

Applied Mathematical Sciences

Weizhang Huang
Robert D. Russell

Adaptive Moving Mesh Methods

 Springer

Adaptive Moving Mesh Methods Applied Mathematical Sciences

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Russell, 2010-10-26 Moving mesh methods are an effective mesh adaptation based approach for the numerical solution of mathematical models of physical phenomena Currently there exist three main strategies for mesh adaptation namely to use mesh subdivision local high order approximation sometimes combined with mesh subdivision and mesh movement The latter type of adaptive mesh method has been less well studied both computationally and theoretically This book is about adaptive mesh generation and moving mesh methods for the numerical solution of time dependent partial differential equations It presents a general framework and theory for adaptive mesh generation and gives a comprehensive treatment of moving mesh methods and their basic components along with their application for a number of nontrivial physical problems Many explicit examples with computed figures illustrate the various methods and the effects of parameter choices for those methods The partial differential equations considered are mainly parabolic diffusion dominated rather than convection dominated The extensive bibliography provides an invaluable guide to the literature in this field Each chapter contains useful exercises Graduate students researchers and practitioners working in this area will benefit from this book Weizhang Huang is a Professor in the Department of Mathematics at the University of Kansas Robert D Russell is a Professor in the Department of Mathematics at Simon Fraser University **Domain Decomposition Methods in Science and Engineering XXIV**

Petter E. Bjørstad, Susanne C. Brenner, Lawrence Halpern, Hyea Hyun Kim, Ralf Kornhuber, Talal Rahman, Olof B. Widlund, 2019-01-05 These are the proceedings of the 24th International Conference on Domain Decomposition Methods in Science and Engineering which was held in Svalbard Norway in February 2017 Domain decomposition methods are iterative methods for solving the often very large systems of equations that arise when

engineering problems are discretized frequently using finite elements or other modern techniques These methods are specifically designed to make effective use of massively parallel high performance computing systems The book presents both theoretical and computational advances in this domain reflecting the state of art in 2017 **Mesh Generation and Adaptation** Rubén Sevilla, Simona Perotto, Kenneth Morgan, 2022-05-18 The developments in mesh generation are usually driven by the needs of new applications and or novel algorithms The last decade has seen a renewed interest in mesh generation and adaptation by the computational engineering community due to the challenges introduced by complex industrial problems Another common challenge is the need to handle complex geometries Nowadays it is becoming obvious that geometry should be persistent throughout the whole simulation process Several methodologies that can carry the geometric information throughout the simulation stage are available but due to the novelty of these methods the generation of suitable meshes for these techniques is still the main obstacle for the industrial uptake of this technology This book will cover different aspects of mesh generation and adaptation with particular emphasis on cutting edge mesh generation techniques for advanced discretisation methods and complex geometries **Adaptive Numerical Solution of PDEs** Peter Deuflhard, Martin Weiser, 2012-08-31 This book deals with the general topic Numerical solution of partial differential equations PDEs with a focus on adaptivity of discretizations in space and time By and large introductory textbooks like Numerical Analysis in Modern Scientific Computing by Deuflhard and Hohmann should suffice as a prerequisite The emphasis lies on elliptic and parabolic systems Hyperbolic conservation laws are treated only on an elementary level excluding turbulence Numerical Analysis is clearly understood as part of Scientific Computing The focus is on the efficiency of algorithms i e speed reliability and robustness which directly leads to the concept of adaptivity in algorithms The theoretical derivation and analysis is kept as elementary as possible Nevertheless required somewhat more sophisticated mathematical theory is summarized in comprehensive form in an appendix Complex relations are explained by numerous figures and illustrating examples Non trivial problems from regenerative energy nanotechnology surgery and physiology are inserted The text will appeal to graduate students and researchers on the job in mathematics science and technology Conceptually it has been written as a textbook including exercises and a software list but at the same time it should be well suited for self study *Theory, Numerics and Applications of Hyperbolic Problems I* Christian Klingenberg, Michael Westdickenberg, 2018-06-23 The first of two volumes this edited proceedings book features research presented at the XVI International Conference on Hyperbolic Problems held in Aachen Germany in summer 2016 It focuses on the theoretical applied and computational aspects of hyperbolic partial differential equations systems of hyperbolic conservation laws wave equations etc and of related mathematical models PDEs of mixed type kinetic equations nonlocal or and discrete models found in the field of applied sciences **Domain Decomposition Methods in Science and Engineering XXI** Jocelyne Erhel, Martin J. Gander, Laurence Halpern, Géraldine Pichot, Taoufik Sassi, Olof Widlund, 2014-10-10 This volume contains a

selection of papers presented at the 21st international conference on domain decomposition methods in science and engineering held in Rennes France June 25 29 2012 Domain decomposition is an active and interdisciplinary research discipline focusing on the development analysis and implementation of numerical methods for massively parallel computers Domain decomposition methods are among the most efficient solvers for large scale applications in science and engineering They are based on a solid theoretical foundation and shown to be scalable for many important applications Domain decomposition techniques can also naturally take into account multiscale phenomena This book contains the most recent results in this important field of research both mathematically and algorithmically and allows the reader to get an overview of this exciting branch of numerical analysis and scientific computing *Domain Decomposition Methods in Science and Engineering XX* Randolph Bank, Michael Holst, Olof Widlund, Jinchao Xu, 2013-07-03 These are the proceedings of the 20th international conference on domain decomposition methods in science and engineering Domain decomposition methods are iterative methods for solving the often very large linear or nonlinear systems of algebraic equations that arise when various problems in continuum mechanics are discretized using finite elements They are designed for massively parallel computers and take the memory hierarchy of such systems in mind This is essential for approaching peak floating point performance There is an increasingly well developed theory which is having a direct impact on the development and improvements of these algorithms Progress in Industrial Mathematics at ECMI 2014 Giovanni Russo, Vincenzo Capasso, Giuseppe Nicosia, Vittorio Romano, 2017-09-04 This book presents a collection of papers emphasizing applications of mathematical models and methods to real world problems of relevance for industry life science environment finance and so on The biannual Conference of ECMI the European Consortium of Mathematics in Industry held in 2014 focused on various aspects of industrial and applied mathematics The five main topics addressed at the conference were mathematical models in life science material science and semiconductors mathematical methods in the environment design automation and industrial applications and computational finance Several other topics have been treated such as among others optimization and inverse problems education numerical methods for stiff pdes model reduction imaging processing multi physics simulation mathematical models in textile industry The conference which brought together applied mathematicians and experts from industry provided a unique opportunity to exchange ideas problems and methodologies bridging the gap between mathematics and industry and contributing to the advancement of science and technology The conference has included a presentation of EU Maths In European Network of Mathematics for Industry and Innovation a recent joint initiative of ECMI and EMS The proceedings from this conference represent a snapshot of the current activity in industrial mathematics in Europe and are highly relevant to anybody interested in the latest applications of mathematics to industrial problems

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