DTE AICOMAS 2025
Technical Programme

Last updated: 2025-02-10 14:01

Monday, 17/02/2025

Mon, 17/02/2025 08:00 - 09:00
Registration Short Courses

Mon, 17/02/2025 09:00 - 17:00
COURSE 1: Deep Learning in Computational Mechanics: an Introductory Course
Organizers: Leon Herrmann and Stefan Kollmannsberger

Mon, 17/02/2025 09:00 - 17:00
COURSE 2: Data-driven surrogates in multiscale modeling
Organizers: Iuri Rocha and Frans van der Meer

Mon, 17/02/2025 09:00 - 17:00
COURSE 4: From white to grey: fusing physics with data for DTs
Organizers: Lawrence Bull

Mon, 17/02/2025 13:30 - 17:00
Conference Pre - Registration

Tuesday, 18/02/2025

Tue, 18/02/2025 09:30 - 12:00
Registration

Tue, 18/02/2025 12:00 - 12:30 Grand Amphi
Opening

Tue, 18/02/2025 12:30 - 13:30 Grand Amphi
Plenary Lecture I
Chaired by: Prof. Francisco Chinesta (ESI GROUP Chair, ENSAM ParisTech)

Deep Neural Operators as Foundation Models for Digital Twins
G. Karniadakis

Tue, 18/02/2025 13:30 - 14:45
Lunch Break

Tue, 18/02/2025 14:45 - 16:45 Grand Amphi
MS009A - AI, Model Reduction and Data-Driven techniques for multiscale modelling of materials, structures and processes I
Corresponding Organizer: Prof. Julien Yvonnet (Universite Gustave Eiffel)
Chaired by: Prof. Julien Yvonnet (Universite Gustave Eiffel)

Inverse Problems in FEMU-DIC: Regularised Fields of Elastic Constants via Sparse Gaussian Process Priors Keynote
***P. Kerfriden**

Quantum Computing for Data-driven Computational Homogenization
***Y. Xu,** Z. Kuang, Q. Huang, J. Yang, H. Hu

Use of physics in data-driven modeling of process-structure relationships to enhance off-the-shelf machine learning models
***F. Bock,** N. Huber, B. Klusemann

A Data-Driven-based Homogenization Approach for Modelling the Anisotropic Damage of Quasi-brittle Heterogeneous Structures
***Z. CHAFIA,** J. YVONNET, J. BLEYER

Adaptive Physics-Informed Digital Twin for Process Parameters Optimization
***F. Ambrosio Garcia,** H. Devriendt, H. Metin, M. Özer, F. Naets

Tue, 18/02/2025 14:45 - 16:45 Amphi Bezier
MS005A - Data-Driven Methods and Digital Twin Applications in Geotechnical and Ground Engineering I
Corresponding Organizer: Prof. Jelena Ninic (University of Birmingham)
Chaired by: Prof. Jelena Ninic (University of Birmingham), Dr. Hoang Giang Bui (Helmholtz Zentrum Hereon)

A Minimum Viable Product for Long-Term Basement Monitoring Using a Reflective Twin Keynote
N. Babanagar, ***B. Sheil**

Improving Decision-Making In Geotechnical Construction with Probabilistic Digital Twins
***D. Cotoarba,** D. Straub, I. Smith

AI-Enabled Digital Twin Modelling of Dynamic Soil Plug Movement During Caisson Installation
***B. Williams,** S. Suryasentana, K. Donaldson

Digital Twin for Damage Modeling of Tunnel Linings
***J. Ninic,** Z. Ye, H. Bui, K. Altinay, P. Cavallaro, V. Villa

Digital reconstruction of underground space using in-pipe ground penetrating radar and deep learning
***H. Wu,** G. Wang, K. Li, B. Sheil

Tue, 18/02/2025 14:45 - 16:45 Amphi Fournel
MS003A - Physics-Informed Machine Learning for Surrogate Models in Continuum Mechanics I
Corresponding Organizer: Ms. Veronika Travnikova (RWTH Aachen University)
Chaired by: Dr. Matthias Möller (Delft University of Technology), Ms. Veronika Travnikova (RWTH Aachen University)

Accelerating Numerical Simulations in CFD by Model Reduction with Scientific and Physics-Informed Machine Learning Keynote
***G. Rozza**

RANS-Based Turbulence Modelling Using hp-Variational Physics-Informed Neural Networks
***T. Anandh,** S. Pochinapeddi, D. Ghose, S. Ganesan

Towards 3D Surrogate Model of Flow in Stirred Tank Reactors Using Physics-Informed Neural Networks
***V. Trávníková,** E. von Lieres, M. Behr

Surrogate Modeling of Fluid Flow at Different Reynolds Numbers Using Physics-informed Deep Operator Network
***J. Onishi,** H. Kitagawa, M. Tsubokura

4D Flow MRI Velocity Enhancement and Unwrapping Using Divergence-Free Neural Networks
***J. Bisbal,** J. Sotelo, H. Mella, J. Mura, P. Irarrazaval, C. Tejos, T. Sekine, S. Uribe

Tue, 18/02/2025 14:45 - 16:45 Amphi Manet

MS013A - Predictive data-driven model reduction and discovery for dynamical systems I

Corresponding Organizer: Prof. Andrea Manzoni (Politecnico di Milano)
Chaired by: Prof. Andrea Manzoni (Politecnico di Milano), Dr. Mengwu Guo (Lund University)

Non-intrusive reduced-order modeling with quantum reservoir computing Keynote
***V. Jain,** R. Maulik

A physical-generative framework for data-driven modeling with uncertainty quantification
***P. Conti,** J. Kneifl, A. Manzoni, A. Frangi, J. Fehr, S. Brunton, N. Kutz

FUSE: Fast Unified Simulation and Estimation for PDEs
***L. Lingsch,** D. Grund, S. Mishra, G. Kissas

HydroGym: A Platform for Reinforcement Learning in Fluid Dynamics
***C. Lagemann,** S. Ahnert, L. Paehler, S. Mokbel, J. Callaham, E. Lagemann, N. Adams, S. Brunton

Enhancing Sparse Identification of Nonlinear Dynamics With EMD-Based Method
***D. Liu,** A. Sopasakis

Tue, 18/02/2025 14:45 - 16:45 Amphi Pinel

MS016A - Advancements of Data-Driven Methods in Computational Mechanics I

Corresponding Organizer: Prof. WaiChing Sun (Columbia University)
Chaired by: Prof. Jiun-Shyan Chen (University of California, San Diego), Mr. Joep Storm (Delft University of Technology)

A New Mesh-Based Framework for Aerodynamic Design Utilising Evolutionary and Bayesian Optimisation Approaches
***B. Evans,** M. Dodds, S. Walton, B. Smith, J. Salamoun

A Neural Network Enhanced Framework for Data-Driven Inelasticity - Towards Two Dimensional Problems
***M. Harnisch,** T. Bartel, B. Schweizer, A. Menzel

Rank Reduction Autoencoder for parameterization of eigenvalue problems
***S. Rodriguez,** S. Torregrosa, A. Cordero, J. Torregrosa, M. Ziane, F. Chinesta

An Interpretable Multi-task Approach for Physically Recurrent Neural Networks
***M. Maia,** A. van Gils, I. Rocha, F. van der Meer

Spectral Physics-Informed Finite Operator Learning (SPiFOL) for Accelerated Prediction of Heterogeneous Material Behavior
***A. Harandi,** S. Rezaei, T. Brepols, S. Reese

Automated Graph Coarsening: Shell Buckling
***B. Ribeiro,** G. Broggi, J. Ribeiro, P. Reis, M. Bessa

Tue, 18/02/2025 14:45 - 16:45 Amphi Esquillan

MS039A - Deep Learning-based Reduced Order Models in Scientific Computing I

Corresponding Organizer: Phd. Stefania Fresca (Politecnico di Milano)
Chaired by: Phd. Stefania Fresca (Politecnico di Milano), Dr. Federico Pichi (SISSA)

Shallow Recurrent Decoders for Reduced Order Modeling Keynote
***N. Kutz,** M. Gao, J. Williams

Approximately well-balanced Discontinuous Galerkin methods using bases enriched with Physics-Informed Neural Networks
***E. Franck,** V. Michel-Dansac, L. Navoret

Registration-based data assimilation from medical images
***F. Romor,** F. Galarce, J. Zhu, A. Caiazzo

Neural Green's Operators for Parametric Partial Differential Equations
***J. Prins,** H. Melchers, M. Abdelmalik

Sparse Identification for Bifurcating Phenomena in Computational Fluid Dynamics
***L. Tomada,** M. Khamlich, F. Pichi, G. Rozza

Tue, 18/02/2025 14:45 - 16:45 Amphi A

MS038A - Inverse Problems and Data Assimilation for Digital Twins I

Corresponding Organizer: Dr. Rebekah White (Sandia National Laboratories)
Chaired by: Dr. Rebekah White (Sandia National Laboratories), Dr. Tim Wildey (Sandia National Labs)

Real-time SciDL calibration approaches with UQ for digital twins Keynote
***T. Bui-Thanh**

Building-Block Model Aggregation: Reduction of Turbulence Modeling Uncertainties via Bayesian Inference and Machine Learning
***C. Roques,** G. Dergham, X. Merle, P. Cinnella

Optimal Data Acquisition with Data-Consistent Inversion and Learning of Uncertain Quantities
***T. Butler,** H. Hakula, T. Roper

Bayesian calibration in a multi-output transposition context
***C. Sire,** J. Garnier, B. Kerleguer

Tue, 18/02/2025 14:45 - 16:45 Salle de Cours C3

MS021A - Digital Twins: Mathematical Engines and Applications for Sustainable Futures I

Corresponding Organizer: Prof. Laura Mainini (Imperial College London)
Chaired by: Dr. Matteo Diez (CNR-INM), Dr. Domenico Quagliarella (CIRA)

Development of a Digital Twin for Combustion Systems Using Automated Data Generation and Machine Learning Keynote
***I. Cozza,** M. Centini, S. Tosi, F. Aglietti

Bayesian Calibration and Transfer Learning for Fouling Diagnosis in Heat Exchangers
***E. Fuzaro de Almeida,** V. Batista Godoy, S. da Silva

Development of a Digital Twin for the improvement and innovation of CIRA's experimental facilities
***R. Donelli,** F. Capizzano, D. Quagliarella

Dynamic Mode Decomposition for Real-Time Digital Twinning: Applications in Naval, Renewable-Energy, and Urban Systems
***M. Diez,** G. Palma, R. Pellegrini, A. Serani

Digital Twins As Enablers For Safe Green Aviation
***F. Di Fiore,** P. Berri, L. Mainini

Tue, 18/02/2025 14:45 - 16:45 Salle de Cours C4

MS037A - Integrating Scientific Machine Learning with Physics-Based Simulation F INDUSTRIAL MULTIPHYSICS APPLICATIONS I

Corresponding Organizer: Dr. Thibault Dairay (Michelin)
Chaired by: Dr. Thibault Dairay (Michelin), Prof. Florian De Vuyst (University of Technology of Compiègne)

Scientific Machine Learning for Industrial Design Keynote
***F. Casenave**

Reconstruction of Flow Fields from Data Using Physics-Informed Gaussian Process Regression
***A. Padilla-Segarra,** P. Noble, O. Roustant, E. Savin

Hybrid Modeling in Rubber Mixing Process: A Primer
***T. Virin,** P. Bussetta

Real-time data assimilation for reduced-order modelling of a wind-tunnel turbulent wake
***A. Nóvoa,** E. Bekoglu, K. Steiros, L. Magri

Tue, 18/02/2025 14:45 - 16:45 Salle de Cours P4

MS051A - Physics-Enhanced Machine Learning for Structural Health Monitoring I

Corresponding Organizer: Prof. Eleni Chatzi (ETH Zurich)
Chaired by: Prof. Eleni Chatzi (ETH Zurich), Prof. Beatriz Moya (ENSAM Paris)

A Dual Updating Scheme For Damage Identifiation Based on Physics-Informed Neural Networks
***V. Panagiotopoulou,** C. Sbarufatti, E. Chatzi

Physics-embedded Graph Neural Networks for Rapid Assessment of Electrical Substations in Extreme Events
***B. Moya,** H. Liang, E. Chatzi, F. Chinesta

Automated condition monitoring using spectral autoencoders for fault detection in mechanical systems
***F. Jamil,** C. Peeters, J. Helsen

Online Parameter Identification for Flow Quality Monitoring in Solenoid Valves
***V. Smeets,** F. Naets, K. GRyllias

Physics-informed neural networks (PINNs) for bridges with moving loads
***A. Al-Adly,** P. Kripakaran

Mode Shape-Informed Graph Neural Networks for Structural Damage Localization in Truss Bridges
***A. Dadras Eslamlou,** S. Mammeri, M. Cabaleiro, B. Conde, B. Riveiro

Tue, 18/02/2025 16:45 - 17:00

Coffee Break

Tue, 18/02/2025 17:00 - 19:00 Grand Amphi

MS009B - AI, Model Reduction and Data-Driven techniques for multiscale modelling of materials, structures and processes II

Corresponding Organizer: Prof. Julien Yvonnet (Universite Gustave Eiffel)
Chaired by: Prof. Pierre Kerfriden (Mines Paris - PSL UNiversity)

FNO-CG: Accelerating CG Solvers for Homogenization Problems with Fourier Neural Operators
***J. Herb,** F. Fritzen

MuTINN for Fast Simulation of Fully Coupled Nonlinear Thermomechanical Behavior of Composite Structures
***M. El Fallaki Idrissi,** G. Chatzigeorgiou, F. Meraghni, F. Chinesta

Manifold learning using geometrical and topological descriptors for know-how based optimization.
***D. Muñoz,** F. Chinesta, E. Nadal, O. Allix, J. Ródenas

Accelerating FE^2 Computations on Finite Strain Regime through an On-the-fly Approach for (Model-free) Data-Driven Computational Mechanics
***F. Rocha,** A. Platzer, A. Leygue, L. Stainier

A Hierarchical Bayesian Approach for Multiscale Material Model Updating
***S. Pyrialakos,** I. Kalogeris, V. Papadopoulos

Data-Driven Nonlinear Diffusion
***L. Stainier**

Tue, 18/02/2025 17:00 - 19:00 Amphi Bezier

MS005B - Data-Driven Methods and Digital Twin Applications in Geotechnical and Ground Engineering II

Corresponding Organizer: Prof. Jelena Ninic (University of Birmingham)
Chaired by: Dr. Brian Sheil (University of Cambridge), Dr. Hassan Liravi (University of Birmingham)

A Model-Independent Adaptive Sampling Approach for Surrogate Design in Geotechnical Engineering
***Y. Yang,** A. López, A. Tsiampousi, D. Taborda

Two-stage surrogate modelling and prototype test for digital twins of construction disturbance-stratum-existing tunnel system
***Z. Liu,** Q. Ai

Surrogate Modeling for Interactive Subrectangular Tunnel Track Design using the Cut Finite Element Method
***H. Bui,** B. Cao, T. Nguyen, V. Pham, N. Do, J. Ninic

Ensemble Machine Learning and Hyperstatic Reaction Method for the Design of Quasi-rectangular Tunnels
***T. Nguyen,** B. Cao, V. Pham, H. Bui, N. Do

