CURRICULUM VITÆ

MAGNUS SVÄRD

DEGREES

- PhD in Numerical Analysis, November 12, 2004, Uppsala University, Sweden. Title of thesis: Stable High-Order Finite Difference Methods for Aerodynamics (Advisor: Jan Nordström)
- M.Sc in Vehicle Engineering, specialization in fluid dynamics, Royal Institute of Technology, Sweden, December 1999.

POSITIONS

- September 15, 2012-*present*, Professor of Applied and Computational Mathematics, University of Bergen.
- 1/9/12-31/8/18, Honorary Fellow, University of Edinburgh
- May 1-September 15, 2012, Associate Professor of Applied and Computational Mathematics, University of Bergen.
- January 1, 2010-April 30, 2012, Honorary Fellow at the School of Mathematical and Computer Sciences, Heriot-Watt University.
- January 1, 2010-April 30, 2012, Lecturer in Computational Mathematics, University of Edinburgh
- May 1, 2008-December 31, 2009, Research Scientist at SINTEF Applied Mathematics, Oslo, Norway
- Paternity leave, June-September, 2009.
- January 1-June 30, 2008, Assistant Professor of Numerical Analysis, Royal Institute of Technology, Stockholm, Sweden
- March 1, 2007- December 31, 2009, postdoctoral fellow at University of Oslo, Centre of Mathematics for Applications (CMA).
- Paternity leave jan-feb, 2007.
- Sep. -05 to Dec. -06. Post Doctoral Fellow at Stanford University, Center for Turbulence Research.

SCIENTIFIC INTERESTS

- Partial Differential Equations and Conservation Laws; Numerical Analysis; Aerodynamics; Large-Scale and High-Performance computing

GRANTS

- Organising partner in RESCUER, Marie Curie-Sklodowska Doctoral Network, 2.7 MEuro (ca 8 MNOK to UiB). (2024-2028)
- Participant of "Institutional strategic project" (ISP), Project number 239033/F20, 2016-2019. Funded with a total of 5 MNOK.
- Project "Evaluation of the suitability of parallel discretisation schemes for the simulation of Pressure Swing Adsorption systems", joint with Daniel Friedrich, Institute for Materials and Processes, UoE, funded by MAXIMATH (£2000)

PhD supervision

- Ujjwal Koley (co-advisor), U. of Oslo. (Thesis: "On hyperbolic evolution equations: Theory and numerics", Oct 22, 2010)
- Hatice Özcan, U. of Edinburgh. 2015
- Daulet Moldabayev (co-advisor), U. of Bergen. (Graduated, spring 2017)
- Reindorf Borkor, KNUST, Ghana (2015-2019) (Thesis: A Novel Well-posed and Stable Urban Flood InundationDynamics Model with No-Penetration Wall, Far-FieldBoundary and Interface Treatments on Multi-blocks)
- Anita Gjesteland, UiB, 2019-2024 (Thesis: "Energy and entropy stable numerical methods with injected boundary conditions")
- Enrique Martinez (co-advisor), UiB, 2021-

Graduated master's students

- Sofia Eriksson and Johan Lundberg, Uppsala University/Stanford University, (joint with Jan Nordström), 2006
- Inga Sofie Sårheim, UiB, 2012-2014
- Kjell Nedrelid, UiB, 2017-2018
- Anita Gjesteland, UiB, 2018-2019
- Josef Flatlandsmo, UiB, 2019-2020
- Morten Reinskau Olsen, UiB, 2019-2020
- Oda Marit Ølmheim UiB, 2020-2021
- Karl Munthe, UiB, 2020-2021

Conference presentations

- 16th AIAA Computational Fluid Dynamics Conference, Orlando, June 2003.
- 6th International Conference on Spectral and High-Order Methods (ICOSAHOM'04), Providence, June 2004
- The Thermal & Fluid Sciences Affiliates 2006 Conference, Stanford.
- 7th International Conference on Spectral and High-Order Methods (ICOSAHOM'07), Beijing, June 2007
- 8th International Conference on Spectral and High-Order Methods (ICOSAHOM'09), Trondheim, June 2009
- ENUMATH, Leicester, September 2011
- 1st International Workshop on High-Order CFD Methods, January 7-8, 2012, at AIAA Meeting, Nashville, Tennessee
- 2nd International Workshop on High-Order CFD Methods, May 27-28, 2013, Cologne, Germany
- MekIT'13, Computational Mechanics, Trondheim, May 13-14, 2013
- ICOSAHOM'14, June 23-27, Salt Lake City.
- *Invited speaker* at Nordic Math Congress, *Mittag-Leffler Institute*, March 16-20, 2016.
- Enumath17, 23-25 Sept. 2017, Voss, Norway
- ECCM-ECFD, 11-15 June, 2018, Glasgow, Scotland
- ICOSAHOM, 9-13 July, 2018, London, UK
- MekIT'19, Computational Mechanics, Trondheim, May , 2019
- **Invited speaker** Norwegian Meeting on PDEs, Trondheim, June 2019.
- ECCOMAS, 5-9 June 2022, Oslo
- SHARK-FV, May 2022, Sao Felix, Portugal
- SIAM CSE, Feb. 26- Mar. 3, 2023, Amsterdam

