

# Contents

## Keynote Lectures

|                                                                                                     |           |
|-----------------------------------------------------------------------------------------------------|-----------|
| <b>Some Characteristics of Non-Reacting and Reacting Low Swirl Number Jets .....</b>                | <b>1</b>  |
| <i>L. Fuchs</i>                                                                                     |           |
| <b>Inner-Outer Interactions in Wall-Bounded Turbulence .....</b>                                    | <b>3</b>  |
| <i>Javier Jiménez</i>                                                                               |           |
| <b>Turbulence Interaction with Atmospheric Physical Processes .....</b>                             | <b>15</b> |
| <i>Chin-Hoh Moeng, Jeffrey Weil</i>                                                                 |           |
| <b>LES of Pulsating Turbulent Flows over Smooth and Wavy Boundaries .....</b>                       | <b>25</b> |
| <i>A. Scotti, M. Gasser i Rubinat, E. Balaras</i>                                                   |           |
| <b>Numerical Study of Turbulence–Wave Interaction .....</b>                                         | <b>37</b> |
| <i>Lian Shen</i>                                                                                    |           |
| <b>High Reynolds Number Wall-Bounded Turbulence and a Proposal for a New Eddy-Based Model .....</b> | <b>51</b> |
| <i>Alexander J. Smits</i>                                                                           |           |

## Regular Papers

|                                                                                                  |           |
|--------------------------------------------------------------------------------------------------|-----------|
| <b>PANS Methodology Applied to Elliptic-Relaxation Based Eddy Viscosity Transport Model.....</b> | <b>63</b> |
| <i>Branislav Basara, Siniša Krajnović, Sharath Girimaji</i>                                      |           |
| <b>PIV Study of Turbulent Flow in Porous Media .....</b>                                         | <b>71</b> |
| <i>S. Bejatovic, M.F. Tachie, M. Agelichaab, S.S. Paul</i>                                       |           |

|                                                                                                                                                          |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>A Model for Dissipation: Cascade SDE with Markov Regime-Switching and Dirichlet Prior .....</b>                                                       | <b>79</b>  |
| <i>D. Bernard, A. Tossa, R. Emilion, S.K. Iyer</i>                                                                                                       |            |
| <b>Wavelet Analysis of the Turbulent LES Data of the Lid-Driven Cavity Flow .....</b>                                                                    | <b>87</b>  |
| <i>Roland Bouffanais, Guy Courbebaisse, Laurent Navarro, Michel O. Deville</i>                                                                           |            |
| <b>A Two-Phase LES Compressible Model for Plasma-Liquid Jet Interaction .....</b>                                                                        | <b>95</b>  |
| <i>Céline Caruyer, Stéphane Vincent, Erick Meillot, Jean-Paul Caltagirone</i>                                                                            |            |
| <b>Simulation of a Fluidized Bed Using a Hybrid Eulerian-Lagrangian Method for Particle Tracking .....</b>                                               | <b>103</b> |
| <i>Cédric Corre, Jean-Luc Estivalezes, Stéphane Vincent, Olivier Simonin, Stéphane Glockner</i>                                                          |            |
| <b>Wavelet-Adapted Sub-grid Scale Models for LES .....</b>                                                                                               | <b>111</b> |
| <i>J.A. Denev, C.J. Falconi, J. Fröhlich, H. Bockhorn</i>                                                                                                |            |
| <b>Effect of Particle-Particle Collisions on the Spatial Distribution of Inertial Particles Suspended in Homogeneous Isotropic Turbulent Flows .....</b> | <b>119</b> |
| <i>Pascal Fede, Olivier Simonin</i>                                                                                                                      |            |
| <b>Effect of Near-Wall Componental Modification of Turbulence on Its Statistical Properties .....</b>                                                    | <b>127</b> |
| <i>Bettina Frohnäpfel, Yosuke Hasegawa, Nobuhide Kasagi</i>                                                                                              |            |
| <b>Large-Eddy Simulation of Transonic Buffet over a Supercritical Airfoil .....</b>                                                                      | <b>135</b> |
| <i>E. Garnier, S. Deck</i>                                                                                                                               |            |
| <b>Large Eddy Simulation of Coherent Structures over Forest Canopy .....</b>                                                                             | <b>143</b> |
| <i>K. Gavrilov, G. Accary, D. Morvan, D. Lyubimov, O. Bessonov, S. Méradji</i>                                                                           |            |
| <b>Toroidal/Poloidal Modes Dynamics in Anisotropic Turbulence .....</b>                                                                                  | <b>151</b> |
| <i>Fabien S. Godeferd, Alexandre Delache, Claude Cambon</i>                                                                                              |            |
| <b>Grid Filter Modeling for Large-Eddy Simulation .....</b>                                                                                              | <b>159</b> |
| <i>Marc A. Habisreutinger, Roland Bouffanais, Michel O. Deville</i>                                                                                      |            |

