Preface

More than half a century has passed after the pioneering work on atmospheric circulation predictions by Joseph Smagorinsky who established the scientific foundations of Large Eddy Simulations. Almost thirty years later, in 1994, the first international Workshop devoted to Direct and Large Eddy Simulations, DLES1 was hosted at the University Of Surrey. The success of the first ERCOFTAC DLES1 (European Research Community On Flow, Turbulence and Combustion) initiated a series of biannual DLES events. During these years—even with the most conservative estimates—the computing power has increased by at least two orders of magnitude. This continuing progress motivated and inspired researchers to apply DNS and LES to ever more challenging flows at ever higher Reynolds numbers, including multiple physical phenomena.

The present volume contains the proceedings of the 10th ERCOFTAC Workshop on Direct and Large Eddy Simulation, DLES10, which was hosted by the Department of Mechanical and Manufacturing Engineering of the University of Cyprus, 27–29 May 2015 in Limassol, Cyprus. The main goal of the workshop was to discuss state-of-the-art DNS, LES and related techniques for the computation and modelling of turbulent and transitional flows. We hope that this volume, together with the expected advances in computational power, will motivate further developments in turbulent flow predictions and shed more light on this main problem of fluid mechanics.

The gathering at DLES10 of specialists in the field offered a unique opportunity to the participants to exchange ideas and discuss in a fruitful manner recent advances on the partial or full resolution of instantaneous turbulent flow and its statistical aspects. A total of 85 people participated from twenty different countries and three different continents, including seven invited speakers and 37 PhD students who were kindly financially supported by the European Research Community on Flow, Turbulence and Combustion, ERCOFTAC.

The broad range of featured topics for the 10th edition of DLES in Cyprus were as follows: LES fundamentals and modelling, quality of LES, numerical techniques, heat and mass transfer, biological flows, multiphase flows, industrial applications, environmental and geophysical applications as well as reacting flows and

combustion. Based on the submitted contributions, the scientific program was divided into two parallel sessions of oral presentations covering the three days of the workshop. Following the workshop schedule, the material contained in this volume is organized in nine basic thematic areas. The thematic framework of the entire workshop was established by keynote presentations delivered by the invited speakers. Following the increasing interest on the assessment of the quality and reliability of LES results, Prof. Maria Vittoria Salvetti (University of Pisa) presented counter-intuitive results for cases where increased numerical resolution could lead to the deterioration of accuracy. Assoc. Prof. Elisabetta De Angelis (University of Bologna) highlighted improvements of modelling subgrid-stresses in LES based on the energy transfer phenomena in turbulent flows. Professor Elias Balaras (The George Washington University) presented interesting numerical methodologies applied to biological flows with applications in biology, physiology, animal locomotion and bio-prosthetic devices. Dr. Ruud L.G.M. Eggels (Rolls-Royce Deutschland Ltd & Co KG) focused on the role of CFD for the design process of aero engines, spray-modelling, combustion and emissions processes. The need for further developments on modelling the mechanisms of spray break-up and soot prediction was also demonstrated. Professor Dominique Thévenin (University of Magdeburg) discussed the connection between DNS, LES and POD for a variety of transition-related applications. Three main issues were presented in detail: the efficient implementation of—reacting or not—dispersed particles or droplets in DNS, the impact of the disperse phase on the turbulence properties and transition and the possibility of quantifying transition to turbulence using a POD analysis. Professor Maarten Van Reeuwijk (Imperial College London) demonstrated the state of the art for Direct and Large Eddy Simulation of atmospheric boundary layers, with emphasis on turbulent entrainment and stratification effects. Professor Richard D. Sandberg (University of Southampton) presented challenging DNS investigations of compressible flows in realistic configurations for problems related to turbomachinery and aeroacoustics. Impressive results were presented for the significance of various noise sources in a pipe-jet configuration, the flow through a linear high-pressure turbine cascade and the sensitivity of low-pressure turbines to inflow disturbances.

The organization of DLES10 and the preparation of the present volume are the outcome of an international team effort. The local organizers would like first of all to acknowledge the support of ERCOFTAC, as the main sponsor of the event. We are also grateful for the contributions of The University of Cyprus, the J.M. Burgerscentrum (JMBC) and the Cypriot Tourism Organization. Last but not least, the organizers also gratefully acknowledge all participating scientists for providing valuable contributions and all members of the Scientific Committee of DLES10 for their efforts to complete the review process of the submitted contributions.

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Dimokratis G.E. Grigoriadis
Bernard J. Geurts
Hans Kuerten
Jochen Fröhlich
Vincenzo Armenio

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