Curriculum Vitae of Hans De Sterck

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1 General Information

1.1 Research Interests

Computational Mathematics – Scalable Scientific Computing – Finite Element Methods for Nonlinear Hyperbolic PDEs – Multilevel Linear and Nonlinear Solvers – Geophysical and Astrophysical Fluid Dynamics and Magnetohydrodynamics – Parallel Computing and Grid Computing – Parallel Bioinformatics

1.2 Employment history

- *August 2004 – present:* Assistant Professor.
  Department of Applied Mathematics, University of Waterloo, Ontario, Canada
- *October 2001 – July 2004:* Postdoctoral Research Associate.
  Department of Applied Mathematics, University of Colorado at Boulder, USA (with T. Manteuffel and S. McCormick)
- *November 2000 – September 2001:* Visiting Postdoctoral Research Associate.
  Department of Computer Science, **University of Colorado at Boulder, USA** (with X.-C. Cai)
- *October 1999 – October 2000:* Postdoctoral Research Associate.
  Aeronautics and Aerospace Department, von Karman Institute for Fluid Dynamics, Brussels, Belgium (with H. Deconinck)
- *January 1997 – September 1999 :* Graduate Research Assistant.
  High Altitude observatory, National Center for Atmospheric Research, Boulder, CO, USA (with B.C. Low)
- *October 1995 – September 1999 :* Graduate Research Assistant.
  Centre for Plasma Astrophysics, Department of Mathematics, K.U. Leuven, Belgium (with S. Poedts)
- *October 1994 – September 1995 :* Graduate Research Assistant.
  Department of Computer Science, Katholieke Universiteit Leuven, Belgium (with D. Roose)

1.3 Education

period	*diploma*	*final grade*	*institution*
1994-1999	PhD Physics	(grades are not given)	Katholieke Universiteit Leuven (Belgium)
1992-1994	Master Physics	summa cum laude	K.U. Leuven (Belgium) and Univ. Wroclaw (Poland)
1991-1992	Baccalaureat Philosophy	cum laude	K.U. Leuven (Belgium)
1987-1992	Master Electrical Eng.	cum laude	K.U. Leuven (Belgium)

1.4 Fellowships and Awards

- 1995-1999: Graduate Research Fellowship of the Belgian National Fund for Scientific Research.
- 1997-1999: NCAR HAO Newkirk Graduate Research Fellowship.
- 1999 University Corporation for Atmospheric Research (UCAR) **Outstanding Publication Award**.
- July–September 2000: NATO Advanced Training Fellowship.

1.5 Recent Conference and Seminar Presentations

- **Lehrstuhl fuer Simulation**, Department of Computer Science, Universitaet Erlangen-Nuernberg, 24 June 2004. 'Least-Squares Finite Element Methods for Nonlinear Hyperbolic PDEs'.
- **Abteilung fuer Angewandte Mathematik**, University of Feiburg, 17 June 2004. 'Numerical Conservation Properties of Least-Squares Finite Element Methods for Scalar Hyperbolic Conservation Laws'.
- **Center for Plasma Astrophysics**, K.U. Leuven, 15 June 2004. 'Least-Squares Finite Element Methods for Nonlinear Hyperbolic PDEs'.
- **Department of Applied Mathematics Colloquium**, University of Colorado at Boulder, April 2004. 'Least-Squares Finite Element Methods for Nonlinear Hyperbolic PDEs'.
- **Eighth Copper Mountain Conference on Iterative Methods**, March 28 - April 2, 2004. 'Reducing Complexity in Algebraic Multigrid'. (with Ulrike Meier Yang)
- **Department of Applied Mathematics Seminar**, University of Waterloo, January 2004. 'Least-Squares Finite Element Methods for Nonlinear Hyperbolic PDEs'.
- **Bioinformatics Supergroup Seminar**. University of Colorado at Boulder, November 2003. 'A Software Framework for Parallel Bioinformatics on Computational Grids'.
- **Center for Applied Scientific Computing Seminar**. Lawrence Livermore National Laboratory, California, August 2003. 'Numerical Conservation Properties of Least-Squares Finite Element Methods for Scalar Hyperbolic Conservation Laws'.
- **2003 SIAM Annual Meeting**. Montreal, Canada, June 2003. 'H(div)-Conforming Least Squares Finite Element Methods for Nonlinear Hyperbolic Conservation Laws'.
- **2003 ACM Symposium on Applied Computing**. Melbourne, Florida, March 2003. 'A lightweight Java Taskspaces framework for scientific computing on computational grids'.
- **First SIAM-EMS Conference (2001)**. Berlin, Germany, September 2001. 'Multi-Dimensional Upwind Constrained Transport of Divergence-Free Fields on Unstructured Grids'.

