Robust Smoothers For High Order Discontinuous Galerkin

This book describes an array of power tools for data analysis that are based on nonparametric regression and smoothing techniques. These methods relax the linear assumption of many standard models and allow analysts to uncover structure in the data that might otherwise have been missed. While McCullagh and Nelder's Generalized Linear Models shows how to extend the usual linear methodology to cover analysis of a range of data types, Generalized Additive Models enhances this methodology even further by incorporating the flexibility of nonparametric regression. Clear prose, exercises in each chapter, and case studies enhance this popular text.

This book assembles papers which were presented at the biennial sympo sium in Computational Statistics held und er the a!uspices of the International Association for Statistical Computing (IASC), a section of ISI, the Interna tional Statistical Institute. This symposium named COMPSTAT '94 was organized by the Statistical Institutes of the University of Vienna and the University of Technology of Vienna, Austria. The series of COMPSTAT Symposia started 1974 in Vienna. Mean while they took place every other year in Berlin (Germany, 1976), Leiden (The Netherlands, 1978), Edinburgh (Great Britain, 1980), Toulouse (France, 1982), Prague (Czechoslovakia, 1984), Rom (Italy, 1986), Copenhagen (Den mark, 1988), Dubrovnik (Yugoslavia, 1990) and Neuchätel (Switzerland, 1992). This year we are celebrating the 20th anniversary in Vienna, Austria. It has obviously been observed a movement from "traditional" computa tional statistics with emphasis on methods which produce results quickly and reliably, to computationally intensive methods like resampling procedures, Bayesian methods, dynamic graphics, to very recent areas like neural net works, accentuation on spatial statistics, huge data sets, analysis strategies, etc. For the organization of the symposium, new guidelines worked out by the IASC in written form were in effect this time. The goal was to refresh somehow the spirit of the start of COMPSTAT '74, keep the tradition of the series and ensure a certain continuity in the sequence of biannual meetings.

This book focuses on control design with continual references to the practical aspects of implementation. While the concepts of multivariable control are justified, the book emphasizes the need to maintain student interest and motivation over exhaustively rigorous mathematical proof.

Adaptive High-Order Methods in Computational Fluid DynamicsFinite Volumes for Complex Applications VI Problems & PerspectivesFVCA 6, International Symposium, Prague, June 6-10, 2011Springer Science & Business Media

Foreword Looking back the past 30 years. we have seen steady progress made in the area of speech science and technology. I still remember the excitement in the late seventies when Texas Instruments came up with a toy named "Speak-and-Spell" which was based on a VLSI chip containing the state-of-the-art linear prediction synthesizer. This caused a speech technology fever among the electronics industry. Particularly. applications of automatic speech recognition were rigorously attempt ed by many companies. some of which were start-ups founded just for this purpose. Unfortunately. it did not take long before they realized that automatic speech rec ognition technology was not mature enough to satisfy the need of customers. The fever gradually faded away. In the meantime. constant efforts have been made by many researchers and engi neers to improve the automatic speech recognition technology. Hardware capabilities have advanced impressively since that time. In the past few years. we have been witnessing and experiencing the advent of the "Information Revolution." What might be called the second surge of interest to com mercialize speech technology as a natural interface for man-machine communication began in much better shape than the first one. With computers much more powerful and faster. many applications look realistic this time. However. there are still tremendous practical issues to be overcome in order for speech to be truly the most natural interface between humans and machines.

This book presents the state-of-the-art in simulation on supercomputers. Leading researchers present results achieved on systems of the High Performance Computing Center Stuttgart (HLRS) for the year 2006. The reports cover all fields of computational science and engineering ranging from CFD via computational physics and chemistry to computer science with a special emphasis on industrially relevant applications. The book comes with illustrations and tables.

This open access book summarizes the research done and results obtained in the second funding phase of the Priority Program 1648 "Software for Exascale Computing" (SPPEXA) of the German Research Foundation (DFG) presented at the SPPEXA Symposium in Dresden during October 21-23, 2019. In that respect, it both represents a continuation of Vol. 113 in Springer’s series Lecture Notes in Computational Science and Engineering, the corresponding report of SPPEXA’s first funding phase, and provides an overview of SPPEXA’s contributions towards exascale computing in today's sumpercomputer technology. The individual chapters address one or more of the research directions (1) computational algorithms, (2) system software, (3) application software, (4) data management and exploration, (5) programming, and (6) software tools. The book has an interdisciplinary appeal: scholars from computational sub-fields in computer science, mathematics, physics, or engineering will find it of particular interest.

