

Robert Baraldi

Sandia National Laboratories

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Areas of specialization

Nonsmooth Optimization • Nonconvex Optimization • Numerical Analysis • Uncertainty Quantification • Scientific Computing • Data Science

Employment

- 2023- Senior Computer Science R&D S&E, Sandia National Labs.
Group: Optimization and Uncertainty Quantification (1463).
- 2021-23 John von Neumann Fellow, Sandia National Labs.
Group: Optimization and Uncertainty Quantification (1463).
Advisor: [Drew P. Kouri](#).
- 2020 Argonne National Lab: DOE CSGF Practicum: ADMM and Filter Methods.
Advisor: [Sven Leyffer](#).
- 2018 Lawrence Berkeley National Lab: DOE CSGF Practicum: Reduced Order Models and Implicit Sampling.
Advisor: [Matthew Zahr](#).

Education

- 2021 PhD in Applied Mathematics, University of Washington.
PhD Advisor: [Aleksandr Aravkin](#).
- 2016 BS in Mathematics, NC State University.
Academic Advisor: Alina Duca. **Research Advisor:** Harvey Thomas Banks.
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Grants & Awards

STAFF

- 2024 **Title:** ASCEND Optimization & UQ, Randomized Methods Thrusts.
Agency: Advanced Scientific Computing Research.
Role: Senior Personnel.
Opt & UQ Team Members: [Denis Ridzal](#) (PI), [Drew P. Kouri](#), [Joseph Hart](#), [Bart van Bloemen Waanders](#).
Amount: \$2.4 million per year.

- Randomized Methods Team Members:** [Drew P. Kouri](#) (PI), [Eric Phipps](#) (PI), [Riley Murray](#), [Aurya Javeed](#).
- Amount:** \$2.0 million per year.
- 2024 **Title:** Rapid Optimization of Total Variation with Applications to Imaging, Additive Manufacturing, and Qualification.
Agency: Late-Start Laboratory Directed Research and Development.
Role: PI.
Team Members: [Michael Heiden](#), [Drew P. Kouri](#).
- 2023 **Amount:** \$130,000 over 1 year. **Title:** Robust Nonsmooth Stochastic Methods for Machine Learning.
Agency: Laboratory Directed Research and Development.
Role: Co-PI.
Team Members: [Aurya Javeed](#), [Drew P. Kouri](#).
Amount: \$1.2 million over 3 years.
- 2022 **Consultants:** [Jong-shi Pang](#), [Katya Scheinberg](#), [Eric Cyr](#).
Title: Compression and Randomization of Extreme-Scale Training and Optimization (CREST-Opt).
Agency: Air Force Office of Scientific Research
Role: Co-PI.
Team Members: [Harbir Antil](#), [Drew P. Kouri](#), [Denis Ridzal](#).
Amount: \$850,000 over 3 years.

GRADUATE

- 2021 **Title:** John von Neumann Fellowship.
Agency: Department of Energy Advanced Scientific Computing Research.
Role: PI.
Amount: \$170,000 over 2 years.
- 2017-21 Department of Energy Computational Science Graduate Fellowship (DOE CSGF).
- 2017 National Science Foundation Graduate Research Fellowship (NSF-GFRP, declined).
- 2016 Department of Applied Math Boeing Fellowship/Top Scholar Award, UW.

Publications

IN PREPARATION

- 2023- Robert Baraldi, Paul Manns, “Coordinate Descent for Total-Variation Integer Optimal Control”.
- 2023- Robert Baraldi, Drew Kouri, Harbir Antil, “Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization”.
- 2023- Aurya Javeed, Robert Baraldi, Drew Kouri, Katya Scheinberg, “A Stochastic Trust-Region Method for Nonsmooth Optimization”.
- 2023- Robert Baraldi, John Jakeman, Christian Glusa. “A Multifidelity Variational Inference Approach to Sea-Ice Inversion”.

IN REVIEW¹

- 2023 Robert Baraldi, Drew P. Kouri (2023), “[Efficient Proximal Subproblem Solvers for a Nonsmooth Trust-Region Method](#)”, *Computational Optimization and Applications*.
- 2023 Robert Baraldi, Stefan Wild, Sven Leyffer (2023), “[Using Filter Methods to Guide Convergence for ADMM with Applications to Nonnegative Matrix Factorization](#)”, *Journal of Optimization Theory and Applications*.

