

**NOTES ON NUMERICAL FLUID  
MECHANICS · VOLUME 75**

# **Numerical Flow Simulation II**

CNRS-DFG Collaborative Research  
Programmes Results  
1998 – 2000

by Ernst Heinrich Hirschel (Ed.)



**Springer**

# Numerical Flow Simulation Ii Cnrsdfg Collaborative Research Programme Results 1998

**Kozo Fujii, Kazuhiro Nakahashi, Shigeru  
Obayashi, Satoko Komurasaki**



## **Numerical Flow Simulation II Cnrsdfg Collaborative Research Programme Results 1998:**

**Numerical Flow Simulation II** Ernst H. Hirschel, 2013-06-29 The aim of this series is to publish promptly and in a detailed form new material from the field of Numerical Fluid Mechanics including the use of advanced computer systems Published are reports on specialized conferences workshops research programs and monographs Contents This volume contains nineteen reports on work which is conducted since 1998 in the Collaborative Research Programme Numerical Flow Simulation of the Centre National de la Recherche Scientifique CNRS and the Deutsche Forschungsgemeinschaft DFG French and German engineers and mathematicians present their joint research on the topics Development of Solution Techniques Crystal Growth and Melts Flows of Reacting Gases and Turbulent Flows In the background of their work is the still strong growth of the performance of super computer architectures which together with large advances in algorithms is opening vast new application areas of numerical flow simulation in research and industrial work Results of this programme from the period 1996 to 1998 have been presented in NNFM 66 1998      **New Results in Numerical and Experimental Fluid Mechanics V** Hans Josef Rath, Carsten Holze, Hans-Joachim Heinemann, Rolf Henke, Heinz Hönlinger, 2007-12-10 This volume collects contributions to the 14th Symposium of the STAB German Aerospace Aerodynamics Association The association involves German scientists and engineers from universities research establishments and industry who are doing research and project work in numerical and experimental fluid mechanics and aerodynamics mainly for aerospace but for other applications too The volume gives a broad overview of ongoing work in Germany in this field      FLOMANIA - A European Initiative on Flow Physics Modelling Werner Haase, Bertrand Aupoix, Ulf Bunge, Dieter Schwamborn, 2006-10-02 This volume offers of the EU funded 5th Framework project FLOMANIA Flow Physics Modelling An Integrated Approach The book presents an introduction to the project exhibits partners methods and approaches and provides comprehensive reports of all applications treated in the project A complete chapter is devoted to a description of turbulence models used by the partners together with a section on lessons learned accompanied by a comprehensive list of references      MEGAFLOW - Numerical Flow Simulation for Aircraft Design Norbert Kroll, Jens K. Fassbender, 2006-10-02 The aerospace industry increasingly relies on advanced numerical simulation tools in the early design phase This volume provides the results of a German initiative which combines many of the CFD development activities from the German Aerospace Center DLR universities and aircraft industry Numerical algorithms for structured and hybrid Navier Stokes solvers are presented in detail The capabilities of the software for complex industrial applications are demonstrated      *Computational Science and High Performance Computing II* Egon Krause, Yurii I. Shokin, Nina Shokina, 2006-06-18 This volume contains 27 contributions to the Second Russian German Advanced Research Workshop on Computational Science and High Performance Computing presented in March 2005 at Stuttgart Germany Contributions range from computer science mathematics and high performance computing to applications in mechanical and aerospace engineering      Numerical Simulation of Turbulent

Flows and Noise Generation Christophe Brun, Daniel Juvé, Michael Manhart, Claus-Dieter Munz, 2009-03-07 Large Eddy Simulation LES is a high fidelity approach to the numerical simulation of turbulent flows Recent developments have shown LES to be able to predict aerodynamic noise generation and propagation as well as the turbulent flow by means of either a hybrid or a direct approach This book is based on the results of two French German research groups working on LES simulations in complex geometries and noise generation in turbulent flows The results provide insights into modern prediction approaches for turbulent flows and noise generation mechanisms as well as their use for novel noise reduction concepts