Investigation of the Seismic Response of Multi-Storey Steel Structures Using Machine Learning Techniques
***J. Sukhnandan,** N. Schetakis, G. Stavroulakis, G. Drosopoulos

Tunnel point cloud segmentation using deep learning and a novel synthetic data simulator
***W. Yang,** T. Hill, W. Lin, B. Sheil

Tue, 18/02/2025 17:00 - 19:00 Amphi Fournel

MS003B - Physics-Informed Machine Learning for Surrogate Models in Continuum Mechanics II

Corresponding Organizer: Ms. Veronika Travnikova (RWTH Aachen University)
Chaired by: Ms. Veronika Travnikova (RWTH Aachen University), Dr. Matthias Möller (Delft University of Technology)

A machine learning-based surrogate model for an efficient homogenization of open-porous materials
***A. Klawonn,** M. Lanser, L. Mager, A. Rege

On The Combination Of Physically-Guided Neural Networks With Internal Variables And Differential Operators For The Discovery Of Nonlinear, Anisotropic And Heterogeneous Features In Material Sciences
***R. Muñoz-Sierra,** J. Ayensa-Jiménez, M. Doblaré

Identification of Viscoelastic Material Properties Using a Physics-Informed Neural Network Framework with Non-Uniform Complex Modulus
***R. Teloli,** R. Tittarelli, P. Le Moal, E. Ramasso, M. Ouisse

Physics-informed Deep Neural Networks towards Finite Strain Homogenization of Unidirectional Soft Composites
***Q. Chen,** X. Du, G. Chatzigeorgiou, F. Meraghni, Z. Yang

PINNS applied to vibrations of overhead line cables
***J. Redford,** H. Pavy, F. Hafid

Tue, 18/02/2025 17:00 - 19:00 Amphi Manet

MS013B - Predictive data-driven model reduction and discovery for dynamical systems II

Corresponding Organizer: Prof. Andrea Manzoni (Politecnico di Milano)
Chaired by: Mr. Paolo Conti (Polytechnic University of Milan), Dr. Mengwu Guo (Lund University)

Implementation of Hybrid AI Models for Complex Dynamical Systems of the Smart City
***L. Chamoin,** Q. Li, S. Massala, M. Pica Ciamarra, S. Wu

Integrating data-driven and physics-based approach for Bayesian inference of geomechanical model parameters
***H. Cheng**

Sparse Equation Discovery and Optimal Sensing with Guarantees
***K. Manohar**

Data-driven modeling of transitions in fluid flows using spectral submanifolds
***B. Kaszás,** G. Haller

Non-intrusive reduced order model for stochastic dynamical systems
***K. Cheng,** I. papaioannou, D. Straub

Tue, 18/02/2025 17:00 - 19:00 Amphi Pinel

MS016B - Advancements of Data-Driven Methods in Computational Mechanics II

Corresponding Organizer: Prof. WaiChing Sun (Columbia University)
Chaired by: Prof. WaiChing Sun (Columbia University)

Introducing a microstructure-embedded autoencoder approach for reconstructing high-resolution solution field data from a reduced parametric space
***R. Najafi,** S. Rezaei, N. Rauter

Uncertainty-Driven Phase-Field Mixtures of Constitutive Models
***J. Storm,** W. Sun, I. Rocha, F. van der Meer

Learning to Optimize: Artificial Neural Networks Applied to Topology Optimization
***F. Ebrahimian,** A. Badías, A. Ebey Thomas, F. Chinesta

Multi-Fidelity Surrogate Model for Representing Hierarchical Databases To Approximate Human-Seat Interaction
G. Huynh, ***N. Fahse,** J. Kneifl, J. Fehr

A Neural Network Enhanced RKPM for Static and Dynamic Problems
***J. Chen, *S. Casebolt,** Y. Wang

Integrating form-finding and evolutionary optimization for gridshell construction
***J. Melchiorre,** A. Manuello Bertetto, P. Trovalusci

Tue, 18/02/2025 17:00 - 19:00 Amphi Esquillan

MS039B - Deep Learning-based Reduced Order Models in Scientific Computing II

Corresponding Organizer: Phd. Stefania Fresca (Politecnico di Milano)
Chaired by: Dr. Federico Pichi (SISSA), Dr. Nicola Rares Franco (MOX, Politecnico di Milano)

Statistical Learning Theory for Neural Operators Keynote
***N. Reinhardt,** S. Wang, J. Zech

Data-Driven Dimension Reduction Through Symmetry-Promoting Regularization
***N. Zolman,** S. Otto, J. Kutz, S. Brunton

Graph Neural Diffusion for Accelerated Adaptive Mesh Refinement in Finite Element Methods
***J. Rowbottom**

Neural Ordinary Differential Equations for Model Order Reduction of Stiff Systems
***M. Caldana,** J. Hesthaven

A Parametric Framework for Kernel-Based Dynamic Mode Decomposition Using Deep Learning
***K. Kevopoulos,** D. Ye

Tue, 18/02/2025 17:00 - 19:00 Amphi A

MS038B - Inverse Problems and Data Assimilation for Digital Twins II

Corresponding Organizer: Dr. Rebekah White (Sandia National Laboratories)
Chaired by: Dr. Tim Wildey (Sandia National Labs), Dr. Rebekah White (Sandia National Laboratories)

Using data-consistent inversion to build population-informed priors for Bayesian inference
***R. White,** J. Jakeman, T. Wildey, T. Butler

An AI-based integrated framework for solving inversion problems in computational science
***C. Heaney,** D. Guo, B. Chen, C. Pain

Goal-Oriented Projection Based Model Order Reduction for Data Assimilation
***P. Mollo,** K. Veroy-Grepl

Distributed Computing for Physics-based Data-driven Reduced Modeling at Scale
***I. Farcas,** R. Gundevia, R. Munipalli, K. Willcox

Parameter Estimation in a Nonlinear Mechanical System Using an Adaptive Cubature Kalman Filter
***L. Moyne,** E. Ghorbani, O. Tuysuz, F. Gosselin

Tue, 18/02/2025 17:00 - 19:00 Salle de Cours C3

MS021B - Digital Twins: Mathematical Engines and Applications for Sustainable Futures II

Corresponding Organizer: Prof. Laura Mainini (Imperial College London)
Chaired by: Dr. Domenico Quagliarella (CIRA), Dr. Matteo Diez (CNR-INM)

Explainable Deep Learning Model for Radioactive Contamination Detection in Atypical Atmospheric Conditions Keynote
***A. Roblin,** J. Baccou, G. Dougniaux, S. Velasco-Forero

Finite-Element-Based Digital Twinning with Reduced Order Modelling
***W. Bielajewa,** M. Baxter (née Tindall), P. Nithiarasu

Using Machine Learning Methods for Tracklet Association
***P. Lenz, *K. Rack, *K. Pröll, *H. Fiedler,** T. Schildknecht

Tue, 18/02/2025 17:00 - 19:00 Salle de Cours C4

MS037B - Integrating Scientific Machine Learning with Physics-Based Simulation F INDUSTRIAL MULTIPHYSICS APPLICATIONS II

Corresponding Organizer: Dr. Thibault Dairay (Michelin)
Chaired by: Dr. Fabien Casenave (Safran), Prof. iraj Mortazavi (CNAM)

ML-Augmented CFD with Local Corrective Term
***G. Jouan,** M. Schulz, D. Berger, S. Gavranovic, D. Hartmann

Combining Machine Learning With Finite Element Simulations For Fast Computation In Power Module Failure Analysis Due To Wire Bond Degradation
***M. Ghrabli,** M. Bouarroudj, L. Chamoin, E. Aldea

Real Time Reconstruction of High-Fidelity Simulations for Fault Prediction of Centrifugal Pump using Non-Intrusive Reduced Order Modeling
***R. Kannamvar,** J. Marati, P. Rao, T. Wick

A Line Search Heuristic for Optimization Using On-the-fly Model Order Reduction
***P. Luneau,** J. Deteix

Optimal Morphing for Reduced-Order Modeling Under Non-Parametrized Geometrical Variability
***A. Kabalan, *F. Casenave, *F. Bordeu, *V. Ehrlacher,** A. Ern

Data-Driven Fluid Flow Prediction Using Conditional Score-Based Diffusion Models
***W. Genuist,** E. Savin, F. Gatti, D. Clouteau

Tue, 18/02/2025 17:00 - 19:00 Salle de Cours P4

MS051B - Physics-Enhanced Machine Learning for Structural Health Monitoring II

Corresponding Organizer: Prof. Eleni Chatzi (ETH Zurich)
Chaired by: Prof. Eleni Chatzi (ETH Zurich), Mr. Konstantinos Vlachas (ETH ZURICH)

Prediction of Pipe-Jacking Forces Using a Physics-Constrained Neural Network
***M. Rayner-Philipson,** B. Sheil, P. Zhang

Comparative Assessment of ML Algorithms for Reference-Free Damage Detection and Localization Using FBG Sensors in Self-Referencing Configuration
***F. Omidi Moaf,** P. Fiborek, R. Soman

Neural calibration for hysteresis parameter estimation in bolted joint assemblies
***E. Fuzaro de Almeida,** R. de Oliveira Teloli, S. da Silva

Damage Detection and Localization of Damage using FBG sensors in Self-Referencing Configuration
***F. Omidi Moaf,** R. Soman

Leveraging digital twin strategy for predicting failures with limited training data
***H. Gupta,** P. Kundu

Tue, 18/02/2025 19:00 - 20:00

Welcome Cocktail

Wednesday, 19/02/2025

Wed, 19/02/2025 07:30 - 08:00
Registration

Wed, 19/02/2025 08:00 - 09:00 Grand Amphi
Plenary Lecture II
Chaired by: Prof. Stefan Kollmannsberger (Bauhaus University Weimar)

Machine learning, data and physics for constitutive material modeling
L. De Lorenzis

Wed, 19/02/2025 09:00 - 11:00 Grand Amphi
MS009C - AI, Model Reduction and Data-Driven techniques for multiscale modelling of materials, structures and processes III
Corresponding Organizer: Prof. Julien Yvonnet (Universite Gustave Eiffel)
Chaired by: Prof. Laurent STAINIER (Centrale Nantes)

K-Medoids-Accelerated Computational Homogenization Keynote
***M. Shakoor**

Modeling of Aerogel Microstructures through Deep Symbolic Regression
***R. Abdusalamov,** R. Chandrasekaran, M. Itskov

LSTM-Based Design of Non-Symmetric Plate-Lattices
***P. Meyer,** T. Tancogne-Dejean, J. Heidenreich, D. Mohr

Learning Homogenized Tangent Operators in Hyperelasticity for Topology Optimization of Lattice Structures
***B. Ribeiro Nogueira,** G. Allaire

Rotation-Free Parametric Deep Material Network for Thermomechanical Behavior Prediction of Fiber Composites
***T. Li,** L. Vilella Cardoso Ribeiro, H. Ji

Wed, 19/02/2025 09:00 - 11:00 Amphi Bezier
MS005C - Data-Driven Methods and Digital Twin Applications in Geotechnical and Ground Engineering III
Corresponding Organizer: Prof. Jelena Ninic (University of Birmingham)
Chaired by: Dr. Ba Trung Cao (Ruhr University Bochum), Prof. Jelena Ninic (University of Birmingham)

Physics-informed Learning for Geotechnical Engineering: Potential and Challenges Keynote
***P. Zhang**

Generation of Samples of Granular Material Using Diffusion Models
***M. Hassan,** R. Cottereau, F. Gatti, P. Dec

Integrating Machine Learning Classification with Thermal Integrity Profiling for Concrete Pile Assessment
***J. Sánchez Fernández,** A. Ruiz López, D. Taborda

Prediction of shear modulus for clayey soils using ensemble machine learning method
***J. Borderon,** J. Regnier, N. Dufour

A FE-PINN Approach for Addressing Soil–Structure Interaction Problems in Elastodynamics
***H. Liravi,** J. Fakhraei, J. Ninic

Wed, 19/02/2025 09:00 - 11:00 Amphi Fournel
MS003C - Physics-Informed Machine Learning for Surrogate Models in Continuum Mechanics III
Corresponding Organizer: Ms. Veronika Travnikova (RWTH Aachen University)
Chaired by: Dr. Matthias Möller (Delft University of Technology), Ms. Veronika Travnikova (RWTH Aachen University)

Domain decomposition and energy natural gradient descent optimization for physics-informed neural networks
***A. Heinlein,** T. Kapoor, R. Masri, M. Zeinhofer

Point Marching Adaptive Collocation Method for Physics-Informed Neural Networks
***B. Giovanardi,** A. Heinlein, C. Visser

Training of Physics-Informed Neural Networks: a Multi-Criterion Viewpoint
***N. Ricard,** M. Binois, R. Duvigneau

SetPINNs: Set-based Physics-informed Neural Networks
***M. Nagda,** P. Ostheimer, T. Specht, F. Rhein, F. Jirasek, M. Kloft, S. Fellenz

Neural Green's Operators for Parametric Partial Differential Equations
***H. Melchers, *J. Prims,** M. Abdelmalik

Multifidelity Neural Operator for PDE Problems
***G. Faza,** K. Shariatmadar, H. Hallez, D. Moens

Wed, 19/02/2025 09:00 - 11:00 Amphi Manet

MS013C - Predictive data-driven model reduction and discovery for dynamical systems III

Corresponding Organizer: Prof. Andrea Manzoni (Politecnico di Milano)
Chaired by: Dr. Mengwu Guo (Lund University), Prof. Andrea Manzoni (Politecnico di Milano)

Entropy-Consistent Generative Models for Fluid Flow Simulation Keynote
***B. Sanderse,** N. Mücke

Development of a Temporal Convolutional Network for Modeling of Clouds and Climate
***V. Phillips**

Online learning of time-varying systems with EKF-SINDY
***L. Rosafalco,** P. Conti, A. Manzoni, S. Mariani, A. Frangi

Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamical Systems
***D. Voina,** S. Brunton, J. Kutz

Dynamically Accurate Time Series Modeling Using Latent Differential Equations
***C. Delie,** N. Vlaminck, C. Simal, N. Riche, C. Sainvitu, A. Sartenaer

Wed, 19/02/2025 09:00 - 11:00 Amphi Pinel

MS016C - Advancements of Data-Driven Methods in Computational Mechanics III

Corresponding Organizer: Prof. WaiChing Sun (Columbia University)
Chaired by: Prof. Francisco Chinesta (ESI GROUP Chair, ENSAM ParisTech), Mr. Nicholas Zolman (University of Washington)

A Three-Dimensional Machine Learning Volume Of Fluid Method
***M. Pintore,** B. Després

Physics-Informed Neural Networks Enhanced by Finite Element Analysis for System Identification of a Lab-Scale Nonlinear Cantilever Beam
***E. Ghorbani,** M. Hamedi, M. Abda, Q. Dollon, F. Gosselin

A machine learning interatomic potential for high entropy alloys
***T. Li**

Decoding the Hidden Dynamics of Super-Arrhenius Hydrogen Diffusion in Multi-Principal Element Alloys via Machine Learning
***F. Shuang,** P. Dey