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.

This book is dedicated to Pieter J. Zandbergen on the occasion of his sixty-fifth birthday. It contains fourteen original contributions written by specialized authors and deals with the application of mathematics and numerical analysis to a wide variety of problems in fluid dynamics and related fields. At present the research field of computational fluid dynamics is growing strongly and the book is therefore of interest to applied mathematicians, theoretical physicists and engineers.

Robustness in Statistics contains the proceedings of a Workshop on Robustness in Statistics held on April 11-12, 1978, at the Army Research Office in Research Triangle Park, North Carolina. The papers review the state of the art in statistical robustness and cover topics ranging from robust estimation to the robustness of residual displays and robust smoothing. The application of robust regression to trajectory data reduction is also discussed. Comprised of 14 chapters, this book begins with an introduction to robust estimation, paying particular attention to iteration schemes and error structure of estimators. Sensitivity and influence curves as well as their connection with jackknife estimates are described. The reader is then introduced to a simple analog of trimmed means that can be used for studying residuals from a robust point-of-view; a class of robust estimators (called P-estimators) based on the location and scale-invariant Pitman estimators of location; and robust estimation in the presence of outliers. Subsequent chapters deal with robust regression and its use to reduce trajectory data; tests for censoring of extreme values, especially when population distributions are incompletely defined; and robust estimation for time series autoregressions. This monograph should be of interest to mathematicians and statisticians.

This book collects papers presented during the European Workshop on High Order Nonlinear Numerical Methods for Evolutionary PDEs (HONOM 2013) that was held at INRIA Bordeaux Sud-Ouest, Talence, France in March, 2013. The central topic is high order methods for compressible fluid dynamics. In the workshop, and in this proceedings, greater emphasis is placed on the numerical than the theoretical aspects of this scientific field. The range of topics is broad, extending through algorithm design, accuracy, large scale computing, complex geometries, discontinuous Galerkin, finite element methods, Lagrangian hydrodynamics, finite difference methods and applications and uncertainty quantification. These techniques find practical applications in such fields as fluid mechanics, magnetohydrodynamics, nonlinear solid mechanics, and others for which genuinely nonlinear methods are needed.

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.

Robust Control System Design: Advanced State Space Techniques, Second Edition expands upon a groundbreaking and combinatorial approach to state space control system design that fully realizes the critical loop transfer function and robustness properties of state/generalized state feedback control. This edition offers many new examples and exercises to illustrate and clarify new design concepts, approaches, and procedures while highlighting the fact that state/generalized state feedback control can improve system performance and robustness more effectively than other forms of control. Revised and expanded throughout, the second edition presents an improved eigenstructure assignment design method that enhances system performance and robustness more directly and effectively and allows for adjustment of design formulations based on design testing and simulation. The author proposes the systematic controller order adjustment for the tradeoff between performance and robustness based on the complete unification of the state feedback control and static output feedback control. The book also utilizes a more accurate robust stability measure to guide control designs.

Predictive Filtering for Microsatellite Control Systems introduces technological design, modeling, stability analysis, predictive filtering, state estimation problem and real-time operation of spacecraft control systems in aerospace engineering. The book gives a systematically and almost self-contained description of the many facets of envisaging, designing, implementing or experimentally exploring predictive filtering for spacecraft control systems, along with the adequate designs of integrated modeling, dynamics, state estimation, and signal processing of spacecrafts and nonlinear systems. Unifies existing and emerging concepts concerning predictive filtering theory, state estimation, and signal processing for spacecraft control systems Provides a series of latest results in, including but not limited to, nonlinear filtering, attitude determination, and state estimation towards spacecraft control systems Gives numerical and simulation results in each chapter in order to reflect the engineering practice and demonstrate the main focus of the developed analysis and synthesis approach Covers advanced topics in nonlinear filtering with aerospace application

This book introduces a family of new methods for accurate and robust spectral testing and fills an information gap, as the requirements in standard test have grown increasingly challenging in recent high precision testing, especially as the device performance has continued to improve. Test engineers will be enabled to accurately set their devices & systems at much simpler test setup, much reduced complexity and much lower cost.