**Advances in High Performance Computing and Computational Sciences** Yurii I. Shokin, Nargozy Danaev, Murat Orunkhanov, Nina Shokina, 2006-09-25 This volume contains contributions to the First Kazakh German Advanced Research Workshop on Computational Science and High Performance Computing presented in September 2005 at Almaty Kazakhstan The contributions show the potential of bringing together theoretical mathematical modelling and powerful high performance computing systems

**Numerical Flow Simulation III** Ernst Heinrich Hirschel, 2012-12-06 This volume contains eighteen reports on work which is conducted since 2000 in the Collaborative Research Programme Numerical Flow Simulation of the Centre National de la Recherche Scientifique CNRS and the Deutsche Forschungsgemeinschaft DFG French and German engineers and mathematicians present their joint research on the topics Development of Solution Techniques Crystal Growth and Melts Flows of Reacting Gases Sound Generation and Turbulent Flows In the background of their work is the still strong growth of the performance of super computer architectures which together with large advances in algorithms is opening vast new application areas of numerical flow simulation in research and industrial work Results of this programme from the period 1996 to 1998 have been presented in NNFM 66 1998 and NNFM75 2001

**Progress in Computational Flow-Structure Interaction** Werner Haase, Vittorio Selmin, Bengt Winzell, 2013-04-17 Aircraft design processes require extensive work in the area of both aerodynamics and structure forming an environment for aeroelasticity investigations Present and future designs of European aircraft are characterized by an ever increasing aircraft size and performance Strong weight saving requirements are met by introduction of new materials leading to more flexible structure of the aircraft Consequently aeroelastic phenomena such as vortex induced aeroelastic oscillations and moving shock waves can be predominant and may have a significant effect on the aircraft performance Hence the ability to estimate reliable margins for aeroelastic instabilities flutter or dynamic loads buffeting is a major concern to the aircraft designer As modern aircrafts have wing bending modes with frequencies that are low enough to influence the flight control system demands on unsteady aerodynamics and structural analysis to predict flight control effectiveness and riding comfort for passengers are extremely high Therefore the aircraft industries need an improved capacity of robust accurate and reliable prediction methods in the coupled aeroelastic flight mechanics and loads disciplines In particular it is necessary to develop improve and calibrate the numerical tools in order to predict with high level of accuracy and capability complex and

non classical aeroelastic phenomena including aerodynamic non linearities such as shock waves and separation as well as structural non linearities e g control surface free play Nowadays robust methods for structural analysis and linearised unsteady aerodynamics are coupled and used by the aircraft industry to computationally clear a new design from flutter

MEGADESIGN and MegaOpt - German Initiatives for Aerodynamic Simulation and Optimization in Aircraft Design

Norbert Kroll, Dieter Schwamborn, Klaus Becker, Herbert Rieger, Frank Thiele, 2009-11-18 This volume contains results of the German CFD initiative MEGADESIGN which combines CFD development activities from DLR universities and aircraft industry Based on the DLR flow solvers FLOWer and TAU the main objectives of the four years project is to ensure the prediction accuracy with a guaranteed error bandwidth for certain aircraft configurations at design conditions to reduce the simulation turn around time for large scale applications significantly to improve the reliability of the flow solvers for full aircraft configurations in the complete flight regime to extend the flow solvers to allow for multidisciplinary simulations and to establish numerical shape optimization as a vital tool within the aircraft design process This volume highlights recent improvements and enhancements of the flow solvers as well as new developments with respect to aerodynamic and multidisciplinary shape optimization Improved numerical simulation capabilities are demonstrated by several industrial applications

**New Results in Numerical and Experimental Fluid Mechanics III** Siegfried Wagner, Ulrich

Rist, Hans-Joachim Heinemann, Reinhard Hilbig, 2012-09-07 This volume contains the papers of a German symposium dealing with research and project work in numerical and experimental aerodynamics and fluidmechanics for aerospace and other applications It gives a broad overview over the ongoing work in this field in Germany

