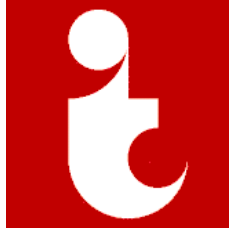


# ANLA research achievements



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Kurt Otto  
Lina von Sydow  
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Henrik Brandén  
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Edited by Kurt Otto  
October 28, 2008

This document is a summary of publications and conference contributions presented by members of the research group<sup>†</sup> Applied Numerical Linear Algebra (ANLA) at the Dept. of Information Technology, Uppsala University, Uppsala, Sweden.

## Theses

- [I] S. HOLMGREN, *Fast Solvers for First-order PDE*, Ph.D. thesis, Dept. of Scientific Computing, Uppsala Univ., Uppsala, Sweden, 1993. (B. Gustafsson)
- [II] K. OTTO, *Construction and Analysis of Preconditioners for First-order PDE*, Ph.D. thesis, Dept. of Scientific Computing, Uppsala Univ., Uppsala, Sweden, 1993. (B. Gustafsson)
- [III] L. HEMMINGSSON, *Domain Decomposition Methods and Fast Solvers for First-order PDEs*, Ph.D. thesis, Dept. of Scientific Computing, Uppsala Univ., Uppsala, Sweden, 1995. (B. Gustafsson)
- [IV] H. BRANDÉN, *Convergence acceleration for flow problems using semicirculant approximations*, Report 214, Lic. thesis, Dept. of Scientific Computing, Uppsala Univ., Uppsala, Sweden, 1999. (S. Holmgren)
- [V] E. LARSSON, *Domain Decomposition and Preconditioned Iterative Methods for the Helmholtz Equation*, Ph.D. thesis, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2000. (K. Otto)
- [VI] H. BRANDÉN, *Convergence Acceleration for Flow Problems*, Ph.D. thesis, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2001. (S. Holmgren)
- [VII] E. MOSSBERG, *Higher order finite difference methods for wave propagation problems*, Lic. thesis, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2002. (B. Gustafsson)
- [VIII] S. SUNDBERG, *Semi-Toeplitz preconditioning for linearized boundary layer problems*, Lic. thesis, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2002. (L. von Sydow)
- [IX] P. SUNDQVIST, *Preconditioners and fundamental solutions*, Lic. thesis, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2003. (H. Brandén)
- [X] E. BÄNGTSSON, *Robust preconditioned iterative solution methods for large-scale nonsymmetric problems*, Lic. thesis, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2005. (M. Neytcheva)
- [XI] P. SUNDQVIST, *Numerical Computations with Fundamental Solutions*, Ph.D. thesis, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2005. (H. Brandén)
- [XII] E. BÄNGTSSON, *Robust Preconditioners Based on the Finite Element Framework*, Ph.D. thesis, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2007. (M. Neytcheva)

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<sup>†</sup>originating from the former research group Solving Systems of Equations for PDE (EQSYS)

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- [2] K. ÅHLANDER AND D. HENRIKSSON, *Sparse generalized Fourier transforms*, BIT, 47 (2007), pp. 213–237.
- [3] K. ÅHLANDER AND H. MUNTHE-KAAS, *Applications of the generalized Fourier transform in numerical linear algebra*, BIT, 45 (2005), pp. 819–850.
- [4] ———, *Eigenvalues for equivariant matrices*, J. Comput. Appl. Math., 192 (2006), pp. 89–99.
- [5] O. AXELSSON AND M. NEYTCHIEVA, *Preconditioning methods for linear systems arising in constrained optimization problems*, Numer. Linear Algebra Appl., 10 (2003), pp. 3–31.
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- [xiii] O. AXELSSON, R. BLAHETA, AND M. NEYTCHEVA, *Preconditioning of boundary value problems using elementwise Schur complements*, Tech. Rep. 2006-048, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2006.
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- [xv] E. BÄNGTSSON AND M. NEYTCHEVA, *Finite element block-factorized preconditioners*, Tech. Rep. 2007-008, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2007.