|                                                                                                                                      |     |
|--------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Pulsating Flow through Porous Media</b> .....                                                                                     | 167 |
| <i>Michele Iervolino, Marcello Manna, Andrea Vacca</i>                                                                               |     |
| <b>Thermodynamic Fluctuations Behaviour during a Sheared Turbulence/Shock Interaction</b> .....                                      | 175 |
| <i>S. Jamme, M. Crespo, P. Chassaing</i>                                                                                             |     |
| <b>LES and DES Study of Fluid-Particle Dynamics in a Human Mouth-Throat Geometry</b> .....                                           | 183 |
| <i>S.T. Jayaraju, S. Verbanck, C. Lacor</i>                                                                                          |     |
| <b>Viscous Drag Reduction with Surface-Embedded Grooves</b> ...                                                                      | 191 |
| <i>Jovan Jovanović, Bettina Frohnäpfel, Antonio Delgado</i>                                                                          |     |
| <b>Study on the Resolution Requirements for DNS in Turbulent Rayleigh-Bénard Convection</b> .....                                    | 199 |
| <i>M. Kaczorowski, C. Wagner</i>                                                                                                     |     |
| <b>On the Role of Coherent Structures in a Lid Driven Cavity Flow</b> .....                                                          | 207 |
| <i>Benjamin Kadoch, Emmanuel Leriche, Kai Schneider, Marie Farge</i>                                                                 |     |
| <b>Local versus Nonlocal Processes in Turbulent Flows, Kinematic Coupling and General Stochastic Processes</b> .....                 | 215 |
| <i>Michael Kholmyansky, Vladimir Sabelnikov, Arkady Tsinober</i>                                                                     |     |
| <b>Time-Resolved 3D Simulation of an Aircraft Wing with Deployed High-Lift System</b> .....                                          | 223 |
| <i>Thilo Knacke, Frank Thiele</i>                                                                                                    |     |
| <b>Fluid Mechanics and Heat Transfer in a Channel with Spherical and Oval Dimples</b> .....                                          | 231 |
| <i>Nikolai Kornev, Johann Turnow, Egon Hassel, Sergei Isaev, Frank-Hendrik Wurm</i>                                                  |     |
| <b>Investigation of the Flow around a Cylinder Plate Configuration with Respect to Aerodynamic Noise Generation Mechanisms</b> ..... | 239 |
| <i>Michael Kornhaas, Dörte C. Sternel, Michael Schäfer</i>                                                                           |     |
| <b>LES of the Flow around Ahmed Body with Active Flow Control</b> .....                                                              | 247 |
| <i>Siniša Krajnović, Branislav Basara</i>                                                                                            |     |
| <b>Enhanced Bubble Migration in Turbulent Channel Flow by an Acceleration-Dependent Drag Coefficient</b> .....                       | 255 |
| <i>J.G.M. Kuerten, C.W.M. van der Geld, B.J. Geurts</i>                                                                              |     |