Some invited presentations

- Center for Turbulence Research, Stanford, October 2005.

- Bonn University, Germany, September, 2006
- Sandia National Laboratory, Livermore, California, USA, October 2006.
- Louisiana State University, Baton Rouge, USA, November 2006
- Centre of Mathematics for Applications, University of Oslo, March 2007
- Royal Institute of Technology, Sweden, February 2007.
- Scottish Computational Mathematics Symposium, September 2009.
- Strathclyde University, April 2010.
- ETH Zürich, May 2010.
- Uppsala Universtity, December 2010.
- Warwick University, May 2011.
- ETH Zürich, October 2012.
- NASA Langley, Virginia, June 2015
- Uppsala University, September 2015
- NASA Langley, Virginia, June 2016
- Linköping University, November, 2016
- Univ. of Edinburgh, December 2017.
- Heriot-Watt, December 2017.
- Charles University, Prague, April 2019
- University of Cologne, May 2019.
- University of Waterloo, October 2021 (online)
- TIFR, India, June 2023 (online)

Extended research visits

- ICASE/NASA Langley, Virginia, USA, September -00
- NIA/NASA Langley, Virginia, USA: May-June -04, January -05, June -05, June -15, May/June 2016

Reviewer for the journals (selection):

- Journal of Computational Physics (Outstanding Reviewer, 2017); Applied Mathematical Modelling; Journal of Computational and Applied Mathematics; Mathematical Problems in Engineering; SIAM Journal on Numerical Analysis; SIAM Journal on Scientific Computing; Applied Numerical Mathematics; BIT Numerical Mathematics; Journal of Scientific Computing; Discrete and Continuous Dynamical System Series B; Journal of Thermophysics and Heat Transfer; Mathematical Modelling and Analysis; Journal of aircraft; Computational and applied mathematics; Numerical Algorithms; Applied Mathematics and Computation; Computers and mathematics with applications; Journal of the Mechanics and Physics of Solids; SN Partial differential equations and applications; International journal for numerical methods in fluids; Biomechanics and modeling in mechanobiology; Computer and mathematics with applications; Water waves; Mathematical modelling and numerical analysis

Teaching

Courses in Pedagogics:
- Basic University Pedagogics, 10 ects (15/5-2018)
- PhD supervision, 5 ects (28/11-2018)
- Evaluation and forms of evaluation, 5 ects (29/1-2019)

Experience: Taught since 2000 at Uppsala University, KTH, University of Edinburgh and University of Bergen at both undergraduate and graduate level. Numerical analysis, fluid dynamics, and mathematics (various calculus courses, differential equations, differential geometry).

Administrative Duties

- Coordinatator of the Generic Skills Programme for Scottish PhD students in the mathematical sciences. (2010-12)
- Director of Studies, School of Maths, Univ. of Edinburgh. (2011/12)
- Served on 4 evaluation committees for PhD positions. (June 2012 and Nov. 2012, June 2017, June 2020, Bergen)
- Served on several trial-lecture committees for PhD candidates in Bergen.
- Head of PhD-evaluation committee, spring 2014.
- Member of IT-committe, Dept. of Mathematics, Bergen. (Head since 2019)
- Member of committe on co-operation between University of Bergen and University College of Bergen.
- Served in Evaluation Committe for faculty positions at Univ. of Bergen (2012), Univ. College Sogn og Fjordane (2016), Univ. College Bergen (2016).
- Member of Department (of mathematics) Council.
- Served in Evaluation Committee for faculty position at University of Bergen, 2019.
- Head of the Fluid Dynamics group, UiB, 2022-

Scientific Duties

- "Midway-opponent" for Ylva Rydin at Uppsala University, 2019.
- Faculty opponent at Giorgio Giangaspero's dissertation. Univ. of Twente, Netherlands, 22. April, 2016.
- Faculty opponent at Peder Aursand's dissertation. NTNU, December 4, 2015.
- Faculty opponent at Anna Nissen's dissertation. Uppsala University, November 25, 2011.
- Scientific Committe and Local steering committee, IWMO2013, Bergen. (International workshop on Ocean Modelling)
- Scientific Committee MekIT'13, MekIT'15, MekIT'17, Trondheim
- Organizer of B'Waves workshop, Bergen, June 13-17, 2016.

