William D. Henshaw

Curriculum Vitae

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Education

1981	B.Math (Hons)	Majoring in Applied Math and Computer Science, University of Waterloo, Waterloo, Ontario, Canada.
1985	Ph.D.	Applied Mathematics, California Institute of Technology, Pasadena, California, USA. Professor Heinz-Otto Kreiss, advisor.

Appointments

1998-	Staff Member, Lawrence Livermore National Laboratory, Livermore, CA, USA.
1994-1998	Staff Member, Los Alamos National Laboratory, Los Alamos, NM, USA.
1986-1994	Staff Member, IBM T.J. Watson Research Center, Yorktown Heights, NY, USA.
1985-1986	Postdoctoral Fellow, California Institute of Technology, Pasadena, CA, USA.

Awards

2000	"DOE Decades of Discovery" award: the Overture software was selected one of the top 101 discoveries from the Department of Energy over the past two-and-a-half decades.
1989	IBM Outstanding Innovation Award.
1985	W.P. Carey Prize in Applied Mathematics for an "outstanding doctoral dissertation", Caltech.
1984	Powell Fellowship, Caltech.
1981	Institute Fellowship, Caltech.
1981	Graduated with the highest average in the Faculty of Mathematics, University of Waterloo.

Research

- I have authored or co-authored over 40 papers in refereed journals, two book chapters, and over 20 papers in conference proceedings.
- My current research is centered on the development of efficient parallel algorithms for the accurate numerical solution of partial differential equations. My interests are broadly based with efforts in incompressible flows, low-speed and high-speed reactive flows, electromagnetics, solid-mechanics, conjugate heat transfer, fluid-structure interactions, high-order accurate schemes, stable boundary and interface conditions, adaptive algorithms, multigrid algorithms, parallel algorithms and grid generation.
- I am the primary developer of the Overture object-oriented parallel framework for solving PDEs in complex moving geometry, and the CG (Composite-Grid) suite of PDE solvers. This software is freely available from `www.OvertureFramework.org`. Overture was recognized as one of the top discoveries in the Department of Energy and is used worldwide by researchers and students.
- Current applications areas include the aerodynamic simulation of wind turbines and wind farms (working with Siemens and GE), building flows for energy efficiency, explosives modeling, fluid-structure interactions (e.g. blast effects), and damage mitigation in laser optics.

Research Grants

Here is a list of funded research grants that I have be involved with as principal investigator (PI) or senior researcher (SR).

Funded Research Grants				
Year	Grant	Funding Agency	Role	Amount
2012	*Fast Running Codes Via High-Fidelity Model Order Reduction*, PI: K. Chand (LLNL).	LLNL LDRD	co-PI	\$580K/year (3 years)
2011	*Domain-Adaptive High-order Accurate Algorithms for PDEs in Moving Geometry.*	ASCR	PI	\$575K
2011	*Computational Methods for Building Efficiency* (LLNL sub-contract for the GPIC Energy Hub: The Greater Philadelphia Innovation Cluster)	DOE	PI	\$400K/year (2 years)
2009	*CgWind : A Parallel High-Order Accurate Simulation Tool for Wind Turbines and Wind Farms.*	LLNL LDRD	PI	\$575K/year (3 years)
2009	*Domain-Adaptive High-order Accurate Algorithms for PDEs in Moving Geometry.*	ASCR	PI	\$400K/year (2 years)
2007	*A Coupled, Multi-Physics Code for Accurate Modeling of Nuclear Reactors*, PI: R. Procasinni (LLNL).	LLNL LDRD	co-PI	\$600K
2006	*Domain-Adaptive High-order Accurate Algorithms for PDEs in Moving Geometry.*	ASCR	PI	\$400K/year (3 years)
2006	*Interoperable Technologies for Advanced Petascale Simulations (ITAPS)*, PI: L. Diachin (LLNL).	ASCR	SR	\$2.5M/year (5 years)
2003	*Agile Solvers for Partial Differential Equations in Complex Geometry.*	ASCR	PI	\$400K/year (3 years)
2001	*The Terascale Simulation Tools and Technologies (TSTT) Center*, PI: J. Glimm (PI, SUNY Stony Brook).	ASCR	SR	\$2.6M/year (5 years)
2000	*Computational Fluid Dynamics.*	ASCR	PI	\$600K/year (3 years)
1999	*Rapid Problem Setup for Diverse Applications: RAPSODI.*	LLNL LDRD	PI	\$300K/year (3 years)
1995	*Computational Fluid Dynamics*, PI: D.L. Brown (LANL).	ASCR	SR	\$500K/year (5 years)
1989	*High-order Accurate Algorithms for Incompressible Flows.*	ONR	PI	\$30K/year (3 years)

