European Community on Computational Methods in Applied Sciences

ECCOMAS Thematic Workshop on

Computational Multi-Physics, Multi-Disciplinary and Multi-Data – CM3

Methods and Tools for Aeronautics Design

CIMNE, Barcelona, 22 – 24 November 2021

Venue: UPC Campus Nord, Department of Civil Engineering
C2 Building, Carrer de Jordi Girona 1-3, Barcelona

Workshop Programme

Monday, 22nd Nov. 2021 **Workshop Day 1,**

Room: *Sala d'Actes Civil Engineering*

13h00 ***Registration***

14h00 **Official Opening and Welcome Addresses**
Chairperson: Gabriel Bugeda, CIMNE/UPC, Spain
- Eugenio Onate, Director of CIMNE
- Jacques Periaux, CIMNE and ECCOMAS Industry Interest Group (IIG)

14h30 – 16h00 **Scene Setting Session on Aircraft Design** *(Part 1) (Invited Lecturers)*
Chairperson: Gabriel Bugeda, CIMNE/UPC, Spain
- Daniel Reckzeh, Airbus, Germany,
"Zero Emission Technology for Future Aircraft - A Master Challenge for Advanced Design and Simulation Capabilities"
- Shahrokh Shahpar, Rolls-Royce, United Kingdom,
"Digital Tools for Greener Aviation – Focus on Turbomachinery"
- Joaquim Martins, University of Michigan, USA
"Exploiting Aircraft Electrification via Multidisciplinary Design Optimization"

16h00 – 16h30 ***Coffee Break***

16h30 – 17h30 **Technical Session 1 – *Aeronautics Design***
Chairperson: Dietrich Knoerzer, Aeronautics Consultant, Belgium
- Michaël Meheut, ONERA, France
"Multi-fidelity and Multi-Disciplinary Optimization for Next Generation Aircraft Design"
- Pedro Diez, CIMNE/UPC, Spain
"Parametric Free-Free Structural Mechanics and Dynamics"
- Cornelia Grabe, DLR, Center for Computer Applications in AeroSpace Science and Engineering ($C^2A^2S^2E$), Germany
"Advanced Numerical Methods and Software Solutions for the Digital Aircraft"

18h00 ***Workshop Welcome Drink at Terrace of Building B0 – End of Day 1***

Tuesday, 23rd Nov. 2021 **Workshop Day 2**

9h00 **Mini-Symposia (MS) Sessions** *(Parts 1 & 2)*

	Room: Sala d'Actes Civil Engineering	*Room: Sala Lectura Tesines (C1001)*
9h00 - 10h30	**MS 1A Novel Wing Digitalized Design** *Chairperson: Marianna Braza, IMFT Toulouse, France*	**MS 1B – New Algorithms and Challenges fo High-Fidelity CFD** *Chairperson: Vincent Couaillier, ONERA, France*
10h30 - 11h00	***Coffee Break***	***Coffee Break***
11h00 - 12h30	**MS 2A Novel Wing Digitalized Design** *(continued))* *Chairperson: Marianna Braza, IMFT Toulouse, France*	**MS 2B – Digital Twins for Simulation-Assisted Predictive Maintenance** *Chairperson: Florian Raddatz, DLR, Germany*

12h30 – 13h30 ***Sandwich Lunch***

13h30 – 14h30 ***Room:*** *Sala d'Actes Civil Engineering*

Technical Session 2 - Computational Methods for Multi-Physics Applications and Optimisation

Chairperson: Jacques Periaux, CIMNE, Spain

- Fabien Casenave, SAFRAN, France

"Physical Reduced Order Modeling for Industrial Simulations"

- Shigeru Obayashi, Tohoku University, Japan

"Towards Ideal Aircraft-Structure Design with Carbon Fiber Reinforced Thermoplastics (CFRTPs)"

- Qian Zhansen, AVIC Aerodynamic Research Institute/ CAE, Shenyang, China

"Progress and Applications of ARI_OPT Software for Aerodynamic Shape Optimization"