A data-driven neural network trained on CFD simulation results for RANS equations for site and wind resource assessment.
***Z. Lakdawala,** H. Kassem, M. Nadeem

ML-Optimization Steel Structure: Offshore Wind Turbine
***J. Alves Ribeiro,** B. Alves Ribeiro, F. Pimenta, S. M. O. Tavares, F. Ahmed

Wed, 19/02/2025 09:00 - 11:00 Amphi Esquillan

MS039C - Deep Learning-based Reduced Order Models in Scientific Computing III

Corresponding Organizer: Phd. Stefania Fresca (Politecnico di Milano)
Chaired by: Dr. Nicola Rares Franco (MOX, Politecnico di Milano), Phd. Stefania Fresca (Politecnico di Milano)

Finite Element Neural Network Interpolation: - Interpretable and adaptive discretisation for solving PDEs
***K. Skardova,** A. Daby-Seesaram, M. Genet

GradINN: Gradient Informed Neural Network
***F. Aglietti,** F. Della Santa, A. Piano, V. Aglietti

Multi-Fidelity Delayed Acceptance: Integrating Deep Learning Surrogate Modeling and Multilevel Delayed Acceptance for Efficient Bayesian Inverse Problem Solving
***F. Zacchei,** P. Conti, A. Frangi, A. Manzoni

Reduced Particle in Cell method for the Vlasov-Poisson system using auto-encoder and Hamiltonian neural networks
***R. Côte,** E. Franck, L. Navoret, G. Steimer, V. Vigon

The Application of Neural Operators to Predict Skin Evolution After Burn Trauma
***S. Husanovis,** G. Egberts, A. Heinlein, F. Vermolen

Data-Driven Investigation of Unsteady Forces on Cylinder Resting on Smooth Wall
***J. Harris,** K. Kuznetsov, F. Aristodemo

Wed, 19/02/2025 09:00 - 11:00 Amphi A

MS038C - Inverse Problems and Data Assimilation for Digital Twins III

Corresponding Organizer: Dr. Rebekah White (Sandia National Laboratories)
Chaired by: Dr. Tim Wildey (Sandia National Labs), Dr. Rebekah White (Sandia National Laboratories)

Efficient Numerical Methods for Inverse Problems Governed by Transport Equations
***A. Mang**

Optimal Placement of Distributed Optic Fiber Sensors for Online Structural Health Monitoring with the Modified Constitutive Relation Error
***J. Pérez,** L. Chamoin, J. Cortial, M. de Buhan, B. Soulier

Assessing the Identifiability of Lumped Parameter Thermal Models
***A. M. Zadeh Fard,** S. Vanpaemel, M. Kirchner, F. Naets

An integrated approach for localizing blast damage in ship structures using inverse finite element method, anomaly index, and machine learning
***J. Bardiani,** A. Manes, C. Sbarufatti

A Sparse State-Space Model for Electrical Circuits
***T. Meissner,** B. Paskaleva, P. Bochev

Model parameter identification and damage detection using a modified dual Kalman filter with optic fiber sensor data
***S. Farahbakhsh,** L. Chamoin, M. Poncelet

Wed, 19/02/2025 09:00 - 11:00 Salle de Cours C3

MS027A - Successes and failures in scientific machine learning I

Corresponding Organizer: Dr. Romit Maulik (Penn State University)
Chaired by: Dr. Romit Maulik (Penn State University)

Constrained Data Assimilation Using Ensemble Transform Kalman Filter and Reinforcement Learning for Physically Consistent Solutions Keynote
***P. Behnoudfar,** N. Chen

Recovering Robust Training of Physics-Informed Deep Operator Networks
***A. Howard,** P. Stinis

Model Aggregation: Combining PDE solvers through Empirical Variance Minimization
***T. Bourdais,** H. Owhadi

FNO: Frustrating neural operators and how to train them
***Q. Sun,** F. Dietrich

Wed, 19/02/2025 09:00 - 11:00 Salle de Cours C4

MS041A - Mathematical modeling, numerical simulations and AI techniques to enhance battery lifetime I

Corresponding Organizer: Prof. Raffaele D'Ambrosio (University of L'Aquila)
Chaired by: Prof. Raffaele D'Ambrosio (University of L'Aquila), Prof. Dajana Conte (Università di Salerno)

Efficient Numerical Solution of PDEs Models for Battery Electrodeposition Keynote
D. Conte, R. D'Ambrosio, G. Pagano, ***B. Paternoster**

Numerical Solution of Fractional Differential Models for the Study of Batteries
***A. Cardone,** D. Conte, G. Frasca-Caccia, B. Paternoster

Low rank based optimization for dominant eigenvalues of specific physical systems
***C. Scalone**

Adapted numerical methods for stochastic PDEs models in battery electrodeposition
***D. Conte,** R. D'Ambrosio, G. Pagano, A. Montano, B. Paternoster

Stochastic numerics in battery modeling
***R. D'Ambrosio**

Wed, 19/02/2025 09:00 - 11:00 Salle de Cours P4

MS004A - Machine Learning Advances in Earth Sciences and Engineering I

Corresponding Organizer: Dr. Javier E. Santos (Los Alamos National Laboratory)
Chaired by: Dr. Joseph Bakarji (American University of Beirut), Dr. Teeratorn Kadeethum (Sandia National Laboratories)

Optimization of porosity distributions for shock physics using deep learning
***M. Fernández-Godino,** M. Shachar, K. Korner, W. Schill, C. Jekel, J. Belof

AI-Based Inverse Design for Control of Shock Wave Dynamics
***J. Belof,** M. Armstrong, L. Benedict, S. Bland, Y. Choi, G. Fernandez, M. Hennessey, C. Jekel, D. Kline, K. Korner, J. Nguyen, R. Rieben, W. Schill, M. Shachar, D. Sterbentz, T. Stitt, J. Strucka, K. Sullivan, D. White

Graph Transformer-Based Flood Susceptibility Assessment of the French Riviera: Implications for Railway Infrastructure Resilience
***S. Vemula,** F. Gatti, P. Jehel

A Hyperlocal Deep Learning Based Digital Twin for Particulate Matter Air Pollution
***Z. Fox,** J. Agbaje, D. Maguire, J. Santos, M. Davis, R. Habre, H. Hanson

Wed, 19/02/2025 11:00 - 11:30

Coffee Break

Wed, 19/02/2025 11:30 - 13:30 Grand Amphi

MS009D - AI, Model Reduction and Data-Driven techniques for multiscale modelling of materials, structures and processes IV

Corresponding Organizer: Prof. Julien Yvonnet (Universite Gustave Eiffel)
Chaired by: Mr. Modesar Shakoor (IMT Nord Europe)

Evaluation of Tensile Strength of Cement Paste using Reconstructed Microstructure from Generative Adversarial Network (GAN) and Bayesian Updating
***D. Eum,** M. Azad, S. Kim, T. Han

Inverse analysis of defects in CFRP specimen with graph neural network using stress distribution of homogenized FEM
***Y. Kojima,** K. Endo, Y. Harada, J. Yvonnet, M. Muramatsu

Rank Reduction Autoencoders: A Novel Framework for Generative Design and Solutions in Composites
***M. El Fallaki Idrissi,** I. Ben-Yelun, J. Mounayer, S. Rodríguez, C. Ghnatios, F. Chinesta

Data-Driven Modelling for Predicting Crystallization Kinetics in a Polyamide Matrix With Carbon Fibres
***M. Palacios Suarez,** C. Ghnatios, A. Barasinski

Understanding The Impact of Architectural Defects on Composite Materials Performance Using Artificial Intelligence
***B. El Said,** I. Tretiak

Data-Driven Multi-Scale Modeling Of Additive Manufacturing
***W. Yan**

Wed, 19/02/2025 11:30 - 13:30 Amphi Bezier

MS002A - Enabling Technologies for Scientific Machine Learning and Reduced Order Modeling I

Corresponding Organizer: Prof. Alvaro Coutinho (COPPE/Federal University of Rio de Janeiro)
Chaired by: Prof. Alvaro Coutinho (COPPE/Federal University of Rio de Janeiro), Prof. Gianluigi Rozza (SISSA)

Hybrid Intrusive/ML-based Reduced Order Model Applied to Shape Optimisation Keynote
***R. Codina,** Z. Dar, J. Baiges

ROM-VMS formulation for environmental flows and wind energy applications
***S. Dave, *A. Korobenko**

Non intrusive interpolation and low rank approximation methods for nonlinear parametric models. Application to mechanical engineering.
***R. Cloarec,** G. Dongmo, Y. Guevel, J. Cadou

Enabling parametric ROMs with LRTD
A. Mamonov, ***M. Olshanskii**

Improving Stability Factor Estimation for Reduced Basis Solutions through Adaptive Gaussian Process Modeling
***S. Kang,** K. Lee

Wed, 19/02/2025 11:30 - 13:30 Amphi Fournel

MS003D - Physics-Informed Machine Learning for Surrogate Models in Continuum Mechanics IV

Corresponding Organizer: Ms. Veronika Travnikova (RWTH Aachen University)
Chaired by: Ms. Veronika Travnikova (RWTH Aachen University), Dr. Matthias Möller (Delft University of Technology)

A graph-based machine learning approach to accelerate plasma simulations
***S. Zhang,** M. Mallon, G. Gregori

Investigation of Physics-informed Neural Networks for Surrogate Modeling of Chromatographic Systems
***R. Reifsteck,** E. von Lieres, A. Jupke

Physics-Informed Neural Networks Based on DeepONet for Ocean Wave Propagation
***J. Wang,** J. HARRIS, M. YATES

Physics informed neural networks for shunted piezoelectric systems
***A. Mouratidou,** M. Daraki, G. Drosopoulos, G. Foutsitzi, W. Larbi, J. Deü, R. Ohayon, G. Stavroulakis

Wed, 19/02/2025 11:30 - 13:30 Amphi Manet

MS013D - Predictive data-driven model reduction and discovery for dynamical systems IV

Corresponding Organizer: Prof. Andrea Manzoni (Politecnico di Milano)
Chaired by: Mr. Paolo Conti (Polytechnic University of Milan), Dr. Mengwu Guo (Lund University)

Autoencoders with Energy-Based Kernels for dimensionality Reduction in Viscoelastic Flow
***F. Amaral,** C. Oishi, S. Otto, N. Kutz, S. Brunton

Neural Operator-based Model Approximation and Discovery
***S. Garmaev, *O. Fink**

ML-Based Acceleration Strategies for FSI Simulation of Deformable Microcapsule Dynamics
***L. Wicher,** C. Dupont, A. Salsac, F. De Vuyst

Data-Driven Strategy for the Identification of Model and Experimental Uncertainties of Electroacoustic Absorbers Using Autoencoders
***L. Ferreira,** R. Teloli, E. de Bono, M. Ouisse

Wed, 19/02/2025 11:30 - 13:30 Amphi Pinel

MS040A - Automatic Learning Of Constitutive Relations In Solid Mechanics I

Corresponding Organizer: Dr. Emmanuel Baranger (CNRS)
Chaired by: Dr. Emmanuel Baranger (CNRS), Mr. Kian Abdolazizi (Hamburg University of Technology)

Experimental Validation of the EUCLID Framework for Automated Discovery of Hyperelastic Material Models
***A. Abbasi,** M. Ricci, P. Carrara, M. Flaschel, S. Kumar, S. Marfia, L. De Lorenzisa

Dual-stage framework for constitutive modeling of hyperelastic materials based on data-driven identification and neural networks
***L. Linden, *K. Kalina, *J. Brummund, *M. Kästner**

Convex neural networks learn generalized standard material models
***M. Flaschel,** P. Steinmann, L. De Lorenzis, E. Kuhl

Constitutive Modeling of Anisotropic Elasticity and Magneto-Elasticity with Neural Networks
***K. Kalina,** J. Brummund, H. Roth, P. Gebhart, W. Sun, M. Kästner

Data Driven Material Modeling for Human Bone Tissue in the Context of Automotive Crash Simulation
***C. Saenz-Betancourt,** D. Draper, S. Peldschus

Wed, 19/02/2025 11:30 - 13:30 Amphi Esquillan

MS039D - Deep Learning-based Reduced Order Models in Scientific Computing IV

Corresponding Organizer: Phd. Stefania Fresca (Politecnico di Milano)
Chaired by: Dr. Federico Pichi (SISSA), Phd. Stefania Fresca (Politecnico di Milano)

Graph Neural Network Surrogates to leverage Mechanistic Expert Knowledge for Reliable and Immediate Pandemic Response
A. Schmidt, H. Zunker, A. Heinlein, ***M. Kühn**

Model Order Reduction with GNN-Based Reduced Bases for Unparametrized Geometries
***V. Matray,** F. Amlani, F. Feyel, D. Néron

3D variational autoencoder to parameterise microstructure as inputs for crystal plasticity surrogate models
***M. White,** M. Atkinson, A. Plowman, P. Shanthraj

Wed, 19/02/2025 11:30 - 13:30 Amphi A

MS046A - Scientific Machine Learning Methodologies with Applications in Computational Mechanics I

Corresponding Organizer: Prof. Azzeddine Soulaimani (École de technologie supérieure, Montréal)
Chaired by: Prof. Azzeddine Soulaimani (École de technologie supérieure, Montréal), Prof. Serge Prudhomme (Polytechnique Montréal)

Non-diffusive neural network method for hyperbolic conservation laws
***E. Lorin**

Physics-Informed Neural Networks for Solving the Shallow-Water Equations
***M. Mullins,** A. Soulaïmani

Hybrid physics-informed neural network based multiscale solver for multi-fidelity upscaling operator learning
***D. Korolev,** M. Hintermüller

Application of Physics-Informed Neural Networks in The Nonlinear Dynamic Analysis of Space Trusses
***P. de Mattos Pimenta,** L. Fernando Alves Macedo

Linear Operator Learning using GreenONets and a Multi-level Neural Network approach
***C. Bilodeau,** Z. Aldirany, R. Cottereau, S. Prudhomme

Deep Neural Operators for Inversion and Surrogate Modeling in Unsaturated Flow
***H. Kamil,** A. Soulaïmani, A. Beljadid

Wed, 19/02/2025 11:30 - 13:30 Salle de Cours C3

MS027B - Successes and failures in scientific machine learning II

Corresponding Organizer: Dr. Romit Maulik (Penn State University)
Chaired by: Dr. Romit Maulik (Penn State University), Dr. Panos Stinis (Pacific Northwest National Laboratory)

Combining Graph Networks and Reinforcement Learning for Consistent Turbulence Modeling Keynote
***M. Kurz,** B. Sanderse

Evaluation of Various Neural Network Approaches to Solving Partial Differential Equations
***S. Ezzehi,** V. Ehrlacher, G. Enchéry

Latent Dynamics Learning for Time-Continuous Reduced Order Models of Parametrized PDEs
***N. Farenga,** S. Brivio, S. Fresca, A. Manzoni

Learning Stochastic Closures via Conditional Diffusion Model and Neural Operator
***X. Dong,** C. Chen, J. Wu

Wed, 19/02/2025 11:30 - 13:30 Salle de Cours C4

MS041B - Mathematical modeling, numerical simulations and AI techniques to enhance battery lifetime II

