

Stuart R. Slattery

Oak Ridge National Laboratory
Computational Sciences and Engineering Division
One Bethel Valley Rd.
P.O. Box 2008, MS-6164
Oak Ridge, TN 37831

Email: slatterysr@ornl.gov
Office: (865) 574-8774
Fax: (865) 241-0381
Homepage: www.ornl.gov/division/csed

Education

- Ph.D. Nuclear Engineering and Engineering Physics, University of Wisconsin - Madison, 2013.
- M.S. Nuclear Engineering and Engineering Physics, University of Wisconsin - Madison, 2011.
- B.S. Nuclear Engineering and Physics (double major), University of Wisconsin - Madison, 2011.

Professional Employment

Oak Ridge National Laboratory

Computing and Computational Sciences Directorate, Computational Sciences and Engineering Division, Computational Engineering and Energy Sciences Group

R&D Staff Member

2013–present

Leading a small team (5-6 staff members, post-doctoral associates, and graduate students) to develop scalable algorithms and software for computational physics.

Focus areas include multiphysics and multiscale simulations, radiation transport, heat transfer, fluid dynamics, continuum mechanics, particle-in-cell methods, and general methods for linear and nonlinear algebra. Science application areas include additive manufacturing, nuclear reactor analysis, and electric vehicle batteries.

University of Tennessee - Chattanooga

Joint Faculty Member

2014–present

Graduate School of Computational Engineering

Student Employment

University of Wisconsin - Madison

Nuclear Regulatory Commission Fellow

2012–2013

Graduate Research Assistant

2010–2012

Computational Nuclear Engineering Research Group, Department of Engineering Physics

Doctoral Dissertation: *Parallel Monte Carlo Synthetic Acceleration Methods for Discrete Transport Problems*. Advisor: Professor Paul P.H. Wilson

Undergraduate Research Assistant

2006–2009

Nuclear Materials Research Group, Department of Engineering Physics

Oak Ridge National Laboratory

Graduate Intern

2011, 2012

Consortium for Advanced Simulation of LWRs (CASL) and Radiation Transport Group, U.S. Department of Energy

Idaho National Laboratory

Undergraduate Intern

2010

Advanced Test Reactor National Scientific User Facility, U.S. Department of Energy

Undergraduate Intern

2009

Nuclear Science and Engineering Division, U.S. Department of Energy

Software Development

- Principal developer of the Data Transfer Kit (DTK) package, a library for massively parallel data transfer in multiphysics simulations (C++). Developed under funding by the Exascale Computing Project (ECP), the Consortium for Advanced Simulation of Light Water Reactors (CASL), the Nuclear Energy Advanced Modeling and Simulation (NEAMS) program, the National Highway Traffic Safety Administration (NHTSA), and the ORNL LDRD program.
- Principal developer of Cabana, a co-design library for particle-based simulations at exascale (C++). Developed under funding by the Exascale Computing Project (ECP).
- Principal developer of the Cicada multiphysics code (C++) for multiphysics simulations of Crud Induced Local Corrosion (CILC) and multiscale model reduction techniques to improve simulations of Crud Induced Power Shift (CIPS) phenomena in nuclear reactors with funding by the Consortium for Advanced Simulation of Light Water Reactors (CASL).
- Principal developer of ExaMPM (C++), a mini-application for exascale exploration of the material point method (MPM) for continuum mechanics and fluid flow. Development funded by the Exascale Computing Project (ECP).
- Developer of Profugus (C++, Python), a parallel, 3D, discrete-ordinates and Monte Carlo radiation transport mini-application for exploratory extreme-scale research at Oak Ridge National Laboratory under funding by the U.S. Department of Energy Office of Science Advanced Scientific Computing Research (ASCR) program.

Technical Skills

- Programming Languages: Expert programming ability in C++ and C. Intermediate programming ability in Python.

- Parallel Programming: Expert ability developing CPU code using MPI and leadership class machines including the Titan Cray XK7 machine at Oak Ridge National Laboratory and the Mira IBM Blue Gene/Q system at Argonne National Laboratory. Expert ability developing GPU code using the NVIDIA CUDA library. Expert ability developing performance portable code using Kokkos.
- Operating Systems: Advanced user of LINUX and other UNIX-based systems. Proficient user of WINDOWS systems.
- Tools and Software Carpentry: Experienced user of the version control system git. Experienced user of AutoTools and CMake build systems. Doxygen code documentation.
- Office Software: MS Office, OpenOffice/LibreOffice
- Advanced user of the L^AT_EX typesetting language.

