

Preface

Simulation of turbulent flow by means of direct numerical simulation (DNS) and large-eddy simulation (LES) started almost fifty years ago. Probably the earliest paper on the application of LES was by Smagorinsky in the March 1963 issue of *Monthly Weather Review*. Although Smagorinsky did not mention the term large-eddy simulation explicitly, he proposed a model to represent the effects of small-scale eddies on the large-scale dynamics of the flow, which was treated explicitly. Smagorinsky applied his now famous model to the simulation and study of the dynamics of the general circulation in the earth's atmosphere.

Direct numerical simulation of wall-bounded flows started some twenty years later with the well-known 1987 paper in the *Journal of Fluid Mechanics* by Kim, Moin and Moser on DNS of turbulent channel flow at a bulk Reynolds number of 3300. Although DNS had been applied before on homogeneous, isotropic turbulence and some preliminary studies on under-resolved channel flow had been performed, this paper presented the first fully resolved DNS of a wall-bounded turbulent flow. The large number of citations reported on Web of Science proves the tremendous impact both papers had and still have on research in turbulence.

The continuing growth of computational power has increasingly stimulated the usage of DNS and LES, since LES and in some applications even DNS can now be used as a design tool for several practical and industrial problems. This is reflected by the possibility of CFD software packages to perform LES, although this should still be treated with care. On the other hand, for flow in simple geometries, such as channel flow, DNS has been extended to higher and higher Reynolds numbers, which brings the study of fundamental properties of turbulent flow at large Reynolds numbers within reach. These examples highlight the two major reasons for usage of DNS and LES: application-driven research and fundamental research into the nature of turbulence and into turbulence models.

The history of this research over the past two decades can well be grasped from the contents of the ERCOFTAC series of Workshops on Direct and Large-Eddy Simulation. This series started in 1994 and, with intervals of approximately two years, has led to the eighth DLES workshop organized at Eindhoven University of Technology in July 2010. Like the previous editions, this workshop has been formatted

around approximately ten invited contributions in different areas of DNS and LES, ranging from fundamental properties to industrial applications and treating various application areas, such as two-phase flow, environmental flow and combustion. Around 70 of the submitted abstracts have been selected for oral presentation during the workshop.

Most of the invited and contributed papers have been submitted to be included in the Proceedings of DLES8 and after a careful review procedure most of them can be found in this volume. The papers are grouped in themes, with slight re-ordering compared to the program of the workshop. The contributions provide a broad overview of the most important current issues and application areas of DNS and LES. Fundamental issues related to the usage of LES and the development of subgrid models are still an important research topic. Contributions to this topic can be found in the first two parts of the Proceedings on fundamentals and on methodologies and modeling techniques. These two parts also contain contributions on fundamental studies of turbulent flow and on numerical issues, such as novel numerical techniques.

During the workshop two special sessions were held. One centered around Lagrangian turbulence and had been planned long before the start of the workshop. The other was a result of the submitted abstracts. It appeared that the number of abstracts on Rayleigh-Bénard flow justified a special session devoted to this topic. The contributions in the session on Lagrangian turbulence were regrouped in Part III on multiphase flow, together with more general contributions on two-phase flow. The contributions on Rayleigh-Bénard flow were allocated a separate part in the Proceedings. The remaining three parts of the Proceedings are devoted to the application areas environmental flows, compressible and reactive flows and industrial applications. Each of these application areas was discussed by an invited presentation as well.

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