Refereed journal publications

The SBP review paper was 5th most cited in JCP since 2012 (5/3-2018) and 3rd most cited since 2014 (28/1-2019)

(1) M. Svärd, Refining the diffusive compressible Euler model, Physica A, Vol. 635, 2024
(2) R. N. Borkor, M. Svärd, P. Amoako-Yirenkyi, "A stable scheme of the Curvilinear Shallow Water Equations with no-penetration and far-field boundary conditions", Computers & Fluids, 269, 2024
(3) Gjesteland, A. , Svärd , M. , "Convergence of Chandrashekar's second-derivative finite-volume approximation", Journal of Scientific Computing 96 (2), 46, 2023
(4) Svärd , M., Munthe, K., "A study of the diffusive properties of a modified compressible Navier-Stokes model", Meccanica 58(6) pp. 1083-1097, 2023
(5) Svärd , M.,"Analysis of an alternative Navier–Stokes system: Weak entropy solutions and a convergent numerical scheme", Mathematical Models and Methods in Applied Sciences,Vol. 32, No. 13, pp. 2601-2671 (2022)
(6) Gjesteland, A. , Svärd , M., "Entropy stability for the compressible Navier-Stokes equations with strong imposition of the no-slip boundary condition", Volume 470, Journal of Computational Physics, 2022.
(7) Gassner, G., Svärd , M., Hindenlang, F.J, "Stability Issues of Entropy-Stable and/or Split-form High-order Schemes: Analysis of Linear Stability" Volume 90, Journal of Scientific Computing, 2022
(8) Svärd, M, "Large Eddy Simulations by approximate weak entropy solutions", Volume 448, Journal of Computational Physics, 2022.
(9) Svärd, M, "Entropy stable boundary conditions for the Euler equations", Volume 426, Journal of Computational Physics, 2021.
(10) Svärd, M, Nordström, J., "Convergence rates of energy stable finite difference schemes with interfaces", Volume 429, Journal of Computational Physics, 2021. (Short note)

(11) Dolejsi, V., Svärd, M, "Numerical study of two models for compressible fluid flows", Vol. 427, Journal of Computational Physics, 2021.

(12) Svärd, M, Nordström, J., "On the convergence rates of energy-stable finite-difference schemes", Volume 397, J. Comp. Phys., 2019

(13) Svärd, M. "A new Eulerian model for viscous and heat conducting compressible flows", Physica A, 506, pp. 350-375, 2018

(14) Svärd, M, Carpenter, M.H, Parsani, M, *Entropy stability and the no-slip wall boundary condition*, SIAM J. Numer. Anal., 56(1), 256-273, 2018.

(15) Svärd, M., Nordström, J., *Response to "Convergence of Summation-by-Parts Finite Difference Methods for the Wave Equation"*, J Sci Comput (2017)

(16) M. H. Carpenter, T.C. Fisher, E.J. Nielsen, M. Parsani, M. Svärd and N. Yamaleev, *Entropy Stable Summation-by-Parts Formulations for Compressible Computational Fluid Dynamics*, Chapter in Handbook of Numerical Methods for Hyperbolic Problems: 495-524, Volume 17, 2016

(17) M. Svärd, *A Convergent Numerical Scheme for the Compressible Navier–Stokes Equations*, SIAM J. Numer. Anal., 54(3), 1484–1506.

(18) M. Svärd, *Entropy solutions of the compressible Euler equations*, BIT Numerical Mathematics, 56(4), pp 1479–1496, 2016.

(19) M. Svärd, *Weak solutions and convergent numerical schemes of modified compressible Navier-Stokes equations*, J. Comp. Phys. 288, pp. 19-51, 2015.

(20) E. v.d. Weide and G. Giangaspero and M. Svärd, *Efficiency benchmarking of an Energy Stable high-order finite difference discretization*, AIAA Journal, 53(7), 2015.

(21) M. Svärd and J. Nordström, *Review of summation-by-parts schemes for initial-boundary-value problems*, Journal of computational physics, 268, pp. 17-38, 2014.

(22) M. Svärd, *A note on L^∞ bounds and convergence rates of summation-by-parts schemes*, BIT numerical mathematics, 54, pp. 823-830, 2014.