14h30 **Mini-Symposia Sessions (MS)** *(Part 3 & 4)*

	Room: *Sala d'Actes Civil Engineering*	***Room:*** *Sala Lectura Tesines (C1001)*
14h30 - 16h00	**MS 3A – EU-Funded Research and Innovation on Advanced Computational Methods for Design in Aviation** *Chairpersons: Leonidas Siozos-Rousoulis EC-CINEA, Belgium, Dietrich Knoerzer, Aeronautics Consultant, Belgium*	**MS 3B – Methods and Tools for Innovative Design Solutions of Aircraft/ Aero-Engines Configurations** *Chairpersons: Pierre Bescond, CEAS, France, Jacques Périaux, CIMNE, Spain*
16h00 - 16h30	***Coffee Break***	***Coffee Break***
16h30 - 18h15	**MS 4A – Multi-disciplinary Adjoint and Applications in Aeronautics – The MADELEINE Project** *Chairperson: Kyriakos C. Giannakoglou, NTUA, Greece*	**MS 4B – Robust Design Optimization Applications in Aerospace** *Chairperson: Domenico Quagliarella, CIRA, Italy*

20h30 ***Workshop Dinner at the Restaurant El Jardí de l'Abadessa Carrer de l'Abadessa Olzet, 26, Barcelona***

Wednesday, 24th Nov. 2021 **Workshop Day 3**

Room: *Sala d'Actes Civil Engineering*

9h00 – 9h40 **Technical Session 3 – Advances in Design Methods**
Chairperson: Gilbert Rogé, Dassault Aviation, France

- Xavier Bertrand, Airbus, France
"Deep Learning & Aerodynamic at Airbus"

- Jorge Ponsin Roca, INTA, Madrid, Spain
"Unsteady High-Lift Aerodynamics – Unsteady RANS Validation – The UHURA Project"

09h40 – 10h40 **Scene Setting Session on Future for Design in Aviation** *(Part 2) (Invited Lecturers)*
Chairperson: Jordi Pons, CIMNE/UPC, Spain

- Oriol Lehmkuhl, Barcelona Supercomputing Center (BSC-CNS), Spain & Eusebio Valero, UPM - Universidad Politécnica de Madrid, Spain
"Current Trends on Numerical Simulation for the Design of New and Disruptive Aircraft Configurations"

- Tom Verstraete, Von-Karman-Inst./ University of Ghent, Belgium
"Challenges and Opportunities in Turbomachinery Design Optimization"

10h40 – 11h00 ***Coffee Break***

11h00 – 11h30 **Introductory Lecture for Discussion Forum:**

Chairperson: Olivier Pironneau, Sorbonne Université, France

- Michael Kyriakopoulos, European Commission, DG Research & Innovation, Belgium
"Horizon Europe – Research and Innovation Opportunities for a More Sustainable and Globally Competitive EU Aviation"

11h30 – 13h30 ***Discussion Forum:***

"Perspectives for the Combined Role of Modelling, Simulation and Digitalisation in Future Aeronautics Design"

Moderator: Olivier Pironneau, Sorbonne Université, France

Participants:
- Cornelia Grabe, German Aerospace Center DLR, Germany
- Michael Meheut, ONERA – The French Aerospace Lab, France
- Jacques Periaux, CIMNE and ECCOMAS IIG, Spain
- Daniel Reckzeh, Airbus, Germany
- Gilbert Rogé, Dassault Aviation, France

13h30 ***End of Workshop***

List of Mini-Symposia (MS)

Mini-Symposium 1A + 2A

Novel Wing Digitalized Design

Tuesday, 23rd Nov. 2021, 9h00 – 10h30 and 11h00 – 12h30; ***Room:*** *Sala d'Actes Civil Engineering*

Organiser and Chairperson: Marianna Braza, IMFT Toulouse, France

- Stefano Pezzano, Régis Duvigneau and Mickaël Binois, Inria Sophia-Antipolis, France
  "A Fully Integrated Geometry-Simulation-Optimization Framework via NURBS Representations with Application to Airfoil Morphing"

- Cédric Raibaudo, ONERA, France, Mateus Carvalho, Carsten Döll, Philippe Mouyon, Jean-François Rouchon, Marianna Braza, IMFT Toulouse, France
  "Feedback Control on a Morphing A320 Reduced Scale Wing towards Aerodynamic Performance Increase"

- Abderahmane Marouf, Univ. of Strasbourg, France, Yannick Hoarau, Marianna Braza, IMFT Toulouse, France, Jan Vos, CFS Engineering Lausanne, Switzerland
  "Aerodynamic Performance Increase over an A320 Airplane with Morphing Wings by Means of Numerical Simulation"