Corresponding Organizer: Prof. Raffaele D'Ambrosio (University of L'Aquila)
Chaired by: Prof. Dajana Conte (Università di Salerno), Prof. Raffaele D'Ambrosio (University of L'Aquila)

A road map towards geometric bulk-surface PDE inspired artificial cells Keynote
***A. Madzvamuse,** F. Yang

Battery Modeling Through Bulk-Surface PDEs
***M. Frittelli,** I. Sgura, M. Quarta, A. Madzvamuse, B. Bozzini

Parameter estimation in battery modeling: Deep-Learning algorithms for metal growth and voltage profiles
***M. Quarta,** I. Sgura, B. Bozzini, R. Barreira

A Step-by-Step Time-Discrete Pinn for a Lithium-Ion Battery Model
***F. Colace,** D. Conte, G. Pagano, B. Paternoster, C. Valentino

Wed, 19/02/2025 11:30 - 13:30 Salle de Cours P4

MS004B - Machine Learning Advances in Earth Sciences and Engineering II

Corresponding Organizer: Dr. Javier E. Santos (Los Alamos National Laboratory)
Chaired by: Dr. M. Giselle Fernández-Godino (Lawrence Livermore National Laboratory), Dr. Javier E. Santos (Los Alamos National Laboratory)

Modelling Local Steady-State and Time-Dependent Reactive Dynamics in Porous Media by Multiscale Neural Networks Keynote
***A. Marcato,** A. Lombardo Pontillo, G. Boccardo, J. Santos, A. Franco, D. Marchisio

Upscaling Microscale Flow Effects Integrating Deep Learning and Differentiable Solvers
***A. Macato,** D. O'Malley, E. Guiltinan, H. Viswanathan, J. E. Santos

Developing a Foundation Model for Predicting Material Failure
***A. Marcato,** J. Santos, A. Pachalieva, G. Kai, R. Hill, E. Rougier, Q. Kang, J. Hyman, A. Hunter, J. Chua, E. Lawrence, H. Viswanathan, D. O'Malley

Discovering dimensionless relations from data in complex fluids Keynote
***L. Wayzani,** C. Oishi, J. Bakarji

Wed, 19/02/2025 13:30 - 14:45

Lunch Break

Wed, 19/02/2025 14:45 - 15:45 Amphi Bezier

Semi-Plenary Lectures

Chaired by: Prof. Ludovic CHAMOIN (ENS Paris-Saclay)

Deep learning & reduced order modeling: opportunities, challenges & perspectives
A. Manzoni

The challenges of integrating neural networks for solving parametric PDEs
D. Pardo

Wed, 19/02/2025 14:45 - 15:45 Amphi Fournel

Semi-Plenary Lectures

Chaired by: Prof. Beatriz Moya (ENSAM Paris)

Statistical Finite Elements: A Bayesian Perspective on Digital Twinning
F. Cirak

A Theoretical Framework for Digital Twinning: Enhancements in Structural Health Monitoring
C. Farhat

Wed, 19/02/2025 15:45 - 16:15

Coffee Break

Wed, 19/02/2025 16:15 - 18:15 Grand Amphi

MS009E - AI, Model Reduction and Data-Driven techniques for multiscale modelling of materials, structures and processes V

Corresponding Organizer: Prof. Julien Yvonnet (Universite Gustave Eiffel)
Chaired by: Mr. Felipe ROCHA (Université Paris-Est Créteil)

Machine Learning-Based Scale Bridging for Permeability Prediction of 3D Fibrous Structures
***D. Natarajan,** T. Schmidt, M. Duhovic, A. Dengel

Tailored Gaussian Process Kernels for Learning Representative Volume Elements (RVE) From EBSD Texture Data of Polycrystals
***B. Li,** P. Breitkopf, L. Cauvin

PDE Learning for Continuum Dislocation Dynamics
***N. Heinemann,** T. Hochrainer

Physically Informed Koopman Analysis of Evolving Dislocation Data
***T. Hochrainer,** B. Heininger, N. Heinemann, G. Kar

Data-Driven Surrogate Modelling Approach for Combining Simulation and Experimental Data for Crystalline Microstructures
***B. Katzer,** K. Schulz

Digital Twin of a Reheat Furnace Integrating Machine Learning and Chemical Reactor Networks
***S. Shubham,** J. Lumbreras, L. Pachano, D. Mira

Wed, 19/02/2025 16:15 - 18:15 Amphi Bezier

MS002B - Enabling Technologies for Scientific Machine Learning and Reduced Order Modeling II

Corresponding Organizer: Prof. Alvaro Coutinho (COPPE/Federal University of Rio de Janeiro)
Chaired by: Prof. Alvaro Coutinho (COPPE/Federal University of Rio de Janeiro), Prof. Gianluigi Rozza (SISSA)

A Mesh Based Graph Neural Network Approach for Surrogate Modeling of Free Surface Fluid Flows Keynote
***F. Lanteri,** M. Cremonesi

Reduced-Order Modeling for transistor overheating study in a downhole telemetry board
***J. Araujo da Silva,** J. Jith Chakkungalthodikayil, S. Salvadori Velu, V. Nguyen, A. Battentier, V. Singh, D. Andres Tinoco Estrada

Towards Algorithmic Framework for Nonlinear Reduced Order Modeling in Industrial Digital Twin Applications
***P. Malleval,** R. Scanff, D. Néron

Model Reduction and Scientific Machine Learning for the Urban Microclimate
***G. Stabile**

Hard-Constrained Mass Conserving Neural Network Modelling for Industrial Manufacturing Processes
***B. Boussaid,** C. Ghnatios, M. JEBAHI, R. Bonidal, F. Chinesta

Wed, 19/02/2025 16:15 - 18:15 Amphi Fournel

MS011A - Machine Learning and AI in Multibody System Dynamics I

Corresponding Organizer: Prof. Johannes Gerstmayr (University of Innsbruck)
Chaired by: Prof. Johannes Gerstmayr (University of Innsbruck), Dr. Grzegorz Orzechowski (LUT University)

MBD-NODE: Physics-informed data-driven modeling and simulation of constrained multibody systems
***J. Wang,** S. Wang, H. Unjhawala, J. Jinlong Wu, D. Negrut

Classical Time Integration Schemes for Mechanical Systems Modeled With Artificial Neural Networks
***A. Zwölfer,** B. Todorov, T. Slimak

Discovering Antagonists in Network of Robots
***I. Wenger,** H. Ebel, P. Eberhard

Generating Digital Twins of Multibody Systems Using Motion Capture, IMU Sensing, and an LLM
***S. Wang,** J. Wang, J. Wu, R. Serban, D. Negrut

Leveraging Multiple Specialized Neural Networks to Improve Extrapolation of Mechanical System Dynamics
***T. Slimak,** B. Todorov, A. Zwölfer

Data-Driven Design Assistance for the Synthesis of Task-Specific Four-Bar Linkages
***B. Röder,** H. Ebel, P. Eberhard

Wed, 19/02/2025 16:15 - 18:15 Amphi Manet

MS050A - AI-Enhanced and HPC Methods for Challenging Computational Mechanics Applications I

Corresponding Organizer: Prof. Ioannis Kalogeris (National Technical University of Athens)
Chaired by: Prof. Vissarion Papadopoulos (National Technical University Of Athens), Dr. Gerasimos Sotiropoulos (N.T.U.A.)

Automated Multigrid Design Using Genetic Programming For Nonlinear Thermoelastic Finite Element Simulations
***D. Parthasarathy,** T. Bevilacqua, A. Klawonn, H. Köstler, M. Lanser

A Dynamic Adaptive Learning Strategy for Enhanced Surrogate Modeling inThermodynamic-CFD Coupling
***Y. KEDDAD,** B. DELHOM, R. GAYNO, J. GRATIEN, T. FANEY, A. MICHEL

AI-Enhanced Surrogate Models for Aerodynamic and Multidisciplinary Design Optimization Assisted by Multi-Fidelity and Offline Data
***D. Maruyama**

Simulation-Based and Statistical Tools for Uncertainty Quantification in a Digital Twin of a Steam Generator
***E. Jaber,** V. Chabridon, E. Remy, M. Mougeot, D. Lucor

TORCHDA: Data assimilation with neural networks
***S. Cheng,** J. Min, K. Wang, S. Dance, M. Piggot, M. Bocquet, R. Arcucci

Adaptive Random Fourier Features Training Stabilized By Resampling With Applications in Image Regression
***A. Kammonen,** A. Pandey, E. von Schwerin, R. Tempone

Wed, 19/02/2025 16:15 - 18:15 Amphi Pinel

MS040B - Automatic Learning Of Constitutive Relations In Solid Mechanics II

Corresponding Organizer: Dr. Emmanuel Baranger (CNRS)
Chaired by: Prof. Oliver Weeger (TU Darmstadt), Prof. Ludovic CHAMOIN (ENS Paris-Saclay)

Implicit Constitutive Modelling: Training Gated-Recurrent Units with Unlabeled Data and the Virtual Fields Method
***R. Lourenço,** A. Andrade-Campos, P. Georgieva

Extended Minimal State Cells (EMSC): Self-Consistent Recurrent Neural Networks for Rate- and Temperature Dependent Materials
***J. Heidenreich,** P. Meyer, D. Mohr

Neural Network Meets Phase-Field: A Hybrid Fracture Model
***F. Dammass,** K. Kalina, M. Kästner

Material model discovery with FEMU
***S. Ghouli,** J. Heinzmann, A. Abbasi, P. Carrara, L. De Lorenzis

A Data Informed Ductile Damage Model for Metallic Materials
***Y. Bao,** C. Ling, D. Li, E. Busso

Wed, 19/02/2025 16:15 - 18:15 Amphi Esquillan

MS045A - Discovering Evolution Equations Using Structure-Preserving Data-Driven Methods I

Corresponding Organizer: Dr. Shenglin Huang (Nanyang Technological University)
Chaired by: Dr. Shenglin Huang (Nanyang Technological University), Prof. Beatriz Moya (ENSAM Paris)

Deep learning of structure-preserving coarse graining models Keynote
***Q. Hernández,** N. Trask

Strutcure preservation in neural networks and for approximating dynamics
***E. Celledoni**

Coupled Lie-Poisson Neural Networks (CLPNets): Data-Based Computing of Coupled Hamiltonian Systems
***V. Putkaradze**

Incorporating geometric biases into machine learning models for dynamical systems
***B. Tapley**

Structure-informed model reduction of Maxwell-type systems
***A. Gruber, *J. Actor, *E. Cyr**

Wed, 19/02/2025 16:15 - 18:15 Amphi A

MS046B - Scientific Machine Learning Methodologies with Applications in Computational Mechanics II

Corresponding Organizer: Prof. Azzeddine Soulaimani (École de technologie supérieure, Montréal)
Chaired by: Prof. Azzeddine Soulaimani (École de technologie supérieure, Montréal), Prof. Serge Prudhomme (Polytechnique Montréal)

A Hybrid Deep Ritz Method for Solving Generalized Monge-Ampère Equations
***A. Peruso,** A. Caboussat

DryMAMBA: simulation and predction in drying process in the potato by State Space model
***A. Liang,** D. Zhang, F. Jia

A Machine learning Computational Fluid Dynamics solver for simulating flashing jets
***A. Kallianioti,** D. Bhatia, K. Lyras

Recurrent Neural Network-based error estimator in spectral methods for solving PDEs
***A. Liatsetskaya,** Z. Monfared, C. Datar, F. Dietrich

Digital Twin Framework application for Aeronautical Hydrogen Microinjectors Design
***A. Deshons,** J. Leparoux, G. Fournier, F. Monnier, A. Vandel, G. Cabot, F. Grisch, N. Treleaven

Wed, 19/02/2025 16:15 - 18:15 Salle de Cours C3

MS024A - Digital Twins and AI-Enhanced Computational Methods for Structural Analysis I

Corresponding Organizer: Prof. Sergio Tavares (Universidade de Aveiro)
Chaired by: Prof. Sergio Tavares (Universidade de Aveiro), Eng. Natacha Rosa (University of Aveiro)

A Staggered Approach for Hidden Stress Field Inference and Constitutive Model Discovery
***G. Manyam,** V. Narouie, H. Wessels, K. Andreas Meyer

Real-Time Defect Detection and Segmentation in Composite Materials Using YOLOv8
***N. Motamedi,** D. Vasiukov

Conditional and Unconditional Generation of Seismic Signals Using Diffusion Model
***H. Gabrielidis,** F. Gatti, S. Vlalle

Wed, 19/02/2025 16:15 - 18:15 Salle de Cours C4

MS042A - Generation and Exploitation of Experimental Full-Field Data in Solid Mechanics I

Corresponding Organizer: Prof. Robin Bouclier (INSA Toulouse, France)
Chaired by: Prof. Robin Bouclier (INSA Toulouse, France)

Uniform and Isotropic Random Patterns for Digital Image Correlation
***S. Bossuyt**

Development of a novel test design incorporating strain path changes for the inverse calibration of elastoplastic models
***J. Henriques,** A. Andrade-Campos, J. Xavier

Building a Toolset to Calibrate Models from Heterogeneous Experimental Data: What are the Industrial Requirements?
***A. Vintache,** R. Gras, F. Mathieu, F. Hild

Validation of a Method Using Tapered Specimens to Characterize Static Strain Aging
***V. Björklund,** S. Bossuyt

Wed, 19/02/2025 16:15 - 18:15 Salle de Cours P4

MS034A - Model Order Reduction and Data Models in Medical Applications I

Corresponding Organizer: Prof. Chady Ghnatios (University of North Florida)
Chaired by: Prof. Chady Ghnatios (University of North Florida), Dr. Frederic Panthier (Tenon Hospital)

Choice of Distances in Non Parametric Statistics, Survival Data and Statistical Learning via Neural Networks. Application to Alzheimer Disease.. Keynote
***C. Huber**

Graph Neural Networks for Anatomical Personalisation of Hepatic Digital Twins
***L. Tesan,** E. Cueto

Predicting Kidney Allograft Survival Using Pre-Transplant Data
***R. Attieh,** C. Ghnatios

Multimodal Deep Learning for Dynamic and Static Neuroimaging: Integrating MRI and fMRI for Alzheimer's Disease Analysis
***A. Kujur,** Z. Monfared, F. Dietrich

Thursday, 20/02/2025

Thu, 20/02/2025 07:30 - 08:00
Registration

Thu, 20/02/2025 08:00 - 09:00 Grand Amphi
Plenary Lecture III
Chaired by: Prof. Vissarion Papadopoulos (National Technical University Of Athens)

Physics-Enhanced Machine Learning for Monitoring & Twinning | An Exercise in Balance
E. Chatzi

Thu, 20/02/2025 09:00 - 11:00 Grand Amphi
MS018A - Digital Twins for Predictive Decision Making of Engineering Systems I
Corresponding Organizer: Mr. Matteo Torzoni (Politecnico di Milano)
Chaired by: Prof. Andrea Manzoni (Politecnico di Milano), Mr. Matteo Torzoni (Politecnico di Milano)

Algorithmic decision-making for intervention planning of degrading engineering systems Keynote
***C. Andriotis**

Data-Driven Digital Twinning for Railway Network Optimal Maintenance Planning with Multi-Agent Reinforcement Learning Solutions
***G. Arcieri,** G. Duthé, C. Muller, D. Haener, E. Chatzi

