

# Robert Baraldi

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## Areas of specialization

Inverse Problems • Nonsmooth Optimization • Nonconvex Optimization • Trust Regions Methods  
• PDE-constrained Optimization • Uncertainty Quantification

I am interested in algorithm design and convergence analysis for nonsmooth and nonconvex problems, with applications to seismic inversion, physical/biological modeling, and data analysis.

## Employment

2021 John von Neumann Postdoctoral Fellow, Sandia National Labs. **Group:** Optimization and Uncertainty Quantification (1463). **Postdoctoral Advisor:** [Drew Kouri](#).

## Education

2021 PhD in Applied Mathematics, University of Washington. **PhD Advisor:** [Aleksandr Aravkin](#).  
2017 MSc in Applied Mathematics, University of Washington  
2016 BS in Mathematics, NC State University. **Academic Advisor:** Alina Duca. **Research Advisor:** Harvey Thomas Banks.

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## Internship Experience

### GRADUATE

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](#).

### UNDERGRADUATE

2013-2016 Student Researcher, Center for Research in Scientific Computation, NC State University. **Advisor:** [Harvey Thomas Banks](#).  
2015 Undergraduate Researcher, Cold Spring Harbor Labs. **Advisor:** [Jesse Gillis](#).  
2014, 2016 Summer Student Worker, Pfizer Inc. **Advisor:** Cynthia Musante, Theodore Rieger.

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## Grants, honors & awards

## POSTDOCTORAL

2021 Air Force Office of Scientific Research Grant: Compression and Randomization of Extreme-Scale Training and Optimization (CREST-Opt)  
**Team Members:** [Harbir Antil](#), [Evelyn Herberg](#), [Drew Kouri](#), [Denis Ridzal](#)

## GRADUATE

2021 Sandia National Laboratory John von Neumann Postdoctoral Fellowship  
2017-2021 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

## UNDERGRADUATE

2014 Mathematical Honors Program  
2013 Business and Finance Scholarship  
2012 University Honors Program  
2012 Goodnight Scholarship  
2012 SECU Foundation Scholarship  
2012-2016 Dean's List

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## Teaching

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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## Service

2019- Reviewer: Inverse Problems, SIAM Journal On Scientific Computing, Mathematical Computing, Optimization Letters  
2016-2021 Member of UW Applied Mathematics SIAM Student Chapter  
2016-2019 Organizer of UW Applied Mathematics Numerical Analysis Research Club

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## Coding Languages

Current Matlab, Python, Julia, C++  
Past Java, R, PyTorch, Markdown, HTML, OpenMP/MPI  
Repos [UW-AMO Group](#), [Personal](#)

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## Publications & talks

### IN PREPARATION

2022 Robert Baraldi, Drew Kouri (2022), "A Proximal Trust-Region Method for Nonsmooth Optimization with Inexact Function and Gradient Evaluations", *Submitted - Mathematical Programming*.

## PUBLISHED

- 2021 Robert Baraldi, Aleksandr Aravkin, Dominique Orban (2021), “A Proximal Quasi-Newton Trust-Region Method for Nonsmooth Regularized Optimization”, *SIAM Journal of Optimization*. (to appear)
- 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.
- 2016a 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.
- 2016b 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.
- 2015a 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.
- 2015b 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.
- 2015c 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

- 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

## CONFERENCE PRESENTATIONS

- 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 (2020), “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.

#### TECHNICAL REPORTS

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.

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## References

Drew Kouri - Sandia National Laboratories: [dpkouri@sandia.gov](mailto:dpkouri@sandia.gov)

Aleksandr Aravkin - University of Washington: [saravkin@uw.edu](mailto:saravkin@uw.edu)

Dominique Orban - Polytechnique Montréal: [dominique.orban@gerad.ca](mailto:dominique.orban@gerad.ca)

Sven Leyffer - Argonne National Lab: [leyffer@mcs.anl.gov](mailto:leyffer@mcs.anl.gov)

Randall LeVeque - University of Washington: [rjl@uw.edu](mailto:rjl@uw.edu)

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