

# Notes on Numerical Fluid Mechanics

Volume 52

## **Flow Simulation with High-Performance Computers II**

Edited by  
Ernst Heinrich Hirschel



# Flow Simulation With Highperformance Computers I

**Siegfried Wagner, Matthias  
Steinmetz, Arndt Bode, Matthias Brehm**



## **Flow Simulation With Highperformance Computers I:**

Flow Simulation with High-Performance Computers II Ernst Heinrich Hirschel, 2013-04-17 Der Band enthält den Abschlussbericht des DFG Schwerpunktprogramms Flusimulation mit Höchstleistungsrechnern. Es führt die Arbeiten fort, die schon als Band 38 in der Reihe Notes on Numerical Fluid Mechanics erschienen sind. Work is reported which was sponsored by the Deutsche Forschungsgemeinschaft from 1993 to 1995. Scientists from numerical mathematics, fluid mechanics, aerodynamics and turbomachinery present their work on flow simulation with massively parallel systems on the direct and large eddy simulation of turbulence and on mathematical foundations, general solution techniques and applications. Results are reported from benchmark computations of laminar flow around a cylinder in which seventeen groups participated. *Flow Simulation with High-performance Computers I* Ernst-Heinrich Hirschel, 1993 **Flow Simulation with High-performance**

**Computers** Ernst Heinrich Hirschel, 1996 Visualization Methods in High Performance Computing and Flow Simulation W. Borchers, 1996-12 The developments of new algorithms in applied mathematics of new concepts in computer sciences and of new hardware in computer technology have led to an immense output of data streams describing the solutions of important physical or technological problems. In order to understand and to explore the results of calculations, new visualization methods have been developed. These novel methods are indispensable for mathematicians and engineers working with problems such as flow theory or elasticity. These proceedings contain selected contributions from the DFG workshop on visualization held at the University of Paderborn, January 18-20, 1994, and will be of interest to researchers in the above mentioned fields. High Performance Scientific And Engineering Computing Michael Breuer, Franz Durst, Christoph Zenger, 2012-12-06 In Douglas Adams' book *Hitchhiker's Guide to the Galaxy*, hyperintelligent beings reached a point in their existence where they wanted to understand the purpose of their own existence and the universe. They built a supercomputer called Deep Thought and upon completion they asked it for the answer to the ultimate question of life, the universe and everything else. The computer worked for several millennia on the answers to all these questions. When the day arrived for hyperintelligent beings to receive the answer, they were stunned, shocked and disappointed to hear that the answer was simply 42. The still open questions to scientists and engineers are typically much simpler and consequently the answers are more reasonable. Furthermore, because human beings are too impatient and not ready to wait for such a long period, high performance computing techniques have been developed, leading to much faster answers. Based on these developments in the last two decades, scientific and engineering computing has evolved to a key technology which plays an important role in determining or at least shaping future research and development activities in many branches of industry. Development work has been going on all over the world, resulting in numerical methods that are now available for simulations that were not foreseeable some years ago. However, these days the availability of supercomputers with Teraflop performance supports extensive computations with technical relevance. A new age of engineering has started. *High Performance Computing in*