Toward Dynamic Digital Twin: Enhancing Model Accuracy with Adaptive Sensor Steering Strategies.
***C. Ogbodo,** T. Rogers, M. Dal Borgo, D. Wagg

Predictive Digital Twins for Health Monitoring: From Structural Safety to Personalized Medicine
***M. Torzoni,** M. Tezzele, M. Massi, D. Carnevali, E. Varetti, E. Di Angelantonio, S. Mariani, F. Ieva, A. Manzoni, K. Willcox

Thu, 20/02/2025 09:00 - 11:00 Amphi Bezier
MS002C - Enabling Technologies for Scientific Machine Learning and Reduced Order Modeling III
Corresponding Organizer: Prof. Alvaro Coutinho (COPPE/Federal University of Rio de Janeiro)
Chaired by: Prof. Gianluigi Rozza (SISSA), Prof. Alvaro Coutinho (COPPE/Federal University of Rio de Janeiro)

Massively-parallel and GPU-accelerated DMD: an Implementation in the Python Library Heat
***F. Hoppe,** P. Knechtges, A. Rüttgers

Accelerating Finite Element Analysis Through Precise Matrix Preidiction Based on Deep Learning
***G. Yoon,** H. Jin, Y. Song

A Streaming, Distributed Out-of-Core SVD Library on Hybrid CPU/GPU Architectures Applied to Fluid Mechanics Data
***Y. Ajanif,** L. Silva, L. Lestandi

Leveraging the Cross-Entropy Method for Model Calibration and Data-Driven Modeling
***A. Cunha Jr,** M. Issa, J. Basilio, J. Telles Ribeiro

Integrating DASH with Jupyter Notebooks: an Approach for Effective SciML Results Communication
***S. Guo**

A High-Performance FNO pipeline for Three-phase Flow in Porous Media
G. Barros, R. Silva, A. Oliveira, E. Santos, R. Freitas, D. Velveti, X. Wu, F. Rochinha, ***A. Coutinho**

Thu, 20/02/2025 09:00 - 11:00 Amphi Fournel
MS011B - Machine Learning and AI in Multibody System Dynamics II
Corresponding Organizer: Prof. Johannes Gerstmayr (University of Innsbruck)
Chaired by: Dr. Andreas Zwölfer (Technical University of Munich), Prof. Henrik Ebel (LUT University)

Slide: A Machine-Learning Based Method for Forced Dynamic Response Estimation of Multibody Systems Keynote
***P. Manzl,** A. Humer, Q. Khadim, J. Gerstmayr

ChronoLLM: Using LLMs to Generate Chrono Digital Twins and to Judge Their Suitability for Simulation
***J. Wang,** H. Zhang, S. Wang, H. Unjhawala, K. Slaton, R. Serban, J. Wu, D. Negrut

Hybrid Friction Modeling In Mechanical Systems
***S. Han,** G. Orzechowski, M. Wojtyra, J. Kim, A. Mikkola

Virtual Labs with Large Language Models and Multibody Simulation
***T. Möltner,** M. Pieber, P. Manzl, J. Gerstmayr

Modelling Deformation Response of a Multibody Dynamic System using LSTM Model
***S. Baisthakur,** B. Fitzgerald

Thu, 20/02/2025 09:00 - 11:00 Amphi Manet

MS050B - AI-Enhanced and HPC Methods for Challenging Computational Mechanics Applications II

Corresponding Organizer: Prof. Ioannis Kalogeris (National Technical University of Athens)
Chaired by: Prof. Vissarion Papadopoulos (National Technical University Of Athens), Dr. Gerasimos Sotiropoulos (N.T.U.A.)

High-resolution Coastal Change Detection using AI and HPC
***W. Koslow,** K. Rack, F. Hoppe, A. Ruettgers, L. Dell Amore, P. Rizzoli

Virtual Real-time Monitoring of Metal Laser-based Direct Energy Deposition using an AI-Driven Simulation Approach
***R. Ramma,** A. Molotnikov, C. Moreira, M. Chiumenti, T. Herzog, R. Das

Prediction of Random Fields of Mechanical Properties from Microstructure Images using Convolutional Neural Networks
P. Gavallas, ***G. Stefanou,** D. Savvas, C. Mattrand, J. Bourinet

Blockchain Digital Twin approach to modeling HPC Data Center
***M. CHINNICI,** D. de chiara, M. antonini, G. guarnieri, G. santomauro, L. acampora, F. genovese, G. PONTI, L. telesca

Properly constrained and approximated reference prior for efficient and robust Bayesian learning of seismic fragility curves
***A. Van Biesbroeck,** N. Baillie, C. Feau

Ai Enhanced Partitioned Solution Scheme with Applications in Tumour Growth Models
***G. Sotiropoulos,** K. Atzarakis, V. Papadopoulos

Thu, 20/02/2025 09:00 - 11:00 Amphi Pinel

MS040C - Automatic Learning Of Constitutive Relations In Solid Mechanics III

Corresponding Organizer: Dr. Emmanuel Baranger (CNRS)
Chaired by: Dr. Karl Kalina (TU Dresden), Prof. Laura De Lorenzis (ETH Zurich)

Isotropic Polyconvex Hyperelastic Energies and Hulls: A Novel Neural Network Framework Satisfying the Universal Approximation Theorem
***G. Geuken,** P. Kurzeja, D. Wiedemann, J. Mosler

On the role of interpretability of data-driven constitutive modeling by Constitutive Artificial Neural Networks
***K. Abdolazizi,** C. Cyron, K. Linka

A Blind Source Separation Perspective on the Model Identification Problem for Constitutive Material Laws
***L. Mabileau,** C. Jailin, E. Baranger

Symmetric and Parameterized Physics-Augmented Neural Networks for Hyperelastic Constitutive Modeling in Beam Theory
***J. Schommartz,** D. Klein, J. Alzate Cobo, O. Weeger

Neural Networks meet Hyperelasticity: On Benefits and Limits of Polyconvexity
***D. Klein,** O. Weeger

Thu, 20/02/2025 09:00 - 11:00 Amphi Esquillan

MS045B - Discovering Evolution Equations Using Structure-Preserving Data-Driven Methods II

Corresponding Organizer: Dr. Shenglin Huang (Nanyang Technological University)
Chaired by: Dr. Shenglin Huang (Nanyang Technological University), Prof. Beatriz Moya (ENSAM Paris)

Symbolic pruning with projected neural additive model for polymer-bonded energetic materials Keynote
***N. Phan,** W. Sun

Learning Latent Dynamics With Second-Order Time Derivatives
***R. Stephany,** Y. Choi

Noether's razor: Learning conserved quantities
***T. van der Ouderaa, *M. van der Wilk, *P. de Haan**

Codiscovering Graphical Structure and Functional Relationships within Data: A Gaussian Process Framework for Connecting the Dots
***T. Bourdais**

Preserving Symmetries in Neural Closure Models for Large-Eddy Simulation
***S. Agdestein,** B. Sanderse

Thu, 20/02/2025 09:00 - 11:00 Amphi A

MS030A - Scientific Machine Learning and Uncertainty Quantification for Robust Digital Twins in Science and Engineering I

Corresponding Organizer: Dr. Dimitrios Loukrezis (Siemens AG)
Chaired by: Dr. Dimitrios Loukrezis (Siemens AG), Prof. Dimitris Giovanis (Johns Hopkins University)

Solving Time-Dependent Partial Differential Equations with a Random Feature Neural Ansatz
***C. Datar,** A. Rahma, F. Dietrich

Knowledge Distillation from Unstructered Data using Reliability Aware Physically-Guided Neural Networks
***J. Ayensa-Jiménez,** R. Muñoz-Slerra, M. Doblare

A Sobolev neural network with adaptive residual weighting scheme as a surrogate for computational mechanics
***A. Kilicsoy,** M. Valdebenito, M. Faes

Digital twins empowered by Thermodynamics-Informed Neural Networks
***A. Tierz,** I. Alfaro, D. Gonzalez, F. Chinesta, E. Cueto

Physics-Augmented Model Order Reduction for Industrial Structural Digital Twin Applications
***D. Fleres,** D. De Gregoriis, O. Atak, F. Naets

AI-SOLVE: Accelerating Computational Science with a Machine Learning-Enhanced Linear Algebra Library
***I. Kalogeris,** G. Sotiropoulos, K. Atzarakis, G. Stavroulakis, V. Papadopoulos

Thu, 20/02/2025 09:00 - 11:00 Salle de Cours C3

MS057A - Digital Twins for Ship and Offshore Structures I

Corresponding Organizer: Prof. Trond Kvamsdal (Norwegian University of Science and Technology (NTNU))
Chaired by: Prof. Trond Kvamsdal (Norwegian University of Science and Technology (NTNU)), Dr. Eivind Fonn (SINTEF Digital)

Digital Twinning in the European Naval Industry
***A. Rullan Contreras,** C. Baixas, A. Facio Valero, I. Pena Regueiro, P. Gualeni, J. Ruiz Herrer, J. Silvera Vez, F. W. Lindberg

Hybrid real-time structural ROM of the RV Gunnerus
***E. Fon,** T. Kvamsdal, K. Okstad, T. Rølvåg

Discrepancy Modeling and Physical Models Augmentation Using Machine Learning Algorithms
***C. Ghnatios,** F. Chinesta

Corrective Source Term Approach for Turbulent Flow Problems
***V. Tsiolakis,** M. Tabib, A. Rasheed, T. Kvamsdal

Digital Twin for Risk-Based Structural Integrity Management of Offshore Structures
***S. Li**

Data Driven Uncertainty Quantification of a Reduced Order Model
***V. Halonen,** T. Kvamsdal, A. Rasheed, I. Pölönen, V. Tsiolakis

Thu, 20/02/2025 09:00 - 11:00 Salle de Cours C4

MS042B - Generation and Exploitation of Experimental Full-Field Data in Solid Mechanics II

Corresponding Organizer: Prof. Robin Bouclier (INSA Toulouse, France)
Chaired by: Dr. Julien RETHORE (CNRS)

Digital Twin Of Large High Pressure Die Casting Parts Using A Tomograph Simulation
***L. Simon,** J. Dufour, F. Gaté, J. Genée, L. Penazzi

Uncertainty Quantification of Surface Microplasticity Using Stochastic Subsurface Microstructure Generation
***S. Engel,** J. Quinta da Fonseca, P. Shanthraj

Understanding Ice Fracture Using Digital Image Correlation
***W. Ahmad,** S. Bossuyt, J. Tuhkuri

On the Construction of CAD-based Twins of Lattice Structures from Tomographic Images
D. Bichet, J. Passieux, J. Périé, ***R. Bouclier**

Thu, 20/02/2025 09:00 - 11:00 Salle de Cours P4

MS043A - Advancements of Physics-Informed Machine Learning in Modelling and Simulation for Engineering and Science I

Corresponding Organizer: Prof. Eleni Chatzi (ETH Zurich)

Real-Time Process Monitoring Using Hybrid Methods: Set-Encoders and Physics-Informed Neural Networks
***M. ELAARABI, *S. COMAS-CARDONA, *D. BORZACCHIELLO, *P. LE BOT**

Physics-Informed Machine Learning for Parameter Identification on Shallow-Water Equations
***H. Boulenc,** R. Bouclier, P. Garambois, J. Monnier

Physics-informed neural networks for solving of unsaturated groundwater flow
***I. Đepina,** H. Gotovac

Physics Informed-Neural Network for Modelling the Glucose-Insulin System in Type 1 Diabetes
***V. Singh,** R. Mallick, S. Saxena, D. Harusampath, K. Kant Mishra, R. Munusamy, A. Prasad Shrivastava

2D Shallow-Water Bathymetry Inversion with Physics-Informed Neural Networks
***P. Rivera-Casillas,** S. Dutta, J. Lee, T. Hesser, M. Farthing

Domain Decomposition with Bayesian Physics-Informed Neural Networks
***J. Figueres, *J. Vanderhaeghen,** K. Morozovska, K. Shukla

Thu, 20/02/2025 11:00 - 11:30

Coffee Break

Thu, 20/02/2025 11:30 - 13:30 Grand Amphi

MS018B - Digital Twins for Predictive Decision Making of Engineering Systems II

Corresponding Organizer: Mr. Matteo Torzoni (Politecnico di Milano)
Chaired by: Mr. Matteo Torzoni (Politecnico di Milano), Prof. Andrea Manzoni (Politecnico di Milano)

Integrating Digital Twin Technology, Multiscale Mechanics, AI, and Human Factors for Enhanced Safety in the Energy Transition
***H. Tan**

Adaptive Reduced order modeling for engineering decision support
***K. Vlachas,** A. Kamariotis, E. Chatzi

Graph Neural Networks for CFD Space and Time Prediction: an Application to Solar Panels
***T. Michel,** P. Garnier, P. Meliga, E. Hachem

A MPC Framework for Smart Predictive Digital Twins enhancing Demand-Side-Management in Water Supply Systems
***A. Reis,** A. Andrade-Campos, C. Antunes, M. Lopes

Thu, 20/02/2025 11:30 - 13:30 Amphi Bezier

MS002D - Enabling Technologies for Scientific Machine Learning and Reduced Order Modeling IV

Corresponding Organizer: Prof. Alvaro Coutinho (COPPE/Federal University of Rio de Janeiro)
Chaired by: Prof. Gianluigi Rozza (SISSA), Prof. Alvaro Coutinho (COPPE/Federal University of Rio de Janeiro)

Enabling Uncertainty Quantification in Seismic Images Employing Generative Variational Autoencoders
C. Barbosa, R. Freitas, C. Silva, B. Silva, ***F. Rochinha,** A. Coutinho

Learning Biases in Plasticity Modelling
***M. M Iparraguirre,** I. Alfaro, D. Gonzalez, F. Chinesta, E. Cueto

A Study on the Possibility of Developing Foundational Models for the Simulation of Physical Phenomena
***A. Tierz,** M. Martinez Iparraguirre, I. Alfaro, D. Gonzalez, F. Chinesta, E. Cueto

General framework to apply the CLN method to any magnetoquasistatic potential formulations
***W. Chen, *T. Henneron, *S. Clénet**

Machine Learning Approaches to Support Design for Crashworthiness
***F. Duddeck**

Inverse Estimation of the Centerline Boundary Conditions in Confined Planar Mixing Layers
M. Ferreira, J. Assis, V. Egger, ***M. Grave,** C. Pacheco, L. Alves

Thu, 20/02/2025 11:30 - 13:30 Amphi Fournel

MS011C - Machine Learning and AI in Multibody System Dynamics III

Corresponding Organizer: Prof. Johannes Gerstmayr (University of Innsbruck)
Chaired by: Prof. Dan Negrut (University of Wisconsin-Madison), Mr. Peter Manzl (Universität Innsbruck)

When Nonholonomic Systems Meet Machine Learning and Control: A Curse of Geometry?
***H. Ebel**

Physics Informed Neural Network for Feedforward Control of a 3-DOF Manipulator with Flexure Joints
B. Harbers, ***R. Aarts**

Data-driven Model For Clearance Detection Using Neural Networks
***V. Nguyen,** A. Rodríguez González, G. Orzechowski, A. Mikkola, J. Kim, F. González

