# Preface

This volume contains a selection of 52 papers presented at the 19th International Conference on Domain Decomposition, DD19, hosted by the School of Mathematics and Computational Science of the Xiangtan University and the Hunan Key Laboratory for Computation and Simulation in Science and Engineering and held in Zhanjiajie, China, August 17–22, 2009. The conference featured 12 plenary lectures delivered by leaders in the field, 9 Minisymposia, and 33 contributed talks. 128 scientists from 21 countries participated and there were a total of 92 presentations, which accentuates the international scope and relevance of this meeting.

The International Conferences on Domain Decomposition Methods have become the most important market place world wide for exchanging and discussing new ideas about the old algorithmic paradigm of "Divide and Conquer". Since the beginning in Paris in 1987, they have been held in twelve countries in the Far East, Europe, the Middle East, and North America. Much of the reputation of this series results from the close interaction of experts in numerical analysis with practitioners from large scale scientific computing in various fields of applications.

In the time of "petascale" computers with more than 200,000 independent processor cores, there are essentially no alternatives to domain decomposition as a strategy for parallelization. The need for robust and efficient preconditioners thus motivates ongoing theoretical research on new Schwarz and iterative substructuring techniques for very large stationary problems arising in finite element simulations. The development of optimized transmission conditions, to enhance the rate of convergence of these iterative methods, remains a very active field and so does research on space-time domain decomposition. Moreover, different physical properties, in different subdomains, often suggest a splitting of the domain, e.g., into subdomains occupied by fluid or structure or even into bounded and unbounded domains that are glued together by suitable coupling conditions. This kind of heterogeneous domain decomposition has become a well-established approach to mathematical modeling.

We note that multigrid methods based on a decomposition into frequencies, rather than subdomains, can be used as subdomain solvers or as stand-alone methods for a variety of linear and nonlinear problems.

The present volume reviews many of these aspects of domain decomposition. Applications comprise acoustics, biomechanics, computational mechanics, fluid dynamics and fluid-structure interaction, electromagnetics, microelectronics, quantum dots and, of course, large scale computations.

For further information, we recommend the homepage of International Domain Decomposition Conferences, `www.ddm.org`, maintained by Martin Gander. This site features free online access to the proceedings of almost all previous DD conferences, information about past and future meetings, as well as bibliographic and personal information pertaining to domain decomposition. A bibliography with all previous proceedings is provided below, along with some major review articles and monographs. (We apologize for unintentional omissions to our necessarily incomplete list.) No attempts have been made to supplement this list with the larger and closely related literature of multigrid and general iterative methods, except for the books by Hackbusch and Saad, which have significant domain decomposition components.

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