## Supervised M.Sc. theses

- [1] L. FRÄNDÉN, *Implementation of a CG-like iterative method and a new preconditioner on a hypercube*, UPTEC Report 89 070E, Dept. of Technology, Uppsala Univ., Uppsala, Sweden, 1989. (S. Holmgren and K. Otto)
- [2] A. HOLMBERG, *Parallel and vector solution of bidiagonal and tridiagonal systems of equations*, Internal Report 91:06, Dept. of Scientific Computing, Uppsala Univ., Uppsala, Sweden, 1991. (S. Holmgren)
- [3] E. STERNER, *An ADI-preconditioner for block-tridiagonal systems of equations*, UPTEC Report 91 055E, Dept. of Technology, Uppsala Univ., Uppsala, Sweden, 1991. (S. Holmgren)
- [4] A. GRAHN, *A direct solver for first order systems of PDE*, Internal Report 92:07, Dept. of Scientific Computing, Uppsala Univ., Uppsala, Sweden, 1992. (S. Holmgren)
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- [10] A. KÄHÄRI, *An implementation of a new parallel preconditioner for the time dependent Euler equations*, Report 4, Parallel and Scientific Computing Institute ( $\Psi$ ), Royal Institute of Technology, Stockholm, Sweden, 1996. (L. von Sydow)
- [11] G. PERSSON, *Preconditioning for low Mach numbers in EURANUS*, UPTEC Report F 98 095, School of Engineering, Uppsala Univ., Uppsala, Sweden, 1998. (S. Holmgren)
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- [13] R. ESCOVAR, *Parallelization of the creation of a Schur complement matrix*, M.Sc. thesis, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 1999. (E. Larsson)
- [14] P. MATTSSON, *A multigrid analysis for the rotated Laplacian*, UPTEC Report F 99 011, School of Engineering, Uppsala Univ., Uppsala, Sweden, 1999. (A. Wathen and L. von Sydow)
- [15] M. AGAH, *Large eddy simulations with Fluent 5*, UPTEC Report F 00 044, School of Engineering, Uppsala Univ., Uppsala, Sweden, 2000. (S. Holmgren)

- [16] P. SUNDQVIST, *Preconditioners based on fundamental solutions*, UPTEC Report F 00 002, School of Engineering, Uppsala Univ., Uppsala, Sweden, 2000. (H. Brandén)
- [17] D. WALLIN, *Performance of a high-accuracy PDE solver on a self-optimizing NUMA architecture*, UPTEC Report F 01 017, School of Engineering, Uppsala Univ., Uppsala, Sweden, 2001. (S. Holmgren)
- [18] A. BERGSTRÖM, *Domain embedding for the finite difference method*, UPTEC Report F 04 030, School of Engineering, Uppsala Univ., Uppsala, Sweden, 2004. (H. Brandén)
- [19] R. HIDEFJÄLL, *Områdesinbäddning för ODE*, B.Sc. thesis, Dept. of Mathematics, Uppsala Univ., Uppsala, Sweden, 2004. (H. Brandén)
- [20] D. HENRIKSSON, *Exploiting symmetries when solving the heat equation on a spherical icosahedral grid*, UPTEC Report F 06 018, School of Engineering, Uppsala Univ., Uppsala, Sweden, 2006. (K. Åhlander)
- [21] N. FORS, *Enhancing flexibility in iterative solution methods*, UPTEC Report F 07 112, School of Engineering, Uppsala Univ., Uppsala, Sweden, 2007. (M. Neytcheva and V. Simoncini)
- [22] K. KARLSTRÖM, *Glacial rebound: Numerical simulations of a linear viscoelastic problem*, UPTEC Report F 07 031, School of Engineering, Uppsala Univ., Uppsala, Sweden, 2007. (M. Neytcheva)
- [23] S. MAHMOUDI, *Large scale numerical simulations of problems arising from micro finite element analysis of trabecular bone structures*, M.Sc. thesis, Dept. of Information Technology, Uppsala Univ., Uppsala, Sweden, 2007. (M. Neytcheva)