(23) M. Svärd and H. Özcan, *Entropy-Stable Schemes for the Euler Equations with Far-Field and Wall Boundary Conditions*, Journal of Scientific Computing, 58(1) (2014), 61-89.

(24) M. Svärd, *Third-order accurate entropy stable scheme for initial-boundary-value conservation laws*, ZAMP, 63 (2012), 599-623

(25) M. Svärd and S. Mishra, *Entropy stable schemes for intial-boundary-value conservation laws*, ZAMP, 63:985-1003, (2012).

(26) U. Koley, S. Mishra, N.H. Risebro and M. Svärd, *Higher order finite difference schemes for the magnetic induction equations with resistivity*, IMA Journal of Numerical Analysis, 32(3): 1173-1193, 2012

(27) Magnus Svärd and Siddhartha Mishra, *Implicit-explicit schemes for flow equations with stiff source terms*, Journal of Computational and Applied Mathematics, 235 (2011), 1564-1577

(28) M. Svärd, J. Lundberg, J. Nordström, *A computational study of vortex–airfoil interaction using high-order finite difference methods*, Comp & Fluids, 39 (2010) 1267-1274

(29) S. Mishra and M. Svärd, *On stability of numerical schemes via frozen coefficients and the magnetic induction equations*, BIT Numerical Mathematics, (2010) 50: 85-108.

(30) M. Shoeybi, M. Svärd b, F. E. Ham , P. Moin, *An adaptive implicit-explicit scheme for the DNS and LES of compressible flows on unstructured grids*, J. Comp. Phys., 229, 2010, (5944–5965)

(31) J. Nordström, J. Gong, E. v.d. Weide, Magnus Svärd, *A stable and conservative high order multi-block method for the compressible Navier-Stokes equations*, J. Comp. Phys., 228, 2009, (9020–9035)

(32) J. Nordström, F. Ham, M. Shoeybi, E. v.d. Weide, M. Svärd, K. Mattsson, G. Iaccarino, J. Gong, *A hybrid method for unsteady inviscid fluid flow*, Comp & Fluids, 38, 2009, (875–882)

(33) U. Koley, S. Mishra, N.H. Risebro and M. Svärd, *Higher order finite difference schemes for the magnetic induction equations*, BIT Numer Math (2009) 49: 375–395

(34) Magnus Svärd and Siddhartha Mishra *Shock capturing artificial dissipation for high-order finite difference schemes*, J Sci Comput (2009) 39: 454–484

(35) Magnus Svärd and Jan Nordström, *A Stable High-Order Finite Difference Scheme for the Compressible Navier-Stokes Equations, no-slip wall boundary conditions*, Journal of computational physics, Volume 227, Issue 10, Pages 4805-4824, 2008

(36) K. Mattson, M. Svärd and M. Shoeybi, *Stable and accurate schemes for the compressible Navier-Stokes equations*, Journal of Computational Physics, Volume 227, Issue 4, 1 February 2008, Pages 2293-2316

(37) Magnus Svärd, Jing Gong, Jan Nordström, *An Accuracy Evalutation of Unstructured Node-Centred Finite Volume Methods*, Applied Numerical Mathematics, Volume 58, Issue 8, Pages 1142-1158, 2008

(38) Magnus Svärd, Mark Carpenter and Jan Nordström, *A Stable High-Order Finite Difference Scheme for the Compressible Navier-Stokes Equations, far-field boundary conditions*, Journal of Computational Physics, Vol 225, pp 1020-1038, 2007

(39) K. Mattsson, M. Svärd, M. Carpenter, J. Nordström, *High order accurate computations for unsteady aerodynamics*, Computers and Fluids, Vol 36(3), pp 636-649, 2007.

(40) Magnus Svärd, Jan Nordström, *On the Order of Accuracy for Difference Approximations of Initial-Boundary Value Problems*, Journal of Computational Physics, Vol 218(1),pp 333-352,2006

(41) Magnus Svärd, Jing Gong, Jan Nordström, *Stable artificial dissipation operators for finite volume schemes on unstructured grids*, Applied Numerical Mathematics, Vol 56(12), pp 1481-1490,2006

(42) J. Nordström, M. Svärd, *Well Posed Boundary Conditions for the Navier-Stokes Equations*, SIAM Journal on Numerical Analysis, Vol 43(3), pp 1231-1255, 2005

(43) K. Mattsson, M. Svärd, J. Nordström, *Stable and Accurate Artificial Dissipation*, Journal of Scientific computing, vol 21, no 1,(57 - 79), August 2004.

