
Preface

This volume contains a selection of 71 refereed papers presented at the 17th International Conference on Domain Decomposition Methods held at St. Wolfgang / Strobl, Austria, July 3 - 7, 2006.

1 Background of Conference Series

Domain Decomposition (DD) is an active, interdisciplinary research area concerned with the development, analysis, and implementation of coupling and decoupling strategies in mathematical and computational models arising in Computational Science and Engineering. Historically, it has emerged from the analysis of partial differential equations, beginning with the work of H. A. Schwarz in 1869, in which he established the existence of harmonic functions in domains with complicated boundaries (see logo on the cover), continuing with the variational setting of the alternating Schwarz method by S.L. Sobolev in 1934, and leading to the powerful “Schwarz machinery” developed during the last two decades. Another historical origin of modern domain decomposition methods (DDM) is the classical substructuring techniques which were first developed by mechanical engineers for the finite element analysis of complex structures in the 1960s. We note that the DD technologies are also well suited for treating coupled field problems by hybrid discretization techniques.

The appearance of parallel computers, in particular, of massively parallel computers with distributed memory in the mid 1980s, led to an extensive development of parallel algorithms for solving partial differential equations — problems which play a fundamental role in computational sciences. Time was therefore then right to organize the first international conference, which was held in Paris in 1987. There are now conferences in this series with roughly 18-month intervals:

- Paris, France, 1987

- Los Angeles, CA, USA, 1988
- Houston, TX, USA, 1989
- Moscow, USSR, 1990
- Norfolk, VA, USA, 1991
- Como, Italy, 1992
- University Park, PA, USA, 1993
- Beijing, China, 1995
- Ullensvang, Norway, 1996
- Boulder, CO, USA, 1997
- Greenwich, UK, 1998
- Chiba, Japan, 1999
- Lyon, France, 2000
- Cocoyoc, Mexico, 2002
- Berlin, Germany, 2003
- New York, NY, USA, 2005
- St. Wolfgang, Austria, 2006

The DD conferences are now not only attended by numerical analysts and people interested in parallel computing, but also by scientists from all computational sciences.

The activities of the domain decomposition community are coordinated by the International Scientific Committee on Domain Decomposition Methods:

- Petter Bjørstad, Bergen
- Roland Glowinski, Houston, TX
- Ronald Hoppe, Augsburg and Houston, TX
- Hideo Kawarada, Chiba, Japan
- David Keyes, New York, NY
- Ralf Kornhuber, Berlin
- Yuri Kuznetsov, Houston, TX
- Ulrich Langer, Austria
- Jacques Periaux, Paris
- Alfio Quarteroni, Lausanne, Switzerland
- Zhong-Ci Shi, Beijing
- Olof Widlund, New York, NY
- Jinchao Xu, University Park, PA

Information on and proceedings of the domain decomposition conferences and the ongoing activities of the domain decomposition community can be found on the DDM home page

<http://www.ddm.org> .

2 The Seventeenth Conference

The 17th International Conference on Domain Decomposition Methods (DD17) was held at the Institute for Adult Education in St. Wolfgang / Strobl, Austria, July 3 - 7, 2006. The DD17 was hosted by the Johann Radon Institute for Computational and Applied Mathematics (RICAM), in cooperation with the Special Research Program F013 (SFB F013) on “*Numerical and Symbolic Scientific Computing*” and the Institute for Computational Mathematics (NuMa) of the Johannes Kepler University Linz (JKU). The conference was chaired by Ulrich Langer (NuMa, RICAM and SFB F013). 162 scientists from 29 countries participated. Among the highlights were the talks of the 15 invited speakers:

- Mark Adams (Columbia University, USA): Algebraic Multigrid Methods for Mechanical Engineering Applications,
- Mark Ainsworth (Strathclyde University, UK): Robustness of Some Simple Smoothers for Finite Element and Boundary Elements on Nonquasiuniform Meshes,
- Zoran Andjelić (ABB Schweiz AG, SWITZERLAND): BEM: Opening the New Frontiers in the Industrial Products Design,
- Martin Gander (University of Geneva, SWITZERLAND): Time Domain Decomposition Methods,
- Laurence Halpern (University of Paris 13, FRANCE): Schwarz Waveform Relaxation Algorithms: Theory and Applications,
- Matthias Heinkenschloss (Rice University, USA): Domain Decomposition Methods for PDE Constrained Optimization,
- Hyea Hyun Kim (Courant Institute of Mathematical Sciences, New York University, USA): Domain Decomposition Algorithms for Mortar Discretizations,
- Rolf Krause (University of Bonn, GERMANY): On the Multiscale Solution of Constrained Problems in Linear Elasticity,
- Yuri Kuznetsov (University of Houston, USA): Domain Decomposition Preconditioners for Anisotropic Diffusion,
- Raytcho Lazarov (Texas A&M University, USA): Preconditioning of Discontinuous Galerkin FEM of Second Order Elliptic Problems,
- Young-Ju Lee (University of California, Los Angeles, USA): Convergence Theories of the Subspace Correction Methods for Singular and Nearly Singular System of Equations,
- Günter Leugering (Friedrich-Alexander-University of Erlangen-Nürnberg, GERMANY): Domain Decomposition in Optimal Control of Partial Differential Equations on Networked Domains,
- Jacques Périaux (CIMNE/UPC Barcelona, SPAIN): A Domain Decomposition/Nash Equilibrium Methodology for the Solution of Direct and Inverse Problems in Fluid Dynamics,
- Olaf Steinbach (Graz University of Technology, AUSTRIA): Boundary Element Domain Decomposition Methods: Challenges and Applications,

