



ERCOTAC SERIES

Direct and Large Eddy Simulation II

Edited by Jean-Pierre Chollet, Peter R. Voke
and Leonhard Kleiser

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Direct And Large Eddy Simulation Ii Ercoftac Series

Guillaume Favre



Direct And Large Eddy Simulation II Ercoftac Series:

Direct and Large-Eddy Simulation II Jean-Pierre Chollet, Peter R. Voke, Leonhard Kleiser, 2012-12-06 Progress in the numerical simulation of turbulence has been rapid in the 1990s. New techniques both for the numerical approximation of the Navier-Stokes equations and for the subgrid-scale models used in large eddy simulation have emerged and are being widely applied for both fundamental and applied engineering studies along with novel ideas for the performance and use of simulation for compressible chemically reacting and transitional flows. This collection of papers from the second ERCOFTAC Workshop on Direct and Large Eddy Simulation held in Grenoble in September 1996 presents the key research being undertaken in Europe and Japan on these topics. Describing in detail the ambitious use of DNS for fundamental studies and of LES for complex flows of potential and actual engineering importance, this volume will be of interest to all researchers active in the area.

Direct and Large-Eddy Simulation V Rainer Friedrich, Bernard Geurts, Olivier Métais, 2004-04-30 The fifth ERCOFTAC workshop Direct and Large Eddy Simulation 5 DLES 5 was held at the Munich University of Technology August 27-29 2003. It is part of a series of workshops that originated at the University of Surrey in 1994 with the intention to provide a forum for presentation and discussion of recent developments in the field of direct and large eddy simulation. Over the years the DLES series has grown into a major international venue focussed on all aspects of DNS and LES but also on hybrid methods like RANS/LES coupling and detached eddy simulation designed to provide reliable answers to technical flow problems at reasonable computational cost. DLES 5 was attended by 111 delegates from 15 countries. Its three-day programme covered ten invited lectures and 63 original contributions partially presented in parallel sessions. The workshop was financially supported by the following companies, institutions and organizations: ANSYS Germany GmbH, AUDI AG, BMW Group, ERCOFTAC, FORTVER, Bavarian Research Association on Combustion, JM BURGERS CENTRE for Fluid Dynamics. Their help is gratefully acknowledged. The present Proceedings contain the written versions of nine invited lectures and fifty-nine selected and reviewed contributions which are organized in four parts: 1. Issues in LES modelling and numerics; 2. Laminar-turbulent transition; 3. Turbulent flows involving complex physical phenomena; 4. Turbulent flows in complex geometries and in technical applications.

Direct and Large Eddy Simulation of Turbulence II Jean-Pierre Chollet, Peter R.

Voke, Leonhard Kleiser, 1997 *Quality and Reliability of Large-Eddy Simulations II* Maria Vittoria Salvetti, Bernard Geurts, Johan Meyers, Pierre Sagaut, 2010-11-03 The second Workshop on Quality and Reliability of Large Eddy Simulations QLES2009 was held at the University of Pisa from September 9 to September 11 2009. Its predecessor QLES2007 was organized in 2007 in Leuven, Belgium. The focus of QLES2009 was on issues related to predicting, assessing and assuring the quality of LES. The main goal of QLES2009 was to enhance the knowledge on error sources and on their interaction in LES and to devise criteria for the prediction and optimization of simulation quality by bringing together mathematicians, physicists and engineers and providing a platform specifically addressing these aspects for LES. Contributions were made by leading

experts in the field The present book contains the written contributions to QLES2009 and is divided into three parts which reflect the main topics addressed at the workshop i SGS modeling and discretization errors ii Assessment and reduction of computational errors iii Mathematical analysis and foundation for SGS modeling