# Conference contributions, participations, etc.

*In chronological order*

- 1988 .....
- HOLMGREN AND OTTO  
A draft of article [iii] was presented as a poster at: *The Second International Conference on Vector and Parallel Computing Issues in Applied Research and Development*, June 6–10 1988, Tromsø, Norway.
- 1989 .....
- HOLMGREN AND OTTO  
A draft of article [iv] was presented as a talk (*Iterative solution methods and preconditioners for non-diagonally dominant, block-tridiagonal systems of equations arising from hyperbolic PDEs*) at: *Second Annual Meeting of the SIAM Nordic Section*, August 28–29 1989, Espoo, Finland.
  - HOLMGREN, OTTO, AND FRÄNDÉN  
Article [42] was presented as a poster at: *First European Workshop on Hypercube and Distributed Computers*, October 4–6 1989, Rennes, France.
- 1990 .....
- HOLMGREN AND OTTO  
A draft of article [37] participated in the “Student Paper Competition” for the *First Copper Mountain Conference on Iterative Methods*, April 1–5 1990, Copper Mountain, CO, USA. The report was awarded third place in the competition and was presented as a talk at the conference.
  - Hemmingsson attended: *Fourth International Symposium on Domain Decomposition Methods for Partial Differential Equations*, May 21–25 1990, Moscow, USSR.
  - Some of the work in article [37] was presented in a talk by Prof. Lars Eldén at: *Householder Symposium XI*, June 18–22 1990, Tylösand, Sweden.
  - OTTO AND HOLMGREN  
An extension of article [37] was presented as a talk (*Parallelization of Preconditioned Iterative Methods*) at: *Supercomputers in Engineering*, October 18–19 1990, Linköping, Sweden.
- 1992 .....
- OTTO AND HOLMGREN  
A draft of article [38] was presented as a talk at: *Second Copper Mountain Conference on Iterative Methods*, April 9–14 1992, Copper Mountain, CO, USA.
  - HOLMGREN AND OTTO  
An extension of article [38] was presented as a talk (*A direct solver for first-order PDE*) at: *Industrial Mathematics Week*, August 17–21 1992, Trondheim, Norway.
  - Hemmingsson attended: *Workshop on Parallel Computing*, August 24–25 1992, Lyngby, Denmark.
- 1993 .....

- HEMMINGSSON  
Article [29] was presented as a talk at: *Parallel CFD '93*, May 10–12 1993, Paris, France.
- OTTO AND HOLMGREN  
Article [39] was presented as a talk at: *Householder Symposium XII*, June 13–18 1993, Lake Arrowhead, CA, USA.
- HEMMINGSSON  
An extension of article [31] was presented as a talk (*A domain decomposition method for hyperbolic problems in 2D*) at: *Seventh International Conference on Domain Decomposition Methods in Scientific and Engineering Computing*, October 27–30 1993, University Park, PA, USA.
- HOLMGREN, OTTO, AND VILMUSENAHO  
Work from article [v] and Vilmusenaho's M.Sc. thesis was presented as a talk (*Solvers for systems of equations arising from PDE-problems*) at: *Conference on Parallel High-Performance Applications*, December 16–17 1993, Stockholm, Sweden.

## 1994

- HEMMINGSSON  
A draft of article [34] participated in the “Student Paper Competition” for the *Colorado Conference on Iterative Methods*, April 5–9 1994, Breckenridge, CO, USA. Hemmingsson's report was awarded second place in the competition and was presented as a talk at the conference.
- OTTO AND HOLMGREN  
Work from articles [40, 41] was presented as a talk (*A Framework for the Construction of Preconditioners for Systems of PDE*) at: *Colorado Conference on Iterative Methods*, April 5–9 1994, Breckenridge, CO, USA.
- Otto visited and gave a seminar at the Dept. of Computer Science, Stanford Univ., Stanford, CA, USA, April 10–13 1994.
- Hemmingsson visited the Dept. of Computer Science, Stanford Univ., Stanford, CA, USA, April 10–23 1994.

## 1995

- HOLMGREN AND OTTO  
Work from articles [40, 41] was presented as a talk (*A Framework for Preconditioners for Systems of PDE*) at: *Conference on Numerical Analysis in Honor of Germund Dahlquist's 70th Birthday*, January 11–13 1995, Stockholm, Sweden.
- Holmgren visited Para||ab, Univ. of Bergen, Bergen, Norway, January 16–20 1995. He gave a seminar presenting work from articles [40, 41].
- From October 1994 through June 1995 Otto visited the Computer Science Dept., Univ. of Maryland at College Park, MD, USA, in the position of Postdoctoral Research Associate. He was involved in a project concerning high-order discretizations and iterative solution of the Helmholtz equation in underwater acoustics.
- OTTO AND LARSSON  
A draft of article [57] was presented as a talk (*Iterative solution of the Helmholtz equation*) at: *IMA Conference on Linear Algebra and its Applications*, July 10–12 1995, Manchester, UK.

