

Brian T. Helenbrook

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EDUCATION

Princeton University Princeton, NJ
August 1992 - November 1997
Doctoral degree in the Mechanical and Aerospace Engineering program, with concentration in the areas of computational fluid dynamics and combustion. Master of Arts degree received June 1994. Advisor: Professor C. K. Law.

University of Notre Dame Notre Dame, IN
September 1987 - June 1991
Bachelor of Science degree in Mechanical Engineering. Undergraduate research advisor: Professor J. M. Powers. Research topic: numerical and analytical studies of reacting systems.

EXPERIENCE

Clarkson University Potsdam, NY
*Associate Professor, Mechanical and Aeronautical Eng. Dept. January 2001 -
Courtesy Appointment, Math. and Computer Science Dept.*
Current research is on developing computational fluid dynamics algorithms and studying the physics of two-fluid flows. Classes taught: ME531-Computational Fluid Dynamics, ME515-Introduction to the Finite Element Method, ES330-Fluid Mechanics, ME326-Intermediate Fluid Mechanics.

NASA Faculty Fellowship Program Cape Canaveral, FL
Fellow June 2005 - August 2005
Analyzed granular flow and cryogenic insulation problems with Hayley Shen. Host: P. Metzger (NASA Kennedy)

NASA Faculty Fellowship Program Hampton, VA
Fellow June 2002 - August 2002
Developed and analyzed iterative algorithms for solving high-order discretizations of the Euler and Navier-Stokes equations. Hosts: D. Mavriplis (ICASE) and H. L. Atkins (NASA Langley)

Stanford University Stanford, CA
Research Associate May 1998 - December 2000
Developed a spectral element algorithm for simulating incompressible two fluid flow. Other duties included providing guidance for graduate students in the numerical simulation branch of Professor C. F. Edwards' group.

Princeton University Princeton, NJ
Graduate/Post-Doctoral Student September 1992 - April 1998
Developed an algorithm for solving incompressible flow problems with a surface of discontinuity on a fixed mesh. Applied this algorithm to the study of premixed flames; specifically turbulent combustion phenomena. Also, performed asymptotic studies of hydrogen/oxygen ignition.

Trico Products Inc. Buffalo, NY
Design Engineer July 1991 - July 1992
Designed windshield wiper systems for automotive manufacturers.

- S. P. Lin, N. S. Barlow, B. T. Helenbrook, and Z. L. Wang. Transience to instability in a liquid sheet. *in preparation*, 2008.
- N. S. Barlow, B. T. Helenbrook, and S. P. Lin. A numerical investigation of the stability of expanding liquid sheets and the influence of boundary conditions. *Comput. & Fluids*, submitted., 2008.
- M. A. Karri, B. T. Helenbrook, and E. F. Thacher. Exhaust energy conversion by thermoelectric generator: Two case studies. *in preparation*, 2008.
- B. T. Helenbrook and H. L. Atkins. Coupling p -multigrid to geometric multigrid for discontinuous galerkin formulations of the poisson equation. *AIAA Journal*, accepted.
- B. J. O'Donnell and B. T. Helenbrook. Proper orthogonal decomposition and incompressible flow: An application to particle modeling. *Comput. & Fluids*, 36(7):1174–1186, August 2007.
- B. Mascarenhas, B. T. Helenbrook, and H. L. Atkins. Coupling p -multigrid to geometric multigrid for discontinuous Galerkin solutions of the wave equation. *in preparation*, 2007.
- B. T. Helenbrook and G. W. Cowles. Preconditioning for dual-time-stepping simulations of the shallow water equations including coriolis effects. *J. Comp. Phys.*, accepted, 2007.
- B. T. Helenbrook. Proof of the non-existence of a Gauss-Lobatto integration rule on the triangle. *SIAM J. Numer. Anal.*, submitted, 2007.
- B. Mascarenhas, B. T. Helenbrook, and H. L. Atkins. Solution to discontinuous galerkin formulations of the euler equations using p -multigrid. *submitted to NASA internal review*, 2007.
- B. T. Helenbrook, H. H. Shen, M. P. Powers, and P. T. Metzger. Continuum modeling and discrete element simulations of elastic-quasi-static granular flow in a compressing slot. *Powder Technology*, submitted., 2007.
- E. F. Thacher, B. T. Helenbrook, M. A. Karri, and C. J. Richter. Testing an automobile exhaust thermoelectric generator in a light truck. *Proc. IMechE, Part D: J. Automobile Engineering*, 221(D1):95–107, 2007.
- B. T. Helenbrook and H. L. Atkins. Application of “ p ”-multigrid to discontinuous Galerkin formulations of the Poisson equation. *AIAA Journal*, 44(3):566–575, March 2005.
- B. T. Helenbrook. Preconditioning for incompressible flows with free-surfaces and two-fluid interfaces. *J. Comp. Phys.*, 207(1):282–308, 2005.
- W. Y. Jiang, S. J. Weinstein, B. T. Helenbrook, and S. P. Lin. Low Reynolds number instabilities in three-layer flow down an inclined wall. *J. Fluid Mech.*, 539:387–416, 2005.
- B. J. O'Donnell and B. T. Helenbrook. Drag on ellipsoids at finite Reynolds numbers. *Atomization and Sprays*, 15(4):363–376, 2005.
- W. Y. Jiang, B. T. Helenbrook, and S. P. Lin. Inertialess instability of a two-layer liquid film flow. *Phys. Fluids*, 16(3):652–663, March 2004.
- B. T. Helenbrook. Mesh deformation using the biharmonic operator. *Int. J. Num. Meth. Eng.*, 56(7):1007–1021, 2003.
- B. T. Helenbrook and C. F. Edwards. Quasi-steady deformation and drag of uncontaminated liquid drops. *Int. J. Multi-Phase Flows.*, 28:1631–1657, 2002.
- B. T. Helenbrook. A two-fluid spectral element method. *Comp. Meth. Appl. Mech. Eng.*, 191(3–5):273–294, November 2001.

