

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- Member of Technical Staff - Senior Computer Scientist, Sandia National Laboratories.
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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Public Grants & Awards

STAFF

- 2024 **Title:** ASCEND Applied Mathematics and Scientific Computing Ecosystem for the New Digital Era.
Agency: Department of Energy 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 .
2024	Amount: \$2.0 million per year. 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 (Co-PI), Drew P. Kouri . Amount: \$1.2 million over 3 years. Consultants: Jong-shi Pang , Katya Scheinberg , Eric Cyr .
2022	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: \$340,000 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, UW.

Publications

IN REVIEW¹

2025	Harbir Antil, Robert Baraldi, Rohit Khandelwal, Drew Kouri (2025), “An Adaptive Finite Element Trust-Region Method for Regularized PDE-Constrained Optimization”, <i>SIAM Journal on Scientific Computing</i> .
2025	Robert Baraldi, Michael Hintermüller, Qi Wang. (2025) “ A Multilevel Proximal Trust-Region Method for Nonsmooth Optimization with Applications ”, <i>Optimization Methods and Software</i> .

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

- 2025 Robert Baraldi, Aurya Javeed, Drew P. Kouri, Katya Scheinberg (2025), “[ProxSTORM – A Stochastic Trust-Region Algorithm for Nonsmooth Optimization](#)”. *Computational Optimization and Applications*.

PEER-REVIEWED

- 2026 Robert Baraldi, Stefan Wild, Sven Leyffer (2026), “[Using Filter Methods to Guide Convergence for ADMM with Applications to Nonnegative Matrix Factorization](#)”, *Journal of Optimization Theory and Applications* (to appear).
- 2026 Harbir Antil, Robert Baraldi, Drew P. Kouri (2026), “Memory-Efficient Nonsmooth Dynamic Optimization using Adaptive Randomized Compression”, *Optimization and Engineering* (to appear).
- 2025 Robert Baraldi, Paul Manns (2025), “[Domain Decomposition for Integer Optimal Control with Total Variation Regularization](#)”, *SIAM Journal on Control and Optimization* 63(6), 3825–3855.
- 2025 Robert Baraldi, Drew P. Kouri (2025), “[Efficient Proximal Subproblem Solvers for a Nonsmooth Trust-Region Method](#)”, *Computational Optimization and Applications* 90, 193-226.
- 2024 Aleksandr Aravkin, Robert Baraldi, 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.
- 2023 Robert Baraldi, Drew P. Kouri (2023), “[A Proximal Trust-Region Method for Nonsmooth Optimization with Inexact Function and Gradient Evaluations](#)”, *Mathematical Programming*. 201(1), 559-598.
- 2022 Robert Baraldi, Randall LeVeque, Christopher Liu, Donsub Rim, Kenjiro Terada (2022), “[Tsunami Early Warning from Global Navigation Satellite System Data using Convolutional Neural Networks](#)”, *Geophysical Review Letters* 49(20).
- 2021 Aleksandr Aravkin, Robert Baraldi, Dominique Orban (2021), “[A Proximal Quasi-Newton Trust-Region Method for Nonsmooth Regularized Optimization](#)”, *SIAM Journal of Optimization*. 32(2): 900-929.
- 2021 Robert Baraldi, Randall LeVeque, Christopher Liu, Donsub Rim (2021), “[Comparison of Machine Learning Approaches for Tsunami Forecasting from Sparse Observations](#)”, *Pure and Applied Geophysics* 178, 5129-5153.
- 2019 Aleksandr Aravkin, Robert Baraldi, Rajiv Kumar (2019), “[Basis Pursuit Denoise with Nonsmooth Constraints](#)”, *IEEE Transactions on Signal Processing* 67(22): 5811-5823.
- 2019 Aleksandr Aravkin, Robert Baraldi, Kenneth Creager, Rajiv Kumar, Carl Ulberg (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 Minimizing Uncertainty in Dynamic Equilibrium Systems](#)”, *Eurasian Journal of Mathematical and Computer Applications* 3: 20-43.
- 2015 Harvey Thomas Banks, Robert Baraldi, Karissa Cross, Kevin Flores, Christina McChesney, Laura Poag, Emma Thorpe (2015), “[Uncertainty quantification in modeling HIV viral mechanics.](#)”, *Mathematical Biosciences and Engineering* 12(5): 937-964.

CONFERENCE PROCEEDINGS

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

TECHNICAL REPORTS (NOT PEER-REVIEWED)

- 2024 Robert Baraldi, Michael Heiden, Drew Kouri (2024) [Rapid Optimization of Total Variation with Applications in Imaging, Additive Manufacturing, and Qualification](#), Sandia Technical Report SAND-2024-14136, Albuquerque, NM.
- 2014 Harvey Thomas Banks, Robert Baraldi, John Nardini, Emma Thorpe (2014), [The Effects of Parameterization on Inverse Problems](#), CRSC Technical report CRSC-TR14-07, Raleigh, NC.
- 2013 Harvey Thomas Banks, Robert Baraldi, Karissa Cross, Kevin Flores, Christina McChesney, Laura Poag, Emma Thorpe (2013), [Mathematical Modeling of HCV Viral Kinetics](#). CRSC Technical report CRSC-TR13-07, Raleigh, NC.