**New Developments in**

**Computational Fluid Dynamics** Kozo Fujii, Kazuhiro Nakahashi, Shigeru Obayashi, Satoko Komurasaki, 2006-01-05 Contains 20 papers presented at the Sixth International Nobeyama Workshop on the New Century of Computational Fluid Dynamics Nobeyama Japan April 21-24 2003 These papers cover computational electromagnetics astrophysical topics CFD research and applications in general large eddy simulation mesh generation topics visualization and more

*Recent Results in Laminar-Turbulent Transition* Siegfried Wagner, Markus Kloker, Ulrich Rist, 2004 Methodic investigations of laminar turbulent transition in wall bounded shear flows under controlled conditions are essential for untangling the various complex phenomena of the transition process occurring in flows at practical conditions They allow understanding of the instability processes of the laminar flow and thus enable the development of tools for flow control On the one hand the laminar flow regime can be extended by delaying transition to reduce viscous drag and on the other hand large scale flow disturbances or transition can be forced in order to enhance momentum and mass exchange Thus flow separation can be prevented or mixing of fuel and air in combustion engines enhanced for instance The DFG Verbund Schwerpunktprogramm Transition a cooperative priority research program of universities research establishments and industry in Germany has been launched in April 1996 with the aim to explore transition by a coordinated use development and validation of advanced experimental

techniques and theoretical numerical simulation methods binding together all the appropriate resources available in Germany At the very beginning of the six year research period specifically selected test problems were to be investigated by various theoretical and experimental methods to identify and possibly rule out inadequate numerical or experimental methods With respect to experiments it was planned to use multi sensor surface measuring techniques the infrared measuring technique and particle image velocimetry PIV in addition to hot wire techniques to get instantaneous images of flows in sections on surfaces or within the complete flow field

**Hermann Schlichting - 100 Years** Rolf Radespiel, Cord-Christian Rossow, Benjamin Winfried Brinkmann, 2009-03-06 Hermann Schlichting is one of the internationally leading scientists in the field of fluid mechanics during the 20 century He contributed largely to modern theories of viscous flows and aircraft aerodynamics His famous monographies Boundary Layer Theory and Aerodynamics of Aircraft are known worldwide and they appeared in six languages He held Chairs of Aerodynamics and Fluid Mechanics at Technische Universität Braunschweig during 37 years and directed the Institute of Aerodynamics of the Deutsche Forschungsanstalt für Luftfahrt in Braunschweig He also directed the Aerodynamische Versuchsanstalt Göttingen and served in the Executive Board of the German Aerospace Center DLR Hermann Schlichting played a leading role in the rebuilding of aerospace research in Germany after the Second World War The occasion of his 100 birthday in the year 2007 was an excellent opportunity to acknowledge important ideas and accomplishments that Hermann Schlichting contributed to science The editors of this volume are the present successors of Hermann Schlichting in his role as director of the two research institutes in Braunschweig We were glad to host a scientific colloquium in his honor on 28 September 2007 Invited former scholars of Hermann Schlichting reviewed his work in boundary layer theory and in aircraft aerodynamics followed by presentations of important research results of his institutes today

Computational Fluid Dynamics for the 21st Century Mohamed Hafez, Koji Morinishi, Jacques Periaux, 2013-03-09 The goal of this book is to present the new trend of Computational Fluid Dynamics CFD for the 21 st Century It consists of papers presented at a symposium honoring Prof Nobuyuki Satofuka on the occasion of his 60th birthday The symposium entitled Computational Fluid Dynamics for the 21st Century was held at Kyoto Institute of Technology KIT in Kyoto Japan on July 15-17 2000 The symposium was hosted by KIT as a memorial event celebrating the 100 year anniversary of this establishment The invited speakers were from Japan as well as from the international community in Asia Europe and North America It is a great pleasure to dedicate this book to Prof Satofuka in appreciation of his contributions to this field During the last 30 years Prof Satofuka made many important contributions to CFD advancing the numerics and our understanding of flow physics in different regimes The details of his contributions are discussed in the first chapter The book contains chapters covering related topics with emphasis on new promising directions for the 21 st Century The chapters of the book reflect the 10 sessions of the symposium on both the numerics and the applications including grid generation and adaptation new numerical schemes optimization techniques and

parallel computations as well as applications to multi scale and multi physics problems design and flow control and new topics beyond aeronautics In the following the chapters of the book are introduced      **Aerodynamic Drag Reduction**

