Robert Baraldi

University of Washington Department of Applied Mathematics
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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 Lab. **Group**: Optimization and Uncertainty Quantification.

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.

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.

Grants, honors & awards

Graduate

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

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
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

Publications & talks

In preparation

2021 Robert Baraldi, Aleksandr Aravkin, Dominique Orban (2021), "A Proximal Quasi-Newton Trust-Region Method for Nonsmooth Regularized Optimization", *Under Review - SIAM Journal of Optimization.*
2021 Christopher Liu, Donsub Rim, Robert Baraldi, Randall LeVeque (2021), "Comparison of Machine Learning Approaches for TsunamiForecasting from Sparse Observations", *Pure and Applied Geophysics* (to appear).

Published

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.

References

Aleksandr Aravkin - University of Washington: saravkin@uw.edu
Dominique Orban - Polytechnique Montréal: dominique.orban@gerad.ca
Sven Leyffer - Argonne National Lab: leyffer@mcs.anl.gov
Randall LeVeque - University of Washington: rjl@uw.edu

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