- **2001 Gesellschaft fuer Angewandte Mathematik und Mechanik (GAMM) annual meeting**. ETH Zuerich, Switzerland, February 2001. 'Overcompressive shocks in 3D magnetohydrodynamic bow shock flows'.
- **Eighth International Conference on Hyperbolic Problems (2000)**. Magdeburg, Germany, March 2000. 'Multiple-front 3D MHD bow shock flows with intermediate shock segments'. **INVITED**.

1.6 Recent Research Visit

- 2 May – 22 May 2004, **Center for Applied Scientific Computing (CASC), Lawrence Livermore National Laboratory (LLNL)**. Project: Scalability of Parallel AMG for Hyperbolic PDEs, with R. Falgout and Ulrike Meier Yang.
- 13 August – 5 September 2003, **Center for Applied Scientific Computing (CASC), Lawrence Livermore National Laboratory (LLNL)**. Project: Scalability of Parallel AMG for Hyperbolic PDEs, with R. Falgout and Ulrike Meier Yang.

2 Publications

2.1 Journal Publications

1. H. De Sterck, T. J. Manteuffel, S. F. McCormick, and L. Olson, 'Numerical Conservation Properties of $H(div)$-Conforming Least-Squares Finite Element Methods for the Burgers Equation', **SIAM J. Sci. Comput.**, *accepted, 2004.*
2. H. De Sterck, T. J. Manteuffel, S. F. McCormick, and L. Olson, 'Least–Squares Finite Element Methods and Algebraic Multigrid Solvers for Linear Hyperbolic PDEs', **SIAM J. Sci. Comput.** *26, 31-54, 2004.*
3. C. Michler, H. De Sterck, and H. Deconinck, 'An Arbitrary Lagrangian Eulerian Formulation for Residual Distribution Schemes on Moving Grids', **Computers and Fluids** *32(1), 59, 2003.*
4. H. De Sterck, A. Csik, D. Vanden Abeele, S. Poedts, and H. Deconinck, 'Stationary two-dimensional magnetohydrodynamic flows with shocks: characteristic analysis and grid convergence study', **J. Comput. Phys.** *166, 28, 2001.*
5. H. De Sterck, 'Hyperbolic theory of the shallow water magnetohydrodynamics equations', **Phys. Plasmas** *8, 3293, 2001.*
6. H. De Sterck and S. Poedts, 'Disintegration and reformation of intermediate shock segments in three-dimensional MHD bow shock flows', **J. Geophys. Res.** *106, 30,023, 2001.*
7. J. De Keyser, H. De Sterck, M. Roth, and S. Poedts , 'Magnetically dominated solar wind in the inner heliosphere', **Space Sci. Rev.** *97, 201, 2001.*
8. H. De Sterck and S. Poedts, 'Intermediate shocks in three-dimensional magnetohydrodynamic bow shock flows with multiple interacting shock fronts', **Phys. Rev. Lett.** *84 (24), 5524, 2000.*
9. H. De Sterck and S. Poedts, 'Stationary slow shocks in the magnetosheath for solar wind conditions with $\beta < 2/\gamma$: Three-dimensional MHD simulations', **J. Geophys. Res.** *104 (A10), 22,401, 1999.*
10. H. De Sterck, B. C. Low, and S. Poedts, 'Characteristic analysis of a complex two-dimensional magnetohydrodynamic bow shock flow with steady compound shocks', **Phys. Plasmas** *6 (3), 954-969, 1999.*

11. H. De Sterck and S. Poedts, 'Field-aligned magnetohydrodynamic bow shock flows in the switch-on regime. Parameter study of the flow around a cylinder and results for the axi-symmetrical flow over a sphere', **Astron. Astrophys.** *343, 641-649, 1999.*
12. H. De Sterck, B. C. Low, and S. Poedts, 'Complex magnetohydrodynamic bow shock topology in field-aligned low-β flow around a perfectly conducting cylinder', **Phys. Plasmas** *5 (11), 4015-4027, 1998.*
    Recipient of the 1999 **UCAR Outstanding Publication Award**.
13. H. De Sterck, S. Poedts, and J.P. Goedbloed, 'Dynamics of hot filaments in a tokamak plasma', **J. Plasma Physics** *59/2, 277-302, 1998.*

