Progress in Engineering Turbulence Modelling and Measurement

Hickel, Stefan; Salvetti, Maria Vittoria; Rodriguez, Ivette; Lehmkuhl, Oriol

DOI
10.1007/s10494-025-00657-4

Publication date
2025

Document Version
Final published version

Published in
Flow, Turbulence and Combustion

Citation (APA)
Hickel, S., Salvetti, M. V., Rodriguez, I., & Lehmkuhl, O. (2025). Progress in Engineering Turbulence Modelling and Measurement. *Flow, Turbulence and Combustion*, *115*(1), 1-2. https://doi.org/10.1007/s10494-025-00657-4

Important note
To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Flow, Turbulence and Combustion (2025) 115:1–2
https://doi.org/10.1007/s10494-025-00657-4

EDITORIAL

Progress in Engineering Turbulence Modelling and Measurement

Stefan Hickel[1] · Maria Vittoria Salvetti[2] · Ivette Rodriguez[3] · Oriol Lehmkuhl[4]

Published online: 22 April 2025

This special issue features 15 articles selected from presentations at the 14th ERCOFTAC Symposium on Engineering Turbulence Modelling and Measurements (ETMM14), held in Barcelona from September 6 to 8, 2023. Since its inception in 1990, ETMM – organized by the European Research Community on Flow, Turbulence and Combustion (ERCOFTAC) – has been a leading forum for advancing knowledge in flow, turbulence, and combustion. By bringing together experts from industry and academia, it effectively bridges fundamental research and practical applications, fostering innovation across disciplines.

We firmly believe that the discussions and knowledge exchange at ETMM14 have further strengthened international cooperation in turbulence research, particularly in engineering applications involving complex physical phenomena. With about 200 presentations the symposium addressed a broad spectrum of multiphysics challenges – including turbulent flows, heat and mass transfer, combustion, phase change, and multiphase transport – reinforcing its role in shaping the future of the field.

In addition to regular parallel sessions, the conference featured seven invited keynote lectures delivered by renowned experts in experimental and computational turbulence research, as well as seven mini-symposia dedicated to topics from turbulence modeling and experimental techniques to advanced symmetry-preserving numerical methods, data-driven approaches, aerodynamics, reactive flows, and industrial applications.The articles in this issue reflect the breath of research presented at ETMM14, encompassing both fundamental and applied aspects of turbulence research.

Experimental techniques are represented through studies on time-averaged Magnetic Resonance Velocimetry (MRV) for CFD validation in a rod bundle benchmark and the effect of hot-wire length on streamwise velocity fluctuation attenuation in canonical and non-

✉ Stefan Hickel
S.Hickel@tudelft.nl

1 Delft University of Technology, Delft, The Netherlands

2 University of Pisa, Pisa, Italy

3 Universitat Politècnica de Catalunya, Barcelona, Spain

4 Barcelona Supercomputing Center, Barcelona, Spain

canonical turbulent boundary layers. Large-Eddy Simulations (LES) have been applied to various engineering problems, including buoyant flow in a thermal energy storage tank, flow past a three-element high-lift wing, passive control of shock-wave boundary-layer interactions, and the transition to turbulence in a compressible boundary layer. Hybrid Reynolds-Averaged Navier-Stokes (RANS)-LES models are addressed by proposing an extension that includes variable-resolution terms and by exploring different strategies to reduce grid-resolution requirements in aeronautical applications. Emerging topics, such as the application of machine-learning techniques for flow control, are also explored in this issue, highlighting advancements in data-driven approaches for optimizing drag reduction. Further contributions focus on LES and Direct Numerical Simulations (DNS) applied to two-phase flows and combustion processes. These include the development of an Eulerian-Lagrangian framework based on the Volume-Of-Fluid (VOF) approach for LES of liquid jet atomization, LES studies on autoignition and flame propagation, multi-cycle DNS simulations of a laboratory-scale engine at technically relevant speeds, and DNS of a lean n-octanol-ethanol fuel blend under Reactivity Controlled Compression Ignition (RCCI) conditions. Finally, advancements in numerical modeling are also represented through significant contributions such as a new numerical model for scale-resolving simulations and an analysis of temporal errors in time integration schemes for incompressible turbulent flows.

Together, these studies highlight the latest developments in turbulence research, experimental validation techniques, high-fidelity simulations, and numerical modeling approaches, reinforcing their importance in advancing both theoretical understanding and engineering applications.

All manuscripts in this special issue underwent a rigorous peer-review process, meeting the high standards of Flow, Turbulence and Combustion (FTaC). We express our sincere gratitude to all authors and reviewers for their invaluable contributions. We also hope this special issue serves as a valuable resource for researchers and practitioners, promoting scientific exchange and strengthening collaborations within the research community.