|                                                                                                                                |     |
|--------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Experimental and Numerical Study of Unsteadiness in Boundary Layer / Shock Wave Interaction</b> .....                       | 263 |
| <i>L. Larchevêque, P. Dupont, E. de Martel, E. Garnier, J.-F. Debiève</i>                                                      |     |
| <b>Measurement of Particle Accelerations with the Laser Doppler Technique</b> .....                                            | 271 |
| <i>H. Nobach, M. Kinzel, R. Zimmermann, C. Tropea, E. Bodenschätz</i>                                                          |     |
| <b>A Novel Numerical Method for Turbulent, Two-Phase Flow</b> .....                                                            | 279 |
| <i>A. Pecenko, J.G.M. Kuerten</i>                                                                                              |     |
| <b>Modeling of High Reynolds Number Flows with Solid Body Rotation or Magnetic Fields</b> .....                                | 287 |
| <i>Annick Pouquet, Julien Baerenzung, Jonathan Pietarila Graham, Pablo Mininni, Hélène Politano, Yannick Ponty</i>             |     |
| <b>Direct Numerical Simulation of Buoyancy Driven Turbulence inside a Cubic Cavity</b> .....                                   | 295 |
| <i>R. Puragliesi, A. Dehbi, E. Leriche, A. Soldati, M. Deville</i>                                                             |     |
| <b>Numerical Simulations of a Massively Separated Reactive Flow Using a DDES Approach for Turbulence Modelling</b> ....        | 303 |
| <i>Bruno Sainte-Rose, Nicolas Bertier, Sébastien Deck, Francis Dupoirieux</i>                                                  |     |
| <b>Particle Dispersion in Large-Eddy Simulations: Influence of Reynolds Number and of Subgrid Velocity Deconvolution</b> ..... | 311 |
| <i>Maria Vittoria Salvetti, Cristian Marchioli, Alfredo Soldati</i>                                                            |     |
| <b>Use of Lagrangian Statistics for the Direct Analysis of the Turbulent Constitutive Equation</b> .....                       | 319 |
| <i>François G. Schmitt, Ivana Vinkovic</i>                                                                                     |     |
| <b>Numerical Simulation of Supersonic Jet Noise with Overset Grid Techniques</b> .....                                         | 327 |
| <i>J. Schulze, J. Sesterhenn</i>                                                                                               |     |
| <b>Large Eddy Simulation of Turbulent Jet Flow in Gas Turbine Combustors</b> .....                                             | 337 |
| <i>Y. Shimada, B. Thornber, D. Drikakis</i>                                                                                    |     |
| <b>Computations of the Flow around a Wind Turbine: Grid Sensitivity Study and the Influence of Inlet Conditions</b> .....      | 345 |
| <i>R.Z. Szasz, L. Fuchs</i>                                                                                                    |     |
| <b>Stochastic Synchronization of the Wall Turbulence</b> .....                                                                 | 353 |
| <i>Sedat Tardu</i>                                                                                                             |     |

|                                                                                                                                                                       |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Large-Eddy Simulations of an Oblique Shock Impinging on a Turbulent Boundary Layer: Effect of the Spanwise Confinement on the Low-Frequency Oscillations .....</b> | <b>361</b> |
| <i>Emile Toubert, Neil D. Sandham</i>                                                                                                                                 |            |
| <b>Parameter-Free Symmetry-Preserving Regularization Modelling of Turbulent Natural Convection Flows .....</b>                                                        | <b>369</b> |
| <i>F.X. Trias, R.W.C.P. Verstappen, M. Soria, A. Oliva</i>                                                                                                            |            |
| <b>An <i>a Priori</i> Study for the Modeling of Subgrid Terms in Multiphase Flows .....</b>                                                                           | <b>377</b> |
| <i>P. Trontin, S. Vincent, J.L. Estivalezes, J.P. Caltagirone</i>                                                                                                     |            |
| <b>Computation of Flow in a 3D Diffuser Using a Two-Velocity Field Hybrid RANS/LES .....</b>                                                                          | <b>385</b> |
| <i>J.C. Uribe, A. Revell, C. Moulinec</i>                                                                                                                             |            |
| <b>On the Dynamics of High Reynolds Number Turbulent Axisymmetric and Plane Separating/Reattaching Flows .....</b>                                                    | <b>393</b> |
| <i>Pierre-Élie Weiss, Sébastien Deck, Jean-Christophe Robinet, Pierre Sagaut</i>                                                                                      |            |
| <b>Numerical Simulation and Statistical Modeling of Inertial Droplet Coalescence in Homogeneous Isotropic Turbulence .....</b>                                        | <b>401</b> |
| <i>Dirk Wunsch, Pascal Fede, Olivier Simonin, Philippe Villedieu</i>                                                                                                  |            |
| <b>Gas-Phase Mixing in Droplet Arrays .....</b>                                                                                                                       | <b>409</b> |
| <i>M.R.G. Zoby, S. Navarro-Martinez, A. Kronenburg, A.J. Marquis</i>                                                                                                  |            |
| <b>Author Index .....</b>                                                                                                                                             | <b>417</b> |