

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 inherent 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 – Present
- Recipient of the Siewert Fellowship
- BA** **New York University**, Mathematics, Computer Science – New York, NY May 2016 – May 2020
- Minor in Classics

Experience

- 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>

PyOED: An Extensible Suite for Data Assimilation and Model-Constrained Optimal Design of Experiments <i>Abhijit Chowdhary</i> , Shady E. Ahmed, Ahmed Attia https://dl.acm.org/doi/10.1145/3653071	June 2024
Sensitivity Analysis of the Information Gain in Infinite-Dimensional Bayesian Linear Inverse Problems <i>Abhijit Chowdhary</i> , Shanyin Tong, Georg Stadler, Alen Alexanderian https://doi.org/10.1615/Int.J.UncertaintyQuantification.2024051416	May 2024
Weak Diffusive Stability of Roll Solutions at the Zigzag Boundary <i>Abhijit Chowdhary</i> , Mason Haberle, William Ofori-atta, Qilian Wu https://doi.org/10.48550/arXiv.2310.12365	Oct 2023

Software

PyOED	May 2023 – Present
<ul style="list-style-type: none"> • Core maintainer of PyOED, an open source research software for model-constrained optimal experimental 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 • SIAM CSE 2025, Fort Worth, Texas	Mar 2025
Robust optimal design of large-scale Bayesian nonlinear inverse problems • Applied Math Graduate Student Seminar, Raleigh, NC	Nov 2024
Robust OED for Large-Scale Nonlinear Bayesian Inverse Problems • SIAM MDS 2024, Atlanta Georgia	Oct 2024
PyOED and Enabling the Robust Optimal Experimental Design of Non-linear Inverse Problems • SASSy Seminar, Argonne National Laboratory	Aug 2024
PyOED: An Open Source, Backend-Agnostic, Bayesian OED Toolbox for Rapid Development • SIAM UQ 2024, Trieste, Italy	Feb 2024
Scalable Sensitivity Analysis and Optimal Design for Bayesian Inference • Applied Math Graduate Student Seminar, Raleigh, NC	Aug 2023
Robust Optimal Experimental Design for Non-Linear Bayesian Inference • SASSy Seminar, Argonne National Laboratory	May 2023
Sensitivity Analysis of the Information Gain in Infinite-Dimensional Bayesian Linear Inverse Problems • SIAM CSE 2023, Amsterdam, Netherlands	Mar 2023
Computing Eigenvalue Sensitivities for Sensitivity Analysis of the Information Gain in Bayesian Linear Inverse Problems • Applied Math Graduate Student Seminar, Raleigh, NC	Sept 2022
Infinite-Dimensional Bayesian Inversion for Fault Slip from Surface Measurements • Applied Math Graduate Student Seminar, Raleigh, NC	Apr 2022