



**1st Workshop on Machine Learning for Fluid Dynamics  
PARIS-Sorbonne University**

**Location: CICSU (Sorbonne Université, Jussieu Campus, Centre International de Conférences de Sorbonne Université), Tower 44**

Wednesday, 6 <sup>th</sup> March 2024			
08:50	<b>Opening - 1st Floor, Room 108</b>		
09:00	<b>Bruno Desprès, Sorbonne U, France</b> <i>"On Some Foundations of Machine Learning Approximations, with Application to Interface Transport"</i>		
	<b>Room: 108</b> <span style="float: right;"><b>Room: 106</b></span>		
	<b>Chair B. Desprès</b> <span style="float: right;"><b>Chair H. Mandler</b></span>		
10:00	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p><b>Numerically Consistent Turbulence Modelling via Machine Learning</b> <b>Hyun Jane Bae, Adrián Lozano-Durán</b> California Institute of Technology, Pasadena, USA</p> </td> <td style="width: 50%; vertical-align: top;"> <p><b>Tailoring Tensor Basis Neural Networks For RANS Modeling in Wall-Bounded Flows</b> <b>Jiayi Cai, Pierre-Emmanuel Angeli, Guillaume Damblin, Didier Lucor</b> Universite Paris-Saclay, CEA, Service de Thermo-hydraulique et de Mécanique des Fluides, Gif-sur-Yvette, France</p> </td> </tr> </table>	<p><b>Numerically Consistent Turbulence Modelling via Machine Learning</b> <b>Hyun Jane Bae, Adrián Lozano-Durán</b> California Institute of Technology, Pasadena, USA</p>	<p><b>Tailoring Tensor Basis Neural Networks For RANS Modeling in Wall-Bounded Flows</b> <b>Jiayi Cai, Pierre-Emmanuel Angeli, Guillaume Damblin, Didier Lucor</b> Universite Paris-Saclay, CEA, Service de Thermo-hydraulique et de Mécanique des Fluides, Gif-sur-Yvette, France</p>
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11:00	<b>Coffee break: Room 102</b>		



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	<b>Room: 108</b>	<b>Room: 106</b>
	<b>Chair: O. Semeraro</b>	<b>Chair: P. Cinnella</b>
11:30	<p><b>Discretization-Consistent Turbulence Closure Models via Reinforcement Learning</b></p> <p><b>Marius Kurz, Andrea Beck</b> <i>Institute of Aerodynamics and Gas Dynamics, University of Stuttgart, Germany</i></p>	<p><b>Data-Driven Turbulence Modeling for Separated Flow around Axisymmetric Bodies</b></p> <p><b>Seoyeon Heo, Yeji Yun, Solkeun Jee</b> <i>Gwangju Institute of Science and Technology, Gwangju, South Korea</i></p>
11:45	<p><b>Approximately Well-balanced Discontinuous Galerkin Methods Using Bases Enriched with Physics-Informed Neural Networks</b></p> <p><b>Emmanuel Franck, Victor Michel-Dansac, L. Navoret</b> <i>Université de Strasbourg, CNRS, Inria, IRMA, France</i></p>	<p><b>Machine-Learning-Assisted Blending of Data-Driven Turbulence Models</b></p> <p><b>Louenas Zemmour, M. Oulghelou, S. Cherroud, X. Merle, P. Cinnella</b> <i>Jean Le Rond D'Alembert Institute, Sorbonne University, Paris, France</i></p>
12:00	<p><b>Reinforcement Learning Based Shock Capturing for High-Order Discontinuous Galerkin</b></p> <p><b>Anna Schwarz, Jens Keim, Lukas Zech, Andrea Beck</b> <i>Institute of Aerodynamics and Gasdynamics, University of Stuttgart, Germany</i></p>	<p><b>A Novel Data-Based Strategy for RANS Wall Models Inspired From Dirichlet-to-Neumann Map</b></p> <p><b>Michele Romanelli, Samir Beneddine, Ivan Mary, Heloise Beaugendre, Michel Bergmann, Denis Sipp</b> <i>Aerodynamics, Aeroelasticity and Acoustics Department (DAAA), ONERA, University of Paris Saclay, France; Project team Memphis, Inria Bordeaux-Sud Ouest, France</i></p>
12:15	<p><b>Learning Partially Observed Dynamical Systems with the Mori-Zwanzig Formalism</b></p> <p><b>Thibault Monsel, Onofrio Semeraro, Lionel Mathelin, Guillaume Charpiat</b> <i>Univ. Paris-Saclay, Inria, Lab. Interdisciplinaire des Sciences du Numérique (LISN); Univ. Paris-Saclay, CNRS, Lab. Interdisciplinaire des Sciences du Numérique (LISN)</i></p>	<p><b>Progressive Augmentation of RANS Turbulence Models by Simulation-Driven Surrogate Optimization</b></p> <p><b>Ali Amarloo, Mario J. Rincón, Martino Reclari, Xiang I. A. Yang, Mahdi Abkar</b> <i>Department of Mechanical and Production Engineering, Aarhus University, Denmark</i></p>
12:30	<p><b>A Study on Efficient Training of Physics-Informed Neural Networks for Unsteady Flows</b></p> <p><b>Junya Onishi, Makoto Tsubokura</b> <i>Center for Computational Science, RIKEN, Kobe, Japan</i></p>	<p><b>Data-Driven Approach to Modelling Momentum Deficit in a Turbulent Boundary Layer over a Rough Surface</b></p> <p><b>Martina Formichetti, Uttam Cadambi Padmanaban, Sean Symon, Bharathram Ganapathisubramani</b> <i>Aeronautical and Astronautical Engineering, University of Southampton, UK</i></p>
12:45	<b>Lunch: Room 102</b>	