DOE=Department of Energy. ONR=Office of Naval Research.
ASCR=DOE Office of Advanced Scientific Research, Applied Math Program.
LDRD=Laboratory Directed Research and Development.
LLNL=Lawrence Livermore National Laboratory. LANL=Los Alamos National Laboratory.

Recent Talks

- *High Efficiency Algorithms for Incompressible Flows and Moving Geometry*, SIAM Conference on Computational Science and Engineering, Boston, MA, 2013.
- *Efficient Solution of Incompressible Flows with Moving Bodies*, University of Delaware, 2012.
- *Efficient Solution of Incompressible Flows with Moving Bodies*, Rensselaer Polytechnic Institute, 2012.
- *Solving Fluid Structure Interaction Problems on Overlapping Grids*, MIT Distinguished Speaker Series, MIT 2012.

- *Solving Fluid Structure Interaction Problems on Overlapping Grids*, University of Notre Dame, 2012.
- *Recent Developments in Overture*, 11th Symposium on Overset Grids and Solution Technology, Dayton Ohio, 2012.
- *Solving Fluid Structure Interaction Problems on Overlapping Grids*, Virgina Tech, 2012.
- *Solving Fluid Structure Interaction Problems on Overlapping Grids*, NASA Ames, Mountainview CA, 2012.
- *High-order accurate algorithms for overlapping grids*, Workshop: Eigenvalues/singular values and fast PDE algorithms: acceleration, conditioning and stability, Banff International Research Station, Banff, Alberta, Canada, 2012.
- *An Overture Overview*, Thirteenth DOE ACTS Workshop, Berkeley California, 2012.
- *Efficient High-Order Accurate Schemes for Incompressible Flows in Complex Moving Geometry*, invited poster at the NNSA 2012 LDRD Symposium, Washington, DC, 2012.
- *Deforming Composite Grids for Fluid-Structure Interaction: Overcoming the Added-Mass Instability for Compressible Fluids and Elastic Solids*, J.W. Banks and WDH, DOE Applied Mathematics program meeting, Washington, DC, 2011.
- *Deforming Composite Grids for Fluid Structure Interactions*, AME Seminar Series invited speaker, USC, Los Angeles, California, April 28, 2011.
- *An Overture Overview*, Twelfth DOE ACTS Workshop, Berkeley California, 2011.
- *Efficient High-Order Schemes for Incompressible Flows in Complex Geometry*, LLNL Computations Directorate External Review Committee, 2011.
- *An Introduction to Overset Grids*, 2nd Bay Area Overset Network Meeting, Stanford California, 2011
- *Deforming Composite Grids for Fluid Structure Interactions*, SIAM Conference on Computational Science and Engineering, Reno, Nevada, 2011.
- *An Introduction to Overture and Solving PDEs on Overlapping Grids*, University of Cambridge, UK, 2011.
- *Solving PDEs on Overlapping Grids with Overture*, University of Illinois at Urbana-Champaign, 2010.
- *Recent Developments in Overture*, 10th Symposium on Overset Grids and Solution Technology, Nasa Ames Research Center, Moffett Field, CA, 2010.
- *An Overture Overview*, Eleventh DOE ACTS Workshop, Berkeley California, 2010.
- *Solving PDEs on Overlapping Grids with Overture*, ACM Colloquium, California Institute of Technology, Pasadena California, 2009.
- *Recent Developments in Overture, a Framework for Solving PDEs on Overlapping Grids*, University of Louisville, Kentucky, 2009.
- *A High-Order Accurate Parallel Solver for the Time Domain Maxwell's Equations on Overlapping Grids*, 10th International Computational Accelerator Physics Conference, San Francisco California, 2009.

