


# HiFiLeD SYMPOSIUM



Towards High-Fidelity Industrial LES/DNS - Paving the Way for Future Accurate CFD

supported by the EU H2020 TILDA  project

## Programme

<b>Afternoon Sessions (Wednesday, 14 November 2018)</b>	
11:45 – 12:45	<b>Registration</b>
12:45 – 12:50	<b>Welcome – Opening</b> by <b>C. Hirsch</b> (NUMECA, Belgium)
12:50 – 13:10	<b>C. Hirsch</b> (NUMECA, Belgium) The EU TILDA project, a guide to future high-fidelity CFD
13:10 – 15:10	<b>Session 1: “LES/DNS and transition from laminar to turbulent flows”</b> <b>Chairperson: C. Hirsch</b> (NUMECA, Belgium)
13:10 – 13:30	<b>P. S. Negi, A. Hanifi and D. S. Henningson</b> (Linné FLOW Centre and Swedish e-Science Research Centre (SeRC), KTH Royal Institute of Technology, Sweden) LES of the Unsteady Response of a Natural Laminar Flow Airfoil
13:30 – 13:50	<b>V.-T. Nguyen, D. J. Wise and K. T. E. Chua</b> (Institute of High-Performance Computing, A*STAR, Singapore) DNS investigation of laminar-to-turbulent transition under favourable pressure gradient
13:50 – 14:10	<b>G. Janiga, C. Chi, A. Abdelsamie, A. Hosseini, D. Thévenin</b> (University of Magdeburg) Direct Numerical Simulations of reacting flows involving transition to turbulence in complex geometries
14:10 – 14:30	<b>A. Villa Ortiz, L. Koloszar</b> (von Karman Institute for Fluid Dynamics, Belgium) Controlled transition on a vertical natural convection boundary layer with $Pr=0.71$
14:30 – 14:50	<b>G. Jeanmasson, I. Mary and L. Mieussens</b> (ONERA, France, Université Bordeaux, France) Explicit local time stepping scheme for the simulation of transitional flows with LES or DNS
14:50 – 15:10	<b>M. Franciolini, A. Crivellini, A. Colombo, L. Botti</b> (Università Politecnica delle Marche, Italy, Università degli Studi di Bergamo, Italy) Numerical computation of the ERCOFTAC T3L test case suite using an implicit p-multigrid matrix-free DG solver
15:10 – 15:30	<b>Coffee</b>

15:30 – 16:15	<p><b>Invited Lecture I: K. Duraisamy, University of Michigan, USA)</b>  Machine Learning for Turbulence Modelling: Progress, Challenges and Opportunities for Future Research  <b>Chairperson: L. Vervisch, (CORIA-CNRS)</b></p>
16:15 – 18:15	<p><b>Session 2: “Applications of Machine Learning and Neural Networks to Turbulence Research”</b>  <b>Chairperson: K. Duraisamy (University of Michigan, USA)</b></p>
16:15 – 16:35	<p><b>C. J. Lapeyre, A. Misdariis, N. Cazard, T. Poinso (CERFACS, France)</b>  Replacing a sub-grid closure model with a trained deep convolutional neural network</p>
16:35 – 16:55	<p><b>A. Beck, D. Flad, C.-D. Munz (University of Stuttgart, Germany)</b>  Deep Neural Networks for Data-Driven Turbulence Models</p>
16:55 – 17:15	<p><b>R. P. Dwight and M. Kaandorp (TU Delft, The Netherlands)</b>  Stochastic Random Forests with Invariance for RANS Turbulence modelling</p>
17:15 – 17:35	<p><b>M. Schmelzer., R. P. Dwight and P. Cinnella (TU Delft, The Netherlands, Laboratoire DynFluid, Arts et Métier ParisTech, France)</b>  Learning Algebraic Corrections for RANS Turbulence Model from Data</p>
17:35 – 17:55	<p><b>A. Seltz, P. Domingo, L. Vervisch (CORIA – CNRS, Normandie Université, INSA de Rouen, France, SAFRAN Aircraft Engines, France)</b>  Machine Learning for Turbulent Combustion Modeling in High-Fidelity LES</p>
17:55 – 18:15	<p><b>N. Discacciati, J. S. Hesthaven, D. Ray (Ecole Polytechnique Fédérale de Lausanne, Switzerland)</b>  Controlling spurious oscillations in high-order methods through deep neural networks</p>
18:15	<p><b>End of first day</b></p>