Direct and Large Eddy Simulation XII Manuel García-Villalba, Hans Kuerten, Maria Vittoria Salvetti, 2020-05-09 This book gathers the proceedings of the 12th instalment in the bi annual Workshop series on Direct and Large Eddy Simulation DLES which began in 1994 and focuses on modern techniques used to simulate turbulent flows based on the partial or full resolution of the instantaneous turbulent flow structure With the rapidly expanding capacities of modern computers this approach has attracted more and more interest over the years and will undoubtedly be further enhanced and applied in the future Hybrid modelling techniques based on a combination of LES and RANS approaches also fall into this category and are covered as well The goal of the Workshop was to share the state of the art in DNS LES and related techniques for the computation and modelling of turbulent and transitional flows The respective papers highlight the latest advances in the prediction understanding and control of turbulent flows in academic and industrial applications

Direct and Large-Eddy Simulation VIII Hans Kuerten, Bernard Geurts, Vincenzo Armenio, Jochen Fröhlich, 2011-10-05 This volume continues previous DLES proceedings books presenting modern developments in turbulent flow research It is comprehensive in its coverage of numerical and modeling techniques for fluid mechanics After Surrey in 1994 Grenoble in 1996 Cambridge in 1999 Enschede in 2001 Munich in 2003 Poitiers in 2005 and Trieste in 2009 the 8th workshop DLES8 was held in Eindhoven The Netherlands again under the auspices of ERCOFTAC Following the spirit of the series the goal of this workshop is to establish a state of the art of DNS and LES techniques for the computation and modeling of transitional turbulent flows covering a broad scope of topics such as aerodynamics acoustics combustion multiphase flows environment geophysics and bio medical applications This gathering of specialists in the field was a unique opportunity for discussions about the more recent advances in the prediction understanding and control of turbulent flows in academic or industrial situations

Direct and Large-Eddy Simulation X Dimokratis G.E. Grigoriadis, Bernard J. Geurts, Hans Kuerten, Jochen Fröhlich, Vincenzo Armenio, 2017-10-06 This book addresses nearly all aspects of the state of the art in LES DNS of turbulent flows ranging from flows in biological systems and the environment to external aerodynamics domestic and centralized energy production combustion propulsion as well as applications of industrial interest Following the advances in increased computational power and efficiency several contributions are devoted to LES DNS of challenging applications mainly in the area of turbomachinery including flame modeling combustion processes and aeroacoustics The book includes work presented at the tenth Workshop on Direct and Large Eddy Simulation DLES 10 which was hosted in Cyprus by the University of Cyprus from May 27 to 29 2015 The goal of the workshop was to establish a state of the art in DNS LES and related techniques for the computation and modeling of turbulent and transitional flows The book is of interest to scientists and engineers both in the early stages of their career and

at a more senior level **Direct and Large-Eddy Simulation XI** Maria Vittoria Salvetti, Vincenzo Armenio, Jochen Fröhlich, Bernard J. Geurts, Hans Kuerten, 2019-02-02 This book gathers the proceedings of the 11th workshop on Direct and Large Eddy Simulation DLES which was held in Pisa Italy in May 2017 The event focused on modern techniques for simulating 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 In light of the growing capacities of modern computers these approaches have been gaining more and more interest over the years and will undoubtedly be developed and applied further The workshop offered a unique opportunity 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 discuss about recent advances and applications 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 **Direct and Large-Eddy Simulation IX** Jochen Fröhlich, Hans Kuerten, Bernard J. Geurts, Vincenzo Armenio, 2015-01-27 This volume reflects the state of the art of numerical simulation of transitional and turbulent flows and provides an active forum for discussion of recent developments in simulation techniques and understanding of flow physics Following the tradition of earlier DLES workshops these papers address numerous theoretical and physical aspects of transitional and turbulent flows At an applied level it contributes to the solution of problems related to energy production transportation magneto hydrodynamics and the environment A special session is devoted to quality issues of LES The ninth Workshop on Direct and Large Eddy Simulation DLES 9 was held in Dresden April 3 5 2013 organized by the Institute of Fluid Mechanics at Technische Universität Dresden This book is of interest to scientists and engineers both at an early level in their career and at more senior levels Direct and Large-Eddy Simulation VII Vincenzo Armenio, Bernard Geurts, Jochen Fröhlich, 2010-04-28 After Surrey in 1994 Grenoble in 1996 Cambridge in 1999 Enschede in 2001 Munich in 2003 and Poitiers in 2005 the 7th Workshop DLES7 will be held in Trieste again under the auspices of ERCOFTAC Following the spirit of the series the goal of this latest workshop is to establish a state of the art of DNS and LES techniques for the computation and modeling of transitional turbulent flows covering a broad scope of topics such as aerodynamics acoustics combustion multiphase flows environment geophysics and bio medical applications This gathering of specialists in the field should once again be a unique opportunity for discussions about the more recent advances in the prediction understanding and control of turbulent flows in academic or industrial situations **Direct and Large-Eddy Simulation I** Peter R. Voke, Leonhard Kleiser, Jean-Pierre Chollet, 2012-12-06 It is a truism that turbulence is an unsolved problem whether in scientific engineering or geophysical terms It is strange that this remains largely the case even