Honors, Awards, & Scholarships

- R&D 100 Award Winner, "Virtual Environment for Reactor Applications (VERA)", 2016.
- ANS Mathematics & Computation Division Best Summary and Presentation Award for the presentation titled, "GPU Acceleration of History-Based Multigroup Monte Carlo." 2016 ANS Winter Meeting.
- UT-Battelle Significant Event Award, "Release of the VIBE", 2015.
- Nuclear Regulatory Commission Fellowship, 2012.
- Graduate Research Assistantship, University of Wisconsin - Madison, 2010.
- U.S. Department of Energy Science and Energy Research Challenge (SERCh) finalist, first place in computational science division, 2009.
- Nuclear Energy University Programs Scholarship, U.S. Department of Energy, 2009.
- Exelon Scholarship, University of Wisconsin - Madison, 2009.
- Exelon Scholarship, University of Wisconsin - Madison, 2008.

Professional and Community Service

- Mentoring of graduate students, post-doctoral associates, and junior staff members at ORNL
- Ph.D. committee member for students at partner universities
- Reviewer for ORNL LDRD/SEED proposals
- Reviewer for journals in areas of computational physics and applied mathematics
- Reviewer for conferences and workshops by the Association for Computing Machinery (ACM) and the American Nuclear Society (ANS)
- Professional membership of ACM, ANS, and SIAM

Graduate Students and Post-Doctoral Associates Supervised

- Kwitae Chong, ORNL Post-Doctoral Associate
- Will Gurecky, University of Texas - Austin, Advisor: Derek Haas
- Dan Moser, University of Texas - Austin, Advisor: Jayathi Murthy
- Alex Toth, North Carolina State University, Advisor: C. Tim Kelley

Conference Sessions and Workshops Organized

- Mini-symposium co-organizer, "Computational Techniques for Additive Manufacturing Modeling", SIAM MS2018, Portland, OR, July 9, 2018.
- Session co-organizer, "Scalable Applications", Smoky Mountains Conference on Computational Science, Gatlinburg, TN, August 29-30, 2018.
- Workshop lead organizer, 11th Material Point Method Workshop, Oak Ridge, TN, September 6-7, 2018.
- Session co-organizer, "Implementation and High-Performance Computing", USACM conference on Meshfree and Particle Methods: Applications and Theory, Santa Fe, NM, September 10-12, 2018.

Journal Articles

1. R. Salko, D. Pointer, M. Delchini, W. Gurecky, S. Slattery, V. Petrov, A. Manera, "Implementation of a Grid Heat Transfer Hi2Low Reconstruction Capability into the Thermal Hydraulics Subchannel Code CTF", Nuclear Technology, *In Preparation*.
2. S. Hamilton, S. Slattery, T. Evans, "Multigroup Monte Carlo on GPUs: Comparison of history- and event-based algorithms", Annals of Nuclear Energy, vol. 113, pp. 506-518, 2018.
3. A. Toth, J. Ellis, T. Evans, S. Hamilton, C. Kelley, R. Pawlowski, S. Slattery, "Local Improvement Results for Anderson Acceleration with Inaccurate Function Evaluations", SIAM Journal on Scientific Computing, 2017. DOI: 10.1137/16M1080677.
4. M. Benzi, T. Evans, S. Hamilton, M. Pasini, S. Slattery, "Analysis of Monte Carlo Accelerated Iterative Methods for Sparse Linear Systems", Numerical Linear Algebra with Applications, 2017. DOI: 10.1002/nla.2088.
5. S. Slattery, "Mesh-Free Data Transfer Algorithms for Partitioned Multiphysics Problems: Conservation, Accuracy, and Parallelism", Journal of Computational Physics, vol. 307, pp. 164-188, 2016.
6. S. Slattery, T. Evans, P. Wilson, "A Spectral Analysis of the Domain Decomposed Monte Carlo Method for Linear Systems", Nuclear Engineering and Design, vol. 295, pp. 632-638, 2015.