On Automated Calibration of Multibody Simulators with Non-ideal Constraints
***H. Marklund, *M. Servin, *M. Larsson**

AI-driven Decision-Making Strategies for Autonomous Excavation Systems
***O. Rogov,** A. Liuha, G. Orzechowski

Thu, 20/02/2025 11:30 - 13:30 Amphi Manet

MS049A - Inverse Problems & Inverse Design I

Corresponding Organizer: Mr. Leon Herrmann (Technische Universität München)
Chaired by: Mr. Leon Herrmann (Technische Universität München), Prof. Stefan Kollmannsberger (Bauhaus University Weimar)

Reinforcement Learning for Solving Optimal Design Tasks in Computational Mechanics Keynote
***D. Wolff,** A. Popp

Integrating Bayesian Inference with Data Driven DCGAN for Unsupervised Anomaly Detection: Case of Catenary Pole
***Y. Alemu,** T. Lahmer, C. Walther

Evaluating the Impact of Constitutive Models on Xgboost Performance for Material Parameter Identification
***P. Prates,** D. Mitreiro, A. Campos

Wave Equation Solvers Using Neural Networks in Inverse Problems
***Q. Sun,** D. Singh, L. Herrmann, S. Kollmannsberger, F. Dietrich

Accelerating full waveform inversion by transfer learning
***D. Singh,** L. Herrmann, T. Buerchner, Q. Sun, F. Dietrich, S. Kollmannsberger

Thu, 20/02/2025 11:30 - 13:30 Amphi Pinel

MS040D - Automatic Learning Of Constitutive Relations In Solid Mechanics IV

Corresponding Organizer: Dr. Emmanuel Baranger (CNRS)
Chaired by: Prof. Laura De Lorenzis (ETH Zurich), Dr. Emmanuel Baranger (CNRS)

Physics-augmented neural networks for hyperelastic material modeling with softening
***J. Fey,** D. Klein, O. Weeger

Addressing Compressibility in Hyperelastic Materials: A Comparative Study of Classical Constitutive Laws and Physics-Augmented Neural Networks
***L. Maurer,** S. Eisenträger, D. Juhre

Unsupervised Learning of Constitutive Model With Neural Networks and Sparse Identification of Internal Variables
***A. Benady,** B. Emmanuel, C. Jailin, L. Chamoin

Data-driven modeling based on the Constitutive Relation Error for history-dependent materials
***P. LADEVEZE,** L. CHAMOIN

Differentiable Constitutive Modeling in a Machine Learning-Compatible Framework
***J. Bleyer**

Thu, 20/02/2025 11:30 - 13:30 Amphi Esquillan

MS045C - Discovering Evolution Equations Using Structure-Preserving Data-Driven Methods III

Corresponding Organizer: Dr. Shenglin Huang (Nanyang Technological University)
Chaired by: Prof. Beatriz Moya (ENSAM Paris), Dr. Shenglin Huang (Nanyang Technological University)

A Metriplectic Transformer Architecture for Dissipative Dynamical Systems
***P. Urdeitx,** F. Chinesta, E. Cueto

A Thermodynamic-Consistent Reduced-Order Machine Learning Model for Non-Equilibrium Materials Response
***S. Huang,** H. Gao

Thermodynamics -Informed Deep Learning for Flow Prediction
***C. Bermejo Barbanoj,** A. Badías, D. González, F. Chinesta, E. Cueto

Learning equilibrium state transitions with graph neural networks: aplication to thin shells buckling
***P. Martins, *E. Cueto,** B. Moya, F. Chinesta

Learning non canonical Hamiltonian systems using variational integrator
***E. Franck,** L. Tremant, L. Navoret, C. Courtès, M. Krauss

Physics-Guided Neural Networks for Lyapunov-Stable Dynamic System Identification
***F. Roth,** M. Kannapinn, D. Klein, O. Weeger

Thu, 20/02/2025 11:30 - 13:30 Amphi A

MS030B - Scientific Machine Learning and Uncertainty Quantification for Robust Digital Twins in Science and Engineering II

Corresponding Organizer: Dr. Dimitrios Loukrezis (Siemens AG)
Chaired by: Prof. Dimitris Giovanis (Johns Hopkins University)

Probabilistic methods for learning compact dynamical representations of nonlinear systems
***M. Guo**

Data-driven Uncertainty Quantification on Manifolds for Cardiac Digital Twins
***D. Giovanis,** J. Tso, K. Zhang, S. Goswami, M. Maggioni, I. Kevrekidis, N. Trayanova

Uncertainty Quantification in Machine Learning for Glass Transition Temperature Prediction of Polymers
***Y. Li**

Comparing Surrogate Models for Real-Time Dynamic Reactor Simulations
***L. Peterson,** A. Forootani, E. Sanchez Medina, I. Gosea, P. Benner, K. Sundmacher

Data-Driven Reduced Order Modeling Framework for Surrogate Modeling and Uncertainty Quantification in Electric Machine Design
***A. Partovizadeh,** S. Schöps, D. Loukrezis

Digital Twinning Tools for 3D Bioprinting of Functional Materials
***J. Urrea-Quintero,** H. Wessels

Thu, 20/02/2025 11:30 - 13:30 Salle de Cours C3

MS006A - Uncertainty quantification and design optimization of complex structures and innovative construction process using machine learning I

Corresponding Organizer: Dr. Duc Phi Do (University of Orleans)
Chaired by: Prof. Dashnor HOXHA (Laboratory of MEchanics, Gabriel Lamé, University of Orleans), Dr. Duc Phi Do (University of Orleans)

Application of Machine Learning on the Uncertainty Quantification of Fresh Concrete Properties and Reliability-Based Design Optimization of the 3D Printing Process
***Y. ABOUSAID,** D. DO, S. Rémond, C. Florence, Y. JIN

Bayesian Model Updating for Predictive Digital Twins under Model Form Uncertainty
***J. Unger,** A. Robens-Radermacher, D. Andrés-Arcones, S. Ur-Rehman

Artificial Intelligence in Stochastic Optimal Control for Planning Production Activities in a Manufacturing System
***L. Ndzie Enama,** J. Kenné, A. Gharbi

Uncertainty Quantification in Semiconductor Models
***L. Taghizadeh**

Thu, 20/02/2025 11:30 - 13:30 Salle de Cours C4

MS014A - Autoencoders for Fluid Mechanics and More I

Corresponding Organizer: Phd. Ettore Saetta (University of Naples Federico II)
Chaired by: Phd. Ettore Saetta (University of Naples Federico II), Phd. Stefania Fresca (Politecnico di Milano)

Graph-Based Machine Learning Approaches for Model Order Reduction Keynote
***F. Pichi,** B. Moya, O. Morrison, J. Hesthaven

On Latent Dynamics Learning in Nonlinear Reduced Order Modeling
***S. Fresca,** N. Farenga, S. Brivio, A. Manzoni

Learning Unsteady Trajectories in a Latent Space for Studying Ignition in Rocket Combustors
***T. Zahtila,** E. Saetta, D. Rossinelli, G. Iaccarino

Thu, 20/02/2025 11:30 - 13:30 Salle de Cours P4

MS033A - Advanced and hybrid computational modeling (FEM, AI, MR) for evidence-based diagnosis in Healthcare I

Corresponding Organizer: Prof. Marie-Christine HO BA THO (Université de technologie de Compiègne)
Chaired by: Prof. Marie-Christine HO BA THO (Université de technologie de Compiègne), Prof. Tien-Tuan Dao (Centrale Lille Institut)

Childbirth Virtual Human Twin Coupled with Modern AI: Exploring the First Discovery Journey of the Human Being Keynote
***T. Dao**

IntegratING Viscoelastic and Poroelastic Modeling for Predicting Soft Tissue RESPONSE and PREVENTING PRESSURE ULCER RISK
G. SCIUME, A. SEGAIN, T. LAVIGNE, S. BORDAS, H. PILLET, ***P. ROHAN**

Deep Learning-Based Imputation on the Facemocap Dataset for Facial Movement Analysis
***E. Rodriguez,** F. Marcellin, E. Colin, F. Sarhan, S. Dakpé

Patient Specific Modelling Of The Face Towards Predictive Digital Twins For Facial Expression
***M. Ho Ba Tho,** T. Dao

Thu, 20/02/2025 13:30 - 14:45

Lunch Break

Thu, 20/02/2025 14:45 - 15:45 Grand Amphi

Plenary Lecture IV

Chaired by: Prof. Ruben Sevilla (Swansea University)

Trustworthy and Sustainable AI: From Mathematical Foundations to Next Generation AI Computing
G. Kutyniok

Thu, 20/02/2025 15:45 - 16:15

Coffee Break

Thu, 20/02/2025 16:15 - 18:15 Grand Amphi

MS018C - Digital Twins for Predictive Decision Making of Engineering Systems III

Corresponding Organizer: Mr. Matteo Torzoni (Politecnico di Milano)
Chaired by: Mr. Matteo Torzoni (Politecnico di Milano), Prof. Andrea Manzoni (Politecnico di Milano)

Physics-informed decision support for a rock breaker system
***E. Wallin,** K. Mickelsson, M. Servin

DT4DED: A Digital Twin with Real-Time Slicing for Residual Stress Design of L/DED-W Additive Manufacturing
***M. Kannapinn,** F. Roth, O. Weeger

Structural Damage Detection based on Aerodynamic Pressure Measurements
***P. Franz,** I. Abdallah, G. Duthé, J. Deparday, A. Jafarabadi, A. Popp, S. Barber, E. Chatzi

A Digital Twin Framework for Helicopter Fleet Maintenance Integrating Real Time Degradation Tracking
***E. Petriconi,** M. Giglio, C. Sbarufatti

Machine Learning Approaches for Water Leakage Detection in Water Supply Systems: A Comparative Study
***A. Sousa,** A. Andrade-Campos, E. Rocha

Digital Twins for Military Aircraft: a Machine Learning Approach for Monitoring Structural Aging
***C. Ferrassou,** P. Escande, M. Duval, R. Bouclier, L. Risser

Thu, 20/02/2025 16:15 - 18:15 Amphi Bezier

MS020A - Digital twins of living systems: theoretical, implementation & application challenges I

Corresponding Organizer: Prof. Martin Genet (École Polytechnique)
Chaired by: Prof. Martin Genet (École Polytechnique), Dr. Philippe Moireau (Ecole polytechnique)

Towards a digital twin of magnetic nanoparticle-mediated cancer therapy
***B. Wirthl,** C. Janko, B. Schrefler, C. Alexiou, W. Wall

Autonomous catheter navigation for predictive mixed reality during endovascular interventions
***M. Duprez,** S. Cotin, F. Nageotte, V. Scarponi

Mechanistic and Data-Driven Digital Twins of Patients on Non-Invasive Respiratory Support
***L. Weaver,** H. Yu, H. Shamohammadi, S. Saffaran, D. Bates

Patient-Specific Perfusion Assessment: A Digital Twin Workflow Driven by Dynamic Imaging
***J. Kowalski,** J. Hanna, S. Koning, L. Sala, R. Peul, M. Kruiswijk, J. Van der Vorst, I. Vignon-Clementel

Combining Physics-Based Modeling and Data Analytics Methods To Develop a Digital Twin for Ocular Applications
T. Saigre, V. Chabannes, C. Prud'homme, ***M. Szopos**

Thu, 20/02/2025 16:15 - 18:15 Amphi Fournel

MS008A - Advances in machine learning and data-driven techniques for aerodynamic optimization and uncertainty quantification I

Corresponding Organizer: Dr. Esther Andrés Pérez (INTA)
Chaired by: Dr. Esther Andrés Pérez (INTA), Dr. Domenico Quagliarella (CIRA)

Beta-Variational Autoencoders for Data-Driven Aerodynamic Models
***V. Francés-Belda,** A. Solera-Rico, J. Nieto-Centenero, E. Andrés, C. Sanmiguel Vila, R. Castellanos

Leveraging Machine Learning for CFD Flow Field Classification
***R. Margheritti,** O. Semeraro, M. Quadrio, G. Boracchi

Extracting Large-scale Coherent Structures from Turbulent Flow by Combining Dynamic Mode Decomposition and β-Variational Autoencoders
***R. Halder,** B. Eiximeno, O. Lehmkuhl

Multi-fidelity surrogate-assisted multi-objective optimization: application to a low reynolds number compressor blade design
***M. Schouler,** A. Belme, P. Cinnella

Thu, 20/02/2025 16:15 - 18:15 Amphi Manet

MS049B - Inverse Problems & Inverse Design II

Corresponding Organizer: Mr. Leon Herrmann (Technische Universität München)
Chaired by: Prof. Stefan Kollmannsberger (Bauhaus University Weimar)

A Deep Learning Approach to Forward and Inverse Problems in Topology Optimization via Rank Reduction Autoencoders
***I. Ben-Yelun,** M. El Fallaki Idrissi, J. Mounayer, S. Rodríguez, C. Ghnatios, F. Chinesta

Designing spinodoid architected materials by Bayesian optimization
***A. Raßloff,** P. Seibert, K. Kalina, M. Kästner

Vibroacoustic Plate Design Using Guided Diffusion
***J. Schultz,** J. van Delden, C. Blech, S. C. Langer, T. Lüddecke

Parametrizing Design Variables with Neural Networks
***L. Herrmann,** O. Sigmund, S. Kollmannsberger

Structural Optimization of Lattice Structures Using Neural Networks for Geometry Representation
***M. Kofler,** S. Elgeti

Simultaneous and Meshfree Topology Optimization with Physics-informed Gaussian Processes
***R. Bostanabad**

Thu, 20/02/2025 16:15 - 18:15 Amphi Pinel

MS025A - Mathematical Aspects of Machine Learning Methods in Computional Mechanics I

Corresponding Organizer: Prof. Mats G. Larson (Umea University)
Chaired by: Prof. Mats G. Larson (Umea University)

Neural Green's Operators for Parametric Partial Differential Equations
***H. Melchers,** J. Prins, M. Abdelmalik

Combining Finite Element Methods and Neural Networks to Solve Elliptic Problems on 2D Geometries
***F. Lecourtier,** N. Victorion, H. Barucq, M. Duprez, F. Faucher, E. Franck, V. Lleras, V. Michel-Dansac

Neural Network Approximation to Piecewise Constant Functions and its Applications to Hyperbolic Conservation Laws
***Z. Cai,** J. Choi, M. Liu

Opening the black-box: approximation and generalization properties of convolutional neural networks in surrogate modeling
***N. Franco,** S. Fresca, S. Brugiapaglia, A. Manzoni, P. Zunino

ELM training for Physics-Informed Neural Networks
***D. De Falco**

Neural Network-Based Implicit Finite Volume Schemes for Hyperbolic System of Conservation Laws in 1D and 2D
***L. Ávila León,** M. Castro Díaz

Thu, 20/02/2025 16:15 - 18:15 Amphi Esquillan

MS031A - Digital Twins and Artificial Intelligence Approaches for Complex/Multiscale Physiological Systems in Oncology I

Corresponding Organizer: Mr. Paolo Zunino (MOX, Department of Mathematics, Politecnico di Milano)
Chaired by: Dr. Guillermo Lorenzo (University of A Coruña), Mr. Paolo Zunino (MOX, Department of Mathematics, Politecnico di Milano)