- *A Composite Grid Solver for Conjugate Heat Transfer Problems*, SIAM Conference on Computational Science and Engineering, Miami Florida, 2009.
- *Recent Developments in Overture, a Framework for Solving PDEs on Overlapping Grids*, Royal Institute of Technology (KTH), Stockholm, Sweden, 2009.
- *An Overview of the Overture Framework for Solving PDEs on Overlapping Grids*, Électricité de France Research and Development, Clamart France, 2009.
- *Parallel Adaptive Mesh Refinement on Overlapping Grids*, Électricité de France Research and Development, Clamart France, 2009.
- *An Overture Overview*, Tenth DOE ACTS Workshop, Berkeley California, 2009.
- *Parallel Computation of Three-Dimensional Flows using Overlapping Grids with Adaptive Mesh Refinement*, SIAM Conference on Parallel Processing for Scientific Computing, Atlanta, Georgia, March 2008.
- Parallel Adaptive Mesh Refinement on Overlapping Grids, ASTRONUM-2008, St. John, U.S. Virgin Islands, March 2008.
- *Simulating High Speed Flows in Complex Geometry*, presentation for Raytheon Missile Systems, 2008.
- *Recent Developments in Overture*, 9th Symposium on Overset Grids and Solution Technology, Penn State University, Pennsylvania, 2008.
- *An Overture Overview*, Ninth DOE ACTS Workshop, Berkeley California, 2008.

Short Courses

In addition to giving a yearly tutorial and hands-on demonstration of Overture at the DOE ACTS (Advanced Computational Software Collection) Workshop, I am requested to give tutorials and a more extensive short course at other times.

Short Courses		
Year	Course	Place
2012	Overture tutorial and hands-on	DOE ACTS Workshop, UC Berkeley.
2012	Overture tutorial and hands-on	U. of Notre Dame.
2012	Overture tutorial and hands-on	Overset Grid Symposium, Dayton OH.
2011	Overture short course	AMR workshop, U. Cambridge.
2011	Overture tutorial and hands-on	DOE ACTS Workshop, UC Berkeley.
2010	Overture tutorial and hands-on	Overset Grid Symposium, Nasa Ames, Mountainview, CA.
2010	Overture tutorial and hands-on	DOE ACTS Workshop, UC Berkeley.
2009	Overture tutorial and hands-on	DOE ACTS Workshop, UC Berkeley.
2008	Overture tutorial and hands-on	Overset Grid Symposium, Penn State, Pennsylvania.
2008	Overture tutorial and hands-on	DOE ACTS Workshop, UC Berkeley.
2007	Overture tutorial and hands-on	DOE ACTS Workshop, UC Berkeley.
2006	Overture demo	Overset Grid Symposium, Houston, Texas.
2006	Overture tutorial and hands-on	DOE ACTS Workshop, UC Berkeley.
2005	Overture tutorial and hands-on	DOE ACTS Workshop, UC Berkeley.
2004	Overture short course	Work-shop on AMR for Atmospheric Flow, U. Cambridge.
2004	Overture tutorial and hands-on	DOE ACTS Workshop, UC Berkeley.
2004	Overture tutorial and demo	Overset Grid Symposium, Long Beach, California.
2003	Overture tutorial and demo	DOE ACTS Workshop, UC Berkeley.

University Courses Taught

I spent two winter quarters at UCLA under an exchange program with Los Alamos National Laboratory (where I was employed) and taught some courses in the Math department.

Year	Course	Place
1997	The Numerical Solution of PDEs (Undergraduate course, Math 153).	UCLA
1996	The Numerical Solution Of PDEs Using C++ (Graduate course, Math 285J).	UCLA

Collaborations

The Overture library and Composite Grid PDE solvers are used by researchers worldwide. Typical users are graduate students and University/Lab researchers. Here is a list of some current collaborations.