7. R. Schmidt, K. Belcourt, R. Hooper, R. Pawlowski, K. Clarno, S. Simunovic, S. Slattery, J. Turner, S. Palmtag, "An Approach for Coupled-Code Multiphysics Core Simulations from a Common Input", *Annals of Nuclear Energy*, vol. 84, pp. 140-152, 2014.
8. T.M. Evans, S.W. Mosher, S.R. Slattery, S.P. Hamilton, "A Monte Carlo Synthetic-Acceleration Method for Solving the Thermal Radiation Diffusion Equation", *Journal of Computational Physics*, vol. 258, pp. 338-358, 2014.
9. G. Cao, S. J. Weber, S. O. Martin, T. L. Malaney, S. R. Slattery, M. H. Anderson, K. Sridharan and T. R. Allen, "In-situ Measurements of High Temperature Spectral Emissivity of Materials for Very High Temperature Reactor Applications," *Nuclear Technology*, vol. 175, No. 2, pp. 460-467, 2011.

Reviewed Conference Proceedings

1. R. Salko, D. Pointer, M. Delchini, W. Gurecky, S. Slattery, V. Petrov, A. Manera, "Implementation of a Grid Heat Transfer Hi2Low Reconstruction Capability into the Thermal Hydraulics Subchannel Code CTF", *ANS Best Estimate Plus Uncertainty International Conference*, Lucca, Italy, May 2018.
2. S. Hamilton, T. Evans, S. Slattery, "GPU Acceleration of History-Based Multigroup Monte Carlo", *ANS Winter Meeting*, Las Vegas, NV, USA, 2016.
3. S. Slattery, S. Hamilton, T. Evans, "A Modified Moving Least Square Algorithm for Solution Transfer on a Spacer Grid Surface", *ANS MC2015 - Joint International Conference on Mathematics and Computation (M&C), Supercomputing in Nuclear Applications (SNA) and the Monte Carlo (MC) Method*, Nashville, Tennessee · April 19–23, 2015, on CD-ROM, American Nuclear Society, LaGrange Park, IL (2015).
4. A. Toth, C.T. Kelley, S. Slattery, S. Hamilton, K. Clarno, R. Pawlowski, "Analysis of Anderson Acceleration on a Simplified Neutronics/Thermal Hydraulics System", *ANS MC2015 - Joint International Conference on Mathematics and Computation (M&C), Supercomputing in Nuclear Applications (SNA) and the Monte Carlo (MC) Method*, Nashville, Tennessee · April 19–23, 2015, on CD-ROM, American Nuclear Society, LaGrange Park, IL (2015).
5. S. Slattery, T.M. Evans, P.P.H. Wilson, "A Multiple-Set Overlapping-Domain Decomposed Monte Carlo Synthetic Acceleration Method for Linear Systems", *SNA+MC 2013 - Joint International Conference on Supercomputing in Nuclear Applications + Monte Carlo*, Paris, France, 2013.
6. S. Slattery, P.P.H. Wilson, R. Pawlowski, "The Data Transfer Kit: A Geometric Rendezvous-Based Tool for Multiphysics Data Transfer", *International Conference on Mathematics and Computational Methods Applied to Nuclear Science & Engineering (M&C 2013)*, American Nuclear Society, Sun Valley, ID, May 5-9, 2013.
7. S. Slattery, T.M. Evans, P.P.H. Wilson, "A Spectral Analysis of the Domain Decomposed Monte Carlo Method for Linear Systems", *International Conference on Mathematics and Computational Methods Applied to Nuclear Science & Engineering (M&C 2013)*, American Nuclear Society, Sun Valley, ID, May 5-9, 2013.

8. S. Slattery, D.W. Nigg, J.D. Brockman, M.F. Hawthorne, "Improved Computational Characterization of the Thermal Neutron Source for Neutron Capture Therapy Research at the University of Missouri", Proceedings of PHYSOR-10-Advances in Reactor Physics to Power the Nuclear Renaissance, American Nuclear Society, Pittsburgh, PA, May 9-14, 2010.
9. S. Slattery, S. Weber, T. Malaney, K. Sridharan, M. Anderson, T. Allen, "System for High Temperature Spectral Emissivity Measurement of Materials for VHTR Applications", Conference Proceedings – 4th International Topical Meeting on High Temperature Reactor Technology, 2008.