Code Development

- 2022- PyROL - A python interface for ROL - python.
 2022- Rapid Optimization Library (part of Trilinos) - C++.
 2019-23 RegularizedOptimization (part of JuliaSmoothOptimizers) - Julia.

- 2019-23 [ShiftedProximalOperators](#) (part of [JuliaSmoothOptimizers](#)) - [Julia](#).
2019-23 [RegularizedProblems](#) (part of [JuliaSmoothOptimizers](#)) - [Julia](#).
2019-21 [UW-AMO Group](#) - MATLAB.
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Service

- 2019- Reviewer: Mathematical Programming, SIAM Journal on Optimization, SIAM Journal on Scientific Computing, Optimization Letters, Operations Research Letters, Computational Optimization and Applications, Inverse Problems, Mathematical Computing, Advances in Continuous and Discrete Models.
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 University of Washington Teaching Assistant: MATH 126 Calculus 3.
2013 NC State University Mathematics Tutor: MA 121 Calculus 1, MA 241 Calculus 2.
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Current and Former Students/Interns

- 2025- [Arjun Sethi-Olowin](#) - University of Washington Applied Math (advisor: Aleksandr Aravkin & [Heather Wilbur](#))
2024- [Qi Wang](#) - WIAS, Nonsmooth Variational Problems and Operator Equations Group (advisor: [Michael Hintermüller](#))
2024 [Leandro Maia](#) - School of Mechanical, Industrial, and Manufacturing Engineering (MIME) at Oregon State University (formerly Texas A&M, advisor: [David Huckleberry Gutman](#))
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References

- [Harbir Antil](#) - George Mason University: hantil@gmu.edu
[Michael Hintermüller](#) - WIAS: hintermueller@wias-berlin.de
[Randall LeVeque](#) - University of Washington: rjl@uw.edu
[Sven Leyffer](#) - Argonne National Lab: leyffer@mcs.anl.gov
[Dominique Orban](#) - Polytechnique Montréal: dominique.orban@gerad.ca
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Recent Seminar/Conference Presentations

- 2025

- 2025 Robert Baraldi (2025), "An Adaptive Inexact Trust-Region Method for PDE-Constrained Optimization with Regularized Objectives", PNWS-SIAM 2025, October 3-5, Seattle.
- 2025 Harbir Antil, Robert Baraldi, Rohit Khandelwal, Drew P. Kouri (2025), "An Adaptive Finite Element Trust-Region Method for Regularized PDE-Constrained Optimization", ICCOPT 2025, July 20-24, Los Angeles.
- 2025 Robert Baraldi, Michael Hintermüller, Drew P. Kouri (2025), "Optimization of Total Variation-Regularized Functions using Inexact Proximal Solves", The 30th Biennial Numerical Analysis Conference, June 24-27, Glasgow.
- 2025 Harbir Antil, Robert Baraldi, Rohit Khandelwal, Drew P. Kouri (2025), "An Adaptive Finite Element Trust-Region Method for Regularized PDE-Constrained Optimization", East Coast Optimization Meeting, April 17-18, Washington DC.
- 2025 Robert Baraldi (2025), "A Nonsmooth Trust-Region Framework for Applications in Data Science and PDE Constrained Optimization", Simon Fraser University MOCAD Seminar, March 10, Vancouver, Canada.
- 2025 Robert Baraldi, Michael Hintermüller, Drew P. Kouri (2025), "Optimization of Total Variation-Regularized Functions using Inexact Proximal Solves", SIAM CSE, March 3-7, Ft. Worth, TX.
- 2024 Harbir Antil, Robert Baraldi, Drew P. Kouri (2024), "Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization", INFORMS24, October 19-23, Seattle, WA.
- 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 Harbir Antil, Robert Baraldi, Drew P. Kouri (2024), "Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization", ISMP24, July 21-26, Montréal, Canada.
- 2024 Harbir Antil, Robert Baraldi, Drew P. Kouri (2024), "Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization", PASC24, June 3-5, Zurich, Switzerland.
- 2024 Robert Baraldi, Christian Glusa, Aurya Javeed, Drew Kouri, Kim Liegeois (2024), "Training Neural Networks with PyROL: Algorithms and Examples", Copper Mountain Iterative Methods, April 14-19, Copper Mountain Co.
- 2024 Harbir Antil, Robert Baraldi, Drew P. Kouri (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 Harbir Antil, Robert Baraldi, Evelyn Herberg, 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 In-

- exact 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 Harbir Antil, Robert Baraldi, Evelyn Herberg, Drew P. Kouri (2023), “Adaptive Randomized Sketching for Dynamic Nonsmooth Optimization”, IMAX XLI, February 15, Austin, TX.

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