*Science and Engineering* 16 Wolfgang E. Nagel, Dietmar H. Kröner, Michael M. Resch, 2017-01-11 This book presents the state of the art in supercomputer simulation It includes the latest findings from leading researchers using systems from the High Performance Computing Center Stuttgart HLRS in 2016 The reports cover all fields of computational science and engineering ranging from CFD to computational physics and from chemistry to computer science with a special emphasis on industrially relevant applications Presenting findings of one of Europe's leading systems this volume covers a wide variety of applications that deliver a high level of sustained performance The book covers the main methods in high performance computing Its outstanding results in achieving the best performance for production codes are of particular interest for both scientists and engineers The book comes with a wealth of color illustrations and tables of results *High Performance Computing in Science and Engineering 2000* E. Krause, W. Jäger, 2012-12-06 An overview of recent developments in high performance computing and simulation with special emphasis on the industrial relevance of the presented results and methods The book showcases an innovative combination of the state of the art modeling novel numerical algorithms and the use of leading edge high performance computing systems Advances in High Performance Computing and Computational Sciences Yuri 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 **High Performance Computing in Science and Engineering, Munich 2004** Siegfried Wagner, Werner Hanke, Arndt Bode, Franz Durst, 2005-12-06 Leading edge research groups in the field of scientific computing present their outstanding projects using the High Performance Computer in Bavaria HLRB Hitachi SR8000 F1 one of the top level supercomputers for academic research in Germany The projects address modelling and simulation in the disciplines Biosciences Chemistry Chemical Physics Solid State Physics High Energy Physics Astrophysics Geophysics Computational Fluid Dynamics and Computer Science The authors describe their scientific background their resource requirements with respect to top level supercomputers and their methods for efficient utilization of the costly high performance computing power Contributions of interdisciplinary research projects that have been supported by the Competence Network for Scientific High Performance Computing in Bavaria KONWIHR complete the broad range of supercomputer research and applications covered by this volume High-Performance Computing R.J. Allan, M.F. Guest, A.D. Simpson, D.S. Henty, D. Nicole, 2012-12-06 Over the past decade high performance computing has demonstrated the ability to model and predict accurately a wide range of physical properties and phenomena Many of these have had an important impact in contributing to wealth creation and improving the quality of life through the development of new products and processes with greater efficacy efficiency or reduced harmful side effects and in contributing to our ability to understand and describe the world around us Following a survey of the U K's urgent need for a supercomputing facility for

academic research see next chapter a 256 processor T3D system from Cray Research Inc went into operation at the University of Edinburgh in the summer of 1994 The High Performance Computing Initiative HPCI was established in November 1994 to support and ensure the efficient and effective exploitation of the T3D and future generations of HPC systems by a number of consortia working in the frontier areas of computational research The Cray T3D now comprising 512 processors and total of 32 GB memory represented a very significant increase in computing power allowing simulations to move forward on a number of fronts The three fold aims of the HPCI may be summarised as follows 1 to seek and maintain a world class position in computational science and engineering 2 to support and promote exploitation of HPC in industry commerce and business and 3 to support education and training in HPC and its application **High Performance**

**Computing** Carlos Jaime Barrios Hernández, Isidoro Gitler, Jaime Klapp, 2017-04-28 This book constitutes the proceedings of the Third Latin American Conference on High Performance Computing CARLA 2016 held in Mexico City Mexico in August September 2016 The 30 papers presented in this volume were carefully reviewed and selected from 70 submissions They are organized in topical sections named HPC Infrastructure and Applications Parallel Algorithms and Applications HPC Applications and Simulations **High Performance Computing in Science and Engineering, Garching 2004** Arndt

Bode, Franz Durst, 2006-01-20 This volume of High Performance Computing in Science and Engineering is fully dedicated to the final report of KONWIHR the Bavarian Competence Network for Technical and Scientific High Performance Computing It includes the transactions of the final KONWIHR workshop that was held at Technische Universität München October 14 15 2004 as well as additional reports of KONWIHR research groups KONWIHR was established by the Bavarian State Government in order to support the broad application of high performance computing in science and technology throughout the country KONWIHR is a supporting action to the installation of the German supercomputer Hitachi SR 8000 in the Leibniz Computing Center of the Bavarian Academy of Sciences The report covers projects from basic research in computer science to develop tools for high performance computing as well as applications from biology chemistry electrical engineering geology mathematics physics computational fluid dynamics materials science and computer science High Performance