Collaborations
Tear films and droplets (Dr. Kara Maki, RIT, and Prof. Richard Braun, U. Delaware).
Blood flow and blood clot filters (Dr. Mike Singer).
Wind turbines (Prof. Ravi Samtaney, KAUST, Prof. Dale Pullin, Caltech).
Reduced order models and control (Prof. John Burns, Prof. Jeff Borggaard, Virginia Tech).
Flapping airfoils, mircro-air vehicles (Prof. Yongsheng Lian, U. of Louisville).
Wave-energy devices (Dr. Robert Read, Prof. Harry Bingham, Technical U. of Denmark).
Plasma physics (Dr. Jeff Banks, Dr. Richard Berger, LLNL).
Flapping airfoils (Dr. Joel Guerrero, U. of Genoa).
High-order accurate subsonic/transonic aero-acoustics (Dr. Philippe Lafon, CNRS, EDF).
Elastic wave equation (Dr. Daniel Appelö, U. of New Mexico).
Compressible flow/ice-formation (Graeme Leese, Prof. Nikos Nikiforakis, U. Cambridge).
Relativistic hydrodynamics and Einstein field equations (Dr. Philip Blakely, U. Cambridge).
Converging shock waves, shock focusing (Prof. Veronica Eliasson, USC).
Pitching airfoils (Dr. D. Chandar, U. of Wyoming, Prof. M. Damodaran, NTU, Singapore).
Hypersonic flows for reentry vehicles, (Dr. Bjorn Sjögreen, LLNL, Dr. Helen Yee, NASA).
High-order accurate, compact Hermite-Taylor schemes (Prof. Tom Hagstrom, SMU).
High-order accurate aero-acoustics (Dr. Ramesh Balakrishnan, ANL).
Aerodynamics (Prof. Daniel Bodony, U. Illinois).

Theses using Overture

The Overture software and PDE solvers have played an important part in numerous Ph.D. and Masters theses. Here is a list of some of these.

Theses developed using the Overture software				
Year	Degree	Candidate	Topic	Institution
2011	Ph.D.	Graeme Leese	On the accretion of ice on aircraft.	U. of Cambridge, UK
2010	Ph.D.	Melih Ozlem	A numerical study of shock-induced cavity collapse	Rensselaer Polytechnic Institute
2010	Ph.D.	Philip Blakely	Numerical solutions of the general relativistic equations for black hole fluid dynamics.	U. of Cambridge, UK
2010	Ph.D.	Dominic Chandar	Computational modeling of unsteady low Reynolds flapping wing aerodynamics	Nanyang Technological University
2009	Ph.D.	Kara Maki	Computational solutions of linear systems and models of the human tear film	U. of Delaware
2007	Ph.D.	Thomas Emmert	Development of a multidomain high-order algorithm for computational aeroacoustics	École Central de Lyon, France
2007	Ph.D.	Veronica Eliasson	On focusing of shock waves	Royal Institute of Technology, Sweden
2006	Ph.D.	Jeffrey W. Banks	A high-resolution Godunov method for high speed multi-material flows	Rensselaer Polytechnic Institute
2006	Ph.D.	Guilherme de Oliveira	Numerical studies of the behavior of heterogeneous explosives using the ignition-and-growth model	Rensselaer Polytechnic Institute
2006	Ph.D.	Ioan Saparuic	A numerical study of a fractional step scheme for the reactive Euler equations	Rensselaer Polytechnic Institute
2005	Ph.D.	Graeme Thorn	Mathematical and computational modeling of friction stir welding.	U. of Cambridge
2001	Ph.D.	Bill Wangard	A transient, three-dimensional numerical study of chemical vapor deposition in batch reactors.	Colorado State University
1999	Ph.D.	Petri Fast	Dynamics of interfaces in non-Newtonian Hele-Shaw flow	Courant Institute, NYU
1999	Ph.D.	Krister Åhlander	An object-oriented framework for PDE solvers	Uppsala University, Sweden
1995	Ph.D.	Fredrik Olsson	A numerical method for modeling time-dependent viscoelastic fluid flow	Royal Institute of Technology, Sweden
1994	Ph.D.	Johan Malmliden	Development of numerical methods for ship flow using composite overlapping grids	Royal Institute of Technology, Sweden

Student Mentoring

Here is a list of the post-docs I have supervised.

Post-docs supervised		
Year	Post-doc	Topic
2008-2009	Jeffrey Banks	Numerical methods for high-speed multi-material flows and detonations.
1999-2002	Petri Fast	Algorithms for fluid flows and deforming bodies.
1998-2000	Thomas Rutanginera	Fast algorithms for elliptic grid generation.
1998-2001	Brian Miller	Fast level-set methods for overlapping grids.

Here is a list of some of the students (summer students and student visitors) I have mentored.