Anisotropies occur naturally in CFD where the simulation of small scale physical phenomena, such as boundary layers at high Reynolds numbers, causes the grid to be highly stretched leading to a slow down in convergence of multigrid methods. Several approaches aimed at making multigrid a robust solver have been proposed and analyzed in literature using the scalar diffusion equation. However, they have been rarely applied to solving more complicated models, like the incompressible Navier-Stokes equations. This paper contains the first published numerical results of the behavior of two popular robust multigrid approaches (alternating-plane smoothers combined with standard coarsening and plane implicit smoothers combined with semi-coarsening) for solving the 3-D incompressible Navier-Stokes equations in the simulation of the driven cavity and a boundary layer over a flat plate on a stretched grid. The discrete operator is obtained using a staggered-grid arrangement of variables with a finite volume technique and second-order

accuracy is achieved using defect correction within the multigrid cycle. Grid size, grid stretching and Reynolds number are the factors considered in evaluating the robustness of the multigrid methods. Both approaches yield large increases in convergence rates over cell-implicit smoothers on stretched grids. The combination of plane implicit smoothers and semi-coarsening was found to be fully robust in the fiat plate simulation up to Reynolds numbers 10(exp 6) and the best alternative in the driven cavity simulation for Reynolds numbers above 10(exp 3). The alternating-plane approach exhibits a better behavior for lower Reynolds numbers (below to 10(exp 3) in the driven cavity simulation. A parallel variant of the smoother, tri-plane ordering, presents a good trade-off between convergence and parallel properties.

The underlying theory on which much modern robust and nonlinear control is based can be difficult to grasp. This volume is a collection of lecture notes presented by experts in advanced control engineering. The book is designed to provide a better grounding in the theory underlying several important areas of control. It is hoped the book will help the reader to apply otherwise abstruse ideas of nonlinear control in a variety of real systems.

A new edition of this popular text on robust statistics, thoroughly updated to include new and improved methods and focus on implementation of methodology using the increasingly popular open-source software R. Classical statistics fail to cope well with outliers associated with deviations from standard distributions. Robust statistical methods take into account these deviations when estimating the parameters of parametric models, thus increasing the reliability of fitted models and associated inference. This new, second edition of Robust Statistics: Theory and Methods (with R) presents a broad coverage of the theory of robust statistics that is integrated with computing methods and applications. Updated to include important new research results of the last decade and focus on the use of the popular software package R, it features in-depth coverage of the key methodology, including regression, multivariate analysis, and time series modeling. The book is illustrated throughout by a range of examples and applications that are supported by a companion website featuring data sets and R code that allow the reader to reproduce the examples given in the book. Unlike other books on the market, Robust Statistics: Theory and Methods (with R) offers the most comprehensive, definitive, and up-to-date treatment of the subject. It features chapters on estimating location and scale; measuring robustness; linear regression with fixed and with random predictors; multivariate analysis; generalized linear models; time series; numerical algorithms; and asymptotic theory of M-estimates. Explains both the use and theoretical justification of robust methods Guides readers in selecting and using the most appropriate robust methods for their problems Features computational algorithms for the core methods Robust statistics research results of the last decade included in this 2nd edition include: fast deterministic robust regression, finite-sample robustness, robust regularized regression, robust location and scatter estimation with missing data, robust estimation with independent outliers in variables, and robust mixed linear models. Robust Statistics aims to stimulate the use of robust methods as a powerful tool to increase the reliability and accuracy of statistical modelling and data analysis. It is an ideal resource for researchers, practitioners, and graduate students in statistics, engineering, computer science, and physical and social sciences.

