COMPUTATIONAL METHODS IN MULTI-SCALE, MULTI-UNCERTAINTY AND MULTI-PHYSICS PROBLEMS

Porto | 15 -16 – 17 July

@Fundação Dr. António Cupertino de Miranda

Avenida da Boavista, 4245
Porto

Chairpersons

CHAIRPERSONS

Dr. F.M. Andrade Pires
Department of Mechanical Engineering (DEMec)
Faculty of Engineering, University of Porto (FEUP)
Phone: +351 22 5083479,
fpires@fe.up.pt

Dr. Chenfeng Li
College of Engineering, Swansea University
Phone: +44 (1792) 602256,
c.f.li@swansea.ac.uk

LOCAL ORGANIZING COMMITTEE

Carla Monteiro
Department of Mechanical Engineering (DEMec)
Faculty of Engineering, University of Porto (FEUP
monteiro@fe.up.pt

About

The development of multi-scale, multi-uncertainty and multi-physics models has received significant attention over the last two decades. New mathematical formulations and numerical solution strategies allied to the increase in computational power/cost ratio have fostered a dramatic growth in this rapidly expanding field. Research activity in this area has been devoted to the development and combination of different analytic tools (homogenization, asymptotic analysis) and computational methods (parallel computing, stochastic analysis, code coupling) for application in fields as diverse as metal processing, composite material, oil & gas development, fuel cell technology and biomedical tissue engineering, etc. Such developments have played a central role in the understanding of the interaction among multi-physics and multi-uncertainty phenomena taking place at multiple scales in space and time.

In the most general format, the ECCOMAS Thematic Conference CM4P targets the latest advances in the modelling of in multi-scale, multi-uncertainty and multi-physics problems, and welcomes the following (not exhaustive) research topics:

- Computational homogenization and multi-scale modelling
- Stochastic modelling, probabilistic engineering, reliability and risk assessment
- Computer simulation of multi-physics processes/systems

PROGRAM

CM4P

ECCOMAS Thematic Conference

July 15th	
08:20 - 09:20	Registration
09:20 - 09:30	Welcome Remarks
09:30 - 10:20	**Plenary Session 1** **CHARACTERIZATION OF MAGNETO-ELECTRIC COMPOSITES: AN ALGORITHMIC SCALE-BRIDGING SCHEME** **Jörg Schröder** | Institute of Mechanics, Civil engineering – Duisberg – Essen University | Germany
10:20 - 10:40	**Coffee-Break**
Session Chairs:	@Auditorium: @Room A: @Room B:
10:40 – 11:00	Presentation 1.1_**Paper 5**_Irina Tezaur: **The Schwarz Alternating Method for Multiscale Coupling in Solid Mechanics**_Sandia National Laboratories_ **@Auditorium** Presentation 1.2_**Paper 18**_Michele Serpilli: **On modeling interfaces in composite with multi-physic coupling**_Università Politecnica delle Marche_ **@Room A** Presentation 1.3_**Paper 43**_Bert Mortier: **Diffusion-Kinetic Monte Carlo Methods for Neutral Transport in Plasma Edge Simulations of Nuclear Fusion Reactors**_ KU Leuven_ **@Room B**
11:00 - 11:20	Presentation 1.4_**Paper 41**_Wan-Chun Chuang: **Simulation Model for Single unit Warpage of Shadow moire in Flip-Chip Process**_National Sun Yat-sen Universit_ **@Auditorium** Presentation 1.5_**Paper 37**_Marco Delucia: **Development of a modified Voronoi's tesselation algorithm for the determination of the effective properties of cork-based composites**_Laboratoire I2M, Arts et Métiers ParisTech_ **@Room A** Presentation 1.6_**Paper 44**_Dmytro Pivovarov: **Development of a simple ergodic stochastic representative volume element for heterogeneous materials with random geometry of microstructure_LTM**, FAU Erlangen-Nuremberg_ **Room B**