Student Mentoring			
Year	Student	Institution	Topic
2012	Chris Jarvis	Virgina Tech	Reduced order models for incompressible flows.
2011-2012	Robert Read	Tech. U. of Denmark	Water waves and wave energy devices.
2008-2011	Graeme Leese	U. Cambridge	Algorithms for compressible flows and ice accretion.
2008-2010	Philip Blakely	U. Cambridge	Numerical methods for relativistic hydrodynamics.
2007-2010	Dominic Chandar	Nanyang Technological University	Algorithms for moving and deforming wings.
2007-2009	Kara Maki	U. Delaware	Modeling of tear drops in the eye.
2004-2005	Jeffrey Banks	RPI	Multi-fluid algorithms for high-speed flows.
2003-2005	Graeme Thorn	U. Cambridge	Algorithms for simulating friction stir-welding.
2004-2006	Brian Taylor	UIUC	Reactive flows and detonations.
2000-2001	Nathan Crane	UIUC	Structural deformations and crack propagation for solid rocket fuels.
2000-2001	Diem-Phuong Nguyen	U. of Utah	Sub-grid scale models for reactive turbulent flows.
2001	Diana Jackson	(undergrad) Wofford College, SC	Optimizing graphics in Overture.
1999-2000	Bill Wangard	Colorado State U.	Multi-component diffusion.
2000	Krister Ölander	Uppsala University	Object oriented parallel frameworks.
1998	Petri Fast	NYU, Courant Institute	Algorithms for non-Newtonian Hele-Shaw flows.
1996	Lotta Olsson	Uppsala University	Simulation of flows in lakes and oceans.
1994	Johan Malmliden	Royal Inst. of Tech.	Simulation of flows past ships.
1993	Frederik Olsson	Royal Inst. of Tech.	Visco-elastic fluid flows.

Ph.D. Examinations

I have served numerous times as the Ph.D. *opponent* and *examiner* as well as on examination committees.

- Elliot English, Stanford, April 2013 (scheduled), (examination committee).
- Graeme Leese, U. Cambridge, 2011, (Ph.D. Examiner).
- Adam Reichert, U. of Illinois Urbana-Champaign, 2011, (examination committee).
- Philip Blakely, U. Cambridge, 2010, (Ph.D. Examiner).
- Macro Kupianinen, Royal Institute of Technology, 2009, (Ph.D. Opponent).
- Armin Brüger, Royal Institute of Technology, 2005 (Ph.D. Opponent).
- Graeme Thorne, U. Cambridge, 2005, (Ph.D. Examiner).
- Jacob Yström, Royal Institute of Technology, 1996 (Ph.D. Opponent).
- Johan Malmiden, Royal Institute of Technology, 1994, (Ph.D. Opponent).