<b>Morning Sessions (Thursday, 15 November 2018)</b>	
<b>09:00 – 09:45</b>	<b>Invited Lecture II: P.G. Tucker</b> ( <i>University of Cambridge (UK)</i> ) Zonal, Scale Resolved Simulations of Flow and Geometry Applied to Turbomachinery <b>Chairperson: P. Spalart</b> (Boeing, USA)
<b>09:50 – 11:10</b>	<b>Session 3: “High-Order methods development”</b> <b>Chairperson: P. Vincent</b> (Imperial College London, UK)
09:50 – 10:10	<b>R. Hartmann</b> ( <i>DLR, Germany</i> ) Recent developments in wall-resolved and wall-modelled ILES based on high-order DG methods
10:10 – 10:30	<b>A. Cimpoeru, M. Allan, D. Standingford</b> ( <i>The Centre for Modelling and Simulation, UK, Zenotech Ltd, UK</i> ) An Industrial High Order Flux Reconstruction Framework To Tackle Turbulent Flows
10:30 – 10:50	<b>M. de la Llave Plata, F. Naddei, V. Couaillier</b> ( <i>ONERA, France</i> ) Assessment of high-order hp-adaptive methods for the simulation of turbulent flows
10:50 – 11:10	<b>K. Puri, E. Lorrain and C. Hirsch</b> ( <i>NUMECA, Belgium</i> ) Robustness, accuracy and reliability of high-order implicit-LES for transitional and turbulent turbomachinery flows
11:10 – 11:30	<b>Coffee</b>
<b>11:30 – 13:30</b>	<b>Session 4: “Interdisciplinary (heat transfer and mixing, acoustics) applications”</b> <b>Chairperson: V. Couaillier</b> (ONERA, France)
11:30 – 11:50	<b>D. Angeli and E. Stalio</b> ( <i>Università degli Studi di Modena e Reggio Emilia, Italy</i> ) Direct Numerical Simulation of turbulent mixed convection around a bundle of heated rods at low-Prandtl number
11:50 – 12:10	<b>E. Cascioli, S. Buckingham, C. Spaccapaniccia, S. Keijers, K. Van Tichelen, S. Kenjeres</b> ( <i>Delft University of Technology, The Netherlands, SCK•CEN Belgian Nuclear Research Centre, Belgium, The von Karman Institute for Fluid Dynamics, Belgium</i> ) Numerical and experimental investigation of a forced plane jet flow with heated co-flow at medium and low Prandtl number values
12:10 – 12:30	<b>C. Evrim and E. Laurien</b> ( <i>University of Stuttgart, Germany</i> ) Numerical Investigation of Thermal Mixing in a Vertical T-Junction Configuration
12:30 – 12:50	<b>A. Fregni, D. Angeli, A. Cimarelli and E. Stalio</b> ( <i>Università degli Studi di Modena e Reggio Emilia, Italy, Cardiff University, UK</i> ) Direct Numerical Simulation of interacting buoyant jets at low-Prandtl number
12:50 – 13:10	<b>T. Haga, S. Tsutsumi and E. Shima</b> ( <i>Japan Aerospace Exploration Agency (JAXA), Japan</i> ) Development of a Robust Flux Reconstruction Scheme for Launch Acoustics Simulation
13:10 – 13:30	<b>F. Vuillot, A. Langenais, J. Troyes, C. Peyret</b> ( <i>ONERA, France, University of Paris-Saclay, France</i> ) Two-Way Coupling between Flow and High-Order Non-linear Acoustic Unstructured Solvers: Application to Space Launcher Lift-off Acoustics
<b>13:30 – 14:30</b>	<b>Lunch</b>