- HOLMGREN AND OTTO  
Work from articles [40, 41] was presented as a talk (*A framework for transform-based preconditioners for systems of PDE*) at: *Sixth International Symposium on Computational Fluid Dynamics*, September 4–8 1995, Lake Tahoe, NV, USA.
- OTTO visited the Computer Science Dept., Univ. of Maryland at College Park, MD, USA, September 11–18 1995.

1996 .....

- HOLMGREN AND BRANDÉN  
A draft of article [18] was presented as a talk (*Convergence Acceleration for Time-independent First-order PDE Using Optimal PNB-approximations*) at: *Fourth Copper Mountain Conference on Iterative Methods*, April 9–13 1996, Copper Mountain, CO, USA.
- LARSSON AND OTTO  
Work from article [57] was presented as a talk (*Iterative solution of the Helmholtz equation*) at: *Fourth Copper Mountain Conference on Iterative Methods*, April 9–13 1996, Copper Mountain, CO, USA.
- HEMMINGSSON AND KÄHÄRI  
Work from article [30] was presented as a talk (*A Domain Decomposition Method for Combustor Flows*) at: *SWISC 96, Domain Decomposition and Large Scale Simulations*, May 30–31 1996, Stockholm, Sweden.
- OTTO AND LARSSON  
An extension of article [57] was presented as a talk (*Iterative solution of the Helmholtz equation*) at: *SWISC 96, Domain Decomposition and Large Scale Simulations*, May 30–31 1996, Stockholm, Sweden.
- HEMMINGSSON  
Work from articles [28, 30] was presented as a talk (*A Domain Decomposition Method for Almost Incompressible Flow*) at: *Ninth International Conference on Domain Decomposition Methods*, June 3–8 1996, Bergen, Norway.
- Holmgren and Larsson attended: *International Linear Algebra Year, Workshop on Iterative Methods*, June 10–13 1996, Toulouse, France.
- HEMMINGSSON  
Ph.D. thesis [III] was one out of four candidates on the short list for the Alston S. Householder Award (1996). For that reason, Hemmingsson was invited to give a talk (*Iterative Solution Techniques for First-order Problems Using a Schur-Complement Method*) at: *Householder Symposium XIII*, June 17–21 1996, Pontresina, Switzerland.
- OTTO  
A draft of article [56] was presented as a talk at: *Householder Symposium XIII*, June 17–21 1996, Pontresina, Switzerland.
- MOSSBERG, OTTO, AND THUNÉ  
A draft of article [52] was presented as a talk at: *SciTools '96, International Workshop on Modern Software Tools for Scientific Computing*, September 16–18 1996, Oslo, Norway.
- HEMMINGSSON  
Work from Ph.D. thesis [III] was presented as a seminar at Rutherford Appleton Lab., Didcot, UK, October 1996.

- Holmgren visited Oxford University Computing Lab., Oxford, UK, March 18–20 1997. He gave a seminar presenting work from article [36].
- Larsson and Mossberg attended: *Summer School on Multilevel Preconditioning Methods with Parallel Implementation Aspects and Applications in Scientific Computing*, May 19–26 1997, Nijmegen, The Netherlands.
- HOLMGREN  
Work from article [36] was presented as an invited minisymposium talk (*Fast transform-based preconditioners for inviscid and viscous flows*) at: *SIAM 45th Anniversary and Annual Meeting*, July 14–18 1997, Stanford, CA, USA.
- OTTO  
Report [vi] was presented as an invited minisymposium talk at: *SIAM 45th Anniversary and Annual Meeting*, July 14–18 1997, Stanford, CA, USA.
- From August 1996 through July 1997 Hemmingsson visited Oxford University Computing Lab., Oxford, UK, in the position of Postdoctoral Research Associate. She was involved in a project concerning preconditioning of the incompressible Navier–Stokes equations.
- LARSSON  
Article [46] was presented as a talk at: *Tenth International Conference on Domain Decomposition Methods*, August 10–14 1997, Boulder, CO, USA.
- ABRAHAMSSON AND LARSSON  
Article [47] was presented as a talk (*Numerical validation of PE models in ocean acoustics*) at: *Hydroakustik 1997*, September 9–10 1997, Stockholm, Sweden.
- HOLMGREN, BRANDÉN, AND STERNER  
Article [36] was presented as a talk at: *Seventh International Symposium on Computational Fluid Dynamics*, September 15–19 1997, Beijing, China.