though we now know how to solve directly with the help of sufficiently large and powerful computers accurate approximations to the equations that govern turbulent flows. The problem lies not with our numerical approximations but with the size of the computational task and the complexity of the solutions we generate which match the complexity of real turbulence precisely in so far as the computations mimic the real flows. The fact that we can now solve some turbulence in this limited sense is nevertheless an enormous step towards the goal of full understanding. Direct and large eddy simulations are these numerical solutions of turbulence. They reproduce with remarkable fidelity the statistical structural and dynamical properties of physical turbulent and transitional flows though since the simulations are necessarily time dependent and three dimensional they demand the most advanced computer resources at our disposal. The numerical techniques vary from accurate spectral methods and high order finite differences to simple finite volume algorithms derived on the principle of embedding fundamental conservation properties in the numerical operations. Genuine direct simulations resolve all the fluid motions fully and require the highest practical accuracy in their numerical and temporal discretisation. Such simulations have the virtue of great fidelity when carried out carefully and represent a most powerful tool for investigating the processes of transition to turbulence.

Closure Strategies for Turbulent and Transitional Flows Brian Edward Launder, N. D.

Sandham, 2002-02-21 Publisher Description [Direct and Large-Eddy Simulation VI](#) Eric Lamballais, Rainer

Friedrich, Bernard J. Geurts, Olivier Métais, 2006 **Direct and Large-Eddy Simulation VI** E. Lamballais, Rainer

Friedrich, Bernard J. Geurts, Olivier Métais, 2006-10-19 The sixth ERCOFTAC Workshop on Direct and Large Eddy Simulation DLES 6 was held at the University of Poitiers from September 12-14 2005. Following the tradition of previous workshops in the DLES series this edition has reflected the state of the art of numerical simulation of transitional and turbulent flows and provided an active forum for discussion of recent developments in simulation techniques and understanding of flow physics.

[IUTAM Symposium on Transformation Problems in Composite and Active Materials](#) Yehia A. Bahei-El-Din, George J.

Dvorak, 2006-04-11 The field of composite materials has seen substantial development in the past decade. New composite systems are being continually developed for various applications. Among such systems are metal intermetallic and superalloy matrix composites, carbon-carbon composites as well as polymer matrix composites. At the same time a new discipline has emerged of active or smart materials which are often constructed as composite or heterogeneous media and structures. One unifying theme in these diverse systems is the influence that uncoupled and coupled eigenfields or transformation fields exert on the various types of overall response as well as on the respective phase responses. Problems of this kind are currently considered by different groups which may not always appreciate the similarities of the problems involved. The purpose of the IUTAM Symposium on Transformation Problems in Composite and Active Materials held in Cairo, Egypt from March 10 to 12 1997 was to bring together representatives of the different groups so that they may interact and explore common aspects of these seemingly different problem areas. New directions in micromechanics research in both composite and active materials