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### Wednesday, 6th March 2024 - Afternoon

**Romit Maulik, Penn State, US**

*“Turbulence Modeling for Large-eddy Simulations Using Machine Learning”*

Room: 108

**Room: 108**

**Chair: M. Juniper**

**Room: 106**

**Chair: P. Volpiani**

14:45

**Assimilating Data from Video Footage into a Low Order Model of an Acoustically Forced Laminar Flame**

**Matthew Yoko, Alessandro Giannotta, Pietro De Palma, Stefania Cherubini, Matthew Juniper**

University of Cambridge, United Kingdom

**Robust Features Design For Machine-Learning Augmented Turbulence Closure Models**

**Bartolomeo Fanizza, Pedro Stefanin Volpiani, Florent Renac, Denis Sipp**

DAAA, ONERA, Université Paris Saclay, Meudon, France

15:00

**Flow Reconstruction from Noisy Partial Observations**

**Yaxin Mo, Luca Magri**

Imperial College London, United Kingdom

**Learning Consistent Nonlinear Eddy Viscosity Models for Generalizability**

**Zhuoran Liu, Xuhui Zhou, Heng Xiao**

Stuttgart Center for Simulation Science (SC SimTech), University of Stuttgart, Germany

15:15

**Real-Time Inference Of Model Errors from Experimental Data: Application in Hydrogen-Based Annular Combustors**

**Andrea Nóvoa, Nicolas Noiray, James R. Dawson, Luca Magri**

University of Cambridge, United Kingdom; Imperial College London, United Kingdom

**Adjoint-Trained Deep-Learning Sub-Grid Scale Models for Large Eddy Simulation of Compressible Airfoil Flows**

**Tom Hickling, Justin Sirignano, Jonathan MacArt**

University of Oxford, United Kingdom

15:30

**Uncertainty and Explainability in Unsupervised Machine Learning: Application to Particles Dispersion**

**Nicholas Christakis, Dimitris Drikakis**

University of Nicosia, Cyprus

**Building-Block Flow Model for Large Eddy Simulation: Applications to Complex Geometries**

**Sam Costa, Yuenong Ling, Gonzalo Arranz, Mori Mani, Konrad Goc, Adrián Lozano-Durán**

Massachusetts Institute of Technology, USA

15:45

**Bayesian inverse Navier–Stokes Problems: Flow Reconstruction and Parameter Inference**

**Alexandros Kontogiannis**

University of Cambridge, United Kingdom

**Improving Subgrid-Scale Parameterizations in Climate Models with Online Learning**

**Hugo Frezat, Julien Le Sommer, Guillaume Balarac, Ronan Fablet**

Univ. Grenoble-Alpes, CNRS UMR LEGI, Grenoble, France

16:00

**Coffee break: Room 102**



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	Room: 108	Room: 106