Mathematical Models as the Engine of Digital Twins in Radiation Oncology
***H. Enderling**

Digital-Twin Framework to Quantify Vertebral Fracture Risk due to Metastatic Cancer
***S. Laranjeira,** S. Walker-Samuel, R. Shipley

a Physics-Informed Machine Learning model for Digital Twins: application to Prostate Cancer
***D. Camacho-Gomez,** C. Borau, J. Garcia-Aznar, M. Gomez-Benito, M. Girolami, M. Perez

Towards a Digital Twin for Microvascular Environment in Head and Neck Cancer
***L. Possenti,** S. Materne, F. Pisani, P. Vitullo, A. Cicchetti, C. Macaluso, T. Rancati, P. Zunino

Designing Digital Twins for Personalized Risk Assessment in Breast Cancer Radiotherapy: Insights From the Tetris Project
***P. Zunino,** C. Fiorino, D. Gibon, S. Gutierrez-Enriquez, E. Onjukka, S. Pereira, A. Vega, T. Rancati

Thu, 20/02/2025 16:15 - 18:15 Amphi A

MS019A - Digital Twins and Their Enabling Technologies for Infrastructures I

Corresponding Organizer: Dr. Daniel Wolff (University of the Bundeswehr Munich)
Chaired by: Prof. Alexander Popp (University of the Bundeswehr Munich), Dr. Daniel Wolff (University of the Bundeswehr Munich)

FEM and ALE-Based Simulation of Long-Term Road Behavior Under Moving Loads and Thermal Effects for Digital Twin Applications
Keynote
***A. Chihadeh,** M. Kaliske

Data-driven Modeling of Processes for a Pedestrian Flow Simulation
***E. Eftimova,** C. Nellinger, T. Koch

Leveraging Sensor Data to Enhance Multi-physics Simulations for Pedestrian Flow in a Digital Twin Framework
***J. Bonari,** D. Gioia, M. von Danwitz, A. Popp

Towards Digital Twins for Real-Time Urban Physics Simulations via Model Order Reduction
***L. Kühn,** J. Bonari, M. von Danwitz, A. Popp

Probabilistic Trajectory Modelling in a Digital Twin of UK Airspace
***N. Pepper,** A. Hodgkin, A. Keane, M. Thomas

Thu, 20/02/2025 16:15 - 18:15 Salle de Cours C3

MS006B - Uncertainty quantification and design optimization of complex structures and innovative construction process using machine learning II

Corresponding Organizer: Dr. Duc Phi Do (University of Orleans)
Chaired by: Dr. Duc Phi Do (University of Orleans), Prof. Dashnor HOXHA (Laboratory of MEchanics, Gabriel Lamé, University of Orleans)

Grammar-Based Generative Design of Truss Structures with Monte Carlo Tree Search
***M. Torzoni,** G. Garayalde, L. Rosafalco, M. Bruggi, A. Corigliano

Incorporating Uncertainties of EBFs using various Machine Learning Methods and Sampling-based Reliability Approaches
***M. MASOOMZADEH, *M. CHARKHTAB BASIM**

Time-dependent convergence prediction, uncertainty quantification of creep rock behavior and design optimization of deep tunnel support using ai methods
P. Quang Hieu, ***T. Toan Trung,** D. Duc Phi, V. Minh Ngoc, H. Dashnor

Optimlized LSTM Neural Networks via Neural Architecture Search for Predicting Damage Evolution in Composite Laminates
***O. Friderikos,** A. Mendoza, E. Baranger, D. Sagris, C. David

A Two-Stage Metamodeling Approach for Efficient Global Robust Optimization
***T. Wanglomklang,** F. GILLOT, S. BESSET

Efficient Robust Optimization of Network Systems under Uncertainty
J. Paulson, ***A. Kudva**

Thu, 20/02/2025 16:15 - 18:15 Salle de Cours C4

MS014B - Autoencoders for Fluid Mechanics and More II

Corresponding Organizer: Phd. Ettore Saetta (University of Naples Federico II)
Chaired by: Prof. Gianluigi Rozza (SISSA), Dr. Federico Pichi (SISSA)

Reduced-Order Modeling of Experimental Turbulent Flows: from Linear Projection-Based Methods to Autoencoders
***N. Tonioni,** L. Agostini, F. Kerhervé, L. Cordier, R. Vinuesa

Autoencoder-Based Dimensionality Reduction of Turbulent Channel Flow Under Spanwise Wall Oscillations
***L. Guérin,** T. Fisk, L. Cordier, C. Flageul, L. Agostini

Physics Informed Spatio-Temporal Autoencoder for Flow Field Prediction in Bed Configurations
***A. Mjalled,** M. Mönnigmann, R. Namdar, F. Varnik

Reservoir computing for system identification and predictive control with limited data
***J. Williams,** N. Kutz, K. Manohar

Thu, 20/02/2025 16:15 - 18:15 Salle de Cours P4

MS007A - Advances in ML-hybrid methods for computational solid mechanics problems I

Corresponding Organizer: Dr. Panos Pantidis (New York University Abu Dhabi)
Chaired by: Dr. Panos Pantidis (New York University Abu Dhabi), Dr. Mostafa Mobasher (New York University Abu Dhabi)

Bridging Neural Operators and Numerical Methods for Parametric PDE Solutions and Optimization
***S. Rezaei**

Efficient and Robust Phase-Field Fracture Simulations Leveraging I-FENN
***P. Pantidis,** L. Svolos, R. Saji, D. Abueidda, M. Mobasher

Multimodal Pre-Training Enables Time-Dependent Physics Inference from B-Rep
***Y. Chen,** J. Bi, C. Ngo Ngoc, O. Bettinotti, V. Oancea

Graph Neural Network-based Gauss Quadrature for Isogeometric Analysis
***D. Nath,** D. Neog, S. Gautam

Insights from Community Detection and Clustering through Modularity Function in 3D Model Glasses: an Unsupervised Machine Learning Approach
***S. Swayamjyoti,** S. Alshabab, P. Jha, S. Khawas, R. Kishore, K. Sahu, B. Markert, F. Bamer

Thu, 20/02/2025 19:15 - 23:55

Banquet Dinner

Friday, 21/02/2025

Fri, 21/02/2025 07:30 - 08:00
Registration

Fri, 21/02/2025 08:00 - 09:00 Grand Amphi
Plenary Lecture V

Modern Sensing and Physics Learning with Shallow Recurrent Decoders
N. Kutz

Fri, 21/02/2025 09:00 - 11:00 Grand Amphi
MS018D - Digital Twins for Predictive Decision Making of Engineering Systems IV
Corresponding Organizer: Mr. Matteo Torzoni (Politecnico di Milano)
Chaired by: Mr. Matteo Torzoni (Politecnico di Milano), Prof. Andrea Manzoni (Politecnico di Milano)

Predictive Digital Twins for Underground Thermal Energy Storage using Differentiable Programming
***Ø. Klemetsdal,** O. Andersen, S. Krogstad

The Role of Digital Twins in Smart Energy Systems
***A. Di Meglio,** N. Massarotti

Digital Twin for Predictive Maintenance of Steam Generators
V. Chabridon, ***E. Remy,** M. Garo Sail, E. Jaber, A. Arnaud, A. Ajenjo, E. Dautrême, J. Caron, J. Delplace, P. Coffy, E. Ngarukiye

A Robust Pump Scheduling Optimization Model for Energy Cost Reduction in Smart Predictive Digital Twins
***M. Brás, *A. Moura, *A. Andrade-Campos**

performance metrics and unified approaches for digital twin implementation in energy sectors
***A. Razikazemi**

Fri, 21/02/2025 09:00 - 11:00 Amphi Bezier
MS020B - Digital twins of living systems: theoretical, implementation & application challenges II
Corresponding Organizer: Prof. Martin Genet (École Polytechnique)
Chaired by: Prof. Martin Genet (École Polytechnique), Dr. Philippe Moireau (Ecole polytechnique)

An Efficient Framework for Generating Patient-Specific Human Atrial Electrophysiology
***E. Zappon,** L. Azzolin, M. Gsell, A. Neic, G. Plank

Patient-Specific Myocardial Microvessel Generation Using a Modified Constrained Constructive Optimization Algorithm
***N. Thekkethil,** G. Pelagi, J. Mackenzie, H. Gao, N. Hill, X. Luo

Estimating Active Stress in Cardiac Biomechanical Models Based on Physics-Informed Neural Networks
***M. Höfler,** F. Regazzoni, S. Pagani, E. Karabelas, C. Augustin, A. Quarteroni, G. Plank, G. Haase, F. Caforio

Towards a Lumped-Parameter Model Digital Twin of the Pulmonary Arterial Hypertension Patient
***M. Balmus,** Z. Goh, M. Wilkins, A. Rothman, S. Niederer

Towards Digital Twins for Predicting Cardiac Growth and Remodeling
***M. Sadeghinia,** H. Finsberg, E. Espe, S. Wall1, J. Sundnes

Fri, 21/02/2025 09:00 - 11:00 Amphi Fournel
MS008B - Advances in machine learning and data-driven techniques for aerodynamic optimization and uncertainty quantification II
Corresponding Organizer: Dr. Esther Andrés Pérez (INTA)
Chaired by: Dr. Domenico Quagliarella (CIRA), Dr. Esther Andrés Pérez (INTA)

Optimizing UAV Electric Propulsion Systems using Artificial Neural Networks: A Data-Driven Approach
***S. Goli,** D. Kurtuluş, M. Waqar, I. Imran, L. Alhems, T. Kouser, A. Memon

Green AI for Near-Optimal Mesh Generation
***C. Lock,** O. Hassan, R. Sevilla, J. Jones

Efficient High-dimensional Design under Uncertainty: Multi-fidelity Deep Learning Approaches
***D. Kilic,** M. Nikbay

Design-Space Dimensionality Reduction By Physics-Informed Parametric Model Embedding: Application To Bioinspired Underwater Gliders
***A. Serani,** G. Palma, M. Diez

Sensitivity and optimization of shock bubble interaction within the framework of differentiable fluid dynamics
***W. Wang,** X. Zhang, X. Chu

Fri, 21/02/2025 09:00 - 11:00 Amphi Manet

MS044A - Neural Operators for PDEs in Complex Geometries I

Corresponding Organizer: Phd. Oriol Colomés (Delft University of Technology)
Chaired by: Dr. Alexander Heinlein (TU Delft), Phd. Oriol Colomés (Delft University of Technology)

When big neural networks are not enough: physics, multifidelity and kernels
***A. Howard,** W. Chen, S. Qadeer, P. Stinis

Efficient and accurate training of physics-informed deep operator networks with the conjugate kernel
***A. Howard, *P. Stinis,** S. Murphy, S. Qadeer, T. Chiang

Neural Operator-Based Modeling of Hypersonic Flows Around Varying Geometries
***A. Peyvan, *G. Karniadakis**

Bridging the Gap between Isogeometric Analysis and Deep Operator Learning
***M. Möller**

Scalable Neural Network Approach for Heat Transport in Groundwater
***J. Pelzer,** M. Schulte

DeepONet-based Preconditioning for Krylov Methods
***A. Kopaničáková**

Fri, 21/02/2025 09:00 - 11:00 Amphi Pinel

MS025B - Mathematical Aspects of Machine Learning Methods in Computional Mechanics II

Corresponding Organizer: Prof. Mats G. Larson (Umea University)
Chaired by: Prof. Mats G. Larson (Umea University)

Solving Parametric Partial Differential Equation Using Least-Squares-Based Neural Networks
***S. Baharlouei,** J. Taylor, C. Uriarte, D. Pardo

Assessing the interpretability and robustness of MLP in tsunami prediction
***J. Rodríguez Gálvez, *J. Macías Sánchez, *M. Castro Diaz,** B. Gaite Castrillo, J. Cantavella Nadal, L. Puertas González

Energy Minimisation Using Tensor-Product Free-Knot B-Splines
***A. Magueresse,** S. Badia

A Graph-based approach towards a Hybrid Digital Twin for Satellite Thermal Management
***L. Sosta,** S. Pagani, N. Parolini, F. Regazzoni, C. Ciancarelli, A. Nervo, F. Corallo, D. Di Ienno, L. Marini

Solving Ill-Posed and Inverse Problems Using Stabilized Finite Elements and Machine Learning
***E. Burman,** M. Larson, K. Larsson, C. Lundholm

Fri, 21/02/2025 09:00 - 11:00 Amphi Esquillan

MS031B - Digital Twins and Artificial Intelligence Approaches for Complex/Multiscale Physiological Systems in Oncology II

Corresponding Organizer: Mr. Paolo Zunino (MOX, Department of Mathematics, Politecnico di Milano)
Chaired by: Mr. Paolo Zunino (MOX, Department of Mathematics, Politecnico di Milano), Dr. Guillermo Lorenzo (University of A Coruña)

Patient-specific forecasting of prostate cancer progression during active surveillance using biomechanistic models and hybrid classifiers
***G. Lorenzo,** C. Wu, J. Yung, J. Ward, H. Gomez, A. Reali, T. Yankeelov, A. Venkatesan, T. Hughes

Mathematical Modeling and Optimization of Tumor and Therapeutic Cell Delivery Incorporating Interstitial Fluid Flow
***R. Woodall,** J. Hibbard, M. Gutova, C. Brown, J. Munson, R. Rockne

Biological features relevant to poor prognosis in breast cancer
***J. Oh,** F. Pareja, R. Elkin, K. Xu, L. Norton, J. Deasy

The “Second Way In” : Modeling Perivascular Drug Delivery
***C. Daversin-Catty,** H. Finsberg, K. Mardal, M. Rognes

Modeling of Heat Therapies Preventing Liver Cancer
***T. Koeppl,** M. Weiser, M. Weber

Fri, 21/02/2025 09:00 - 11:00 Amphi A

MS019B - Digital Twins and Their Enabling Technologies for Infrastructures II

Corresponding Organizer: Dr. Daniel Wolff (University of the Bundeswehr Munich)
Chaired by: Dr. Daniel Wolff (University of the Bundeswehr Munich), Mr. Tobias Koch (German Aerospace Center (DLR))

Tensor Decomposition-Based HP-Variational Physics-Informed Neural Networks Optimized for Edge Devices
***D. Ghose,** T. Anandh, J. Biju, S. Ganesan

Extension of Physics-Informed Neural Networks to Solve Solid and Contact Mechanics Problems in 3D
***T. Sahin,** D. Wolff, A. Popp

Probabilistic Virtual Sensing of Reinforced Concrete Structures Based on Gaussian Processes and Mixed-Dimensional Modelling
***B. Maradni,** S. Brandstaeter, A. Popp

Adjoint-Based Material Parameters and Constitutive Model Identification From Deformation Measurements
***T. Ansari,** R. Löhner, R. Wüchner, H. Antil, S. Warnakulasuriya, I. Antonau, F. Airaudo

Developing a Calibrated Physics Based Digital Twin for Construction Vehicles
***D. Karanfil,** D. Lindmark, M. Servin, D. Torick, B. Ravani