- GUSTAFSSON AND HEMMINGSSON  
Article [23] was presented as a talk at: *A Numerical Analysis Conference in Honor of Olof B. Widlund on the Occasion of His 60th Birthday*, January 23–24 1998, New York, NY, USA.
- HOLMGREN AND BRANDÉN  
Work from article [18] was presented as a talk (*Convergence Acceleration using Optimal PNB Approximations*) at: *Seventh International Conference on Hyperbolic Problems*, February 9–13 1998, Zürich, Switzerland.
- LARSSON AND ABRAHAMSSON  
Work from article [47] was presented as a talk (*Parabolic wave equations versus the Helmholtz equation in ocean acoustics*) at: *Fourth International Conference on Mathematical and Numerical Aspects of Wave Propagation*, June 1–5 1998, Golden, CO, USA.
- KÄHÄRI AND HEMMINGSSON  
Article [33] was presented as a talk at: *PARA'98, International Workshop on Applied Parallel Computing*, June 14–17 1998, Umeå, Sweden.

- Holmgren attended: *PARA'98, International Workshop on Applied Parallel Computing*, June 14–17 1998, Umeå, Sweden.
- HEMMINGSSON AND GUSTAFSSON  
Work from article [24] was presented as a talk (*Implicit High Order Difference Methods and Domain Decomposition*) at: *Fourth International Conference on Spectral and High Order Methods*, June 22–26 1998, Herzliya, Israel.
- GUSTAFSSON AND HEMMINGSSON  
Work from article [23] was presented as a talk (*A Fast High Order Domain Decomposition Poisson Solver*) at: *Fourth International Conference on Spectral and High Order Methods*, June 22–26 1998, Herzliya, Israel.
- Larsson and Mossberg attended: *EPSRC VIII-th Summer School in Numerical Analysis*, July 5–10 1998, Leicester, UK. Larsson gave a seminar presenting article [46].
- Holmgren attended: *Cluster and Distributed Computing Workshop*, September 24–25 1998, Stockholm, Sweden.
- Holmgren and Larsson attended: *PSCI Workshop on Computational Electromagnetics*, December 16 1998, Stockholm, Sweden.

## 1999

- LARSSON AND ABRAHAMSSON  
Article [47] was presented as a talk at: *Fourth International Conference on Theoretical and Computational Acoustics*, May 10–14 1999, Trieste, Italy.
- OTTO  
Article [56] was presented as a talk at: *Fourth International Conference on Theoretical and Computational Acoustics*, May 10–14 1999, Trieste, Italy.
- KÄHÄRI AND SUNDBERG  
Work from article [33] was presented as a talk (*Convergence acceleration for the Euler equations using a parallel semi-Toeplitz preconditioner*) at: *Parallel CFD '99*, May 23–26 1999, Williamsburg, VA, USA.
- BRANDÉN AND HOLMGREN  
Work from articles [18, 19] was presented as a poster at: *International Conference on Preconditioning Techniques for Large Sparse Matrix Problems in Industrial Applications*, June 10–12 1999, Minneapolis, MN, USA.
- HEMMINGSSON-FRÄNDÉN AND WATHEN  
Article [35] was presented as a talk at: *Householder Symposium XIV*, June 14–18 1999, Whistler, Canada.
- LARSSON  
Work from articles [46, 47, 49] was presented as a talk (*Domain decomposition preconditioners for the Helmholtz equation*) at: *Twelfth International Conference on Domain Decomposition Methods*, October 25–29 1999, Chiba, Japan.
- Holmgren attended: *Supercomputing 99*, November 13–19 1999, Portland, OR, USA.
- LARSSON, BRANDÉN, SUNDBERG, HOLMGREN, HEMMINGSSON-FRÄNDÉN, KÄHÄRI, AND MOSSBERG  
A large part of the research group visited the Numerical Analysis Group at Oxford

University Computing Laboratory for *The Oxford–Uppsala Numerical Analysis Day*, November 26 1999, Oxford, UK. Larsson, Brandén, and Sundberg presented their current research.

- Brandén visited Oxford University Computing Lab., Oxford, UK, October–December 1999. He was Prof. Trefethen’s guest.