PEER-REVIEWED

- 2024 Robert Baraldi, Aleksandr Aravkin, Dominique Orban (2024), “[A Levenberg - Marquardt Method for Nonsmooth Regularized Least Squares](#)”, *SIAM Journal on Scientific Computing* 46(4), A2557-A2581.
- 2024 Robert Baraldi, Drew P. Kouri (2024), “[Local Convergence Analysis of an Inexact Trust-Region Method for Nonsmooth Optimization](#)”, *Optimization Letters* 18, 663-680.
- 2022 Robert Baraldi, Drew P. Kouri (2022), “[A Proximal Trust-Region Method for Nonsmooth Optimization with Inexact Function and Gradient Evaluations](#)”, *Mathematical Programming*. 201(1), 559-598.
- 2022 Donsub Rim, Robert Baraldi, Christopher Liu, Randall LeVeque, Kenjiro Terada (2022), “[Tsunami Early Warning from Global Navigation Satellite System Data using Convolutional Neural Networks](#)”, *Geophysical Review Letters* 49(20).
- 2021 Robert Baraldi, Aleksandr Aravkin, Dominique Orban (2021), “[A Proximal Quasi-Newton Trust-Region Method for Nonsmooth Regularized Optimization](#)”, *SIAM Journal of Optimization*. 32(2): 900-929.
- 2021 Christopher Liu, Donsub Rim, Robert Baraldi, Randall LeVeque (2021), “[Comparison of Machine Learning Approaches for Tsunami Forecasting from Sparse Observations](#)”, *Pure and Applied Geophysics* 178, 5129-5153.
- 2019 Robert Baraldi, Rajiv Kumar, Aleksandr Aravkin (2019), “[Basis Pursuit Denoise with Nonsmooth Constraints](#)”, *IEEE Transactions on Signal Processing* 67(22): 5811-5823.
- 2019 Robert Baraldi, Carl Ulberg, Rajiv Kumar, Kenneth Creager, Aleksandr Aravkin (2019), “[Relaxation Algorithms for matrix completion, with applications to seismic travel-time data interpolation](#)”, *Inverse Problems* 35(10):105009.
- 2016 Harvey Thomas Banks, Robert Baraldi, Jared Catenacci, Nicholas Myers (2016), “[Parameter Estimation Using Unidentified Individual Data in Individual Based Models](#)”. *Mathematical Modeling of Natural Phenomena* 11(6):103-121.
- 2016 Harvey Thomas Banks, Robert Baraldi, Kevin Flores, Michael Stemkovski (2016), “[Validation of a Mathematical Model for Green Algae \(*Raphidocelis subcapitata*\) Growth and Implications for a Coupled Dynamical System with *Daphnia Magna*](#)”, *Applied Sciences* 6(5): 155.
- 2015 Kaska Adoteye, Harvey Thomas Banks, Robert Baraldi, John Nardini, W Clay Thompson (2015), “[Correlation of Parameter Estimators for Models Admitting Multiple Parametrizations](#)”, *International Journal of Pure and Applied Mathematics* 105(3): 497-522.
- 2015 Harvey Thomas Banks, Robert Baraldi, Kevin Flores (2015), “[Optimal Design for Minimiz-](#)

¹Note that Sandia National Laboratories’ Review and Approval process may prevent some of this work from being publically available on ArXiv until cleared.

ing [Uncertainty in Dynamic Equilibrium Systems](#)”, *Eurasian Journal of Mathematical and Computer Applications* 3: 20-43.

- 2015 Harvey Thomas Banks, Robert Baraldi, Karissa Cross, Christina McChesney, Laura Poag, Emma Thorpe, Kevin Flores (2015), “[Uncertainty quantification in modeling HIV viral mechanics](#).”, *Mathematical Biosciences and Engineering* 12(5): 937-964.

CONFERENCE PROCEEDINGS

- 2023 Robert Baraldi, Evelyn Herberg, Drew P. Kouri, Harbir Antil (2023), “Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization”, *Proceedings of the International Model Analysis Conference XLI: Model Validation and Uncertainty Quantification*, #14609.
- 2014 Harvey Thomas Banks, Robert Baraldi, et al. (2014), [Uncertainty quantification for a model of HIV-1 patient response to antiretroviral therapy interruptions](#). *Proceedings of the 2014 American Control Conference*, 2753-2758.