B. T. Helenbrook and C. K. Law. The role of Landau-Darrieus instability in large scale flows. *Comb. Flame*, 117:155–169, 1999.

B. T. Helenbrook, L. Martinelli, and C. K. Law. A numerical method for solving incompressible flow problems with a surface of discontinuity. *J. Comp. Phys.*, 148:366–396, 1999.

B. T. Helenbrook, H. G. Im, and C. K. Law. Theory of radical-induced ignition of counter-flowing hydrogen versus oxygen at high temperatures. *Combustion and Flame*, 112:242–252, 1998.

H. G. Im, B. T. Helenbrook, S. R. Lee, and C. K. Law. Ignition in the supersonic hydrogen/air mixing layer with reduced mechanisms. *J. Fluid Mech.*, 322:275–296, 1996.

B. T. Helenbrook, C. J. Sung, C. K. Law, and Wm. T. Ashurst. Stretch-affected flame propagation in vortical flows. *Combustion and Flame*, 104:460–468, 1996.

**REFEREED
CONFERENCE
PAPERS**

B. T. Helenbrook and H. L. Atkins. Coupling p -multigrid to geometric multigrid for discontinuous Galerkin formulations of the Poisson equation. In *The 18th AIAA Computational Fluid Dynamics Conference*, Miami, FL, June 2007. AIAA-2007-4082.

B. Mascarenhas, B. T. Helenbrook, and H. L. Atkins. Application of the p -multigrid algorithm to discontinuous Galerkin formulations of the compressible Euler equations. In *The 18th AIAA Computational Fluid Dynamics Conference*, Miami, FL, June 2007. AIAA-2007-4331.

B. T. Helenbrook, H. H. Shen, M. P. Powers, and P. T. Metzger. Continuum modeling and discrete element simulations of elastic-quasi-static granular flow in a compressing slot. In *Proceedings of the 5th World Congress on Particle Technology*, Orlando, Florida, April 2006.

B. T. Helenbrook. Artificial compressibility preconditioning for incompressible flows under all conditions. In *The 44th Aerospace Sciences Meeting and Exhibit Conference*, Reno, NV, Jan 2006. AIAA-2006-0689.

B. T. Helenbrook and H. L. Atkins. Application of p -multigrid to discontinuous Galerkin formulations of the Poisson equation. In *The 17th AIAA Computational Fluid Dynamics Conference*, Toronto, CA, June 2005. AIAA-2005-5111.

H. L. Atkins and B. T. Helenbrook. Numerical evaluation of p -multigrid method for the solution of discontinuous Galerkin discretizations of diffusive equations. In *The 17th AIAA Computational Fluid Dynamics Conference*, Toronto, CA, June 2005. AIAA-2005-5110.

B. T. Helenbrook, H. L. Atkins, and D. J. Mavriplis. Analysis of “ p ”-multigrid for continuous and discontinuous finite element discretizations. In *The 16th AIAA Computational Fluid Dynamics Conference*, Orlando, Florida, June 2003. AIAA-2003-3989.

B. T. Helenbrook and T. J. Baker. An adaptive spectral element method for two-fluid flows. In *Proceedings of the 2002 Joint ASME/European Fluids Engineering Division Summer Conference*, Montreal, Quebec, Canada, July 2002. ASME, FEDSM2002-31227.

B. Moses, C. F. Edwards, and B. T. Helenbrook. Development of a spatially-filtered method for calculation of multiphase flow. In *Proceedings of the 2002 Joint ASME/European Fluids Engineering Division Summer Conference*, Montreal, Quebec, Canada, July 2002. ASME, FEDSM2002-31231.

