organized by: Massimiliano Lupo Pasini

ID.37

Spatiotemporal Cluster Pathway Analysis for High-Fidelity Physics-Based Simulations

Warren Leon Davis

Sandia National Laboratories, Albuquerque, United States

ID.40

Nonhomogenous Markov Chains in Engineering Applications of Machine Learning

Neven Hadžic

University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia

ID.53

Variational Physics-Informed Neural Networks for Solid and Contact Mechanics

Tarik Sahin⁽¹⁾, Daniel Wolff⁽¹⁾, Alexander Popp^(1,2)

⁽¹⁾University of the Bundeswehr Munich, Neubiberg, Germany, ⁽²⁾German Aerospace Center (DLR), Sankt Augustin, Germany

ID.142

Surrogate Modeling With PINNs Over Freeform Domains: Exploring the Effect of the Residual On Interpolation and Extrapolation

Francesco Mezzadri

University of Modena and Reggio Emilia, Modena, Italy

ID.191

Advanced Machine Learning Models for the Prediction of Aircraft Surface Pressure Distributions

Fermin Gutierrez⁽¹⁾, Miguel Jaraiz⁽¹⁾, Pablo Yeste⁽¹⁾, Lucas Lacasa⁽²⁾, Eusebio Valero (1,3), Gonzalo Rubio (1,3)

⁽¹⁾ETSIAE-UPM—School of Aeronautics, Universidad Politécnica de Madrid, Spain, ⁽²⁾Institute for Cross-Disciplinary Physics and Complex Systems (IFISC), CSIC-UIB, Madrid, Spain, ⁽³⁾Center for Computational Simulation, Universidad Politécnica de Madrid, Boadilla del Monte, Spain



Math to Product 2025

Emerging Technologies in Computational Science for Industry,
Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

FRIDAY, JUNE 6TH

09:10-10:30

Room 13-IS17: APPLICATIONS OF MACHINE LEARNING TO CHEMICAL PROCESSES

Chairperson: Francesco Calabro

Organized by: F. Calabrò, D. E. De Falco, C. Ehm, R. Cipullo, V. Busico

ID.77

Artificial intelligence applications in the mechanical recycling of polyolefin wastes

Vincenzo Vocca, Salvatore Cuomo, Francesco Piccialli, Roberta Cipullo
University Federico II, Naples, Italy

ID.123

AI-Assisted Prediction and Optimisation of Micropollutants Removal With Forward Osmosis Membranes

Mehryar Jafari, Christina Tzirtzipi
University of Bath - BATH, Bath, United Kingdom

ID.164

Quantitative Structure-Property Relationships With Physics/ Chemistry-Informed Machine Learning

Davide Elia De Falco
Scuola Superiore Meridionale, Naples, Italy

ID.94

Bridging catalyst design and optimization with machine learning

Luigi Cavallo
KAUST, Thuwal, Saudi Arabia

08:30-10:30

Room 15-IS09: FAST AND SCALABLE SOLVERS IN PDE APPROXIMATION OF COMPLEX PHYSICS

Chairpersons: Nicolás A. Barnafi & Ngoc Mai Monica Huynh

Organized by: Nicolás A. Barnafi, Ngoc Mai Monica Huynh, Alberto F. Martin

ID.163

Scalable Domain Decomposition Solver for Three-Grid Immersed Finite Element Method (**Keynote Lecture**)

Jakub Sistek
Institute of Mathematics of the Czech Academy of Sciences, Prague, Czech Republic

ID.60

Stability of Loosely Coupled Fluid-Structure Interaction Schemes in Presence of Large Added Mass

Francesca Renzi, Christian Vergara
Politecnico di Milano, Italy

ID.32

Scalable and Multilevel Preconditioners for Composite Discontinuous Galerkin Discretizations of the Cardiac EMI Model