- César Jimenez Navarro, Jean-Baptiste Tô, Pawel Flaszynski, Richard Szwaba, Piotr Doerffer, IMP-PAN Gdansk, Poland, Abderahmane Marouf, Univ. of Strasbourg, Nikolaos Simiriotis, Yannick Hoarau, Jean-François Rouchon, Marianna Braza, IMFT Toulouse, France
  "Numerical Study and Physical Analysis of Trailing Edge Electroactive Morphing on an A320 Type Morphing Wing in the Transonic Regime Including Wobulation Effects"

- Clément Rouaix, Mateus Carvalho, César Jimenez Navarro, Abderahmane Marouf, Cédric Raibaudo, Yannick Hoarau, Jean-François Rouchon, Marianna Braza, IMFT Toulouse, France
  "Electroactive Morphing Wobulation Effects in the Aerodynamic Performance of a Subsonic A320 Aerofoil by Means of Numerical Simulation and Experiment"

- Amaury Kitouni, Jean-Baptiste Tô, Jean-Baptiste Paris, Vincent Lamour, Abderahmane Marouf, Yannick Bmegaptche, Mateus Carvallho, Marianna Braza, IMFT Toulouse, France
  "Numerical Simulation of Multi-Point Dynamic Pressure Sensing on a High-Lift Wing-Flap Morphing Configuration Compared with Bragg Grating Pressure Sensing at High Reynolds Number"

Mini-Symposium 1B

New Algorithms and Challenges for High-fidelity CFD

Tuesday, 23rd Nov. 2021, 9h00 – 10h30; ***Room:*** *Sala Lectura Tesines (C1001)*

Organiser and Chairperson: Vincent Couaillier, ONERA, France

- Vincent Couaillier Couaillier, ONERA, France
  "Development of High-Fidelity CFD in advanced softwares"

- Michael Wagner, DLR, Germany
  "Spliss: Transparent Integration of Heterogeneous HPC Architectures into CFD Solvers and Applications"

- Fabio Naddei, Marta de la Llave Plata and Vincent Couaillier, ONERA, FRANCE
  "p-adaptive LES of transitional flows using discontinuous Galerkin methods"

- M. Zauner, V. Mons, O. Marquet and B. Leclaire, ONERA, France
  "Nudging-based data assimilation of the turbulent flow around a square cylinder"

Mini-Symposium 2B

Digital Twins for Simulation-Assisted Predictive Maintenance

Tuesday, 23rd Nov. 2021, 11h00 – 12h30; ***Room:*** *Sala Lectura Tesines (C1001)*

Organiser and Chairperson: Florian Raddatz, DLR, Germany

- H. Meyer, DLR, Germany
  "Predictive Maintenance in Aviation Using Digital Twins"

- Steffen Parth, Jan-Christopher Knufinke, Lufthansa Technik, Germany
  "Optimized Structural Repair Processes Using Digital Twins and Simulation"

- Sebastian Freund, Simon Schulz, DLR, Germany
  "Operational Loads Monitoring and CFRP Damage Accumulation for Predictive Maintenance"

- Martin Rädel, Fabian Lange, R. Hollmann, Kristof Risse, Tobias Wille, DLR, Germany
  "DLR Virtual Product House: Digital End-to-End Development Process for Multifunctional Moveables"

Mini-Symposium 3A

EU-Funded Research and Innovation on Advanced Computational Methods for Design in Aviation

Tuesday, 23rd Nov. 2021, 14h30 – 16h00; ***Room:*** *Sala d'Actes Civil Engineering*

Organisers and Chairpersons: Leonidas Siozos-Rousoulis, EC-CINEA, Belgium & Dietrich Knoerzer, Aeronautics Consultant, Belgium

- Moisés Zarzoso and Carlos González, IMDEA & UPM, Juan José Vilatela, UPM, Pablo Romero-Rodríguez, AIMEN, Spain
  "Multiscale Modeling of Composites: Towards Artificial Intelligence Assisted Virtual Testing of Composites"

- Tobias Wille, Martin Liebisch, DLR, Germany
  "SuCoHS Project – Sustainable Cost-Efficient High-Performance Composite Structures Demanding Temperature or Fire Resistance"

- Christopher Teruna, Leandro Rego, Damiano Casalino, Francesco Avallone, Daniele Ragni, Faculty of Aerospace Engineering, Delft Univ. of Technology, The Netherlands
  "A Numerical Study of Aircraft Noise Mitigation Using Porous Edges Treatments"

- Werner Haase, Ulf Michel, CFD Software Entwicklungs- und Forschungsgesellschaft mbH, Berlin, Germany
  "DJINN - Decrease Jet Installation Noise – Perspectives and Results"