Publications

Refereed research papers

1. Banks, J. W., W. D. Henshaw, and B. Sjögreen (2013). A stable FSI algorithm for light rigid bodies in compressible flow. *J. Comput. Phys.* (accepted).
2. Appelö, D., J. W. Banks, W. D. Henshaw, and D. W. Schwendeman (2012). Numerical Methods for Solid Mechanics on Overlapping Grids: Linear Elasticity. *J. Comput. Phys.* (231), 6012–6050.
3. Banks, J. W. and W. D. Henshaw (2012). Upwind schemes for the wave equation in second-order form. *J. Comput. Phys.* **231**(17), 5854–5889.
4. Banks, J. W., W. D. Henshaw, and D. W. Schwendeman (2012). Deforming Composite Grids for Solving Fluid Structure Problems. *J. Comput. Phys.* **231**(9), 3518–3547.
5. Broering, T., Y. Lian, and W. Henshaw (2012). Numerical Investigation of Energy Extraction in a Tandem Flapping Wing Configuration. *AIAA Journal* **50**(11), 2295–2307.
6. Lani, A., B. Sjögreen, H. C. Yee, and W. D. Henshaw (2012). Variable high-order multiblock overlapping grid methods for mixed steady and unsteady multiscale viscous flows, part II: hypersonic nonequilibrium flows. *Commun. Comput. Phys.* **13**(2), 583–602.
7. Ozlem, M., D. Schwendeman, A. Kapila, and W. Henshaw (2012). A numerical study of shock-induced cavity collapse. *Shock Waves* **22** (2), 89–117.
8. Schwendeman, D. W., A. K. Kapila, and W. D. Henshaw (2012). A Hybrid Two-Phase Mixture Model of Detonation Diffraction with Compliant Confinement. *Comptes Rendus Mathematique* **340**(11-12), 804–817.
9. Schwendeman, D. W., A. K. Kapila, and W. D. Henshaw (2012). A Comparative Study of Two Macro-Scale Models of Condensed-Phase Explosives. *IMA Journal of Applied Math* **77**, 2–17.
10. Maki, K. L., R. L. Braun, W. D. Henshaw, and P. E. King-Smith (2010). Tear Film Dynamics on an Eye-Shaped Domain I: Pressure Boundary Conditions. *Mathematical Medicine and Biology* **27**(3), 227–254.
11. Maki, K. L., R. L. Braun, P. Ucciferro, W. D. Henshaw, and P. E. King-Smith (2010). Tear Film Dynamics on an Eye-Shaped Domain II: Flux Boundary Conditions. *Journal of Fluid Mechanics* **647**, 361–390.
12. Schwendeman, D. W., A. K. Kapila, and W. D. Henshaw (2010). A study of detonation diffraction and failure for a model of compressible two-phase reactive flow. *Combust. Theory and Modeling* **14**(3), 331–366.
13. Banks, J. W., W. D. Henshaw, and J. N. Shadid (2009). An Evaluation of the FCT Method for High-Speed Flows on Structured Overlapping Grids. *J. Comput. Phys.* **228**, 5349–5369.
14. Henshaw, W. D. and K. K. Chand (2009). A Composite Grid Solver for Conjugate Heat Transfer in Fluid-Structure Systems. *J. Comput. Phys.* **228**, 3708–3741.
15. Singer, M. A., W. D. Henshaw, and S. L. Wang (2009). Computational Modeling of Blood Flow in the Trapease Inferior Vena Cava Filter. *Journal of Vascular and Interventional Radiology* **20**, S136–S137.
16. Banks, J. W., W. D. Henshaw, D. W. Schwendeman, and A. K. Kapila (2008). A Study of Detonation Propagation and Diffraction with Compliant Confinement. *Combustion Theory and Modeling* **12**(4), 769–808.
17. Eliasson, V., W. D. Henshaw, and D. Appelö (Aug. 2008). On Cylindrically Converging Shock Waves Shaped by Obstacles. *Physica D: Nonlinear Phenomena* **237**, 2203–2209.
18. Henshaw, W. D. and D. W. Schwendeman (2008). Parallel Computation of Three-Dimensional Flows using Overlapping Grids with Adaptive Mesh Refinement. *J. Comput. Phys.* **227**(16), 7469–7502.
19. Banks, J. W., D. W. Schwendeman, A. K. Kapila, and W. D. Henshaw (2007). A high-resolution Godunov method for compressible multi-material flow on overlapping grids. *J. Comput. Phys.* **223**, 262–297.
20. Kapila, A. K., D. W. Schwendeman, J. B. Bdzil, and W. D. Henshaw (2007). A Study of Detonation Diffraction in the Ignition-and-Growth Model. *Combustion Theory and Modeling* **11**(5), 781–822.