Computing in Science and Engineering '19 Wolfgang E. Nagel, Dietmar H. Kröner, Michael M. Resch, 2021-05-29 This book presents the state of the art in supercomputer simulation It includes the latest findings from leading researchers using systems from the High Performance Computing Center Stuttgart HLRS in 2019 The reports cover all fields of computational science and engineering ranging from CFD to computational physics and from chemistry to computer science with a special emphasis on industrially relevant applications Presenting findings of one of Europe's leading systems this volume covers a wide variety of applications that deliver a high level of sustained performance The book covers the main methods in high performance computing Its outstanding results in achieving the best performance for production codes are of particular interest for both scientists and engineers The book comes with a wealth of color illustrations and tables of results **High**

**Performance Computing on Vector Systems 2008** Sabine Roller, Katharina Benkert, Martin Galle, Wolfgang Bez, Hiroaki Kobayashi, Toshio Hirayama, 2008-10-23 This book covers the results obtained in the Tera op Workbench project during a four years period from 2004 to 2008 The Tera op Workbench project is a colla ration between the High Performance Computing Center Stuttgart HLRS and NEC Deutschland GmbH NEC HPCE to support users to achieve their research goals using high performance computing The Tera op Workbench supports users of the HLRS systems to enable and cilitate leading edge scienti c research This is achieved by optimizing their codes and improving the process work ow which results from the integration of diff ent modules into a hybrid vector system The assessment and demonstration of industrial relevance is another goal of the cooperation The Tera op Workbench project consists of numerous individual codes grouped together by application area and developed and maintained by researchers or c mercial organizations Within the project several of the codes have shown the ab ity to reach beyond the TFlop s threshold of sustained performance This created the possibility for new science and a deeper understanding of the underlying physics The papers in this book demonstrate the value of the project for different scienti c areas

**High Performance Computing in Science and Engineering, Garching/Munich 2007** Siegfried Wagner, Matthias Steinmetz, Arndt Bode, Matthias Brehm, 2008-10-22 For the fourth time the Leibniz Supercomputing Centre LRZ and the Com tence Network for Technical Scienti c High Performance Computing in Bavaria KONWIHR publishes the results from scienti c projects conducted on the c puter systems HLRB I and II High Performance Computer in Bavaria This book reports the research carried out on the HLRB systems within the last three years and compiles the proceedings of the Third Joint HLRB and KONWIHR Result and Reviewing Workshop 3rd and 4th December 2007 in Garching In 2000 HLRB I was the rst system in Europe that was capable of performing more than one Tera op s or one billion oating point operations per second In 2006 it was replaced by HLRB II After a substantial upgrade it now achieves a peak performance of more than 62 Tera op s To install and operate this powerful system LRZ had to move to its new facilities in Garching However the situation regarding the need for more computation cycles has not changed much since 2000 The demand for higher performance is still present a trend that is likely to continue for the foreseeable future Other resources like memory and disk space are currently in suf cient abundance on this new system

*High Performance Computing in Science and Engineering ' 06* Wolfgang E. Nagel, Willi Jäger, 2007-07-26 The last two years have been great for high performance computing in Baden W urttemberg and beyond In July 2005 the new building for HLRS as well as Stuttgart s new NEC supercomputer which is still leading edge in G many have been inaugurated In these days the SSC Karlsruhe is nalizing the installation of a very large high performance system complex from HP built from hundreds of Intel Itanium processors and more than three th sand AMD Opteron cores Additionally the fast network connection with a bandwidth of 40Gbit s and thus one of the rst installations of this kind in Germany brings the machine rooms of HLRS and SSC Karlsruhe very close together With the investment of more than 60 Million Euro we as the users of such a valuable infrastructure are

not only thankful to science managers and politicians but also to the people running these components as part of their daily business on a 24/7 level. Since about 18 months there are lots of activities on all scientific advisory and political levels to decide if Germany will install an even larger European supercomputer where the hardware costs alone will be around 200 Million Euro for a five year period. There are many good reasons to invest in such a program because beyond the infrastructure such a scientific research tool will attract the best brains to tackle the problems related to the software and methodology challenges.