This monograph is a study of optimal control applied to cancer chemotherapy, the treatment of cancer using drugs that kill cancer cells. The aim is to determine whether current methods for the administration of chemotherapy are optimal, and if alternative regimens should be considered.The research utilizes the mathematical theory of optimal control, an active research area for many mathematicians, scientists, and engineers. It is of multidisciplinary nature, having been applied to areas ranging from engineering to biomedicine. The aim in optimal control is to achieve a given objective at minimum cost. A set of differential equations is used to describe the evolution in time of the process being modelled, and constraints limit the policies that can be used to attain the objective.In this monograph, mathematical models are used to construct optimal drug schedules. These are treatment guidelines specifying which drug to deliver, when, and at what dose. Many current drug schedules have been derived empirically, based upon “rules of thumb”.The monograph has been structured so that most of the high-level mathematics is introduced in a special appendix. In this way, a scientist can skip the more subtle aspects of the theory and still understand the biomedical applications that follow. However, the text is self-contained so that a deeper understanding of the mathematics of optimal control can be gained from the mathematical appendix.The mathematical models in this book and the associated computer simulations show that low intensity chemotherapy is a better choice of treatment than high intensity chemotherapy, under certain conditions.

Robust control has been a topic of active research in the last three decades culminating in H_2/H_\infty and \mu design methods followed by research on parametric robustness, initially motivated by Kharitonov's theorem, the extension to non-linear time delay systems, and other more recent methods. The two volumes of Recent Advances in Robust Control give a selective overview of recent theoretical developments and present selected application examples. The volumes comprise 39 contributions covering various theoretical aspects as well as different application areas. The first volume covers selected problems in the theory of robust control and its application to robotic and electromechanical systems. The second volume is dedicated to special topics in robust control and problem specific solutions. Recent Advances in Robust Control will be a valuable reference for those interested in the recent theoretical advances and for researchers working in the broad field of robotics and mechatronics.

This monograph provides a concise point of research topics and reference for modeling correlated response data with time-dependent covariates, and longitudinal data for the analysis of population-averaged models, highlighting methods by a variety of pioneering scholars. While the models presented in the volume are applied to health and health-related data, they can be used to analyze any kind of data that contain covariates that change over time. The included data are analyzed with the use of both R and SAS, and the data and computing programs are provided to readers so that they can replicate and implement covered methods. It is an excellent resource for scholars of both computational and methodological statistics and biostatistics, particularly in the applied areas of health. ?

Available for the first time in paperback, this ground-breaking industry textbook is heralded as a first in its state-of-the-art coverage of the most important areas emerging in circuits and systems. It is compiled from course material used in a suite of one-day tutorials on circuits and systems designed expressly for engineers and research scientists who want to explore subjects outside, but related to, their immediate fields. Authored by 50 circuits and systems experts, this volume fosters a fundamental and authoritative understanding of each subject.

Introduction to Robust Estimating and Hypothesis Testing, Fifth Edition is a useful ‘how-to’ on the application of robust methods utilizing easy-to-use software. This trusted resource provides an overview of modern robust methods, including improved techniques for dealing with outliers, skewed distribution curvature, and heteroscedasticity that can provide substantial gains in power. Coverage includes techniques for comparing groups and measuring effect size, current methods for comparing quantiles, and expanded regression methods for both parametric and nonparametric techniques. The practical importance of these varied methods is illustrated using data from real world studies. Over 1700 R functions are included to support comprehension and practice. Includes the latest developments in robust regression Provides many new, improved and accessible R functions Offers comprehensive coverage of ANOVA and ANCOVA methods

Currently, the modelling and control of mechatronic and robotic systems is an open and challenging field of investigation in both industry and academia. The book encompasses the kinematic and dynamic modelling, analysis, design, and control of mechatronic and robotic systems, with the scope of improving their performance, as well as simulating and testing novel devices and control architectures. A broad

range of disciplines and topics are included, such as robotic manipulation, mobile systems, cable-driven robots, wearable and rehabilitation devices, variable stiffness safety-oriented mechanisms, optimization of robot performance, and energy-saving systems.

Mathematics of Computing -- Numerical Analysis.

Issues in Psychology and Psychiatry Research and Practice: 2011 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Psychology and Psychiatry Research and Practice. The editors have built Issues in Psychology and Psychiatry Research and Practice: 2011 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Psychology and Psychiatry Research and Practice in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Issues in Psychology and Psychiatry Research and Practice: 2011 Edition has been produced by the world’s leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