21. Henshaw, W. D. (2006). A High-Order Accurate Parallel Solver for Maxwell's Equations on Overlapping Grids. *SIAM J. Sci. Comput.* **28**(5), 1730–1765.
22. Henshaw, W. D. and D. W. Schwendeman (2006). Moving Overlapping Grids with Adaptive Mesh Refinement for High-Speed Reactive and Non-reactive Flow. *J. Comput. Phys.* **216**(2), 744–779.
23. Reed, E., L. Fried, W. Henshaw, and C. Tarver (2006). Analysis of simulation technique for steady shock waves in materials with analytical equations of state. *Physical Review E* **74**(5), 056706.
24. Henshaw, W. D. (2005). On Multigrid For Overlapping Grids. *SIAM J. Sci. Comput.* **26**(5), 1547–1572.
25. Henshaw, W. D., H.-O. Kreiss, and J. Yström (2003). Numerical Experiments on the Interaction Between the Large- and Small-scale Motions of the Navier-Stokes Equations. *SIAM Journal of Multiscale Modeling and Simulation* **1**(1), 119–149.
26. Henshaw, W. D. and D. W. Schwendeman (2003). An Adaptive Numerical Scheme for High-Speed Reactive Flow on Overlapping Grids. *J. Comput. Phys.* **191**, 420–447.
27. Fast, P. and W. D. Henshaw (2002). *Applications Involving Moving Grids and Adaptive Mesh Refinement on Overset Grids*. AIAA paper 2002-1411. Also available as Lawrence Livermore National Laboratory Report UCRL-JC-147263 DR. (2002). American Institute of Aeronautics and Astronautics.
28. Henshaw, W. D. (2002). An Algorithm for Projecting Points onto a Patched CAD Model. *Engineering with Computers* **18**, 265–273.
29. Fast, P. and W. D. Henshaw (2001). *Time-Accurate Computation of Viscous Flow Around Deforming Bodies Using Overset Grids*. AIAA paper 2001-2604. American Institute of Aeronautics and Astronautics.
30. Brown, D., W. Henshaw, and D. Quinlan (1999). Overture: Object-oriented tools for overset grid applications. *AIAA paper No. 99* **9130**.
31. Henshaw, W. D., H.-O. Kreiss, and L. G. M. Reyna (1995). Estimates of the Local Minimum Scale for the Incompressible Navier-Stokes Equations. *Numerical Functional Analysis and Optimization* **16(3&4)**, 315–344.
32. Chesshire, G. S. and W. D. Henshaw (July 1994). A Scheme for Conservative Interpolation on Overlapping Grids. *SIAM J. Sci. Comput.* **15**(4), 819–845.
33. Henshaw, W. D. (July 1994). A Fourth-Order Accurate Method for the Incompressible Navier-Stokes Equations on Overlapping Grids. *J. Comput. Phys.* **113**(1), 13–25.
34. Henshaw, W. D., H.-O. Kreiss, and L. G. M. Reyna (1994). A Fourth-Order Accurate Difference Approximation for the Incompressible Navier-Stokes Equations. *Comput. Fluids* **23**(4), 575–593.
35. Ward, M. J., W. D. Henshaw, and J. B. Keller (1993). Summing Logarithmic Expansions for Strong Localized Perturbations of Linear and Nonlinear Eigenvalue Problems. *SIAM J. of Applied Math* **53**(3), 799–828.
36. Henshaw, W. D., L. G. M. Reyna, and J. A. Zufiria (1991). Compressible Navier-Stokes computations for Slider Air-Bearings. *Journal of Tribology* **113**, 73–79.
37. Brewer, R. G., J. Hoffnagle, R. G. Devoe, L. Reyna, and W. Henshaw (1990). Collision-induced two-ion chaos. *Nature* **344**, 305–309.
38. Chesshire, G. S. and W. D. Henshaw (1990). Composite Overlapping Meshes for the Solution of Partial Differential Equations. *J. Comput. Phys.* **90**(1), 1–64.
39. Henshaw, W. D., H.-O. Kreiss, and L. G. M. Reyna (1990). Smallest scale estimates for the incompressible Navier-Stokes equations. *Arch. Rational Mech. Anal.* **112**, 21–44.
40. Henshaw, W. D., H.-O. Kreiss, and L. G. M. Reyna (1989). On the smallest scale for the incompressible Navier-Stokes equations. *Theoretical and Computational Fluid Dynamics* **1**, 65–95.
41. Henshaw, W. D. (1987). A Scheme for the Numerical Solution of Hyperbolic Systems of Conservation Laws. *J. Comput. Phys.* **68**, 25–47.

42. Henshaw, W. D. and G. S. Chesshire (1987). Multigrid on Composite Meshes. *SIAM J. Sci. Stat. Comput.* **8**(6), 914–923.
43. Henshaw, W. D., N. F. Smyth, and D. W. Schwendeman (1986). Numerical Shock Propagation Using Geometrical Shock Dynamics. *Journal of Fluid Mechanics* **171**, 519–545.

Book chapters

1. Henshaw, W. D. (2010). "Encyclopedia of Aerospace Engineering". In: Wiley. Chap. Adaptive Mesh and Overlapping Grid Methods, pp. 623–630.
2. Henshaw, W. D. (1996). Automatic Grid Generation. *Acta Numerica 1996* **5**, 121–148.
3. Babuska, I., J. E. Flaherty, W. D. Henshaw, J. E. Hopcroft, J. E. Oliger, and T. Tezduyar (1995). *Modeling, Mesh Generation, and Adaptive Numerical Methods for Partial Differential Equations*. New York: Springer-Verlag.

Papers in conference proceedings

1. Lani, A., B. Sjögreen, H. C. Yee, and W. D. Henshaw (2011). *Variable high-order multiblock overlapping grid methods for mixed steady and unsteady multiscale viscous flows, part II: hypersonic nonequilibrium flows*. paper LLNL-CONF-490192. AIAA.
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