11:20 - 11:40	<u>Presentation 1.7</u> **Paper 25**_Emanuela Bosco: **A computational multi-physics model to predict the chemo-mechanical degradation of historical oil paintings**_Eindhoven University of Technology**@Auditorium** <u>Presentation 1.8</u> **Paper 250**_Pawel Holobut: **Assessment of the Size of the Representative Volume Element of Random Heterogeneous Materials**_Institute of Fundamental Technological Research, Polish Academy of Sciences **@Room A** <u>Presentation 1.9</u> **Paper 231**_Anna Matveeva: **Virtual material characteriazation across scales and physics: case studies**_Siemens Industry Software NV **Room B**
11:40 - 12:00	<u>Presentation 1.10</u> **Paper 230**_Szymon Nosewicz: **Multiscale prediction of powder properties during pressure-assisted sintering**_Institute of Fundamental Technological Research Polish Academy of Sciences**@Auditorium** <u>Presentation 1.11</u> **Paper 221**_Avraham Seifert_**On the universality of the Strouhal law for High Reynolds number bluff bodies with flow control**_Tel Aviv University **@Room A** <u>Presentation 1.13</u> **Paper 31**_ Lori Graham-Brady_**Fragment size characterization for granular flow in highly damaged ceramics**_Johns Hopkins University **@Room B**
12:00 - 12:20	<u>Presentation 1.14</u> **Paper 208**_Ben Mansour Dia_**Probabilistic Design Optimization for CO2 Storage with Leakage Risk Control**_CPG-KFUPM**@Auditorium** <u>Presentation 1.15</u> **Paper 20**_ Katharina Kremer_ **Sub-Modeling Approach to Investigate the Cracking Behavior of Reinforced Concrete Structures Considering Polymorphic Uncertainty**_Ruhr-Universitaet Bochum **@Room A** <u>Presentation 1.16</u> **Paper 28**_ Martin Doskar_ **Reduced-order Modelling Scheme for Problems with Fully Resolved Microstructures Generated by Generalized Periodic Unit Cells**_Czech Technical University in Prague **@Room B**
12:20 - 13:30	**Lunch Break**
Afternoon	

13:30 - 14:20	<u>**Plenary Session 2**</u> **BRIDGING THE GAP: A JOINT AUSTRO-CHINESE RESEARCH PROJECT ON MULTISCALE MODELING – STRUCTURAL ANALYSIS – EXPERIMENTS** **Prof. Herbert Mang |**Institute for Mechanics of Materials and Structures, TU Wien | Austria
Session Chairs:	@Auditorium: @Room A: @Room B:
14:40 – 15:00	<u>Presentation 1.17</u> **Paper 246**_ Bahram Haddadi Sisakht_ **Increased Modelling Demands by Moving from Resolved to Unresolved Simulation of Heterogeneous Reactive Systems**_ TU Wien – ICEBE **@Auditorium** <u>Presentation 1.18</u> **Paper 234**_ Mijo Nikolic_ **Modelling of shear bands in fluid saturated poroplastic solids with embedded strong discontinuities**_ University of Split, Faculty of Civil Engineering, Architecture and Geodesy_Croatia_ **@Room A** <u>Presentation 1.19</u> **Paper 42**_ Christian Gierden_**Efficient and accurate two-scale FE-FFT-based prediction of polycrystalline material behavior at finite strains**_ RWTH Aachen University_ **@Room B**
15:00 - 15:20	<u>Presentation 1.20</u> **Paper 220**_Pedro Prates_ **Machine Learning-based Approach for Predicting Defects under Uncertainty in Sheet Metal Forming Processes**_ University of Coimbra**@Auditorium** <u>Presentation 1.21</u> **Paper 242**_Caetano Miranda_ **Nanoscience applied to oil and gas technologies: a multiscale computational approach**_ Universidade de Sao Paulo_ **@Room A** <u>Presentation 1.22</u> **Paper 226**_ Xiangling Gao_**Multi-scale Numerical Simulation of Reinforced Concrete Framed Structure**_ Tongji University_ **@Room B**

15:20 - 15:40	Presentation 1.23 **Paper 267**_ Shreyas Srivatsa_ **Micromechanical Modeling and Estimation of Elastic Properties of Pure MXene (Ti3C2Tx) Films**_ AGH University of Science and Technology Poland_ **@Auditorium** Presentation 1.24 **Paper 241**_ Christian Jordan_ **New Method for Numerical Calibration of a Rotary Kiln Model** - A Multiscale Approach _ TU Wien/Institute of Chemical Engineering **@Room A** Presentation 1.25 **Paper 213**_Lu Hai_ **A phase-field damage model with micro inertial effect for dynamic failure of quasi-brittle materials**_Tongji University **@Room B**
15:40 – 16:00	Coffee Break
16:00- 16:20	Presentation 1.26 **Paper 265**_ Mohamadreza Afrasiabi_**A Thermo-Mechanically Coupled Cutting Simulation of Ti-6Al-4V Using Advanced Meshless Methods**_ ETH Zurich**@Auditorium** Presentation 1.27 **Paper 223**_ Shuai Guo_**Robust Flame Frequency Response Identification via a Multi-Fidelity Approach**_ Technical University Munich **@Room A** Presentation 1.28 **Paper 27**_Linda J. Bolay **Degradation of Lithium-Ion Batteries in Aerospace**_German Aerospace Cente **@Room B**
16:20 - 16:40	Presentation 1.29 **Paper 235**_ Ruofan Gao_**Comparison of Two New Methods for Fatigue Reliability_Analysis**_Tongji University_China**@Auditorium** Presentation 1.30 **Paper 26**_ Emanuela Bosco_**A coupled chemo-mechanical model for biogenic sulfide corrosion in concrete sewer pipes**_ Eindhoven University of Technology_ Netherlands **@Room A** Presentation 1.31_**Paper 8**_Christoph Pohl_**Pore Water State in Heated Concrete - Comparing a Numerical Model to NMR Measurements**_Bundesanstalt für Materialforschung und –prüfung Germany **@Room B**
17:00	**Departure from the Conference´s venue**
17:30	**Welcome Session: Visit to Port Wine Cellars followed by Port Wine Tasting**