BOOK CHAPTERS

- 2023 Robert Baraldi, Drew Kouri, Denis Ridzal (2023), “Trust-Region Methods with Inexact and Adaptive Computations”, *Encyclopedia of Optimization*.

TECHNICAL REPORTS (NOT PEER-REVIEWED)

- 2014 Robert Baraldi, John Nardini, Emma Thorpe, and Harvey Thomas Banks (2014), [The Effects of Parameterization on Inverse Problems](#), CRSC Technical report CRSC-TR14-07, Raleigh, NC.
- 2013 Robert Baraldi, Karissa Cross, Christina McChesney, Laura Poag, Emma Thorpe, Kevin Flores, and Harvey Thomas Banks (2013), “[Mathematical Modeling of HCV Viral Kinetics](#)”. CRSC Technical report CRSC-TR13-07, Raleigh, NC.

Code Development

- 2022- [Rapid Optimization Library](#) (part of [Trilinos](#)) - C++.
- 2019- [RegularizedOptimization](#) (part of [JuliaSmoothOptimizers](#)) - Julia.
- 2019- [ShiftedProximalOperators](#) (part of [JuliaSmoothOptimizers](#)) - Julia.
- 2019- [RegularizedProblems](#) (part of [JuliaSmoothOptimizers](#)) - Julia.
- 2019-21 [UW-AMO Group](#).

CODING LANGUAGES

- Active Matlab, Python, Julia, C++.
- Inactive Java, R, Markdown, HTML, OpenMP/MPI.
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Service

- 2019- Reviewer: Advances in Continuous and Discrete Models, Inverse Problems, SIAM Journal On Scientific Computing, Mathematical Computing, Optimization Letters, Operations Research Letters, SIAM Journal on Optimization.
- 2021- Minisymposia Organizer: SIAM Optimization (2021, 2023), ICCOPT/MOPTA (2022, 2025), SIAM CSE (2021, 2023, 2025), PASC (2024), ISMP (2024), INFORMS (2024).
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Teaching/Tutorials

- 2023- Sandia + GMU [PDECO Seminar](#)
- 2016-21 UW Applied Mathematics SIAM Student Chapter
- 2016-19 Organizer - UW Applied Mathematics Numerical Analysis Research Club
- 2016 Teaching Assistant: MATH 126 Calculus 3, University of Washington.
- 2013 Mathematics Tutor: MA 121 Calculus 1, MA 241 Calculus 2, NC State University.
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Students/Interns

[Alexander Hsu](#) - University of Washington Applied Math (advisor: Aleksandr Aravkin)

[Qi Wang](#) - WIAS, Nonsmooth Variational Problems and Operator Equations Group (advisor: [Michael Hintermüller](#))

Leandro Maia - Texas A&M University Industrial & Systems Engineering (advisor: [David Huckleberry Gutman](#))

References

Drew P. Kouri - Sandia National Laboratories: dpkouri@sandia.gov

Aleksandr Aravkin - University of Washington: saravkin@uw.edu

Dominique Orban - Polytechnique Montréal: dominique.orban@gerad.ca

Harbir Antil - George Mason University: hantil@gmu.edu

Sven Leyffer - Argonne National Lab: leyffer@mcs.anl.gov

Randall LeVeque - University of Washington: rjl@uw.edu

Seminar/Conference Presentations

- 2024 Robert Baraldi, Drew P. Kouri (2024), “A Proximal Trust-Region Method for Nonsmooth Optimization with Inexact Function and Gradient Evaluations”, WCOM24, September 21, Vancouver, Canada.
- 2024 Robert Baraldi, Drew P. Kouri, Harbir Antil (2024), “Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization”, ISMP24, July 21-26, Montréal, Canada.
- 2024 Robert Baraldi, Drew P. Kouri, Harbir Antil (2024), “Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization”, PASC24, June 3-5, Zurich, Switzerland.