Using Digital Twinning and Augmented Reality for Optimizing Train Door Maintenance Processes
***Y. An,** B. Adey, C. Haas

Fri, 21/02/2025 09:00 - 11:00 Salle de Cours C3

MS023A - Digital Twins for Infrastructures and Cities I

Corresponding Organizer: Dr. Jeremy Bleyer (Ecole nationale des ponts et chaussées)
Chaired by: Dr. Jeremy Bleyer (Ecole nationale des ponts et chaussées)

Construction and Calibration of Digital Twins for Metallic Truss Bridges
***C. Menuet**

Application of Supervised Learning in the Field of Tunnel Construction
***L. Guayacán-Carrillo,** J. Pereira, J. Sulem

Digital Twins For The Smart Operation Of Long Thermoactive Urban Tunnels
***I. González Tejada,** J. González Galindo, J. Muñoz Antón

RISK.twin: A Class of Digital Twins for Critical Infrastructure Protection
***A. Popp,** D. Wolff

Data-Driven Condition Monitoring and Load Analysis for a Tram Rail Infrastructure
***L. Heindel,** K. Marburg, D. Zschocke, A. Günther, P. Hantschke, M. Kästner

Fri, 21/02/2025 09:00 - 11:00 Salle de Cours C4

MS024B - Digital Twins and AI-Enhanced Computational Methods for Structural Analysis II

Corresponding Organizer: Prof. Sergio Tavares (Universidade de Aveiro)
Chaired by: Prof. Sergio Tavares (Universidade de Aveiro), Eng. Natacha Rosa (University of Aveiro)

Evaluating digital twin maturity levels a case study of using large language models
***A. Koskinen,** T. Gupta, Q. Khadim, E. Kurvinen

Developing A Digital Twin For Metals Additive Manufacturing
***A. Rollett,** S. Ghosh

Reconciling Physics-based and Data-driven Process Models in the Additive Manufacturing Digital Twin
***P. Witherell,** J. Michopoulos

Energy Systems Assessment Through Model Based Digital Twins for Enhanced Environmental Sustainability
***N. Rosa,** S. M. O. Tavares

Fri, 21/02/2025 09:00 - 11:00 Salle de Cours P4

MS001A - Scientific Deep Learning Approaches for realtime forecast and calibration of digital models I

Corresponding Organizer: Prof. Tan Bui-Thanh (The University of Texas)
Chaired by: Prof. Tan Bui-Thanh (The University of Texas)

Utilizing Scientific Deep Learning to Accelerate Data-Consistent Inversion Keynote
***T. Wildey**

Efficient Digital Twin Development using Reduced Order Modeling for Steel Grade Intermixing in A Multiphase system of Continuous Casting Tundish
***H. Gowrachari,** G. Stabile, G. Rozza

Improving Digital Twin using AI & SCADA
***B. Malbois Le Borgne,** F. GATTI, M. CAPALDO, R. DESMORAT

Fri, 21/02/2025 11:00 - 11:30

Coffee Break

Fri, 21/02/2025 11:30 - 13:30 Grand Amphi

MS018E - Digital Twins for Predictive Decision Making of Engineering Systems V

Corresponding Organizer: Mr. Matteo Torzoni (Politecnico di Milano)
Chaired by: Mr. Matteo Torzoni (Politecnico di Milano), Prof. Andrea Manzoni (Politecnico di Milano)

Transforming Composite Manufacturing: AI-Driven Defect Detection and Prediction in Real-Time
***I. Tretiak,** A. Koptelov, B. El Said

Assessing Cryobot Trajectory in Cryotwin: A Data-Integrated, Modular, and Extendable Virtual Framework
***D. Bhattacharya,** J. Kowalski

Importance of Causality in Digital Twins: A Special Case for Predictive Maintenance of a Gas Turbine Engine
***M. Tiwari,** P. Rao, P. Schlachter

Machine Learning Based Prediction of Chlorine Residuals in Water Supply Systems
***S. Mota,** A. Andrade-Campos, A. Reis

An Industrial Digital Twin Structure Based on Maturity Level
***T. Gupta,** A. Koskinen, Q. Khadim, E. Kurvinen

Fri, 21/02/2025 11:30 - 13:30 Amphi Bezier

MS020C - Digital twins of living systems: theoretical, implementation & application challenges III

Corresponding Organizer: Prof. Martin Genet (École Polytechnique)
Chaired by: Dr. Philippe Moireau (Ecole polytechnique), Prof. Martin Genet (École Polytechnique)

Urban airborne hazard for human health: CFD-DEM approach to respiratory urban airborne particulate
***G. Spasov,** R. Rossi, A. Vanossi, C. Cottini, A. Benassi, G. Stabile

Numerical Preservation of Integral Properties of Growth-Fragmentation Models - Application to Saccharomyces Cerevisiae
B. Daignan-Fornier, C. Etchegaray, ***J. Granet,** B. Pinson, C. Poignard

Digital Twins in the Context of Personalized Medicine
***J. de Wiljes**

Mathematical modeling of cardiac tissue response after Pulsed Field Ablation
***S. Nati Poltri,** A. Collin, C. Poignard

Implicit Neural Field Reconstruction on Complex Shapes from Scattered And Noisy Data
***D. Carrara,** F. Regazzoni, S. Pagani

Fri, 21/02/2025 11:30 - 13:30 Amphi Fournel

MS026A - Simplifying Digital Twin Development: Advances in Automation and AI I

Corresponding Organizer: Mr. Jan Marius Stürmer (German Aerospace Center (DLR))
Chaired by: Mr. Jan Marius Stürmer (German Aerospace Center (DLR)), Mr. Tobias Koch (German Aerospace Center (DLR))

Scaling Digital Physical Asset Monitoring: Data-Driven Twins for Enterprise Implementations
***D. Wilke**

Towards Generic Data Handling for Digital Twins in Product Development
***J. Wagner,** P. Thoma

Towards Integrated Digital Twin For Kw-51 Bridge: Real-Time Structural Response Prediction And Machine Learning-Based Damage Identification
***M. Mobasher,** B. Ahmed, Y. Qiu, D. Abueidda

Pipe Reconstruction From Point Clouds for Automated Digital Twin Generation
***A. Alex**

Fri, 21/02/2025 11:30 - 13:30 Amphi Manet

MS044B - Neural Operators for PDEs in Complex Geometries II

Corresponding Organizer: Phd. Oriol Colomés (Delft University of Technology)
Chaired by: Phd. Oriol Colomés (Delft University of Technology), Dr. Alexander Heinlein (TU Delft)

Unfitted finite element interpolated neural networks for partial differential equations on complex geometries
***W. Li,** S. Badia, A. Martín

Handling geometrical variability in nonlinear reduced order modeling through Continuous Geometry-Aware DL-ROMs
***S. Brivio,** S. Fresca, A. Manzoni

Performance Comparison of Neural Networks and Sparse Polynomials for Operator Surrogates
***J. Westermann,** T. O'Leary-Roseberry, J. Zech

Convolution neural operator preconditioning for the solution of some heterogeneous PDEs
***Y. Xiang,** L. Giraud

A Phi-FEM approach to train a FNO for variable geometries
M. Duprez, V. Lleras, A. Lozinski, V. Vigon, ***K. Vuillemot**

The Generalized Weighted Shifted Boundary Method for geometry-agnostic neural operators
***O. Colomes,** J. Modderman

Fri, 21/02/2025 11:30 - 13:30 Amphi Pinel

MS017A - Digital twin technology for battery cell manufacturing I

Corresponding Organizer: Dr. Martin Thomas Horsch (Norwegian University of Life Sciences)
Chaired by: Prof. Gianluca Boccardo (Politecnico di Torino), Prof. Michael Möckel (University of Applied Sciences Aschaffenburg)

Macine learning in the small data regime for pilot battery cell production Keynote
***X. Xu,** M. Moeckel

Thermal Behavior of Automotive Lithium Batteries: Experimental Analysis and Digital Twin Development
***D. Fedeli,** M. Lagnoni, C. Scarpelli, F. Quilici, A. Bertei, G. Lutzemberger, M. Salvetti, A. Mariotti

Digital Twin and Dataspace Architecture for Vanadium Redox-flow Batteries in View of Requirements for the Digital Materials and Product Passport
***M. Horsch,** D. Fertig, A. Aghabarari, M. Bashir, D. Romanov, F. Al Machot, M. Janssen, E. Valseth, A. Linhart, J. große Austing, S. Chiacchiera, N. Vizcaino, M. Seaton, I. Todorov

Upscaling of Lithium-Ion Battery Models: from the Pore-Scale to the Cell- Scale through Homogenization
***A. Lombardo Pontillo,** E. Buccafusco, A. Marcato, G. Boccardo, D. Marchisio, I. Battiato

Predicting Battery Degradation Using Cellular Neural Network Model
***S. Liyanapathiranage,** F. Al Machot, M. Horsch, A. Dey

Fri, 21/02/2025 11:30 - 13:30 Amphi Esquillan

MS029A - Optimal Control and Decision Making under Uncertainty from Digital Twins I

Corresponding Organizer: Prof. Ludovic CHAMOIN (ENS Paris-Saclay)
Chaired by: Prof. Ludovic CHAMOIN (ENS Paris-Saclay), Prof. Nazih Mechbal (AMVALOR)

Semi-Autonomous Neural ODEs and Applications to Model Predictive Control
Z. Li, K. Liu, ***L. Liverani,** E. Zuazua

Validated prediction using intervals and integrals
***L. Jaulin**

Monitoring and Control of Structures subject to Vibration and Damage using the Koopman operator
***F. Colombo,** S. da Silva, M. Rebillat, N. Mechbal

Data-driven MPC for Real-time Control of Nonlinear Systems
***D. Martin Xavier,** L. Chamoin, L. Fribourg

Optimizing Preform Charges in Sheet Molding Compound Manufacturing Through a Simulation-Based Machine Learning Approach
***M. Tannous,** S. Rodriguez, C. Ghnatios, F. Chinesta

Reinforcement Learning Techniques Applied to the Control of Electroacoustic Resonators
***A. Flor Torquato Fernandes,** L. Ferreira, R. Teloli, E. De Bono, M. Ouisse, S. De Rosa, G. Petrone

Fri, 21/02/2025 11:30 - 13:30 Amphi A

MS047A - AI improved computational methods for slender flexible structures I

Corresponding Organizer: Prof. Elena Celledoni (NTNU)
Chaired by: Prof. Elena Celledoni (NTNU)

Reversible integrators in deep learning
***S. Maslovskaya,** S. Ober-Blöbaum, C. Offen, P. Singh, B. Wembe

Towards AI Supported Estimation of Quasistatic Equilibrium Configurations of Flexible Parts
***M. Roller,** J. Ljunglide, S. Lorin, J. Linn

AI-Based Constitutive Modelling for Composite Cable Structures
***V. Doerlich,** D. Manfredo, J. Linn, M. Arnold

Simulation-based Assessment of Control Methods for the Robotic Manipulation of Deformable Objects
***L. Dehaybe,** O. Brüls

On non-expansive ODEs and numerical integrators on manifolds with applications in computational mechanics and neural networks
***B. Owren**

Neural Networks For The Approximation Of Euler's Elastica
***E. Celledoni,** E. Çokaj, A. Leone, S. Leyendecker, D. Murari, B. Owren, R. Sato Martín de Almagro, M. Stavole

Fri, 21/02/2025 11:30 - 13:30 Salle de Cours C3

MS023B - Digital Twins for Infrastructures and Cities II

Corresponding Organizer: Dr. Jeremy Bleyer (Ecole nationale des ponts et chaussées)
Chaired by: Prof. Ignacio González Tejada (Universidad Politécnica de Madrid)

Numerical Strategies for Cities and Territories using Digital Twin: from Urban Planning to Enhanced management
***J. Waeytens,** T. Hamada, R. Chakir, G. Perrin, P. Lévèque, E. Bourgeois, D. Siegert

Neural Surrogates for Atmospheric Deispersion in Built-Up Areas
***A. de Villeroché,** V. Le Guen, R. Mouradi, P. Massin, M. Bocquet, A. Farchi, S. Cheng, P. Armand

Leveraging Physics-informed Methodologies in Smart Predictive Digital Twins for Optimized Water Supply System Management
***T. C. Pereira,** A. Andrade-Campos, R. Arbos

Real-Time Optimization and Digital Twin Integration for Water Supply Systems: A Case Study in Portugal
***M. Alão,** A. Reis, A. Andrade-Campos

Data-Driven Forecasting of Residential Water, Heating and Electricity Consumption
***N. Vlaminck, *L. Henneaux, *I. Parwatha, *C. Sainvitu**

Fri, 21/02/2025 11:30 - 13:30 Salle de Cours C4

MS048A - Reduced order models for environmental applications in ocean and atmosphere I

Corresponding Organizer: Dr. Jeffrey Harris (École nationale des ponts et chaussées)
Chaired by: Dr. Jeffrey Harris (École nationale des ponts et chaussées), Dr. Konstantin Kuznetsov (GRASP Earth)

Rapid Prediction of Tsunami Waveform with Bayesian Scenario Superposition
***S. Fujita,** R. Nomura, S. Moriguchi, Y. Otake, R. LeVeque, K. Terada

A Reduced Ordel Model for Aerosol Coaguation
***O. Jacquot,** V. Ehrlacher, T. Lelievre, K. Sartelet

Reduced order model for efficient prediction of dynamics of urban boundary layer in Paris
***K. Kuznetsov, *O. Dubovik,** E. Alekseenko

On-the-fly Algorithm of Total Dynamic Mode Decomposition using Incremental Singular Value Decomposition
***D. Matsumoto,** C. Janßen, T. Indinger

Fri, 21/02/2025 11:30 - 13:30 Salle de Cours P4

MS036A - Machine-Learning based Model Order Reduction for Patient-specific computational modeling I

Corresponding Organizer: Prof. David Ryckelynck (Mines Paris PSL - Armines)
Chaired by: Prof. David Ryckelynck (Mines Paris PSL - Armines)

Finite Element Neural Network Interpolation: Hybridisation with the Proper Generalised Decomposition for Surrogate Modelling
***A. Daby-Seesaram,** K. Škardová, M. Genet

Reduced Order Model for Drainage Computation in Lower Limb Lymphedema
***A. Garcia-Llona,** F. Verdugo, M. Aguirre, S. Avril

Real-time prediction of strain in sitting-induced deep tissue injury using dictionary-based rom-nets
***D. RYCKELYNCK,** P. ROHAN

Fri, 21/02/2025 13:30 - 14:45
Lunch Break

Fri, 21/02/2025 14:45 - 15:45 Amphi Bezier
Semi-Plenary Lectures

Machine learning-based multiscale fracture modelling
J. Yvonnet

Solving Inverse and Ill-Posed Problems Using Stabilized Finite Elements, Data, and Machine Learning
M. Larson

Fri, 21/02/2025 14:45 - 15:45 Amphi Fournel
Semi-Plenary Lectures
Chaired by: Prof. Elias Cueto (Universidad de Zaragoza)

Data assimilation from hybrid twins for the practical real-time monitoring of complex engineering systems
L. Chamoin

Digital Twins for the Earth System
***P. Perdikaris**

Fri, 21/02/2025 15:45 - 16:00 Grand Amphi
Closure