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Thematic Conference

July 16th	
09:00 - 09:50	**Plenary Session 3** **HYBRID TWINS: ADAPTING TO MULTI-UNCERTAIN EVOLVING ENVIRONMENTS** **Prof.Francisco Chinesta | ENSAM ParisTech | France**
09:50 - 10:40	**Plenary Session 4** **COMPUTATION-BASED DESIGN POLYMER COMPOSITE FOR SHOCK WAVE ENERGY ATTENUATION** **Zhuo Zhuang** | School of Aerospace Engineering, Tsinghua University, Beijing | China
10:40 - 11:00	Coffee Break
Session Chairs:	@Auditorium: @Room A: @Room B:
11:00 - 11:20	Presentation 2.1 **Paper 244**_De-Cheng Feng_**Stochastic Finite Element Analysis of U-Shaped RC Shear Wall with a Novel Random Field Modeling Strategy for Open Thin-Walled Structural Members**_ Southeast University China**@Auditorium** Presentation 2.2 **Paper 264**_ Lorraine Aparecida Silva_ **Simulation of adhesive squeeze flow using smoothed particle hydrodynamics**_Institut Clément Ader France **@Room A** Presentation 2.3 **Paper 233**_ Christine Espinosa _ **A fully coupled electromagnetic-thermal-transient mechanical simulation of the load suffered by aeronautical composite panels during lightning strikes** _ Institut Clément Ader France **@Room B**

11:20 - 11:40	Presentation 2.4 **Paper 237**_Reza Ghaffari_**A Vibrational study of graphene sheets, carbon nanotubes, and nanocones**_Aachen Institute for Advanced Study in Computational Engineering Science (AICES), RWTH Aachen University Germany**@Auditorium** Presentation 2.5 **Paper 248** Prem Ratan Mohan Ram_**Approximation of frequency response functions with the multi-element generalised polynomial chaos method**_TU Braunschwei Germany **@Room A** Presentation 2.6 **Paper 11**_Witold Ogierman_ **Computationally efficient homogenization for modeling of nonlinear functionally graded materials**_ Silesian University of Technology Poland **@Room B**
11:40- 12:00	Presentation 2.7 **Paper 269**_ Florent Grotto_**Multiphysical simulation of aluminum panels' behaviour hit by lightning strikes**_ICA / ISAE-SUPAERO France**@Auditorium** Presentation 2.8 **Paper 215**_Ye Feng **Two-scale phase field modeling of damage and fracture for disordered media**_Tongji University China **@Room A** Presentation 2.9 **Paper 253** Igor Lopes_**A Fully Second-Order Homogenisation Model for the Analysis of Multi-Phase Materials at Finite Strains**_ University of Porto_Faculty of Engineering Portugal **@Room B**
12:00-12:20	Presentation 2.10 **Paper 266**_ Boussad Abbes_**Multiphysics Simulation of Laser Metal Deposition Manufacturing Process Using a Meshless Method**_University of Reims Champagne-Ardenne | France**@Auditorium** Presentation 2.11 **Paper 232**_Robin Kamenicky_**Heat transfer partitioning models for nucleate boiling**_University of Strathclyde | United Kingdom **@Room A** Presentation 2.12 **Paper 262**_Dmitry Grebennikov_**Computational methods for hybrid multiscale modelling in immunology**_Marchuk Institute of Numerical Mathematics of the Russian Academy of Sciences |Russian Federation **@Room B**
12:20 - 13:30	**Lunch Break**
AFTERNOON	

