Keith Bledsoe

Nuclear Security Modeling Group
Reactor & Nuclear Systems Division
Oak Ridge National Laboratory
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Specialty

Nuclear Engineering

- Inverse Problems
- Sensitivity/Uncertainty Analysis
- Perturbation Theory

Awards and Honors

- Outstanding Presentation in Engineering, 2009 Los Alamos National Laboratory Student Symposium
- American Nuclear Society – Alpha Nu Sigma National Honor Society
- Outreach Award, The Ohio State University Nuclear Engineering Graduate Program, 2007
- Excellence in Research Award, The Ohio State University Nuclear Engineering Graduate Program, 2006
- Excellence in Academics Award, The Ohio State University Nuclear Engineering Graduate Program, 2005
- BS/MS Award (Early entry into graduate school for outstanding undergraduates), The Ohio State University, 2004

Employment

2010-Present: *Research and Development Staff; Nuclear Security Modeling Group; Oak Ridge National Laboratory, Oak Ridge, TN.* Worked on perturbation theory and sensitivity/uncertainty analysis for fixed-source radiation transport problems (i.e. using data from external measurements to reconstruct unknown parameters in the interior of geometries). Applied both deterministic and stochastic methods for uncertainty quantification in inverse transport problems. Developed and implemented modern optimization techniques into inverse transport solvers. Implemented parallel processing into stochastic optimization techniques within inverse transport codes.

2006 - 2010: *Graduate Research Associate*; *Los Alamos National Laboratory, Los Alamos, NM.* Worked on solving various inverse transport problems in single and multidimensional systems using a variety of inverse methods, including perturbation methods, gradient-based methods, and stochastic algorithms. Developed and optimized these algorithms for

improved speed and performance. Studied multidimensional ray-trace techniques and developed a method to use ray-tracing to evaluate surface and volume integrals of uncollided adjoint fluxes and forward-adjoint flux products in general geometries. Investigated first-order perturbation theory as applied to the sensitivity of critical assemblies to perturbations in physical parameters.

Publications

- Jeffrey A. Favorite and Keith C. Bledsoe, "Identification of an Unknown Material in a Radiation Shield Using the Schwinger Inverse Method," *Trans. Am. Nucl. Soc.*, **91**, 125-126 (2004).

- Jeffrey A. Favorite and Keith C. Bledsoe, "Identification of an Unknown Material in a Radiation Shield Using the Schwinger Inverse Method," *Nucl. Sci. Eng.*, **152**, 106-117 (2006).

- Jeffrey A. Favorite and Keith C. Bledsoe, "Using the Levenberg-Marquardt Method for the Solution of Inverse Transport Problems with Scattering," *Joint International Topical Meeting on Mathematics & Computations and Supercomputing in Nuclear Applications*, Monterey, California, April 15-19, 2007 (CD-ROM).

- Keith C. Bledsoe, Jeffrey A. Favorite, and Tunc Aldemir, "Material Identification in Finite Cylindrical Geometries Using the Schwinger Inverse Method," *Trans. Am. Nucl. Soc.*, **96,** 545-547 (2007).

- Keith C. Bledsoe and Jeffrey A. Favorite, "Using the Marquardt Method for Solutions of Inverse Transport Problems in Two-Dimensional Cylinders," *Trans. Am. Nucl. Soc.*, **98**, 591-593 (2008).

- Jeffrey A. Favorite, Keith C. Bledsoe, and David I Ketcheson, "Surface and Volume Integrals of Uncollided Adjoint Fluxes and Forward-Adjoint Flux Products," *Nucl. Sci. Eng.*, **163**, 73-84 (2009).

- Keith C. Bledsoe, Jeffrey A. Favorite, and Tunc Aldemir, "Solutions of Inverse Transport Problems in Finite Cylindrical Geometries Using the Schwinger Inverse Method," *Ann. Nucl. Energy*, **36**, 966-973 (2009).

- Keith C. Bledsoe and Jeffrey A. Favorite, "A Comparison of the Differential Evolution and Levenberg-Marquardt Methods for Solving Inverse Transport Problems with Several Unknowns in Cylindrical Geometries," *Trans. Am. Nucl. Soc.*, **101**, 411-413 (2009).