were also explored in the symposium. Specifically invited lectures in the areas of inelastic behavior of composite materials, shape memory effects, functionally graded materials, transformation problems in composite structures and adaptive structures were delivered and discussed during the three day meeting. This book contains the printed contributions to the IUTAM Symposium *Advances in the Mechanics of Plates and Shells* D. Durban, Dan Givoli, J.G. Simmonds, 2006-04-11. The optimal control of flexible structures is an active area of research. The main body of work in this area is concerned with the control of time dependent displacements and stresses and assumes linear elastic conditions namely linear elastic material behavior and small deformation. See e.g. 1-3 the collections of papers 4-5 and references therein. On the other hand in the present paper we consider the static optimal control of a structure made of a nonlinear elastic material and undergoing large deformation. An important application is the suppression of static or quasi static elastic deformation in flexible space structures such as parts of satellites by the use of control loads. 6 Solar radiation and radiation from other sources induce a temperature field in the structure which in turn generates an elastic displacement field. The displacements must usually satisfy certain limitations dictated by the allowed working conditions of various orientation sensitive instruments and antennas in the space vehicle. For example a parabolic reflector may cease to be effective when undergoing large deflection. The elastic deformation can be reduced by use of control loads which may be implemented via mechanically based actuators or more modern piezoelectric devices. When the structure under consideration is made of a rubber like material and is undergoing large deformation nonlinear material and geometric effects must be taken into account in the analysis. IUTAM Symposium on Nonlinearity and Stochastic Structural Dynamics S. Gummadi, R.N. Iyengar, 2012-12-06. Nonlinearity and stochastic structural dynamics is of common interest to engineers and applied scientists belonging to many disciplines. Recent research in this area has been concentrated on the response and stability of nonlinear mechanical and structural systems subjected to random excitation. Simultaneously the focus of research has also been directed towards understanding intrinsic nonlinear phenomena like bifurcation and chaos in deterministic systems. These problems demand a high degree of sophistication in the analytical and numerical approaches. At the same time they arise from considerations of nonlinear system response to turbulence, earthquake, wind wave and guidance excitations. The topic thus attracts votaries of both analytical rigour and practical applications. This book gives important and latest developments in the field presenting in a coherent fashion the research findings of leading international groups working in the area of nonlinear random vibration and chaos. **Environment, Energy and Climate Change II** Gilles Lefebvre, Elena Jiménez, Beatriz Cabañas, 2015-10-06. This volume provides a comprehensive overview of advanced research in the field of efficient clean and renewable energy production, conversion and storage. The ten chapters written by internationally respected experts address the following topics: 1 solar and wind energy, 2 energy storage in batteries, 3 biomass and 4 socio economic aspects of energy. Given its multidisciplinary approach which combines environmental analysis and an engineering perspective the book offers a valuable resource for all researchers and

students interested in environmentally sustainable energy production conversion storage and its engineering Unsteady Effects of Shock Wave induced Separation Piotr Doerffer, Charles Hirsch, Jean-Paul Dussauge, Holger Babinsky, George N. Barakos, 2010-11-25 This volume contains description of experimental and numerical results obtained in the UFAST project The goal of the project was to generate experiment data bank providing unsteady characteristics of the shock boundary layer interaction The experiments concerned basic reference cases and the cases with application of flow control devices Obtained new data bank have been used for the comparison with available simulation techniques starting from RANS through URANS LES and hybrid RANS LES methods New understanding of flow physics as well as ability of different numerical methods in the prediction of such unsteady flow phenomena will be discussed **IUTAM Symposium on Segregation in Granular Flows** Anthony D. Rosato, Denis L. Blackmore, 2013-04-17 Segregation is a pervasive phenomenon whereby a flowing granular mass consisting of particles with diverse physical properties becomes spatially inhomogeneous In the industrial sector that deals with the handling and processing of bulk solids this non uniformity is highly undesirable since blend homogeneity is generally a stringent requirement of most products In the arena of geophysical flows segregation can enhance the destructive capabilities of natural events such as avalanches and landslides During the last 15 years these issues have provided motivation and fostered collaborations between the communities of mathematicians engineers industrial researchers and physicists to develop predictive models of segregation by integrating the perspectives and approaches of each The collection of unique papers brings to light many of the perplexing scientific and technical issues in our current understanding of this complex phenomenon It addresses advances in experiment computational modeling and theory This volume is one of the very few books devoted entirely to problems of segregation of particulate solids

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