13:30 - 14:20	<u>**Plenary Session 5**</u> **INVERSE BAYESIAN PROBLEMS AS FILTERING MAPS** **Prof. Hermann G. Matthies |** Institute of Scientific Computing – Technische Universität Braunschweig | Germany
Session Chairs:	@Auditorium: @Room A: @Room B:
14:20 - 14:40	<u>Presentation 2.13</u> **Paper 270_** Matteo Riganti _**Modelling of honeycomb composite sandwich panel with flax fiber skin_** ISAE-SUPAERO - Institut Clément Ader – France **@Auditorium** <u>Presentation 2.14</u> **Paper 261_**Daniel de Bortoli_**Fully coupled multi-scale finite element analysis of TRIP-assisted multi-phase alloys**_INEGI_Portugal_ **@Room A** <u>Presentation 2.15</u> **Paper 204_**Chaoqun Liu_**New Vortex Identification Methods for Turbulence**_University of Texas at Arlington_USA_ **@Room B**
14:40 - 15:00	<u>Presentation 2.16</u> Paper **236_**Denis Düsseldorf_ **Construction of optimal basis functions in the Partition of Unity Method and their verification in complex simulations**_University of Bonn_Germany**@Auditorium** <u>Presentation 2.17</u> **Paper 229**_Matthias Birner_**A Global-Local Zooming Technique**_Fraunhofer_Institut_Germany_ **@Room A** <u>Presentation 2.18</u> **Paper 243_**Zhanli Liu_**Designing phononic crystal with anticipated band structure through a deep learning based data-driven method**_Tsinghua University China _**@Room B**
15:00 - 15:20	<u>Presentation 2.19</u> **Paper 256**_Bernardo Proença Ferreira_**A Finite-Strain Elasto-Viscoplastic Model for Rubber Toughened Glassy Polymers: Formulation and Validation**_Faculty of Engineering of the University of Porto_Portugal**@Auditorium** <u>Presentation 2.20</u> **Paper 227_**António M Couto Carneiro_ **Multiscale Moddeling of Self-Affine Rough Contact_**INEGI Portugal**@Room A** <u>Presentation 2.21</u> **Paper 277**_Ashutosh Bhokare_**Performance of drag models in CFD-DEM_** Swansea University United Kingdom_ **@Room B**

15:20 - 15:40	Presentation 2.22 **Paper 268**_Fazilay Abbes_**Computational study of deformation mechanisms in hcp metal: Application to pure zinc**_University of Reims Champagne Ardenne_France**@Auditorium** Presentation 2.23 **Paper 263** Juan Manuel Calleja Vazquez_**Multiscale stochastic simulations using a MFH model constructed from full-field SVE realizations**_University of Liège_Belgium_ **@Room A** Presentation 2.24 **Paper 228**_Fangxin Fang_**Multi-scale adaptive unstructured mesh predictive modelling for environmental problems**_ Imperial College_United Kingdom_ **@Room B**
15:40-16h00	Coffee Break
16:00- 16:20	Presentation 2.25 **Paper 222**_ Sizeng You_**Quantified Relationship between Properties of Fresh Self-compacting Concrete and Workability Test Performance**_Swansea University United Kingdom**@Auditorium** Presentation 2.26 **Paper 278**_ Liang Yang_PyEFEM_**Massively parallel python based FEM framework for flow problems**_ Cranfield University_United Kingdom_ **@Room A** Presentation 2.27 **Paper 219**_Charles Henri Bruneau_**Comparisons of direct numerical simulation and penalized models to compute the flow in a porous-fluid system**_Université de Bordeaux | France_ **@Room B**
16:20 - 16:40	Presentation 2.28 **Paper 12**_Bilen Emek Abali_**Multiphysics Computation in Batteries Involving Electromagnetism and Thermomechanics**_Technische Universitat_Berlin | Germany**@Auditorium** Presentation 2.29 **Paper 202** Hyun Joon Chang **Examining the Mutation Effect of SLC26A4 STAS Domain By Observing the Communication Between Secondary Structures**_Korea University | South Korea_ **@Room A** Presentation 2.30 **Paper 273**_Srinivas Sriramula_**Multi-scale Reliability Based Design Optimisation for Unidirectional FRP Composite Laminates**_University of Aberdeen |United Kingdom_ **@Room B**
16:45	**DEPARTURE AND MINI BUS TOUR**
19:30	**ARRIVAL AT *CASA DA MUSICA*_CONFERENCE DINNER**