- Jeffrey A. Favorite and Keith C. Bledsoe, "Eigenvalue Sensitivity to System Dimensions," *Ann. Nucl. Energy*, **37**, 4, 522-528 (2010).

- Keith C. Bledsoe and Jeffrey A. Favorite, "A Hybrid Differential Evolution/Levenberg-Marquardt Method for Solving Inverse Transport Problems," *Trans. Am. Nucl. Soc.*, **102**, 213-215 (2010).

- Keith C. Bledsoe, Jeffrey A. Favorite and Tunc Aldemir, "Using the Levenberg-Marquardt Method for Solutions of Inverse Transport Problems in One- and Two-dimensional Geometries," *Nuc. Tech*., **176**, 1, 106-126 (2011).

- Keith C Bledsoe, Jeffrey A. Favorite and Tunc Aldemir, "A Comparison of the Covariance Matrix Adaptation Evolution Strategy and the Levenberg-Marquardt Method for Solving Multidimensional Inverse Transport Problems," *Ann. Nucl. Energy*, **38**, 4, 897-904 (2011).

- Keith C. Bledsoe, Jeffrey A. Favorite and Tunc Aldemir, "Application of the Differential Evolution Method to Solving Inverse Transport Problems," *Nucl. Sci. Eng.*, **169**, 2, 208-221 (2011).

- John D. Bess, Keith C. Bledsoe and Bradley T. Rearden, "Evaluation of HEU-Beryllium Benchmark Experiments to Improve Computational Analysis of Space Reactors," *Nuclear & Emerging Technologies for Space (NETS-2011),* Albuquerque, NM, Feb. 7-10, 2011 (CD-ROM).

- Robert D. Busch and Keith C. Bledsoe, "The Effect of U-234 Content on the Neutronic Behavior of Uranium Systems," *Proc. International Conference on Nuclear Criticality (ICNC) 2011*, Edinburgh, Scotland, Septmber 19-22 (2011).

- Edward A. Read, Luiz C. Leal, Keith C. Bledsoe, Bernadette L. Kirk, and C. R. E. Oliveira, "Nuclear Data Error Propagation in Fusion Benchmark Calculations," *Trans. Am. Nucl. Soc.*, **105**, 464-465 (2011).

- Tatiana Ivanova, Cédric Laville, James Dyrda, Dennis Mennerdahl, Yury Golovko, Kirill Raskach, Anatoly Tsiboulia, Gil Soo Lee, Sweng-Woong Woo, Adrien Bidaud, Pouya Sabouri, Amrit Patel, Keith Bledsoe, Bradley Rearden, Jim Gulliford, and Franco Michel-Sendis, "OECD/NEA Expert Group Uncertainty Analysis for Criticality Safety Assessment: Results of Benchmark on Sensitivity Calculation (Phase III)," *Physor 2012 – Advances in Reactor Physics, Linking Research, Industry, and Education*, Knoxville, TN, USA, April 15-20, 2012 (CD-ROM).

- Keith C. Bledsoe, Matthew A. Jessee, and Jeffrey A. Favorite, "Application of Generalized Linear Least-Squares for Uncertainty Analysis in Inverse Transport Problems," *Trans. Am. Nucl. Soc.*, **108**, 445-448 (2013).

- Keith C. Bledsoe and Jeffrey A. Favorite, "Improved Differential Evolution Implementation for Solving Inverse Transport Problems," *Trans. Am. Nucl. Soc.*, **109**, 781-784 (2013).

- Keith C. Bledsoe, Jeffrey A. Favorite, Jordan P. Lefebvre, Robert A. Lefebvre, Matthew A. Jessee, "Application of the DiffeRential Evolution Adaptive Metropolis (DREAM) Method for Uncertainty Quantification in Inverse Transport Problems," *Trans. Am. Nucl. Soc.* (accepted for publication) (2014).

Internal Research Documents – Los Alamos National Laboratory

- Keith C. Bledsoe, "Identification of an Unknown Material in a Radiation Shield Using the Schwinger Inverse Method," Los Alamos National Laboratory Research Note, X-5-RN(U)04-42 (2004).