Conference and Workshop Presentations

1. J. Turner, et. al., "Overview and Status of the Exascale Additive Manufacturing Project ExaAM", 2018 International Conference on Crystal Plasticity, Damage, and Fracture, San Juan, Puerto Rico, January, 2018.
2. S. Slattery, D. Lebrun-Grandie, B. Turcksin, A. Prokopenko, M. Bement, "Assembling Multiphysics Simulations for Additive Manufacturing", SIAM MS2018, Portland, OR, July 9, 2018.
3. S. Slattery, "A Review of Projection-Based Incompressible MPM Methods", 10th MPM Workshop, Livermore, CA, September 7-8, 2017.
4. S. Allu, B. Turcksin, M. Lebrun-Grandie, M. Berrill, S. Slattery, J. Turner, "High performance computing strategy for coupled multi-physics Li-ion battery pack simulations", VII International Conference on Coupled Problems in Science and Engineering (COUPLED PROBLEMS 2017) - 12/14 June 2017, Rhodes Island, Greece.
5. D. Bernholdt, G. Vallee, T. Naughton, S. Slattery, D. Lebrun-Grandie, A.B. Maccabe, "If Virtualization is the Answer, what was the Question?", SOS21 Meeting, Davos, Switzerland, March 23, 2017.
6. S. Hamilton, T. Evans, S. Slattery, "GPU Algorithms for Monte Carlo Particle Transport", SIAM Conference on Computational Science and Engineering, Salt Lake City, Utah, February 26 – March 3, 2017.
7. S. Slattery, T. Evans, "An HPC Approach for FLIP", 9th MPM Workshop, Portland, OR, September 8-9, 2016.
8. S. Hamilton, T. Evans, S. Slattery, M. Pasini, M. Benzi, "GPU Implementation of a Monte Carlo Linear Solver Algorithm", SIAM 14th Copper Mountain Conference on Iterative Methods, Copper Mountain, CO, 2016.
9. C.T. Kelley, A. Toth, R. Pawlowski, A. Ellis, S. Slattery, S. Hamilton, T. Evans, "Local Improvement Results for Anderson Acceleration and Inaccurate Function Evaluations", SIAM 14th Copper Mountain Conference on Iterative Methods, Copper Mountain, CO, 2016.
10. M. Pasini, M. Benzi, T. Evans, S. Hamilton, S. Slattery, "Monte Carlo Acceleration of Iterative Solvers for Eigenvalue Problems", SIAM 14th Copper Mountain Conference on Iterative Methods, Copper Mountain, CO, 2016.

11. S. Slattery, H. Hamilton, T. Evans, "Parallel Algorithms for Monte Carlo Linear Solvers", SIAM Conference on Computational Science and Engineering, Salt Lake City, Utah, March 14-18, 2015.
12. M. Pasini, M. Benzi, T. Evans, H. Hamilton, S. Slattery, "Iterative Performance of Monte Carlo Linear Solver Methods", SIAM Conference on Computational Science and Engineering, Salt Lake City, Utah, March 14-18, 2015.
13. J.A. Turner, S. Hamilton, R.P. Pawlowski, S. Slattery, "Coupled nuclear reactor simulation with the Virtual Environment for Reactor Applications (VERA)", 2nd Frontiers in Computational Physics Conference: Energy Sciences, Zurich, Switzerland, 2015.
14. J.A. Turner, S. Allu, W.R. Elwasif, S. Kalnaus, A. Kumar, D.T. Lebrun-Grandie, S. Pannala, S. Simunovic, S. Slattery, "Coupled multiscale safety simulations of Li-ion batteries", 2nd Frontiers in Computational Physics Conference: Energy Sciences, Zurich, Switzerland, 2015.
15. S.R. Slattery, T.M. Evans, S.P. Hamilton, "Multilevel Monte Carlo Solvers for Linear Systems", SIAM 13th Copper Mountain Conference on Iterative Methods, Copper Mountain, CO, 2014.
16. S.P. Hamilton, T.M. Evans, S.R. Slattery, "Monte Carlo Synthetic Acceleration as Approximate Polynomial Preconditioning", SIAM 13th Copper Mountain Conference on Iterative Methods, Copper Mountain, CO, 2014.
17. R. Pawlowski, E. Cyr, J. Shadid, T. Smith, S. Slattery, P. Wilson, K. Clarno, R. Bartlett, S. Hamilton, T. Evans, "Multiphysics Coupling Tools Applied to Large-scale Simulations of a Light Water Nuclear Reactor Core", SIAM Conference on Computational Science and Engineering, Boston, MA, February 25 - March 1, 2013.
18. T.J. Tautges, J. Kraftcheck, J. Porter, A. Caceres, I. Grindeanu, D. Karpeev, R. Jain, H.J. Kim, S. Cai, S. Jackson, J. Hu, B. Smith, C. Verma, S. Slattery, P. Wilson, "MeshKit: An Open-Source Library for Mesh Generation", Proceedings, SIAM Conference on Computational Science and Engineering. SIAM, Reno, NV, 2011.
19. D.W. Nigg, S. Slattery, J.D. Brockman, W.Y. Yoon, "A New Beamline Facility for NCT Research at the University of Missouri", 2009 Conference of the Test, Research and Training Reactor (TRTR) Organization, Bethesda MD, October 13-16, 2009.