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Thematic Conference

July 17th	
09:00-09:50	**Plenary Session 6:** **FRACTURE OF POLYMER COMPOSITE MATERIALS: SIMULATION ACROSS THE SCALES** **Prof. Pedro P. Camanho |**Faculty of Engineering – University of Porto
09:50 -10:40	**Plenary Session 7** **MULTI-SCALE AND MULTI-PHYSICS CHALLENGES FOR FUTURE AIRCRAFT: A HIERARCHICAL APPROACH** **Paul Tucker|**Cambridge University United Kingdom
10:40-11:00	**COFFEE-BREAK**
Session Chairs:	@Auditorium: @Room A: @Room B:
11:00 -11:20	Presentation 3.1 **Paper 47** Jens-Dominik Müller_**Adjoint Based Optimisation of an Internal Cooling Channel U-Bend**_Queen Mary University of London United Kingdom **@Auditorium** Presentation 3.2 **Paper 276** Jinsheng Wang_**Efficient structural reliability analysis based on polynomial chaos expansion and maximum entropy method**_Swansea University United Kingdom **@Room A** Presentation 3.3 **Paper 46**_ Thiago Doca_ **Multi-uncertainty analysis of the indentation process of key engineering materials**_University of Brasília – Brazil **@Room B**

11:20-11:40	Presentation 3.4 Paper **218** Mohsen Ayoobi_**Data-Drive Approaches in Predicting Premixed Reactive Flow** Wayne State University_ USA**@Auditorium** Presentation 3.5 **Paper 255**_ Miguel V Carvalho_ **Computational Aspects on the Constitutive Modelling of Multiphase Alloys**_Faculty of Engineering of the University of Porto_Portugal_**@Room A** Presentation 3.6 **Paper 224**_ Abdelkhalak El Hami_ **Numerical modelling of the uncertainties in hip prosthesis material parameters** INSA Rouen France_**@Room B**
11:40 -12:00	Presentation 3.7 **Paper 247** Sule Ozturk_**A Turbulence Based Sensitivity Study on Drag Prediction of the NASA Common Research Model Aircraft**_Istanbul Technical University_Turkey**@Auditorium** Presentation 3.8 **Paper 259** Prattya Datta_ **PGD based domain decomposition method applied to parameterized seismic models**_Technical University of Barcelona_Spain_**@Room A** Presentation 3.9 **Paper 212**_ Victor Blanc_ **Dynamic Analysis of a Multi-Contact Problem Using Simplified Models to Study of the Influence of Clearances on Contact Forces**_ French Atomic and Alternatives Energies Commission_France_**@Room B**
12:00 -12:20	Presentation 3.10 **Paper 252** Farzad Shirazian_**A DFT study of single layer blue phosphorus and its implementation in a continuum model**_Aachen Institute for Advanced Study in Computational Engineering Science (AICES), RWTH Aachen University	Germany**@Auditorium** Presentation 3.11 **Paper 210** Yizhi Shao_**Development of Multiscale Multi-physics Based Modelling and Simulations with the Application to Precision Machining of Aerofoil Structures**_Brunel University London	United Kigdom_**@Room A** Presentation 3.12 **Paper 271** Abdelkhalak El Hami_**Probablistic approach of a dynamic analysis of wind turbine on flexible foundation**_ INSA Rouen Normadie_France_**@Room B**

12:20-12:40	Presentation 3.13 **Paper 39**_ Nanda Gopala Kilingar_**Data driven computational analysis of open foam materials**_ University of Liége **@Auditorium** Presentation 3.14 **Paper 254**_Rui Coelho_ **Ductile failure analysis in metallic materials through computational homogenization_FEUP | Portugal @Room A** Presentation 3.15 **Paper 238** Abdelkhalak El Hami_**Metamodels for RBDO of wire bonding in microsystem packages**_ INSA Rouen Normadie_France_ **@Room B**
12:40-13:00	Presentation 3.16 **Paper 211**_Yanan Sun_**An Investigation of stepwise Crack Tip Advancement**_Swansea University_United Kigdom**@Auditorium** Presentation 3.17 **Paper 216** Jie Li_**The Refined Algrithm of Generalized Probability Density Evolution Equation Based on Reproducing Kernel Particle Method**_Tongji University Shanghai, China **@Room A** Presentation 3.18 **Paper 249**_ Ibrahim Cicek_**Optimization of Control Parameters for an Electrified Vertical Take-off Landing Vehicle Using the Integral Squared Method**_ Istanbul Technical University_Turkey **@Room B**
13:00 -14:30	**Lunch Break**
14:30-14:50	Presentation 3.19 **Paper 251** Alberto Moscatello_ **Scaling procedure for the design of a validation experiment on an accidental gas release** _ Politecnico di Torino Italy **@Auditorium** Presentation 3.20 **Paper 201**_Younes Ya Aoues_**System time-variant reliability-based structural design optimization of deteriorated truss bridges**_Normandie Université, INSA Rouen France **@Room B** Presentation 3.21 TO BE CONFIRMED