2.2 Selected Refereed Proceedings Articles

1. G. Bartholomeeusen, H. De Sterck, and G. C. Sills, 'Nonconvex flux functions and compound shock waves in sediment beds', proceedings of the **Ninth International Conference on Hyperbolic Problems***, 347–356, 2003.*
2. H. De Sterck, R.S. Markel, T. Pohl, and U. Rüde, 'A lightweight Java Taskspaces framework for scientific computing on computational grids', proceedings of the **ACM Symposium on Applied Computing, Track on Parallel and Distributed Systems and Networking***, 1024–1030, 2003*
3. H. De Sterck, 'Multi-Dimensional Upwind Constrained Transport on Unstructured Grids for 'Shallow Water' Magnetohydrodynamics', **AIAA Computational Fluid Dynamics Paper** *2001-2623.*
4. A. Csík, H. De Sterck, B. van der Holst, H. Deconinck, and S. Poedts, 'Parallel Residual Distribution Solver for the Ideal 3D MHD Equations: Applications to Flows in Space Physics', **AIAA Computational Fluid Dynamics Paper** *2001-2622.*
5. H. De Sterck and S. Poedts, 'Overcompressive shocks and compound shocks in 2D and 3D magnetohydrodynamic flows', **invited paper** *in Proceedings of the Eighth International Conference on Hyperbolic Problems: Theory, Numerics, Applications,* **Int. Series of Numerical Mathematics** *141, 791, 2001.*
6. H. De Sterck, H. Deconinck, S. Poedts, and D. Roose, 'A bow shock flow containing (almost) all types of ('exotic') MHD discontinuities', *Proceedings of the Seventh International Conference on Hyperbolic Problems: Theory, Numerics, Applications,* **Int. Series of Numerical Mathematics** *129, 195, 1999.*

3 Teaching Experience

3.1 Undergraduate Level Teaching

1. APPM 2360/2380, **Introduction to Linear Algebra and Differential Equations**, 2 semesters (Fall 2001 and Spring 2002), College of Engineering, Department of Applied Mathematics, University of Colorado at Boulder, USA.
2. GEEN 3860/HUMN 3092, **Connections between Physics, Mathematics, Philosophy and Music**, Summer 2001, College of Engineering and College of Arts and Sciences, University of Colorado at Boulder, USA.

3.2 Graduate Level Teaching

1. APPM 7400, **Hyperbolic Systems**, Spring 2001, Department of Applied Mathematics, University of Colorado at Boulder, USA.
2. **Basic properties of magnetohydrodynamic flows**, Spring 2000, Department of Mathematics, Katholieke Universiteit Leuven, Belgium.

3.3 Graduate Student Mentoring

1. 1999-2000, *Christian Michler*, Master thesis, Aeronautics and Aerospace Department, von Karman Institute for Fluid Dynamics (Brussels, Belgium).
   Project title: 'An Arbitrary Lagrangian Eulerian Formulation for Residual Distribution Schemes on Moving Grids'. This work has resulted in a research paper in Computers and Fluids, 2003.
2. 2001-2002, *Rob Markel*, Master thesis, Department of Interdisciplinary Telecommunications, University of Colorado at Boulder. Project title: 'Java Taskspaces for grid computing'. This work has resulted in a research paper for the ACM Symposium on Applied Computing, 2003.
3. 2001-2002, *Gert Bartholomeeusen*, PhD thesis, Department of Engineering Science, University of Oxford, UK. Project title: 'Nonconvex flux functions and compound shock waves in sediment beds'. This collaboration has resulted in a research paper for the proceedings of the Ninth International Conference on Hyperbolic Problems, 2002.
4. 2001-2003, *Luke Olson*, PhD thesis, Department of Applied Mathematics, University of Colorado at Boulder. Project title: 'Least Squares Finite Element Methods for Linear Hyperbolic PDEs'. Several research papers are submitted (SIAM J. Sci. Comput.).
5. 2002-2004, *Feng Tian*, PhD thesis, Department of Astrophysical and Planetary Sciences, University of Colorado at Boulder. Project title: 'Numerical Modeling of Hydrodynamic Escape from Planetary Atmospheres'. Research papers are in preparation.

4 Professional References

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