2000 .....

- BRANDÉN, HEMMINGSSON-FRÄNDÉN, HOLMGREN, KÄHÄRI, LARSSON, SUNDBERG, AND SUNDQVIST  
A large part of the research group attended: *Sixth Copper Mountain Conference on Iterative Methods*, April 3–7 2000, Copper Mountain, CO, USA.
  - Article [vii] was presented as a talk (*A Note on Parasitic Solutions*) by Brandén.
  - Work from articles [32, 35] was presented as a talk (*Semi-circulant approximations in preconditioners for incompressible flow problems*) by Hemmingsson-Frändén.
  - Work from articles [18, 19] was presented as a talk (*Convergence acceleration for the Euler equations*) by Holmgren.
  - Article [49] was presented as a talk (*Parallelization of a domain decomposition method for the Helmholtz equation*) by Larsson.
  - Article [22] was presented as a talk by Sundqvist.
- Otto attended: *PARA2000, International Workshop on Applied Parallel Computing*, June 18–21 2000, Bergen, Norway.
- Otto visited and gave a seminar at the Dept. of Informatics, Univ. of Bergen, Bergen, Norway, June 21 2000.
- HOLMGREN  
organized (jointly with Prof. Andy Wathen) the minisymposium *Preconditioning for Flow and Wave-Propagation Problems* at: *2000 SIAM Annual Meeting*, July 10–14 2000, Rio Grande, Puerto Rico. Holmgren also gave the talk *Fundamental Solution Preconditioners for Fluid Flow Problems* on behalf of Daniel Loghin, Oxford Univ., who was absent from the meeting.
- LARSSON, OTTO, AND HOLMGREN  
Work from article [49] and forthcoming reports was presented as an invited minisymposium talk (*A Flexible Solver for the Helmholtz Equation*) at: *2000 SIAM Annual Meeting*, July 10–14 2000, Rio Grande, Puerto Rico.
- LÖTSTEDT, SÖDERBERG, RAMAGE, AND HEMMINGSSON-FRÄNDÉN  
Article [51] was presented as a talk (*Adaptive, implicit, and parallel solution of hyperbolic equations*) at: *International Conference on Numerical Mathematics on the 40th Anniversary of the Journal BIT*, August 9–12 2000, Lund, Sweden.
- HEMMINGSSON-FRÄNDÉN AND GUSTAFSSON  
Work from articles [23, 24] was presented as an invited minisymposium talk (*High Order Domain Decomposition Methods for PDEs*) at: *Pacific Rim Dynamical Systems Conference*, August 9–13 2000, Lahaina, Maui, HI, USA.
- THUNÉ, ÅHLANDER, M. LJUNGBERG, NORDÉN, OTTO, AND RANTAKOKKO  
Article [62] was presented as an invited talk at: *IFIP WG 2.5 Conference on Software Architectures for Scientific Computing Applications*, October 2–4 2000, Ottawa, Canada.

- Sundqvist and Holmgren attended: *International Conference on Preconditioning Techniques for Large Sparse Matrix Problems in Industrial Applications*, April 29–May 1 2001, Tahoe City, CA, USA. Sundqvist gave a talk presenting article [22].
- HOLMGREN  
gave a talk (*A review of preconditioning using fast transforms*) at: *Symposium on Iterative Methods in Linear Algebra*, May 4 2001, Stanford, CA, USA.
- SUNDQVIST AND BRANDÉN  
Article [22] was presented as a talk at: *Symposium on Iterative Methods in Linear Algebra*, May 4 2001, Stanford, CA, USA.
- OTTO AND GUSTAFSSON  
Work from articles [56, 62] was presented as a talk (*Iterative solution of the Helmholtz equation by higher-order methods*) at: *Fifth International Conference on Theoretical and Computational Acoustics*, May 21–25 2001, Beijing, China.
- LARSSON AND OTTO  
Work from articles [47, 56, 49, 62] was presented as a talk (*A flexible solver for the Helmholtz equation*) at: *Fifth International Conference on Theoretical and Computational Acoustics*, May 21–25 2001, Beijing, China.
- HEMMINGSSON-FRÄNDÉN AND GUSTAFSSON  
gave a talk (*Deferred correction in space and time*) at: *Fifth International Conference on Spectral and High Order Methods*, June 11–15 2001, Uppsala, Sweden.
- OTTO AND GUSTAFSSON  
gave a talk (*Iterative solution of the Helmholtz equation by deferred correction methods*) at: *Fifth International Conference on Spectral and High Order Methods*, June 11–15 2001, Uppsala, Sweden.
- HOLMGREN, PETERSON, PETERSSON, AND KARLSSON  
gave a talk (*A comparison of discretization schemes for problems in quantum dynamics*) at: *Fifth International Conference on Spectral and High Order Methods*, June 11–15 2001, Uppsala, Sweden.
- From August 2000 through August 2001 Larsson visited the Dept. of Applied Mathematics, Univ. of Colorado at Boulder, CO, USA, in the position of Postdoctoral Research Associate. She was involved in a project concerning radial basis function approximations for PDE problems.

