

Keith C. Bledsoe
Nuclear Security Modeling Group
Nuclear Security and Isotope Technology Division

Contact Oak Ridge National Laboratory
PO Box 2008
Bldg 5700, Rm. H212, MS 6165
Oak Ridge, TN, 37831-6165
Phone: (865) 574-8602
Email: bledsoekc@ornl.gov

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

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

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

Experience **2010-Present:** *Research and Development Staff; Nuclear Security Modeling Group, Oak Ridge National Laboratory, Oak Ridge, TN*

- Applied 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/uncertainty quantification methods.
- Developed surrogate modeling techniques to greatly enhance the speed of inverse transport solvers.
- Developed a graphical user interface for inverse transport tools.
- Worked on perturbation theory and sensitivity/uncertainty analysis for fixed-source radiation transport problems in complex geometries.

2006-2010: Graduate Research Associate; Los Alamos National Laboratory, Los Alamos, NM.

- Applied a variety of techniques (perturbation methods, gradient-based methods, stochastic methods) for solving inverse transport problems.
- Studied multidimensional ray-trace techniques and developed a method to use ray-tracing to evaluate surface and volume integrals of adjoint fluxes and forward-adjoint flux products.
- Developed adjoint-based differentiation techniques to aid in solving inverse transport problems with measurements of passive gamma rays, neutron-induced gamma rays, and neutron multiplication.
- Investigated first-order perturbation theory as applied to the sensitivity of critical assemblies to perturbations in physical parameters.

Publications

1. **Keith C. Bledsoe**, Matthew A. Jessee and Justin Knowles. Application of Polynomial Chaos Expansion in Inverse Transport Problems with Neutron Multiplication Measurements and Multiple Unknowns. *20th Topical Meeting of the American Nuclear Society Radiation Protection and Shielding Division (RPSD 2018)* (Accepted for publication)
2. Justin R. Knowles, **Keith C. Bledsoe**, Jordan P. Lefebvre, and Matthew A. Jessee. Determining Physical Parameters of Shielded Uranium using Gamma Spectroscopy and the Differential Evolution Adaptive Metropolis (DREAM) Method. *Trans. Am. Nucl. Soc.*, **116**, 559-562 (2017).
3. **Keith C. Bledsoe**, Matthew A. Jessee, and Jordan P. Lefebvre. Application of Polynomial Chaos Expansion in One-Dimensional Inverse Transport Problems. *Trans. Am. Nucl. Soc.*, **116**, 591-594 (2017).
4. Aaron M. Bevill and **Keith C. Bledsoe**. Uncertainty Quantification for Quantitative Imaging Holdup Measurements. *Proceedings of the INMM 57th Annual Meeting* (2016).
5. **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.*, **111**, 743-746 (2014).
6. **Keith C. Bledsoe** and Jeffrey A. Favorite. Improved Differential Evolution Implementation for Solving Inverse Transport Problems. *Trans. Am. Nucl. Soc.*, **109**, 781-784 (2013).

7. **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).
8. 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).
9. 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).
10. 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, September 19-22 (2011).
11. John D. Bess, **Keith C. Bledsoe** and Bradley T. Rearden. Evaluation of HEU-Beryllium Benchmark Experiments to Improve Computational Analysis of Space Reactor. *Nuclear & Emerging Technologies for Space (NETS-2011)*, Albuquerque, NM, Feb. 7-10, 2011 (CD-ROM).
12. **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).
13. **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).
14. **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).
15. **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).
16. Jeffrey A. Favorite and **Keith C. Bledsoe**. Eigenvalue Sensitivity to System Dimensions. *Ann. Nucl. Energy*, **37**, 4, 522-528 (2010).
17. **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).
18. **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).
 19. 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).
 20. **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).
 21. **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).
 22. 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).
 23. 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).
 24. 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).

Skills

- **Programming Languages:** C++, Fortran 90
- **Particle Transport Codes:** MCNP, Denovo, PARTISN, ADVANTG, SCALE (MAVRIC, KENO, Monaco)
- **Uncertainty Quantification and Optimization:** Dakota, TASMANIAN, SCALE (TSUNAMI, TSURFER, Sampler)
- **Other:** Developer of INVERSE (LANL Emergency Response) and the INVERSE graphical user interface.

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)