<b>Afternoon Sessions (Thursday, 15 November 2018)</b>	
<b>14:30 – 15:15</b>	<b>Invited Lecture III: Philippe Spalart</b> (Boeing, USA): How does knowledge from DNS enter RANS models? <b>Chairperson: C. Rumsey</b> (NASA Langley, USA)
<b>15:15 – 16:55</b>	<b>Session 5: “From DNS to RANS including hybrid methods”</b> <b>Chairperson: P. Spalart</b> (Boeing, USA)
15:15 – 15:35	<b>W. Zhu, Z. Xiao, S. Fu</b> (Tsinghua University, Beijing, P.R. China) Improved delayed detached eddy simulation of jet installation effects
15:35 – 15:55	<b>P.-E. Weiss and S. Deck</b> (ONERA, France, Université Paris Saclay, France) ZDES-based methodologies for unsteady compressible flows around complex geometries
15:55 – 16:15	<b>S. Bosnyakov, S. Mikhaylov, V. Podaruev, A. Troshin, A. Wolkov</b> (Central Aerohydrodynamic Institute (TsAGI), Russia) Detached-Eddy Simulation of Dual Stream Nozzle Jet Using High Order Discontinuous Galerkin Method
16:15 – 15:35	<b>S. Jakirlić</b> (Technische Universität Darmstadt, Germany) RANS-based sub-scale modelling in eddy-resolving simulation methods
16.35 - 16:55	<b>C. Grabe, T. Knopp, S. Probst, M. Burnazzi, T. Landa, W. Breitenstein, P. Scholz, R. Radespiel, M. Strelets</b> (DLR Göttingen, Germany, Technische Universität Braunschweig, Germany, Saint-Petersburg Polytechnical University, Russia) A Strategy for RANS Turbulence Model Improvement
16:55 – 17:15	<b>Coffee</b>
<b>17:15 – 18:55</b>	<b>Session 6: Mini-symposium on: “Numerical methods and modelling for LES of complex flows”</b> <b>Chairperson: M.V. Salvetti</b> , (Uni Pisa, Italy)
17:15 – 17:35	<b>F. Bassi, A. Colombo, A. Crivellini, M. Franciolini, A. Ghidoni, G. Noventa</b> (Uni. Bergamo, Uni.i Politecnica delle Marche, Uni. Brescia, Italy) On the development of a p -adaptive Discontinuous Galerkin method for the accurate simulation of turbulent flows
17:35 – 17:55	<b>F. Bassi, A. Colombo, A. Ghidoni, F. Massa, G. Noventa</b> (Uni. Bergamo, Uni. Brescia, Italy) Implementation of a wall-distance-free composite RANS-LES model in a high-order implicit Discontinuous Galerkin solver
17:55 – 18:15	<b>G. Lodato, J.-B. Chapelier, B. Pinto</b> (Normandie University, INSA de Rouen, CNRS CORIA UMR6614, France, Purdue University, USA) A dynamic sub-grid scale modelling approach for discontinuous finite elements methods
18:15 – 18:35	<b>F. Naddei, M. de la Llave Plata, E. Lamballais</b> (ONERA, France) Development of a scale-partition adaptive DG-VMS method for large-eddy simulation of turbulence
18:35 – 18:55	<b>A. Cassinelli, D. Moxey, J. Peiró and S. J. Sherwin</b> (Imperial College London, UK, University of Exeter, UK) Spectral/hp element methods for under-resolved DNS: paving the way to industry-relevant simulations
<b>18:55</b>	<b>End of day 2</b>
<b>20:00</b>	<b>Dinner at: BELGA QUEEN Brussels, Rue Fossé aux loups 32, Wolvengracht . B-1000 Brussels</b>