- Jeffrey A. Favorite and Keith C. Bledsoe, "First-Order Perturbation Theory for the Sensitivity of Jezebel k_{eff} to ^{239}Nu-Bar," Los Alamos National Laboratory Research Note, X-5-RN(U)05-24 (2005).

- Jeffrey A. Favorite and Keith C. Bledsoe, "Surface and Volume Integrals of Uncollided Adjoint Fluxes and Forward-Adjoint Flux Products," Los Alamos National Laboratory Research Note, X-1-RN(U)08-03 (LA-UR-08-4396) (2008).

- Keith C. Bledsoe, "Using Differential Evolution to Solve Inverse Transport Problems in Spherical Geometries," Los Alamos National Laboratory Research Note, X-1-RN(U)09-12 (LA-UR-09-06202) (2009).

Presentations

- "Using the Schwinger Inverse Method for Identification of an Unknown Material in a Radiation Shield," *American Nuclear Society Winter Meeting*, Washington, D.C. (2004).

- "Using the Levenberg-Marquardt Method for the Solution of Inverse Transport Problems with Scattering," *Joint International Topical Meeting on Mathematics & Computation and Supercomputing in Nuclear Applications*, Monterey, California (2007).

- "Material Identification in Finite Cylindrical Geometries Using the Schwinger Inverse Method," *American Nuclear Society Annual Meeting*, Boston, Massachusetts (2007).

- "Using the Marquardt Method for Solutions of Inverse Transport Problems in Two-Dimensional Cylinders," *American Nuclear Society Annual Meeting*, Anaheim, California (2008).

- "A Comparison of the Differential Evolution and Levenberg-Marquardt Methods for Solving Inverse Transport Problems with Several Unknowns in Cylindrical Geometries," *American Nuclear Society Winter Meeting*, Washington, D.C. (2009)

- "Sensitivity/Uncertainty Quantification Methods for AFIDS," *FY11 Program Review, NA-22 Nuclear Forensics R&D Program*, Patrick Air Force Base, Cocoa Beach, Florida (2011)

- "Sensitivity/Uncertainty Quantification for Radiation Transport*," Presentation to Defense Threat Reduction Agency/NTM Nuclear Weapons Effects Network*, Ft Belvoir, Virginia (2011).

- "Nuclear Data Error Propagation in Fusion Benchmark Calculations," *American Nuclear Society Winter Meeting and Nuclear Technology Expo*, Washington, D.C. (2011)

- "Generalized Linear Least-Squares for Uncertainty Analysis in Inverse Transport Problems," *American Nuclear Society Annual Meeting*, Atlanta, Georgia (2013).

Education

Ph.D., Nuclear Engineering, 2009
The Ohio State University, Columbus, OH
GPA: 4.00
Ph.D. Dissertation: "Inverse Methods for Radiation Transport"

M.S., Nuclear Engineering, 2006
The Ohio State University, Columbus, OH
Specialization in Reactor Physics
GPA: 3.75
Masters Thesis: "Using the Schwinger Inverse Method for Shield Material Identification in One- and Two-Dimensional Radiation Source/Shield Systems"

B.S., Engineering Physics, 2004
The Ohio State University, Columbus, OH
GPA: 3.76

Skills

- Programming Languages: Proficient with Fortran 77, Fortran 90, C++
- Particle Transport Codes: Experience with SCALE, Denovo, ADVANTG, MCNP, and PARTISN
- Other: Proficient with Microsoft Word, Microsoft Excel. Experience with LaTEX. Have worked extensively with Windows XP, Windows Vista, and Unix.

Activities

- Technical Reviewer, *Nuclear Science and Engineering*, 2013-present
- Technical Reviewer, *Progress in Nuclear Energy*, 2013-present
- Technical Reviewer, *Annals of Nuclear Energy*, 2009-present
- Session Chair, 2005 American Nuclear Society Student Conference
- American Nuclear Society (2004-Present)

Note: I have obtained a DOE Q-Clearance (November 2008).