Bringing together the world's leading researchers and practitioners of computational mechanics, these new volumes meet and build on the eight key challenges for research and development in computational mechanics. Researchers have recently identified eight critical research tasks facing the field of computational mechanics. These tasks have come about because it appears possible to reach a new level of mathematical modelling and numerical solution that will lead to a much deeper understanding of nature and to great improvements in engineering design. The eight tasks are: The automatic solution of mathematical models Effective numerical schemes for fluid flows The development of an effective mesh-free numerical solution method The development of numerical procedures for multiphysics problems The development of numerical procedures for multiscale problems The modelling of uncertainties The analysis of complete life cycles of systems Education - teaching sound engineering and scientific judgement Readers of Computational Fluid and Solid Mechanics 2003 will be able to apply the combined experience of many of the world's leading researchers to their own research needs. Those in academic environments will gain a better insight into the needs and constraints of the industries they are involved with; those in industry will gain a competitive advantage by gaining insight into the cutting edge research being carried out by colleagues in academia. Features Bridges the gap between academic researchers and practitioners in industry Outlines the eight main challenges facing Research and Design in Computational mechanics and offers new insights into the shifting the research agenda Provides a vision of how strong, basic and exciting education at university can be harmonized with life-long learning to obtain maximum value from the new powerful tools of analysis

treated in more detail. They are just specimen of larger classes of schemes. Es sentially, we have to distinguish between semi-analytical methods, discretiza tion methods, and lumped circuit models. The semi-analytical methods and the discretization methods start directly from Maxwell's equations. Semi-analytical methods are concentrated on the analytical level: They use a computer only to evaluate expressions and to solve resulting linear algebraic problems. The best known semi-analytical methods are the mode matching method, which is described in subsection 2. 1, the method of integral equations, and the method of moments. In the method of integral equations, the given boundary value problem is transformed into an integral equation with the aid of a suitable Greens' function. In the method of moments, which includes the mode matching method as a special case, the solution function is represented by a linear combination of appropriately weighted basis func tions. The treatment of complex geometrical structures is very difficult for these methods or only possible after geometric simplifications: In the method of integral equations, the Greens function has to satisfy the boundary condi tions. In the mode matching method, it must be possible to decompose the domain into subdomains in which the problem can be solved analytically, thus allowing to find the basis functions. Nevertheless, there are some ap plications for which the semi-analytic methods are the best suited solution methods. For example, an application from accelerator physics used the mode matching technique (see subsection 5. 4).

This book provides an introduction to wavelet analysis with the statistical software system S-PLUS. The book will be of interest primarily to electrical engineers and statisticians. The authors are employees of MathSoft, the publishers of S-PLUS.

Advanced Optical Instruments and Techniques includes twenty-three chapters providing processes, methods, and procedures of cutting-edge optics engineering design and instrumentation. Topics include biomedical instrumentation and basic and advanced interferometry. Optical metrology is discussed, including point and full-field methods. Active and adaptive optics, holography, radiometry, the human eye, and visible light are covered as well as materials, including photonics, nanophotonics, anisotropic materials, and metamaterials.

This book features a selection of high-quality papers chosen from the best presentations at the International Conference on Spectral and High-Order Methods (2016), offering an overview of the depth and breadth of the activities within this important research area. The carefully reviewed papers provide a snapshot of the state of the art, while the extensive bibliography helps initiate new research directions.

Finite volume methods are used for various applications in fluid dynamics, magnetohydrodynamics, structural analysis or nuclear physics. A closer look reveals many interesting phenomena and mathematical or numerical difficulties, such as true error analysis and adaptivity, modelling of multi-phase phenomena or fitting problems, stiff terms in convection/diffusion equations and sources. To overcome existing problems and to find solution methods for future applications requires many efforts and always new

developments. The goal of The International Symposium on Finite Volumes for Complex Applications VI is to bring together mathematicians, physicists and engineers dealing with Finite Volume Techniques in a wide context. This book, divided in two volumes, brings a critical look at the subject (new ideas, limits or drawbacks of methods, theoretical as well as applied topics).

The book describes the main findings of the EU-funded project IDIHOM (Industrialization of High-Order Methods – A Top-Down Approach). The goal of this project was the improvement, utilization and demonstration of innovative higher-order simulation capabilities for large-scale aerodynamic application challenges in the aircraft industry. The IDIHOM consortium consisted of 21 organizations, including aircraft manufacturers, software vendors, as well as the major European research establishments and several universities, all of them with proven expertise in the field of computational fluid dynamics. After a general introduction to the project, the book reports on new approaches for curved boundary-grid generation, high-order solution methods and visualization techniques. It summarizes the achievements, weaknesses and perspectives of the new simulation capabilities developed by the project partners for various industrial applications, and includes internal- and external-aerodynamic as well as multidisciplinary test cases.

