John W. Peterson

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Education

Doctor of Philosophy, May 2008
Aerospace Engineering, The University of Texas at Austin
Overall GPA: 3.8125
Advisor: G. F. Carey
Parallel Adaptive Finite Element Methods for Problems in Natural Convection. Developed adaptive finite element solution methods for solving the system of nonlinear PDEs governing combined buoyant and surface-tension-driven Rayleigh-Bénard-Marangoni flow. Mapped large region of parameter space with combined unsteady and pseudo-arclength continuation procedures, and made qualitative comparisons with experimental results.

Master of Science in Engineering, May 2003
Aerospace Engineering, The University of Texas at Austin
Overall GPA: 3.70/4.0
Advisor: G. F. Carey
A Numerical Investigation of Bénard Convection in Small Aspect Ratio Containers. Numerical simulations of Rayleigh-Bénard-Marangoni flow are conducted for heated fluid layers of small aspect ratio in polygonal containers. Distinct steady-state patterns with 1-8 convection cells are found for a range of aspect ratios between 3 and 11.

Bachelor of Science (with Honors), August 2001
Aerospace Engineering, The University of Texas at Austin
Overall GPA: 3.79/4.0

Experience

- Feb 2011 – Present, **Scientist/Engineer Level 3, Idaho National Labratory**. Member of the Frameworks team in the Fuels Performance Group. Responsible for developing multi-physics applications related to various aspects of nuclear fuels simulation.
- May 2008 – Feb 2011, **Research Associate, Texas Advanced Computing Center**. Member of the High Performance Computing (HPC) group. Responsible for consulting with center users and improving parallel efficiency of their applications.
- Fall 2010, **Lecturer, SSC 222 — Introduction to Scientific Programming**. Team teaching with Dr. Lars Koesterke.

- Fall 2007, **Teaching Assistant, CAM 394F — Introduction to FEM**. With Prof. Mary F. Wheeler.
- Fall 2006, **Lecturer, ME 330 — Fluid Mechanics**. Organized, taught, and evaluated a full section of 35 students.
- Spring 2006, **Teaching Assistant, ASE 362K — Compressible Fluid Mechanics**. With Prof. D. S. Dolling.
- May 2004 – May 2008, **CFDLab Manager, University of Texas at Austin**. With Dr. Graham F. Carey, responsible for day-to-day system administration tasks as well as purchasing new equipment and performing system upgrades for approximately 25 Linux workstations and a 16-node Beowulf cluster.
- Sep 2001 – May 2004, **Graduate Research Assistant, University of Texas at Austin**. With Dr. Graham F. Carey, participated in numerous object-oriented software development projects including finite element, meshing, and graphics applications.
- Jan 2000 – Aug 2001, **Undergraduate Research Assistant, University of Texas at Austin**. With Dr. Graham F. Carey, responsible for research assignments related to finite element shape quality in adaptively-refined moving-mesh applications, and daily maintenance of the Lab's website.
- Sep 1999 – Dec 1999, **Co-Op Engineer, LinCom Corporation, Johnson Space Center**. Worked on a project to devise a navigational aid for modules docking with the International Space Station. Developed the C source code for an iterative method of solving the Clohessy-Wiltshire equations of motion.
- Jun 1999 – Aug 1999, **Summer Intern, Institute for Advanced Technology**. Analyzed the dynamics of the Lunar Prospector spacecraft's moon impact. Used commercial impact software to model possible debris plumes created by the Prospector after its controlled descent to the moon's surface.

Misc. Academic Experience

Guest Lecturer

- Apr 2010, SSC 222, Intro. to Scientific Programming
- Nov 2007, CAM 397, Intro. to Mathematical Modeling
- Jun 2007, EM F397, Num. Simul. Transport in Semiconductors
- Apr 2005, EM 393N, Num. Meth. for Flow & Transport
- Nov 2005, EM 397.4, Grid Generation and Adaptive Grids
- Oct 2005, ASE 211, Engineering Computation

Peer Review

- Editorial Team member, Archive of Numerical Software. `http://journals.tdl.org/ans/index.php/ans/about/editorialTeam`
- Nuclear Engng. and Design
- Int. J. Heat and Mass Transfer
- Int. J. Numerical Methods in Fluids
- Communications in Numerical Methods in Engineering
- Transactions on Mathematical Software

Computer Skills

- Programming Languages: C/C++
- Software: LibMesh, Maple, Matlab/Octave, tecplot, LaTeX, cubit, GMV, cvs/svn, git
- APIs: MPI, openGL, fltk, PETSc
- Linux System Administration: RAID, NFS, emacs, vi, make, bash, autoconf, LVM

Awards

- Outstanding Paper Award, 2011. For "Multi-resolution simulation of double-diffusive convection in porous media," *Int. J. Numerical Methods in Heat and Fluid Flow*, with B. T. Murray and G. F. Carey. `http://www.emeraldinsight.com/authors/literati/awards.htm?year=2011`
- NASA Graduate Student Researcher Program Fellow, 2002-2004
- University of Texas Thrust 2000 Graduate Fellow, 2001-2004
- College of Engineering Boeing Scholarship, 2001
- Aerospace Engineering Ching Yew Scholarship, 1999
- AIAA Spirit of Apollo Scholarship, 1998
- Aerospace Engineering Daniel M. Luna Scholarship, 1998

Publications

[1] H. Zhang, H. Zhao, L. Zou, D. Andrs, J. W. Peterson, R. Berry, and R. Martineau, "RELAP-7 simulation resolving an SBO scenario on a simplified geometry of a BWR," Tech. Rep. INL/EXT-13-29887, Idaho National Laboratory, Aug. 2013. http://www.inl.gov/technicalpublications/Documents/5842313.pdf.