<b>Morning Sessions (Friday, 16 November 2018)</b>	
<b>09:00 – 10:20</b>	<b>Session 7: “LES and DNS High-Fidelity computations - I”</b> <b>Chairperson: K. Hillewaert</b> (CENAERO, Belgium)
09:00 – 09:20	<b>A. Cimarelli, A. Leonforte and D. Angeli</b> (Cardiff University, UK and University Modena, Italy) Subgrid-scale modelling issues in separating and reattaching flows
09:20 – 09:40	<b>J. Lee, G. Xia, G. Kalitzin, G. Medic and O. Sharma</b> (United Technologies Research Center) Large-Eddy Simulation for Boundary-Layer Flows with Transverse Shear
09:40 – 10:00	<b>Z. Xie, Y. Yang, Z. Xiao</b> (China Aerodynamic Research and Development Center, Tsinghua University, China) Direct Numerical Simulation of Unsteady Flows Past an Expansion-Compression Corner
10:00 – 10:20	<b>P. Vincent, A. Iyer, F. Witherden, B. Vermeire, Y. Abe, R.-D. Baier, A. Jameson</b> , (Imperial College London, UK, Concordia University, UK, MTU Aero Engines, Germany, Stanford University, USA) High-Fidelity Scale-Resolving Simulations of Flow of Low-Pressure Turbine Blades
<b>10:20 – 10:40</b>	<b>Coffee</b>
<b>10:40 – 11:25</b>	<b>Invited Lecture IV : Maria Vittoria Salvetti</b> (Pisa University, Italy): Assessment of accuracy and reliability of LES for complex applications: deterministic vs. stochastic approaches <b>Chairperson: K. Hillewaert</b> (CENAERO, Belgium)
<b>11:25 – 12:25</b>	<b>Session 7: “LES and DNS High-Fidelity computations - II”</b> <b>Chairperson: K. Hillewaert</b> (CENAERO, Belgium)
11:25 – 11:45	<b>K. Hillewaert and M. Rasquin</b> (CENAERO, Belgium) DNS studies of a full span LP turbine cascade including end walls
11:45 – 12:05	<b>P. Schlatter</b> (KTH, Sweden) High fidelity simulations of turbulent boundary layers on flat and curved surfaces
12:05 – 12:25	<b>G. N. Coleman, C. L. Rumsey and P. R. Spalart</b> (NASA Langley Research Center, USA, Boeing Commercial Airplanes, USA) Direct Numerical Simulation of a Turbulent Separation Bubble with Sweep
<b>12:25 – 13:25</b>	<b>Lunch</b>

<b>Afternoon Sessions (Friday, 16 November 2018)</b>	
<b>13:25 – 14:10</b>	<b>Invited Lecture V: C. L. Rumsey</b> (NASA Langley, USA): Perspectives on RANS Modeling for Separated Flows <b>Chairperson: Francesco Bassi</b> (Bergamo University, Italy)
<b>14:10 – 16:30</b>	<b>Session 8 “Turbulence modelling for industrial applications”</b> <b>Chairperson: P.G. Tucker</b> (University of Cambridge, UK)
14:10 – 13:30	<b>S. Mouriaux, X. Garnaud, K. Hillewaert</b> (Safran Tech, France, CENAERO, Belgium) Evaluation of a Discontinuous Galerkin method for the Large Eddy Simulation of turbomachinery components
14:30 – 13:50	<b>P. Bechlars</b> (MTU Aero Engines AG, (Germany)) The bridge between fundamental turbulence research and turbulence models for industrial applications
14:50 – 15:10	<b>F. Chalot, P. Yser, J.-M. Hasholder, P.-E. Normand, S. Barre, M. Mallet</b> (Dassault Aviation, France) Scalable Industrial Variational Multi Scale Large Eddy Simulations with High-order Stabilized Continuous Finite Elements
15:10 – 15:30	<b>N. Ashton</b> (University of Oxford, UK) Application of hybrid RANS-LES methods for Formula-1 overtaking analysis
15:30 – 15:50	<b>Y. Ma, P. Tucker</b> (University of Cambridge, UK) High-fidelity Simulation with Filtered Geometry Modeling for Fan-intake Interaction
15:50 – 16:10	<b>M. Barad, E. Sozer, G.-D. Stich, J. Housman, F. Cadieux, and C. Kiris</b> (NASA Ames Research Center, USA) Launch, Ascent, and Vehicle Aerodynamics Scale-resolving Simulations for NASA Applications
16:10 – 16:30	<b>J. Kocheemoolayil, M. Barad, G. Stich, C. Kiris</b> (NASA Ames Research Center, USA) Towards NASA’s In-House Lattice-Boltzmann Solver
<b>16:30 – 16:40</b>	<b>Closing ceremony</b> by <b>C. Hirsch</b> (NUMECA, Belgium)
16:40	<b>Farewell Coffee</b>