ERCOFTAC Series

Volume 25

Aims and Scope of the Series

ERCOFTAC (European Research Community on Flow, Turbulence and Combustion) was founded as an international association with scientific objectives in 1988. ERCOFTAC strongly promotes joint efforts of European research institutes and industries that are active in the field of flow, turbulence and combustion, in order to enhance the exchange of technical and scientific information on fundamental and applied research and design. Each year, ERCOFTAC organizes several meetings in the form of workshops, conferences and summerschools, where ERCOFTAC members and other researchers meet and exchange information.

The ERCOFTAC Series will publish the proceedings of ERCOFTAC meetings, which cover all aspects of fluid mechanics. The series will comprise proceedings of conferences and workshops, and of textbooks presenting the material taught at summerschools.

The series covers the entire domain of fluid mechanics, which includes physical modelling, computational fluid dynamics including grid generation and turbulence modelling, measuring-techniques, flow visualization as applied to industrial flows, aerodynamics, combustion, geophysical and environmental flows, hydraulics, multiphase flows, non-Newtonian flows, astrophysical flows, laminar, turbulent and transitional flows.

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Direct and Large-Eddy Simulation XI

Springer

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ISSN 1382-4309 ISSN 2215-1826 (electronic)
ERCOFTAC Series
ISBN 978-3-030-04914-0 ISBN 978-3-030-04915-7 (eBook)
https://doi.org/10.1007/978-3-030-04915-7

Library of Congress Control Number: 2018962385

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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Preface

The DLES Workshop series, which started in 1994, focuses on modern techniques to simulate turbulent flows based on the partial or full resolution of the instantaneous turbulent flow structures, as Direct Numerical Simulation (DNS), Large-Eddy Simulation (LES), or hybrid models based on a combination of LES and RANS approaches.

With the growing capacities of modern computers, these approaches have been gaining more and more interest over the years. Significant progress has been made in computational techniques as well as in subgrid scale (SGS) modeling. In parallel, these approaches are applied to more and more complex flow problems and configurations, both in academic and industrial contexts, and they will undoubtedly be further enhanced and applied in the future. Nonetheless, open problems and challenges still remain. The increasing complexity of the simulated problems and the use of turbulence resolving approaches in an engineering context require the development of numerical methods being accurate but at the same time able to deal with complex geometries and/or with physical phenomena interacting with turbulence, e.g., particle/droplet dispersion, combustion, or heat transfer. At the same time, physical models must be developed, improved, and validated for the increasing complexity and variety of applications. Validation is indeed a crucial issue for LES and hybrid simulations, since different sources of errors may be present (numerics, boundary conditions, closure models) and these errors may interact in a complicated way. Moreover, systematic sensitivity studies to computational or modeling parameters are difficult to be carried out because of the large cost of each single simulation. On the other hand, the availability of more and more DNS data sets provides a detailed and accurate reference to validate the other approaches and to guide in the development of physical models.

The goal of the workshop series is to establish a state-of-the-art of DNS, LES, and related techniques for the computation and modeling of turbulent and transitional flows and to provide an opportunity for discussions about recent advances and applications.

The 11th edition of the bi-annual Workshop series on Direct and Large-Eddy Simulation (DLES11) was held in Pisa, Italy on May 29–31, 2017. A record number of 140 participants from 17 different countries attended this 3-day workshop. The majority of participants was from academia and research institutes, but several companies were also represented. Eight keynote lectures were given by experts in different scientific fields: extreme scale direct numerical simulations of turbulent combustion (Jacqueline Chen, Sandia National Laboratories, USA), modulation and control of jets and flames (Arthur Tyliszczak, University of Czestochowa, Poland), ocean modeling and idealized DNS applied to rotating and stratified flows (Beth Wingate, University of Exeter, UK), direct numerical simulations of fluid–structure interaction in biological flows (Marco De Tullio, Politecnico di Bari, Italy), simulation and control of wind farms by means of large-eddy simulation (Johan Meyers, Katholieke Universiteit Leuven, Belgium), new insight on how roughness affects the dynamics of turbulence (Ugo Piomelli, Queen's University, Kingston, Canada), applications of DNS and LES to multiphase flows of industrial interest (Djamel Lakehal, ASCOMP, Switzerland), and direct numerical simulations of particulate flows (Markus Uhlmann, Karlsruhe Institute of Technology, Germany).

Next to the invited lectures, 114 oral and poster presentations were selected by a Scientific Committee of 28 experts. This volume contains most of the contributed papers, which were submitted and further reviewed for publication. They cover advances in computational techniques, SGS modeling, boundary conditions, post-processing and data analysis, and applications in several fields, namely, multiphase and reactive flows, convection and heat transfer, compressible flows, aerodynamics of airfoils and wings, bluff-body and separated flows, internal flows and wall turbulence, and other complex flows.

The organization of DLES11 and the preparation of these proceedings would not have been possible without the help of many. Funding from ERCOFTAC (SIG1) enabled the participation of Ph.D. students to DLES11 to be supported. J. M. Burgerscentrum and University of Pisa are also gratefully acknowledged for their support. Finally, thanks go to the members of the Scientific Committee for their help in reviewing the submitted abstracts and the contributions to the proceedings.

Pisa, Italy
March 2018

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