Preface of DD24 Book of Proceedings

This volume contains a selection of 53 papers submitted to the 24th International Conference on Domain Decomposition Methods, hosted by the University of Bergen in cooperation with the Western Norway University of Applied Sciences, and held in Spitsbergen at Svalbard, Norway, February 6–10, 2017.

Background of the Conference Series

With its first meeting in Paris in 1987, the International Conference on Domain Decomposition Methods has been held in 15 countries in Asia, Europe, and North America, and now for the first time north of 78^0 in the kingdom of the Polar Bears. The conference is held at roughly 18-months intervals. A complete list of 25 meetings appears below.

Domain decomposition is often seen as a form of divide-and-conquer for mathematical problems posed over a physical domain, reducing a large problem into a collection of smaller problems, each of which is much easier to solve computationally than the undecomposed problem, and most or all of which can be solved independently and concurrently, and then solving them iteratively in a consistent way. Much of the theoretical interest in domain decomposition algorithms lies in ensuring that the number of iterations required to converge is very small. Domain decomposition algorithms can be tailored to the properties of the physical system as reflected in the mathematical operators, to the number of processors available, and even to specific architectural parameters, such as cache size and the ratio of memory bandwidth to floating point processing rate, proving it to be an ideal paradigm for large-scale simulation on advanced architecture computers.

The principle technical content of the conference has always been mathematical, but the principle motivation has been to make efficient use of distributed memory computers for complex applications arising in science and engineering. While research in domain decomposition methods is presented at numerous venues, the International Conference on Domain Decomposition Methods is the only regularly

occurring international forum dedicated to interdisciplinary technical interactions between theoreticians and practitioners working in the development, analysis, software implementation, and application of domain decomposition methods.

As we approach the dawn of exascale computing, where we will command 1018 floating point operations per second, clearly efficient and mathematically well-founded methods for the solution of large-scale systems become more and more important-as does their sound realization in the framework of modern HPC architectures. In fact, the massive parallelism, which makes exascale computing possible, requires the development of new solutions methods, which are capable of efficiently exploiting this large number of cores as well as the connected hierarchies for memory access. Ongoing developments such as parallelization in time asynchronous iterative methods, or nonlinear domain decomposition methods show that this massive parallelism does not only demand for new solution and discretization methods, but also allowsto fosterthe development of new approaches.

Here is a list of the 25 first conferences on Domain Decomposition:

1. Paris, France, January 7-9, 1987
2. Los Angeles, USA, January 14-16, 1988
3. Houston, USA, March 20-22, 1989
4. Moscow, USSR, May 21-25, 1990
5. Norfolk, USA, May 6-8, 1991
6. Como, Italy, June 15-19, 1992
7. University Park, Pennsylvania, USA, October 27-30□, 1993
8. Beijing, China, May 16-19, 1995
9. Ullensvang, Norway, June 3-8, 1996
10. Boulder, USA, August 10-14, 1997
11. Greenwich, UK, July 20-24, 1998
12. Chiba, Japan, October 25-20, 1999
13. Lyon, France, October 9-12, 2000
14. Cocoyoc, Mexico, January 6-11, 2002
15. Berlin, Germany, July 21-25, 2003
16. New York, USA, January 12-15, 2005
17. St. Wolfgang-Strobl, Austria, July 3-7, 2006
18. Jerusalem, Israel, January 12-17, 2008
19. Zhangjiajie, China, August 17-22, 2009
20. San Diego, California, USA, February 7-11, 2011
21. Rennes, France, June 25-29, 2012
22. Lugano, Switzerland, September 16-20, 2013
23. Jeju Island, Korea, July 6-10, 2015
24. Spitsbergen, Svalbard, Norway, February 6-10, 2017
25. St. John's, Newfoundland, Canada, July 23-27, 2018

International Scientific Committee on Domain Decomposition Methods

- Petter Bjørstad, University of Bergen, Norway
- Susanne Brenner, Louisiana State University, USA
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- Martin Gander, University of Geneva, Switzerland
- Laurence Halpern, University Paris 13, France
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- Alfio Quarteroni, EPFL, Switzerland
- Olof Widlund, Courant Institute, USA
- Jinchao Xu, Penn State, USA
- Jun Zou, Chinese University of Hong Kong, Hong Kong

About the 24th. Conference

The twenty-fourth International Conference on Domain Decomposition Methods had close to 200 participants from about 30 different countries. The conference contained 12 invited presentation selected by the International Scientific Committee, fostering both experienced and younger scientists, 19 minisymposia around specific topics, 3 contributed sessions, and a poster session. The present proceedings contain a selection of 53 papers grouped into three separate groups: 8 plenary papers, 41 minisymposia papers, and 4 contributed papers.

Sponsoring Organizations

- Department of Informatics, University of Bergen
- Simula Research Laboratory
- Faculty of Engineering and Science, WNUAS
- SparebankenVest Bergen
- The Research Council of Norway

Local Organizing/Program Committee Members

- Liv Rebecca Aae (Insititute for Informatics, University of Bergen)
- Petter E. Bjørstad (Insititute for Informatics, University of Bergen)
- Sushmita Gupta (Insititute for Informatics, University of Bergen)
- Talal Rahman (Faculty of Engineering and Science, WNUAS)

Plenary Presentations

- *An additive Schwarz analysis of multiplicative Schwarz methods*, Sue Brenner (Louisiana State University, USA)
- *On nonlinear adaptivity with heterogeneity*, Jed Brown (University of Colorado Boulder, USA)
- *Overlapping methods for high-contrast multiscale problems*, Juan Carlos Galvis-Arrieta (Universidad Nacional de Colombia)
- *Domain Decomposition for high frequency Helmholtz problems*, Ivan Graham (University of Bath, UK)
- *PDE based mesh generation: domain decomposition approaches*, Ron Haynes (Memorial University, Canada)
- *Robust Preconditioners for Coupled Problems*, Xiaozhe Hu (Tufts University, USA)
- *Modeling and discretization of thin inclusions for flow in deformable porous media*, Jan Nordbotten (University of Bergen, Norway)
- *Domain decomposition based methods for multiphysics problems*, Alfio Quarteroni (Ecole polytechnique fédérale de Lausanne, Switzerland)
- *Recent advances on adaptive multilevel BDDC methods for div- and curl-conforming spaces*, Stefano Zampini (KAUST, Saudi Arabia)
- *Communication avoiding iterative solvers and preconditioners*, Laura Grigori (Inria Paris and Laboratoire J.L. Lions UPMC, France)
- *Impact of high abstraction/high performance finite element software in biomedical computing*, Marie Rognes (Simula Research Laboratory, Norway)
- *Scalable multilevel preconditioners for cardiac electro-mechanics*, Simone Scacchi (University of Milano, Italy)

Acknowledgements

The organizers would like to thank all the participants for their enthusiasm and carefully prepared contributions that made this meeting a very successful event, both scientifically and socially. A warm thank also to our sponsors that made the budget come together. Also, our deep appreciation for the people of Longyearbyen. They were helpful in all respect and allocated the city movie theater to our plenary talks,

thus all movies were cancelled for an entire week. We also would like to acknowledge the efforts of our excursion partner, the Svalbard Adventure Group. Unfortunately, our conference experienced the harsh reality of global warming, with temperatures about 25 degress warmer than normal.

Bergen, May 2018.

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