B. T. Helenbrook and C. K. Law. Ignition of hydrogen and oxygen in counterflow at high pressures. In *Proceedings of The Twenty-Sixth (International) Symposium on Combustion*, pages 815–822, 1996.

**INVITED
PRESENTATIONS**

Embedded Reduced Order Models for Thermal and Fluid Simulations, Syracuse University, Dec. 4, 2007

p-Multigrid Applied to Discontinuous Galerkin Formulations of the Poisson Equation, High-Order Methods and High-Fidelity Flow Simulations Workshop, NASA Langley, November 6-7, 2006

Droplet Break-up and Stability, ASME Joint U.S.-European Fluids Engineering Conference, Symposium on Droplet Flows with Highly Nonequilibrium Phase Transition, July 17-20, 2006

High-Order Methods for Multiphysics Simulations, Princeton University, March 14, 2006.

Analysis of *p*-multigrid for the solution of continuous and discontinuous finite element systems, Massachusetts Institute of Technology, December 5, 2003.

Applications of *hp*-finite element methods to multi-phase flow, Chemical Engineering Dept., Clarkson University, November 24, 2003

hp-finite element methods for computational fluid dynamics, Civil and Environmental Engineering, Clarkson University, February 21, 2003

Investigations of “*p*”-multigrid for the solution of continuous and discontinuous finite element discretizations, ICASE, August 16, 2002

Adaptive single- and two-fluid simulations, Mechanical and Aeronautical Engineering Dept., Clarkson University, March 11, 2002

A two-fluid spectral element method with application to drop breakup, Princeton University, March 6, 2001.

A two-fluid spectral element method with application to drop breakup, Mechanical and Aeronautical Engineering Dept., Clarkson University, February 5, 2001.

PROFESSIONAL MEMBERSHIPS

American Society of Mechanical Engineers (ASME)
American Society of Engineering Education (ASEE)
American Institute of Aeronautics and Astronautics (AIAA)
American Physical Society (APS)
International Liquid and Spray Systems (ILASS)
American Institute of Chemical Engineers (AIChE)

PROFESSIONAL SERVICE

Editorial Board: Atomization and Sprays

Meeting Organization: Technical chair of the 17th and 18th Annual ILASS Conferences, Arlington VA, 2004 and Irvine, CA, 2005. Organizer of the Thousand Islands Fluid Dynamics Meeting, Gananoque, ON, 2007. Co-organizer of “Computing on Unstructured Meshes: Work and Legacy of Tim Baker”, Princeton NJ, 2007

Paper Reviews: J. Comp. Phys., J. Fluid Mech., Int. J. Multi-Phase Flow, Atomization and Sprays, ASME Journal of Fluids Eng., Eng. Structures, Combustion Symposium, Canadian Journal of Phys., AIAA Journal, AIAA Computational Fluid Dynamics Conference. Copper Mountain Multigrid Conference.

Proposal Reviews: NSF Graduate Fellowship Research Program Panel, NSF Division of Chemical and Transport Systems, NSF Division of Mathematical Sciences

UNIVERSITY SERVICE

MAE Graduate Committee (chair: 2005-present, member: 2001-2004)
MAE Curriculum and Awards Committee (2002-present)
SOE Faculty Search Committee (2004)
Graduate Student Association (GSA) Advisor (2003-present)
McNair Scholars Program, Undergraduate Research Advisor (2004-Present)
Thesis Committees, (32 total, in mechanical, electrical, civil, and mathematics departments)

**AWARDS
HONORS**

Research Computing Co-Administrator (with J. Fiske and B. Huntley) (cares.clarkson.edu)
AND Teaching: $\pi\tau\sigma$ teaching award (2007). School of Eng. Teaching Excellence, Spring 2006, 2007.

Session Chair: 15th and 16th Annual ILASS conferences, 2002 Joint ASME/European Fluids Engineering Division Summer Conference, 16th AIAA Computational Fluid Dynamics Conference, American Physical Society Division of Fluid Dynamics 56th Annual Meeting

Student Awards:

Fellowships: Mike Brazell CARTI "high-order *hp*-finite element modeling of indoor air quality"

Travel awards: Nate Barlow & Brian O'Donnell \$1000 Institute of Liquid Atomization and Sprays, Brian O'Donnell \$1000 IUTAM Conference on Dilute Multi-Phase Flows

Undergraduate research: Keegan O'Donnell, William Noun, Jim Nobis, Jacob Bosco, Paul Reittinger, "Design, Build, and Modeling of a Pulse Jet Combustor", 2006 AIAA Region 1-NE Student Conference, team competition winners.