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Abhijit Chowdhary

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About Me

I consider myself a computational mathematician and my research interests lie in wielding math to design algorithms for real-world problems. Currently, I practice that in developing scalable algorithms to quantify, analyze, and control the uncertainty unherent in mathematical models. During my Ph.D., I focused on the uncertainty quantification (UQ) of large-scale inverse problems for physical phenomena governed by partial differential equations (PDEs). At the moment, I'm looking into ways to improve neural surrogates for the task of uncertainty quantification, and generally looking to write software for UQ in the distributed or GPU setting.

Education

PhD **North Carolina State University**, Applied Mathematics – Raleigh, NC — Aug 2020 – May 2025
- Recipient of the Siewert Fellowship

BA **New York University**, Mathematics, Computer Science – New York, NY — May 2016 – May 2020
- Minor in Classics

Experience

Postdoctoral Researcher, Tufts University – Somerville, MA, USA — June 2025 – Present
- Working with Elizabeth Newman in uncertainty quantification in SciML.

Givens Intern, Argonne National Laboratory – Lemont, IL, USA — May 2024 – Aug 2024

Givens Intern, Argonne National Laboratory – Lemont, IL, USA — May 2023 – Aug 2023
- Became a core maintainer of the PyOED project and published a peer reviewed paper in TOMS.
- Published novel research in Robust Optimal Experimental Design, in review at SIAM CSE.
- Under the mentorship under Ahmed Attia.

Research Assistant, North Carolina State University – Raleigh, NC — June 2021 – Present
- Published novel research in scalable UQ for infinite-dimensional Bayesian inverse problems.
- Research Assistant for Alen Alexanderian via NSF Grant DMS-2111044.

Teaching Assistant, North Carolina State University – Raleigh, NC
- Led recitations for Calculus I, II, and the honors variants for 5 semesters.

Undergraduate Research Assistant, Ohio State University – Athens, OH — May 2019 – Aug 2019
- Published novel research in the theory of pattern formation, for the 2D Swift-Hohenberg Equation.

Skills

Programming: Proficient in Python, Julia, C, C++, and MATLAB

Technologies: Generally familiar with the GPU programming interfaces, the machine learning stacks, Finite element software, high-performance linear algebra, and Linux

Mathematics: Specialized in scientific computing, uncertainty quantification, and large-scale optimization. Theoretical foundations in the PDE, probability, and functional analysis

Languages: English (native), Latin, Hindi

Publications

Robust optimal design of large-scale Bayesian nonlinear inverse problems — Sept 2024
Abhijit Chowdhary, Ahmed Attia, Alen Alexanderian

https://doi.org/10.48550/arXiv.2409.09137 (In submission)

PyOED: An Extensible Suite for Data Assimilation and Model-Constrained Optimal Design of Experiments June 2024
Abhijit Chowdhary, Shady E. Ahmed, Ahmed Attia
https://dl.acm.org/doi/10.1145/3653071 (ACM Transactions on Mathematical Software)

Sensitivity Analysis of the Information Gain in Infinite-Dimensional Bayesian Linear Inverse Problems May 2024
Abhijit Chowdhary, Shanyin Tong, Georg Stadler, Alen Alexanderian
https://doi.org/10.1615/Int.J.UncertaintyQuantification.2024051416 (IJUQ)

Weak Diffusive Stability of Roll Solutions at the Zigzag Boundary Oct 2023
Abhijit Chowdhary, Mason Haberle, William Ofori-atta, Qilian Wu
https://doi.org/10.1137/24M1639683 (SIAM Journal of Mathematical Analysis)

Software

PyOED May 2023 – Present
- Core maintainer of PyOED, an open source research software for model-constrained optimal design.
- Designed to extend and integrate existing codes to rapidly test new developments.
- Used in multiple research groups worldwide.

Talks

Robust OED for Large-Scale Nonlinear Bayesian Inverse Problems Mar 2025
- SIAM CSE 2025, Fort Worth, Texas

Robust optimal design of large-scale Bayesian nonlinear inverse problems Nov 2024
- Applied Math Graduate Student Seminar, Raleigh, NC

Robust OED for Large-Scale Nonlinear Bayesian Inverse Problems Oct 2024
- SIAM MDS 2024, Atlanta Georgia

PyOED and Enabling the Robust Optimal Experimental Design of Nonlinear Inverse Problems Aug 2024
- SASSy Seminar, Argonne National Laboratory

PyOED: An Open Source, Backend-Agnostic, Bayesian OED Toolbox for Rapid Development Feb 2024
- SIAM UQ 2024, Trieste, Italy

Scalable Sensitivity Analysis and Optimal Design for Bayesian Inference Aug 2023
- Applied Math Graduate Student Seminar, Raleigh, NC

Robust Optimal Experimental Design for Non-Linear Bayesian Inference May 2023
- SASSy Seminar, Argonne National Laboratory

Sensitivity Analysis of the Information Gain in Infinite-Dimensional Bayesian Linear Inverse Problems Mar 2023
- SIAM CSE 2023, Amsterdam, Netherlands

Computing Eigenvalue Sensitivities for Sensitivity Analysis of the Information Gain in Bayesian Linear Inverse Problems Sept 2022
- Applied Math Graduate Student Seminar, Raleigh, NC

Infinite-Dimensional Bayesian Inversion for Fault Slip from Surface Measurements Apr 2022
- Applied Math Graduate Student Seminar, Raleigh, NC