- NORDÉN, HOLMGREN, AND THUNÉ  
Article [54] was presented as a talk at: *The 2002 International Conference on Computational Science*, April 21–24 2002, Amsterdam, The Netherlands.
- NEYTCHEVA AND AXELSSON  
Article [5] was presented as a talk (*Preconditioning methods for linear systems with saddle point matrices*) at: *The 2002 International Conference on Computational Science*, April 21–24 2002, Amsterdam, The Netherlands.

- NEYTCHIEVA AND AXELSSON  
Article [6] was presented as a talk at: *Fifth International Conference on Numerical Methods and Applications*, August 20–24 2002, Borovets, Bulgaria. Neytcheva organized (jointly with Prof. Oleg Iliev) the minisymposium *Robust Iterative Solution Methods and Applications*.
- VON SYDOW  
gave an invited talk (*High order domain decomposition methods for PDEs*) at: *Conference in Numerical Analysis: In celebration of the sixtieth birthday of Axel Ruhe*, October 14 2002, Stockholm, Sweden.

## 2003

- HOLMGREN, BRANDÉN, AND SUNDQVIST  
Article [20] was presented as a talk (*A new preconditioner for first order PDE*) at: *Fourth International Conference on Large-Scale Scientific Computations*, June 4–8 2003, Sozopol, Bulgaria.
- NEYTCHIEVA AND AXELSSON  
gave a talk (*Preconditioning methods for constrained linear elasticity problems*) at: *Fourth International Conference on Large-Scale Scientific Computations*, June 4–8 2003, Sozopol, Bulgaria. Neytcheva was a member of the Scientific Committee and an organizer (jointly with Prof. Radim Blaheta) of the special session *Recent Achievements in Preconditioning*.
- Holmgren and Sundqvist attended: *Workshop on Nonlinear Approximations in Numerical Analysis*, June 22–25 2003, Moscow, Russia. Holmgren gave a talk presenting article [20].
- RAMAGE, VON SYDOW, LÖTSTEDT, AND SÖDERBERG  
Article [50] was presented as a talk (*Preconditioned iterative solvers for discretisations with space-time adaptivity*) at: *Fifth International Congress on Industrial and Applied Mathematics*, July 7–11 2003, Sydney, Australia.
- SUNDQVIST, BRANDÉN, AND HOLMGREN  
Article [20] was presented as a talk (*A preconditioner for first order PDEs*) at: *Fifth International Congress on Industrial and Applied Mathematics*, July 7–11 2003, Sydney, Australia.
- BRANDÉN AND SUNDQVIST  
Article [21] was presented as a talk at: *Fifth International Congress on Industrial and Applied Mathematics*, July 7–11 2003, Sydney, Australia.

## 2004

- BRANDÉN, SUNDQVIST, AND HOLMGREN  
Article [20] was presented as a talk (*A fundamental solution preconditioner for first order PDE*) at: *Eighth Copper Mountain Conference on Iterative Methods*, March 28–April 2 2004, Copper Mountain, CO, USA.
- SUNDQVIST  
Article [xi] was presented as a talk at: *Eighth Copper Mountain Conference on Iterative Methods*, March 28–April 2 2004, Copper Mountain, CO, USA.
- BÄNGTSSON AND NEYTCHIEVA  
Article [10] was presented as a talk at: *Eighth Copper Mountain Conference on Iterative Methods*, March 28–April 2 2004, Copper Mountain, CO, USA.