Mini-Symposium 3B

Methods and Tools for Innovative Design Solutions of Aircraft/Aero-Engines Configurations

Tuesday, 23rd Nov. 2021, 14h30 – 16h00; ***Room:*** *Sala Lectura Tesines (C1001)*

Organisers and Chairpersons: Pierre Bescond, CEAS, France
Jacques Périaux, CIMNE, Spain

- Nicolas R. Gauger, TU Kaiserslautern, Germany
  "Grey-Box Modeling with Applications in Data-driven Turbulence Modeling"

- Zhili Tang, Shaojun Luo, Yongbin Chen, Xin Zhao and Peng Wu, College of Aerospace Engineering, Nanjing University of Aeronautics and Astronautics, China
  "Hierarchical Variable Fidelity Evolutionary Optimization Methods and their Applications in Aerodynamic Shape Design"

- Olivier Pironneau, Lab. Jacques-Louis Lions, Sorbonne Université, Paris, France.
  "A Radiative Transfer Solver for Airplane Contrails and the Greenhouse Effect"

- Jos Vankan, Willem F. Lammen and Erik H. Baalbergen, Royal Netherlands Aerospace Centre (NLR), The Netherlands
  "Modelling, Simulation and Optimization Methodologies for Low-Emission Aircraft Concepts"

Mini-Symposium 4A

Multi-disciplinary Adjoint and Applications in Aeronautics – the MADELEINE Project

Tuesday, 23rd Nov. 2021, 16h30 – 18h15; ***Room:*** *Sala d'Actes Civil Engineering*

Chairperson: Kyriakos C. Giannakoglou, NTUA, Greece

- Diego I. Lopez and Tiziano Ghisu, Univ. degli Studi di Cagliari, Italy and Shahrokh Shahpar, Rolls Royce, UK
  "AI-Assisted Strategies for High-Dimensional Optimisation in Turbomachinery"

- Gilbert Roge, S. Kleinveld, S. Julisson and L. Martin, Dassault Aviation, France, K. Tsiakas, Xenophon Trompoukis, V. Asouti and Kyrakos Giannakoglou, NTUA, Greece and Gabriel Fougeron, ESI Group, France
  "Adjoint-based Aerostructural Airframe Optimization of a Business Jet"

- Mohammad Abu-Zurayk, Andrei Merle, Stefan Keye, Caslav Ilic and Johan Feldwisch, DLR, Germany
  "Comparing the use of Rigid Adjoint and Flexible Adjoint in Aeroelastic Optimization of Industry-Relevant Aircraft Configuration"

- Xenophon Trompoukis, Varvara G. Asouti, Morteza Monfaredi, Marina Kontou, Konstantinos Tsiakas and Kyriakos Giannakoglou, NTUA, Greece
  "Continuous Adjoint-based Aerothermal & Aeroacoustic Optimization of Aero Engine Components using PUMA"

- Itham Salah El Din, ONERA, France, Bambang I. Soemarwoto, NLR, The Netherlands, Armin Geiser, TU Munich, Germany and L. Wu, Univ. of Southampton, UK
  "Isolated Propeller and a Turbofan Fan Adjoint Based Gradient Aero-Acoustic Optimization within the MADELEINE Project"

Mini-Symposium 4B

Robust Design Optimization Applications in Aerospace

Tuesday, 23rd Nov. 2021, 16h30 – 18h15; ***Room:*** *Sala Lectura Tesines (C1001)*

Organiser and Chairperson: Domenico Quagliarella, CIRA, Italy

- Giulio Gori, Franco Auteri and Alberto Guardone, Politecnico di Milano, Italy; Olivier Le Maître and Pietro Marco Congedo, INRIA, France
  "A Confidence-based Aerospace Design Approach Robust to Structural Turbulence Closure Uncertainty"

- A. Schneider, Umberto Iemma, Andrea Serani, Matteo Diez, Roma Tre Univ., Italy
  "Deep Autoencoders for Design-space Dimensionality Reduction with Application to Airfoil Optimization"

- Christie Maddock, Ben Parsonage, Univ. of Strathclyde, UK
  "A Multi-Fidelity Model Management Framework for Multi-Objective Aerospace Design Optimization"

- Domenico Quagliarella, CIRA, Italy
  "Risk Functions Applied to Efficient Robust Aerodynamic Shape Design"