- 2024 Robert Baraldi, Aurya Javeed, Drew Kour, Christian Glusa, Kim Liegeois (2024), “Training Neural Networks with PyROL: Algorithms and Examples”, Copper Mountain Iterative Methods, April 14-19, Copper Mountain Co.
- 2024 Robert Baraldi, Drew P. Kouri, Harbir Antil (2024), “Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization”, SIAM UQ, February 29 - March 1, Trieste, Italy.
- 2024 Robert Baraldi, Drew P. Kouri (2024), “A Proximal Trust-Region Method for Nonsmooth Optimization with Inexact Function and Gradient Evaluations”, Dept. of Mathematics Seminar, February 24, TU Dortmund, Germany.
- 2023 Robert Baraldi, Drew P. Kouri (2023), “A Proximal Trust-Region Method for Nonsmooth Optimization with Inexact Function and Gradient Evaluations”, Applied Inverse Problems, September 4, Göttingen, Germany.
- 2023 Robert Baraldi, Drew P. Kouri (2023), “A Proximal Trust-Region Method for Nonsmooth Optimization with Inexact Function and Gradient Evaluations”, WIAS Research Seminar on Mathematical Optimization Nonsmooth Variational Problems and Operator Equations, August 29, Berlin, Germany.
- 2023 Robert Baraldi, Evelyn Herberg, Harbir Antil, Drew P. Kouri (2023), “Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization”, SIOPT, May 31 - June 4, Seattle, WA.
- 2023 Robert Baraldi, Drew P. Kouri (2023), “Efficient Proximal Subproblem Solvers for an Inexact Nonsmooth Trust-Region Method”, SIAM CSE, February 28 - March 4, Amsterdam, ND.
- 2023 Robert Baraldi, Drew P. Kouri (2023), “An Inexact Trust-Region Algorithm for Nonsmooth Nonconvex Regularized Problems”, Bayreuth Applied Mathematics Seminar, February 24, Bayreuth, Germany.
- 2023 Robert Baraldi, Evelyn Herberg, Harbir Antil, Drew P. Kouri (2023), “Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization”, IMAX XLI, February 15, Austin, TX.
- 2022 Robert Baraldi, Drew P. Kouri (2022), “An Inexact Trust-Region Algorithm for Nonsmooth Nonconvex Regularized Problems”, Centre de recherches mathématiques Seminar at McGill, October 24, Montréal, Quebec.
- 2022 Robert Baraldi, Drew P. Kouri (2022), “An Inexact Trust-Region Algorithm for Nonsmooth Nonconvex Regularized Problems”, GERAD Seminar, October 20, Polytechnique Montréal, Montréal, Quebec.
- 2022 Robert Baraldi, Drew P. Kouri (2022), “An Inexact Trust-Region Algorithm for Nonsmooth Nonconvex Regularized Problems”, Center for Mathematics and Artificial Intelligence Colloquium, September 30 (Virtual).
- 2022 Robert Baraldi, Stefan Wild, Sven Lyeffer (2022), “Using Filter Methods to Guide Convergence for ADMM, with Applications to Nonnegative Matrix Factorization Problems”, ICCOPT/MOPTA 2022, July 25-28. Bethlehem, PA.
- 2021 Robert Baraldi, Aleksandr Aravkin, Dominique Orban (2021), “A Proximal Quasi-Newton Trust-Region Method for Nonsmooth Regularized Optimization”, SIOPT 2021 (virtual), July 22.
- 2021 Robert Baraldi, Stefan Wild, Sven Lyeffer (2021), “Using Filter Methods to Guide Convergence for ADMM, with Applications to Nonnegative Matrix Factorization Problems”, SIAM CSE 2021 (virtual), March 1.

- 2020 “Moreau-Yoshida Regularization and First Order Methods with Firedrake”, Firedrake 2020, Seattle, WA; February 22.
- 2019 “Basis Pursuit Denoise with Nonsmooth Constraints”, DOE CSGF Annual Program Review, Arlington, VA; July 14-18.
- 2019 “An Acceleration Framework for Parameter Estimation using Implicit Sampling and Adaptive Reduced order Models”, SIAM CSE, Spokane WA; 2/25-3/1.
- 2018 “Relaxation Algorithms for matrix completion, with applications to seismic travel-time data interpolation”, DOE CSGF Annual Program Review, Arlington, VA; July 15-19.
- 2016 “Systems Modeling and Data Assimilation in Drug Development”, SIAM Annual Life Sciences Conference, Boston, MA; July 11-15.

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<http://rjbaraldi.github.io/cv>