[2] J. W. Peterson, "Accurate curve fits of IAPWS data for high-pressure, high-temperature single-phase liquid water based on the stiffened gas equation of state," *ArXiv e-prints*, Nov. 2013. http://arxiv.org/abs/1311.0534.

[3] L. Zhang, M. R. Tonks, D. Gaston, J. W. Peterson, D. Andrs, P. C. Millett, and B. S. Biner, "A quantitative comparison between C^0 and C^1 elements for solving the Cahn-Hilliard equation," *Journal of Computational Physics*, vol. 236, pp. 74–80, Mar. 2013. http://dx.doi.org/10.1016/j.jcp.2012.12.001.

[4] D. J. Knezevic and J. W. Peterson, "A High-Performance Parallel Implementation of the Certified Reduced Basis Method," *Comput. Meth. Appl. Mech. Eng.*, vol. 200, pp. 1455–1466, Mar. 2011. http://dx.doi.org/10.1016/j.cma.2010.12.026.

[5] D. B. P. Huynh, D. J. Knezevic, J. W. Peterson, and A. T. Patera, "High-Fidelity Real-Time Simulation on Deployed Platforms," *Computers & Fluids*, vol. 43, pp. 74–81, Apr. 2011. Special issue dedicated to Prof. Michel Deville, Symposium on High Accuracy Flow Simulations (HAFS), École Polytechnique Fédérale de Lausanne, February 15–16, 2010, DOI: http://dx.doi.org/10.1016/j.compfluid.2010.07.007.

[6] J. W. Peterson and G. F. Carey, "Parallel adaptive solution of coupled Rayleigh–Bénard–Marangoni problems with Navier-slip," *Int. J. Numer. Meth. Fluids*, vol. 66, pp. 428–451, June 2011. http://dx.doi.org/10.1002/fld.2264.

[7] J. W. Peterson, G. F. Carey, and B. T. Murray, "Multi-Resolution Simulation of Double-Diffusive Convection in Porous Media," *Int. J. Numer. Meth. for Heat & Fluid Flow*, vol. 20, no. 1, pp. 37–65, 2010. http://dx.doi.org/10.1108/09615531011008118.

[8] J. W. Peterson, "Analytical Formulae for Two of A. H. Stroud's Quadrature Rules," *arXiv.org*, Sept. 2009. http://arxiv.org/abs/0909.5106v1.

[9] J. W. Peterson, *Parallel Adaptive Finite Element Methods for Problems in Natural Convection*. PhD thesis, ASE-EM dept., The University of Texas at Austin, May 2008. http://www.cfdlab.ae.utexas.edu/~peterson/diss.pdf.

[10] J. W. Peterson, G. F. Carey, D. J. Knezevic, and B. T. Murray, "Adaptive finite element methodology for tumor angiogenesis modeling," *Int. J. Numer. Meth. Eng.*, vol. 69, pp. 1212–1238, Feb. 2007. http://dx.doi.org/10.1002/nme.1802.

[11] B. S. Kirk, J. W. Peterson, R. H. Stogner, and G. F. Carey, "libMesh: A C++ Library for Parallel Adaptive Mesh Refinement/Coarsening Simulations," *Engineering with Computers*, vol. 22, pp. 237–254, Dec. 2006. http://dx.doi.org/10.1007/s00366-006-0049-3.

[12] G. F. Carey, W. Barth, B. S. Kirk, and J. W. Peterson, "Parallel CFD for Flow and Transport Applications Including Unstructured and Adaptive Grids," in *Proceedings of Parallel CFD 2004: Multidisciplinary Applications, G. Winter, A. Ecer, J. Periaux, N. Satofuka and P. Fox (Eds)*, (Amsterdam, The Netherlands), Elsevier Science B.V., Oct. 2005. ISBN: 0444520244.

[13] J. W. Peterson, "A Numerical Investigation of Bénard Convection in Small Aspect Ratio Containers," Master's Report, ASE-EM dept., The University of Texas at Austin, May 2003. http://www.cfdlab.ae.utexas.edu/~peterson/masters.pdf.

Conference Papers

[14] D. R. Gaston, J. W. Peterson, C. J. Permann, D. Andrs, A. E. Slaughter, and J. M. Miller, "Continuous integration for concurrent computational framework and application development," in *First Workshop on Sustainable Software for Science: Practice and Experiences (WSSSPE), In Conjunction with SC13, Denver, CO*, Nov. 2013. http://dx.doi.org/10.6084/m9.figshare.790755.