**High Performance Computing for Computational Science -- VECPAR 2010** José M. Laginha M. Palma, Michel Daydé, Osni Marques, Joao Correia Lopes, 2011-02-18 This book constitutes the thoroughly refereed post conference proceedings of the 9th International Conference on High Performance Computing for Computational Science VECPAR 2010 held in Berkeley CA USA in June 2010. The 34 revised full papers presented together with five invited contributions were carefully selected during two rounds of reviewing and revision. The papers are organized in topical sections on linear algebra and solvers on emerging architectures large scale simulations parallel and distributed computing numerical algorithms.

*High Performance Computing* Alex Veidenbaum, Kazuki Joe, Hideharu Amano, Hideo Aiso, 2003-11-18 The 5th International Symposium on High Performance Computing ISHPC V was held in Odaiba Tokyo Japan October 20-22 2003. The symposium was thoughtfully planned organized and supported by the ISHPC Organizing Committee and its collaborating organizations. The ISHPC V program included two keynote speeches several invited talks two panel discussions and technical sessions covering theoretical and applied research topics in high performance computing and representing both academia and industry. One of the regular sessions highlighted the research results of the ITBL project. IT based research laboratory <http://www.itbl.riken.go.jp>. ITBL is a Japanese national project started in 2001 with the objective of realizing a virtual joint research environment using information technology. ITBL aims to connect 100 supercomputers located in main Japanese scientific research laboratories via high speed networks. A total of 58 technical contributions from 11 countries were submitted to ISHPC V. Each paper received at least three peer reviews. After a thorough evaluation process the program committee selected 14 regular 12 page papers for presentation at the symposium. In addition several other papers with favorable reviews were recommended for a poster session presentation. They are also included in the proceedings as short 8 page papers.

The program committee gave a distinguished paper award and a best student paper award to two of the regular papers. The distinguished paper award was given for Code and Data Transformations for Improving Shared Cache Performance on SMT Processors by Dimitrios S Nikolopoulos. The best student paper award was given for Improving Memory Latency Aware Fetch Policies for SMT Processors by Francisco J Cazorla. *High Performance Computing in Science and Engineering* Tomáš Kozubek, Radim Blaheta, Jakub Šístek, Miroslav Rozložník, Martin Čermák, 2016-06-02 This book constitutes the thoroughly refereed post conference proceedings of the Second International Conference on High Performance Computing in Science and Engineering HPCSE 2015 held in Sol Czech Republic in May 2015. The 14 papers presented in this volume were carefully

reviewed and selected from 21 submissions The conference provides an international forum for exchanging ideas among researchers involved in scientific and parallel computing including theory and applications as well as applied and computational mathematics The focus of HPCSE 2015 was on models algorithms and software tools which facilitate efficient and convenient utilization of modern parallel and distributed computing architectures as well as on large scale applications

Computational Science and High Performance Computing Egon Krause, Yuri I. Shokin, Nina Shokina, 2006-08-10

This volume is published as the proceedings of the Russian German Advanced Research workshop on Computational Science and High Performance Computing in Novosibirsk Akademgorodok in September 2003 The contributions of these proceedings were provided and edited by the authors chosen after a careful selection and reviewing The workshop was organized by the Institute of Computational Technologies SB RAS Novosibirsk Russia and the High Performance Computing Center Stuttgart Stuttgart Germany The objective was the discussion of the latest results in computational science and to develop a close cooperation between Russian and German specialists in the above mentioned field The main directions of the workshop are associated with the problems of computational hydrodynamics application of mathematical methods to the development of new generation of materials environment protection problems development of algorithms software and hardware support for high performance computation and designing modern facilities for visualization of computational modelling results The importance of the workshop topics was confirmed by the participation of representatives of major research organizations engaged in the solution of the most complex problems of mathematical modelling development of new algorithms programs and key elements of new information technologies Among the Russian participants were researchers of the Institutes of the Siberian Branch of the Russian Academy of Sciences Institute of Computational Technologies Institute of Computational Mathematics and Mathematical Geophysics Institute of Computational Modelling Russian Federal Nuclear Center All Russian Research Institute of Experimental Physics Novosibirsk State University



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