(44) M. Svärd, K. Mattsson, J. Nordström, *Steady State Computations Using Summation-by-Parts Operators*, Journal of Scientific Computing, Volume 24, Number 1, July 2005, pp. 79 - 95

(45) M. Svärd, J. Nordström, *Stability of Finite Volume Approximations for the Laplacian Operator on Quadrilateral and Triangular Grids*, Applied Numerical Mathematics, vol 51, Pages 101-125, October 2004.

(46) M. Svärd, *On Coordinate Transformations for Summation-by-Parts Operators*, Journal of Scientific Computing, vol 20,(29 - 42), 2004

Refereed conference papers and abstracts

(1) SIAM CSE, Feb. 26- Mar. 3, 2023, Amsterdam

(2) ECCOMAS, 5-9 June 2022, Oslo

(3) SHARK-FV, May 2022, Sao Felix, Portugal

(4) ICOSAHOM, 2018, 9-13 July, London

(5) ECCM-ECFD 2018 (ECCOMAS), 11-15 June, Glasgow.

(6) Enumath17, 25-29 Sept, 2017, Voss, Norway, "Convergence rates of energy stable finite difference schemes"

(7) Presentation at the 27th Nordic Congress of Mathematicians, 16-20 March, Stockholm, Sweden, 2016

(8) Presentation at the 9th International Conference on Spectral and High-Order Methods (ICOSAHOM'14), Salt Lake City, Utah, June 2014, *Entropy stable SBP-SAT schemes for the Euler equations with boundary conditions*

(9) Abstract to 3rd International Workshop on High-Order CFD Methods, Jan. 3-4, 2015, Orlando, Florida, USA (Weide, Svärd, Giangaspero)

(10) M. Svärd, *On entropy stable boundary conditions for the Navier-Stokes equations*, MekIT'13, Akademika Publishing, 2013, pp 297-307.

(11) Abstract to 2nd International Workshop on High-Order CFD Methods, May 27-28, 2013, Cologne, Germany (Weide, Svärd, Giangaspero)

(12) Abstract to 1st International Workshop on High-Order CFD Methods, January 7-8, 2012, at AIAA Meeting, Nashville, Tennessee. (M. Svärd and E. v. d. Weide)

(13) Presentation at the 8th International Conference on Spectral and High-Order Methods (ICOSAHOM'09), Trondheim, June 2009, *Shock capturing for high-order central schemes*

(14) S. Eriksson, M. Svärd and J. Nordström, *Simulations of Ground Effects on Wake Vortices at Runways*, Sixth South African Conference on Computational and Applied Mechanics SACAM08 Cape Town, 26-28 March 2008

(15) Presentation at the 7th International Conference on Spectral and High-Order Methods (ICOSAHOM'07), Beijing, June 2007, *No-slip wall boundary conditions for high-order finite difference schemes*

(16) Presentation at the 6th International Conference on Spectral and High-Order Methods (ICOSAHOM'04), Providence, June 2004, *On the Order of Accuracy for Difference Approximations of Initial-Boundary Value Problems*

(17) M. Shoeybi, F. Ham, M. Svärd, P. Moin, *A stable hybrid implicit/explicit sheme for Large-Eddy Simulation of Compressible flows in complex geometries*, 60th Annual meeting of the Division of fluid dynamics, The American Physical Society, Salt Lake City, Utah

(18) Mattsson et al., *A hybrid method for unsteady aerodynamics*, CP29, "SIAM conference on Computational Science and Engineering, Feb. 19-23,2007,Costa Mesa, California".

(19) J. Alonso et al., *CHIMPS: A High- Performance Scalable Module for Multi- Physics Simulations*, AIAA-paper 2006-5274, "42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit"

(20) Svärd and v.d. Weide, The Thermal & Fluid Sciences Affiliates 2006 Conference, Stanford.

(21) Gunilla Efraimsson, Jing Gong, Magnus Svärd and Jan Nordström, *An investigation of the performance of a high-order accurate Navier-Stokes code*, Conference paper "European Conference on Computational Fluid Dynamics 2006"

(22) Jing Gong, Magnus Svärd, Jan Nordström, *Artificial Dissipation for Strictly Stable Finite Volume Methods on Unstructured Meshes*, Conference paper WCCM VI in conjunction with APCOM'04, Beijing, China, September 2004.

(23) K. Mattsson, M. Svärd, M. Carpenter, J. Nordström, *Accuracy Requirements for Transient Aerodynamics*, AIAA paper 2003-3689, conference paper presented at the "16th AIAA Computational Fluid Dynamics Conference",Orlando,USA, 2003.