- Mary Wheeler (University of Texas at Austin, USA): A Domain Decomposition Multiscale Mortar Mixed Method for Flow in Porous Media.

Ten minisymposia were organized on different topics. In addition, the many contributed talks and posters contributed to the success of the DD17.

Sponsoring Organizations:

- Institute for Computational Mathematics (NuMa) of the Johannes Kepler University, Linz (JKU)
- Johann Radon Institute for Computational and Applied Mathematics, Linz (RICAM)
- Linzer Hochschulfond
- Special Research Program SFB F013 “*Numerical and Symbolic Scientific Computing*”
- Springer Verlag
- Township St. Wolfgang
- Township Strobl

Local Organizing Committee Members:

- Sven Beuchler, JKU (Linz)
- Alfio Borzi, University of Graz (Graz)
- Martin Burger, JKU, SFB013 and JKU (Linz)
- Heinz Engl, JKU, SFB013 and JKU (Linz)
- Martin Gander, University of Geneva (Geneva)
- Gundolf Haase, University of Graz (Graz)
- Karl Kunisch, University of Graz (Graz) and RICAM (Linz)
- Ulrich Langer, JKU, SFB013 and JKU (Linz)
- Ewald Lindner, SFB013 and JKU (Linz)
- Joachim Schöberl, RICAM and SFB013 (Linz)
- Olaf Steinbach, Graz University of Technology (Graz)
- Christoph Überhuber, Vienna University of Technology (Vienna)
- Walter Zulehner, JKU (Linz)

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More information about the conference can be found on the DD17 home page

<http://www.ricam.oeaw.ac.at/dd17> .

3 Conference Proceedings, Selected Books, and Survey Articles

1. P.E. Bjørstad, M.S. Espedal, and David E. Keyes, eds., *Proc. Ninth Int. Conf. on Domain Decomposition Methods for Partial Differential Equations* (Ullensvang, 1997), Wiley, New York, 1999.
2. T.F. Chan, R. Glowinski, J. Périaux, and O. B. Widlund, eds., *Proc. Second Int. Conf. on Domain Decomposition Methods for Partial Differential Equations* (Los Angeles, 1988), SIAM, Philadelphia, 1989.
3. T.F. Chan, R. Glowinski, J. Périaux, and O. B. Widlund, eds., *Proc. Third Int. Conf. on Domain Decomposition Methods for Partial Differential Equations* (Houston, 1989), SIAM, Philadelphia, 1990.
4. T.F. Chan, T. Kako, H. Kawarada, and O. Pironneau, eds., *Proc. Twelfth Int. Conf. on Domain Decomposition Methods in Sciences and Engineering* (Chiba, 1999), DDM.org, Bergen, 2001.
5. T.F. Chan and T.P. Mathew, *Domain Decomposition Algorithms*, Acta Numerica, 1994, pp. 61–143.
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12. D. Keyes, T.F. Chan, G. Meurant, J.S. Scroggs and R.G. Voigt, eds., *Proc. Fifth Int. Conf. on Domain Decomposition Methods for Partial Differential Equations* (Norfolk, 1991), SIAM, Philadelphia, 1992.
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14. D. Keyes and J. Xu, eds., *Proc. Seventh Int. Conf. on Domain Decomposition Methods for Partial Differential Equations* (University Park, 1993), AMS, Providence, 1995.

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16. R. Kornhuber, R. Hoppe, J. Periaux, O. Pironneau, O. Widlund and J. Xu, eds., *Proc. Fifteenth Int. Conf. on Domain Decomposition Methods in Sciences and Engineering* (Berlin, 2003), Springer, Heidelberg, 2004.
17. J. Kruis, *Domain Decomposition Methods for Distributed Computing*, Saxe-Coburg Publication, Dun Eaglais, 2005.
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30. A. Toselli and O. Widlund, *Domain Decomposition Methods – Algorithms and Theory*, Springer, New York, 2005.
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33. J. Xu, *Iterative Methods by Space Decomposition and Subspace Correction: A unifying approach*, SIAM Review, Vol. 34, No. 4, 1992, pp. 581–613.
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4 Organization

Parts I and III of the proceedings collect the plenary and contributed presentations, respectively; the papers appear in alphabetical order by the first-listed author. In part II “Minisymposia”, the organizers of the minisymposia provide short introductions to the minisymposia. Within each minisymposium section, the papers again appear in alphabetical order.

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