- NEYTCHEVA, BLAHETA, AND MARGENOV  
Article [16] was presented as a talk at: *Conference on Iterative Methods, Preconditioning and Numerical PDEs*, May 25–28 2004, Prague, Czech Republic. Neytcheva was a member of the Organizing Committee.
- BÄNGTSSON AND NEYTCHEVA  
Article [10] was presented as a talk at: *Conference on Iterative Methods, Preconditioning and Numerical PDEs*, May 25–28 2004, Prague, Czech Republic.
- ÅHLANDER AND MUNTHE-KAAS  
Article [4] was presented as a talk at: *International Conference on Computational and Mathematical Methods in Science and Engineering*, June 4–8 2004, Uppsala, Sweden.
- LARSSON AND OTTO  
Work from [v] and forthcoming reports was presented as a talk (*An object-oriented Helmholtz solver*) at: *International Conference on Computational and Mathematical Methods in Science and Engineering*, June 4–8 2004, Uppsala, Sweden.

## 2005

- ÅHLANDER  
Article [1] was presented as a talk at: *The 2005 International Conference on Computational Science and its Applications*, May 9–12 2005, Singapore.
- BÄNGTSSON AND NEYTCHEVA  
Article [11] was presented as a talk (*An agglomerate multilevel preconditioner for nonsymmetric saddle point problems*) at: *Fifth International Conference on Large-Scale Scientific Computations*, June 6–10 2005, Sozopol, Bulgaria.
- NEYTCHEVA, BÄNGTSSON, AND KARLSTRÖM  
gave a talk (*Robust iterative solution methods for visco-elastic problems*) at: *Fifth International Conference on Large-Scale Scientific Computations*, June 6–10 2005, Sozopol, Bulgaria. Neytcheva was a member of the Scientific Committee.
- BRANDÉN  
gave an invited talk (*Convergence acceleration and boundary summation equations*) at: *International Conference on Matrix Methods and Operator Equations*, June 20–24 2005, Moscow, Russia.
- SUNDQVIST  
Article [xi] was presented as an invited talk at: *International Conference on Matrix Methods and Operator Equations*, June 20–24 2005, Moscow, Russia.
- Neytcheva attended: *Eighth European Multigrid Conference*, September 27–30 2005, The Hague, The Netherlands.

## 2006

- Bängtsson visited Inst. for Parallel Processing, Bulg. Acad. Sci., Sofia, Bulgaria, March 19–April 13 2006. He was Prof. Margenov’s guest.
- BÄNGTSSON AND NEYTCHEVA  
gave a talk (*Parallelization of a multilevel preconditioner for nonsymmetric saddle point problems*) at the Information Days of the BIS-21++ project, March 21–23 2006, Velingrad, Bulgaria.

- BÄNGTSSON, NEYTCHEVA, AND LUND  
gave a talk (*Solving large scale finite element systems as arising in some viscoelastic problems by iterative solution methods—hopeless or hopeful task?*) at: *Twelfth Conference on the Mathematics of Finite Elements and Applications*, June 13–16 2006, Brunel Univ., Uxbridge, UK.
- NEYTCHEVA  
was a member of the Organizing Committee for the *Fifteenth International Workshop on Matrices and Statistics*, June 13–17 2006, Uppsala, Sweden.
- NEYTCHEVA AND BÄNGTSSON  
gave an invited minisymposium talk (*Preconditioning of nonsymmetric saddle point systems as arising in modelling of visco-elastic problems*) at: *GAMM–SIAM Conference on Applied Linear Algebra*, July 24–27 2006, Düsseldorf, Germany.
- NEYTCHEVA  
was a member of the Scientific Committee for the *Sixth International Conference on Numerical Methods and Applications*, August 20–24 2006, Borovets, Bulgaria.
- BÄNGTSSON, NEYTCHEVA, AND LUND  
gave a talk (*Solving large scale finite element systems as arising in some viscoelastic problems by iterative solution methods—hopeless or hopeful task?*) at: *BIT Numerical Mathematics Circus*, August 31–September 1 2006, Lidingö, Sweden.
- Bängtsson visited and gave a seminar at the Dept. of Computer Science and Engineering, Univ. of Minnesota, Minneapolis, MN, USA, November 4–21 2006. He was Prof. Saad’s guest.

## How to get more information

For more information about the ANLA group and our work, see the World Wide Web:

<http://www.it.uu.se/research/group/anla/>

You may also contact Maya Neytcheva.

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