	<b>Chair: M. Meldi</b>	<b>Chair: H. Choi</b>
16:30	<p><b>Data Assimilation for Updating a Numerical Model of a Semi-industrial Furnace</b></p> <p><b>Laura Donato, Matteo Savarese, Lorenzo Giuntini, Alberto Procacci, Chiara Galletti, Alessandro Parente</b></p> <p><i>Universite Libre de Bruxelles, Belgium; Brussels Institute for Brussels Thermal Energy (BRITE), ULB and VUB, Belgium; University of Pisa, Italy</i></p>	<p><b>Deep Learning for Sub-Filter Density Function Prediction In Turbulent Combustion</b></p> <p><b>Hanying Yang, Nedunchezian Swaminathan</b></p> <p>University of Cambridge, United Kingdom</p>
16:45	<p><b>A Framework of Data Assimilation for Wind Flow Field by Physics-informed Neural Networks</b></p> <p><b>Chang Yan, Thorsten Lutz, Zhenxu Sun, Guowei Yang</b></p> <p>Chinese Academy of Sciences, Beijing, China; University of Stuttgart, Germany</p>	<p><b>Learning Neural Closure Models for Discretely Filtered Turbulence</b></p> <p><b>Syver Døving Agdestein, Benjamin Sanderse</b></p> <p>Centrum Wiskunde &amp; Informatica, Amsterdam, The Netherland</p>
17:00	<p><b>Meanflow Data-Assimilation Using Graph Neural Networks</b></p> <p><b>Michele Quattromini, Michele Alessandro Bucci, Stefania Cherubini, Onofrio Semeraro</b></p> <p>Polytechnic of Bari, Italy; LISN-CNRS, Universite Paris-Saclay Orsay, France</p>	<p><b>Machine-Learning-Based LES of Flow Over a Complex Geometry</b></p> <p><b>Myunghwa Kim, Haecheon Choi</b></p> <p>Seoul National University</p>
17:15	<p><b>Reinforcement Learning for Control of Spatially Developing Flows</b></p> <p><b>Amine Saibi, Lionel Mathelin, Onofrio Semeraro</b></p> <p>Sorbonne Universite, Inst. Jean Le Rond d'Alembert, France; Lab. interdisciplinaire des sciences du numérique (LISN) – CNRS, Univ. Paris-Saclay, Orsay, France</p>	<p><b>Mixture Density Network for the Prediction of the Wall Shear Stress including its Statistical Moments for Turbulent Separated Flows</b></p> <p><b>Margaux Boxho, T. Toulorge, M. Rasquin, G. Dergham, G. Winckelmans, K. Hillewaert</b></p> <p>Cenaero, Gosselies, Belgium; University of Liege, Belgium</p>
17:30		<p><b>A Dynamic Recursive Neural-Network-Based Subgrid-Scale Model for Large Eddy Simulation: From Homogeneous Isotropic Turbulence To Circular Cylinder Flow</b></p> <p><b>Chonghyuk Cho, Haecheon Choi</b></p> <p>Seoul National University</p>
18:30	<b>Welcome cocktail</b>	
	<b>Zamansky Tower Panoramic Rooftop, Tour Zamansky, 24th floor, Sorbonne Université, Jussieu Campus</b>	