[15] B. S. Kirk, J. W. Peterson, and R. H. Stogner, "The libMesh Finite Element Library: A Case for Object-Oriented High-Performance Computing," in *PRACE Summer School 2013 - Frameworks for Scientific Computing on Supercomputers; Ostrava, Czech Republic*, June 17–21, 2013. http://ntrs.nasa.gov/search.jsp?R=20130013759.

[16] L. Zou, J. W. Peterson, H. Zhao, H. Zhang, D. Andrs, and R. C. Martineau, "Solving implicit multi-mesh flow and conjugate heat transfer problems with RELAP-7," in *Proceedings of the International Conference on Mathematics and Computational Methods Applied to Nuclear Science & Engineering (M&C 2013)*, May 5–9, 2013.

[17] D. R. Gaston, C. J. Permann, D. Andrs, and J. W. Peterson, "Massive hybrid parallelism for fully implicit multiphysics," in *Proceedings of the International Conference on Mathematics and Computational Methods Applied to Nuclear Science & Engineering (M&C 2013)*, May 5–9, 2013.

[18] J. W. Peterson, "LibMesh: Experience and Usage." Presentation, Mar. 31, 2008. Invited Speaker, DOD/PET Shortcourse on Parallel Adaptive Finite Element Simulation, Army Research Lab, Aberdeen, MD.

[19] J. Steensland and J. W. Peterson, "A Study of Dynamically Adaptive Partitioning for AMR," in *Proceedings of the 2007 International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA'07) Volume 2*, (Las Vegas, NV), pp. 503–509, CSREA Press, June 25–28, 2007. ISBN: 1-60132-021-3.

[20] J. W. Peterson, "Adaptive FEM for Applications." Presentation, Apr. 25, 2007. Invited Seminar, Army Engineer Research and Development Center, Vicksburg, MS.

[21] J. W. Peterson, B. T. Murray, and G. F. Carey, "Double-Diffusive Convection in Porous Media." Presentation, Mar. 26–28, 2007. 14th International Conference on Finite Elements in Flow Problems, Santa Fe, NM.

[22] J. W. Peterson and G. F. Carey, "Double-Diffusive Convection in Porous Media and Superconvergent Boundary Flux Integrals." Presentation, Mar. 2007. Finite Element Rodeo, Houston, TX.

[23] J. W. Peterson, B. T. Murray, and G. F. Carey, "Adaptive Grid Strategies for FEM Simulations of Double-Diffusive Convection in Porous Media." Presentation, Feb. 21, 2007. Graduate And Industry Networking (GAIN) Conference, Austin, TX.

[24] J. W. Peterson, "LibMesh: Experience and Usage." Presentation, Jan. 12, 2007. Invited Speaker, DOD/PET Workshop on Parallel Adaptive Finite Element Simulation, Army Engineer Research and Development Center, Vicksburg, MS.

[25] J. W. Peterson, B. T. Murray, D. J. Knezevic, and G. F. Carey, "A Stabilized h-Adaptive Continuation Method for Double-Diffusive Convection in Porous Media." Presentation, Mar. 2006. Finite Element Rodeo, College Station, TX.

[26] J. W. Peterson, B. T. Murray, D. J. Knezevic, and G. F. Carey, "Three-Dimensional, Adaptive Finite Element Simulations of Thermosolutal Convection in Porous Media." Presentation, July 2005. United States National Congress for Computational Mechanics VIII, Austin, TX.

[27] J. W. Peterson, B. S. Kirk, and G. F. Carey, "Stabilized Adaptive Finite Element Methods." Presentation, June 7, 2005. LibMesh Workshop, Austin, TX.

[28] J. W. Peterson, G. F. Carey, W. L. Barth, B. S. Kirk, and S. Iqbal, "Parallel Computing on Beowulf Clusters: Performance and Applications." Presentation, July 2004. SIAM Annual Meeting, Portland, OR.

[29] G. F. Carey, L. Branets, S. Iqbal, B. S. Kirk, J. W. Peterson, and R. Stogner, "Unstructured Mesh Technology, Mesh Smoothing, and Adaptivity." Poster Presentation, Mar. 2004. Finite Element Rodeo, University of Texas, Austin, TX.

[30] G. F. Carey, W. L. Barth, B. S. Kirk, J. W. Peterson, J. Woods, and M. Anderson, "Finite Elements for Flow and Transport." Poster Presentation, Oct. 2003. Center for Subsurface Modeling Industrial Affiliates Meeting, University of Texas, Austin, TX.

[31] G. F. Carey and J. W. Peterson, "High Performance Computing in Finite Element Analysis." Presentation, Aug. 2003. University of Manchester, UK.

[32] J. W. Peterson and B. S. Kirk, "A Numerical Investigation of Bénard Convection in Small Aspect Ratio Containers." Presentation, July 2003. United States National Congress for Computational Mechanics VII, Albuquerque, NM.

[33] J. W. Peterson, "Code Coupling: Microgravity Fluid Flow Meets Adaptive Mesh Refinement." Presentation, Aug. 2002. NASA, Visiting Students Enrichment Program, Goddard Space Flight Center, Greenbelt, MD.