Edoardo Centofanti

University of Pavia, Italy

ID.24

Iterative Solvers and Reduced-Order Modelling for the Simulation of Lattice StructuresRaul Rubio^(1,2), Alex Ferrer^(1,2), Joaquin Alberto Hernández^(1,2)⁽¹⁾CIMNE, Barcelona, Spain, ⁽²⁾Universitat politècnica de Catalunya, Barcelona, Spain

ID.38

Deep Reinforcement Learning for Mesh Adaptation in FEMAlessandro Bardelli⁽¹⁾, Massimiliano Lupo Pasini⁽²⁾, Stefano Micheletti⁽³⁾⁽¹⁾Meta, Milan, Italy, ⁽²⁾Oak Ridge National Laboratory, Oak Ridge, United States,⁽³⁾Politecnico di Milano, Milan, Italy

10:30-11:00

COFFEE BREAK

11:00-11:45

Salón de Actos: PLENARY 3: IMPROVING TURBULENCE CONTROL THROUGH EXPLAINABLE DEEP LEARNING

Dr. Ricardo Vinuesa. Associate Professor at the Department of Engineering Mechanics, KTH Royal Institute of Technology in Stockholm.

11:45-12:15

CLOSING CEREMONY

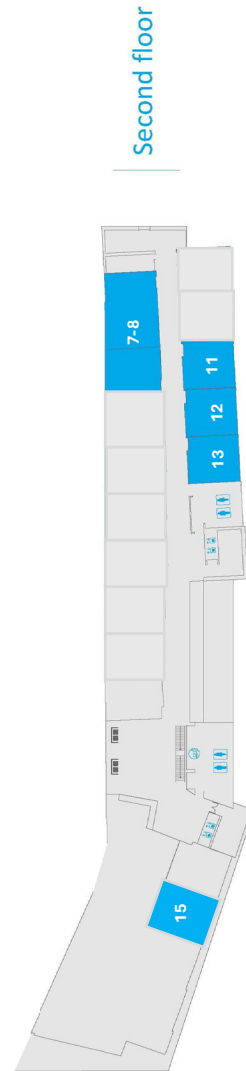
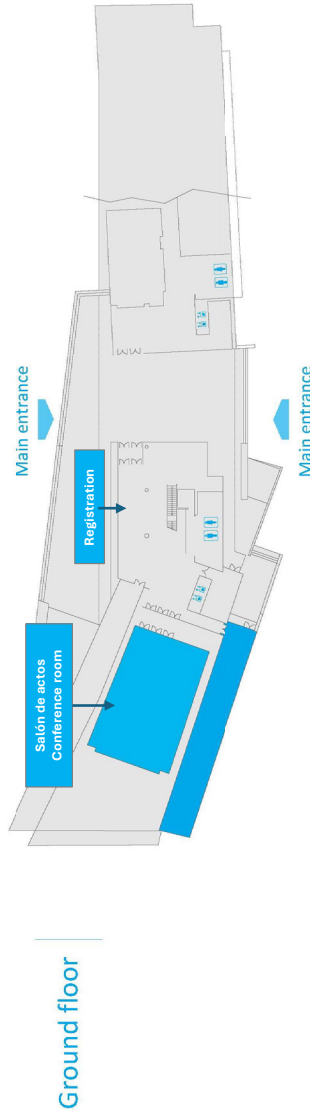


Math to Product 2025

Emerging Technologies in Computational Science for Industry, Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain

Nexus Building



SUPPORTING ORGANISATIONS





Math to Product 2025

Emerging Technologies in Computational Science for Industry,
Sustainability and Innovation

4 - 6 June 2025, Valencia, Spain



www.m2p2025.com

VIAJES El Corte Inglés
CONGRESOS

M.I.C.E. VALENCIA

C.C. Ademuz - C/. Pio XII, 51- 4.^a planta. 46015 Valencia • Tel. +34 963 107 189
E-mail: seicap.congresos@viajeseci.es