**Technologies** Peter Thiede, 2013-06-29 This volume contains the Proceedings of the CEAS DragNet European Drag Reduction Conference held on 19-21 June 2000 in Potsdam Germany This conference succeeding the European Forum on Laminar Flow Technology 1992 and 1996 was initiated by the European Drag Reduction Network DragNet and organised by DGLR under the auspice of CEAS The conference addressed the recent advances in all areas of drag reduction research development validation and demonstration including laminar flow technology adaptive wing concepts turbulent and induced drag reduction separation control and supersonic flow aspects This volume which comprises more than 40 conference papers is of particular interest to engineers scientists and students working in the aeronautics industry research establishments or academia      *Numerical Flow Simulation I* Christian Breitsamter, Ernst Heinrich Hirschel, 2013-06-05      *Coupling of Fluids,*

*Structures and Waves in Aeronautics* Noel G. Barton, Jacques Periaux, 2012-12-06 This volume contains the proceedings of a workshop held in Melbourne Australia entitled Coupling of Fluids Structures and Waves in Aeronautics The 22 papers deal with new computational methods for multi disciplinary design in aeronautics They are grouped into chapters on fluids structures electromagnetics optimisation mathematical methods and tools and aircraft design Several papers treat coupling of these themes in a multi physics setting Included is a 17 page report of a Round Table discussion entitled Future Tools for Design and Manufacture of Innovative Products in the Aeronautics Industry together with a summary of important themes and issues This research promotes the advanced technologies necessary for continued development of efficient and environmentally sustainable transport systems      **LESFOIL: Large Eddy Simulation of Flow Around a High Lift Airfoil**

Lars Davidson, Davor Cokljat, Jochen Fröhlich, Michael A. Leschziner, Chris Mellen, Wolfgang Rodi, 2012-09-22 Large Eddy Simulation is a relatively new and still evolving computational strategy for predicting turbulent flows It is now widely used in research to elucidate fundamental interactions in physics of turbulence to predict phenomena which are closely linked to the unsteady features of turbulence and to create data bases against which statistical closure models can be assessed However its applicability to complex industrial flows to which statistical models are applied routinely has not been established with any degree of confidence There is in particular a question mark against the prospect of LES becoming an economically tenable alternative to Reynolds averaged Navier Stokes methods at practically high Reynolds numbers and in complex geometries Aerospace flows pose particularly challenging problems to LES because of the high Reynolds numbers involved the need to resolve accurately small scale features in the thin and often transitional boundary layers developing on aerodynamic surfaces When the flow also contains a separated region due to high incidence say the range and disparity of the influential scales to be resolved is enormous and this substantially aggravates the problems of resolution and cost It is just this combination of circumstances that has been at the heart of the project LESFOIL to which this book is devoted The

project combined the efforts resources and expertise of 9 partner organisations 4 universities 3 industrial companies and 2 research institutes

**ADIGMA - A European Initiative on the Development of Adaptive Higher-Order Variational Methods for Aerospace Applications** Norbert Kroll, Heribert Bieler, Herman Deconinck, Vincent Couaillier, Harmen van der Ven, Kaare Sorensen, 2010-09-18

This volume contains results gained from the EU funded 6th Framework project ADIGMA Adaptive Higher order Variational Methods for Aerodynamic Applications in Industry The goal of ADIGMA was the development and utilization of innovative adaptive higher order methods for the compressible flow equations enabling reliable mesh independent numerical solutions for large scale aerodynamic applications in aircraft industry The ADIGMA consortium was comprised of 22 organizations which included the main European aircraft manufacturers the major European research establishments and several universities all with well proven expertise in Computational Fluid Dynamics CFD The book presents an introduction to the project exhibits partners methods and approaches and provides a critical assessment of the newly developed methods for industrial aerodynamic applications The best numerical strategies for integration as major building blocks for the next generation of industrial flow solvers are identified



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