This book presents a detailed description of a robust pseudomultigrid algorithm for solving (initial-)boundary value problems on structured grids in a black-box manner. To overcome the problem of robustness, the presented Robust Multigrid Technique (RMT) is based on the application of the essential multigrid principle in a single grid algorithm. It results in an extremely simple, very robust and highly parallel solver with close-to-optimal algorithmic complexity and the least number of problem-dependent components. Topics covered include an introduction to the mathematical principles of multigrid methods, a detailed description of RMT, results of convergence analysis and complexity, possible expansion on unstructured grids, numerical experiments and a brief description of multigrid software, parallel RMT and estimations of speed-up and efficiency of the parallel multigrid algorithms, and finally applications of RMT for the numerical solution of the incompressible Navier Stokes equations. Potential readers are graduate students and researchers working in applied and numerical mathematics as well as multigrid practitioners and software programmers. ContentsIntroduction to multigridRobust multigrid techniqueParallel multigrid methodsApplications of multigrid methods in computational fluid dynamics

This book describes the classical smoothing, filtering and prediction techniques together with some more recently developed embellishments for improving performance within applications. It aims to present the subject in an accessible way, so that it can serve as a practical guide for undergraduates and newcomers to the field. The material is organised as a ten-lecture course. The foundations are laid in Chapters 1 and 2, which explain minimum-mean-square-error solution construction and asymptotic behaviour. Chapters 3 and 4 introduce continuous-time and discrete-time minimum-variance filtering. Generalisations for missing data, deterministic inputs, correlated noises, direct feedthrough terms, output estimation and equalisation are described. Chapter 5 simplifies the minimum-variance filtering results for steady-state problems. Observability, Riccati equation solution convergence, asymptotic stability and Wiener filter equivalence are discussed. Chapters 6 and 7 cover the subject of continuous-time and discrete-time smoothing. The main fixed-lag, fixed-point and fixed-interval smoother results are derived. It is shown that the minimum-variance fixed-interval smoother attains the best performance. Chapter 8 attends to parameter estimation. As the above-mentioned approaches all rely on knowledge of the underlying model parameters, maximum-likelihood techniques within expectation-maximisation algorithms for joint state and parameter estimation are described. Chapter 9 is concerned with robust techniques that accommodate uncertainties within problem specifications. An extra term within Riccati equations enables designers to trade-off average error and peak error performance. Chapter 10 rounds off the course by applying the afore-mentioned linear techniques to nonlinear estimation problems. It is demonstrated that step-wise linearisations can be used within predictors, filters and smoothers, albeit by forsaking optimal performance guarantees.

Abstract: "We discuss the behavior of several plane relaxation methods as multigrid smoothers for the solution of a discrete anisotropic elliptic model problem on cell-centered grids. The methods compared are plane Jacobi with damping, plane Jacobi with partial damping, plane Gauss-Seidel, plane zebra Gauss-Seidel, and line Gauss-Seidel. Based on numerical experiments and local mode analysis, we compare the smoothing factor of the different methods in the presence of strong anisotropies. A four-color Gauss-Seidel method is found to have the best numerical and architectural properties of the methods considered in the present work. Although alternating direction plane relaxation schemes are simpler and more robust than other approaches, they are not currently used in industrial and production codes because they require the solution of a two-dimensional problem for each plane in each direction. We verify the theoretical predictions of Thole and Trottenberg that an exact solution of each plane is not necessary and that a single two-dimensional multigrid cycle gives the same result as an exact solution, in much less execution time. Parallelization of the two-dimensional multigrid cycles, the kernel of the three-dimensional implicit solver, is also discussed. Alternating-plane smoothers are found to be highly efficient multigrid smoothers for anisotropic elliptic problems."

This open access book features a selection of high-quality papers from the presentations at the International Conference on Spectral and High-Order Methods 2018, offering an overview of the depth and breadth of the activities within this important research area. The carefully reviewed papers provide a snapshot of the state of the art, while the extensive bibliography helps initiate new research directions.