ORNL Technical Reports

1. R. Salko, S. Slattery, T. Lange, M. Delchini, W. Gurecky, E. Tatli, B. Collins, "Development of a Preliminary VERA-CS Crud Induced Localized Corrosion Modeling Capability", CASL Report CASL-U-2018-1617-000, 2018.
2. S. Slattery, W. Gurecky, N. Adamowicz, "Cicada - A Package for CILC Analysis", CASL Report CASL-U-2017-1400-000, 2017.
3. R. Salko, W. Gurecky, S. Slattery, K. Clarno, D. Pointer, D. Walker, and V. Petrov. "Implementation of a Grid Heat Transfer and Turbulent Kinetic Energy Hi2Lo Remapping Capability into CTF in support of the CIPS Challenge Problem." CASL Report CASL-U-2017-1322-000, 2017.

4. S. Slattery, W. Gurecky, "Support for CILC L1 Milestone Using STAR-CCM+", CASL Report CASL-U-2016-1237-000, October 2016.
5. S. Slattery, D. Lebrun-Grandie, "Implement DTK Fortran Interface for FSI Activities (M3MS-16OR0401085)", ORNL Report ORNL/TM-2016/525, September 2016.
6. J. Turner, S. Allu, S. Gorti, S. Kalnaus, A. Kumar, D. Lebrun-Grandie, S. Simunovic, S. Slattery, B. Turcksin, H. Wang, "Crashworthiness Models for Automotive Batteries: A Report on the Department of Energy Project 2088-A031-15 for the National Traffic Safety Administration (NHTSA), an Office of U.S. Department of Transportation", ORNL Report ORNL/TM-2016/435, July 2016.
7. A. McCaskey, S. Slattery, J. Billings, "Warthog: A MOOSE-Based Application for the Direct Code Coupling of BISON and PROTEUS (MS-15OR04010310)", ORNL Report ORNL/TM-2015/532, September 2015.
8. S. Slattery, "Demonstration of VERA Interoperability with Commercial CFD Code", CASL Report CASL-U-2015-0294-000, August 2015.
9. S. Slattery, "PHI Development for CFD Interoperability", CASL Report CASL-U-2015-0084-000, March 2015.
10. J. Turner, S. Allu, S. Gorti, S. Kalnaus, A. Kumar, D. Lebrun-Grandie, S. Pannala, S. Simunovic, S. Slattery, H. Wang, "Crash Models for Advanced Automotive Batteries", ORNL Report ORNL/TM-2015/366, February 2015.
11. S. Slattery, R. Pawlowski, "Investigate DTK Interoperability with External Codes", CASL Report CASL-I-2014-0167-000, August 2014.
12. S. Palmtag, R. Bartlett, K. Belcourt, K. Clarno, G. Davidson, T. Evans, A. Godfrey, S. Hamilton, R. Hooper, R. Pawlowski, R. Salko, R. Schmidt, S. Slattery, J. Turner, "Demonstration of Neutronics Coupled to Thermal-Hydraulics for a Full-Core Problem using VERA", CASL Report CASL-U-2013-0196-000, December 2013.
13. D. Davidson, S. Slattery, J. Jarrell, T. Evans, "Coupling Denovo to STAR-CCM+", ORNL Report RNSD-TN-11-010, September 2011.

Media Coverage

- Media coverage for CASL work
 1. <https://www.ornl.gov/news/ornl-wins-seven-rd-100-awards>
 2. <http://www.openhealthnews.com/content/open-source-oak-ridge-graph-analytics-medical-innovation-receives-rd-100-award>
 3. <https://www.ornl.gov/division/rnsd/awards/ornl-rd-100-award-virtual-environment-reactor-applications>
 4. <https://www.rd100conference.com/awards/winners-finalists/6631/virtual-environment-reactor-applications-vera/>
- Media coverage for NHTSA work

1. <http://www.greencarcongress.com/2015/04/20150406-vibe.html>
2. <https://www.ornl.gov/news/battery-boost>

Last updated: July 19, 2018