December 2025

Alex Alberts, Ph.D.
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Research Interests

Inverse problems, uncertainty quantification, scientific machine learning, mathematical physics

Education

Ph.D.	Mechanical Engineering, Purdue University, May 2024
Thesis:	*An information field theory approach to engineering inverse problems*
B.S./M.S.	Applied Mathematics, the University of Akron, August 2019
Thesis:	*Theoretical study of Fano resonance in a cubic nonlinear mechanical system*

Appointments

Postdoctoral Researcher	Purdue University	June 2024 - present
Graduate Research Assistant	Purdue University	August 2019 – May 2024

Journal Publications

1. Alberts, A., Bilionis, I., Desai, A. S., Meckl, P.; Bayesian reconstruction of intake manifold dynamics with parameter calibration. Accepted for publication in the ASME Journal of Verification, Validation, and Uncertainty Quantification, 2025
2. Alberts, A., Bilionis, I.; Physics-informed Information Field Theory for Modeling Physical Systems with Uncertainty Quantification. Journal of Computational Physics, 2023, 486 (112100), https://doi.org/10.1016/j.jcp.2023.112100

Preprints/under review

1. Alberts, A., Bilionis, I.; Bayesian neural networks with interpretable priors from Mercer kernels. arxiv preprint (submitted to CMAME invitation only special issue on scientific machine learning), 2025, https://arxiv.org/abs/2510.23745
2. Bolt, M., Alberts, A., Desai, A. S., Meckl, P., Bilionis, I.; Modeling diesel output particulate matter as the Ornstein-Uhlenbeck process. Being reviewed by Cummins IP team before submission to SAGE IJER, 2025.
3. Alberts, A., Bilionis, I.; An interpretation of the Brownian bridge as a physics-informed prior for the Poisson equation. arxiv preprint (undergoing second round of review for the SIAM ASA Journal on Uncertainty Quantification), 2025, https://arxiv.org/abs/2503.00213
4. Alberts, A., Bilionis, I.; Uniqueness of MAP estimates for inverse problems under information field theory. arxiv preprint (under review with IEEE Transactions on Information Theory), 2024, https://arxiv.org/abs/2401.14224

Manuscripts in preparation

1. Alberts, A., Jacob Thomas, A., Daryabeigi, K., Bilionis, I.; Bayesian identification of fibrous insulation thermal conductivity towards design of spacecraft thermal protection systems.
2. Dionysopoulos, V., Alberts A., Hans, A., Bilionis I., Vlachos P.,; Physics-informed information field theory for Bayesian flow reconstruction and uncertainty quantification in 4D flow MRI

Fellowships and Awards

1. 2023 Purdue College of Engineering inaugural *Travel for Collaborative Research Grant* recipient - $4,500
2. Lynn Fellowship, Purdue University Computational Interdisciplinary Graduate Programs

Minisymposia Organized

1. Inverse Problems and Uncertainty Quantification in Biological Systems. Scheduled for upcoming 2026 SIAM Conference on Uncertainty Quantification (UQ26). Organized with Atharva Hans, Adrian Buganza Tepole, and Ilias Bilionis.
2. Scientific Machine Learning for Biological Mechanics Models from Medical Data. 2025 SIAM Conference on Computational Science and Engineering (CSE25). Organized with Atharva Hans, Ilias Bilionis, and Pavlos Vlachos
3. Information Field Theory: Towards a Unified Paradigm for Uncertainty Quantification – Parts I and II. 2024 SIAM Conference on Uncertainty Quantification (UQ24). Organized with Ilias Bilionis

Conference Presentations

(* denotes speaker)

1. Mirfarah, M.*, Alberts, A., Bilionis, I.; (2026, March 22-25) **Detecting model form error in dynamical systems using information field theory.** Accepted for SIAM Conference on Uncertainty Quantification (UQ26). Minneapolis, Minnesota
2. Alberts, A.*, Bilionis, I.; (2026, March 22-25) **Bayesian neural networks with meaningful functional priors.** Accepted for SIAM Conference on Uncertainty Quantification (UQ26). Minneapolis, Minnesota
3. Bolt, M.*, Alberts, A., Bilionis, I.; (2026, March 22-25) **Information field theory approach to state estimation and calibration of stochastic differential equations.** Accepted for SIAM Conference on Uncertainty Quantification (UQ26). Minneapolis, Minnesota
4. Alberts, A.*; (2025, July 20-24) **Bayesian calibration of intake manifold models with varying degrees of error in internal combustion engines.** 18th US National Congress on Computational Mechanics (USNCCM18). Chicago, Illinois
5. Alberts, A.*, Bilionis, I.; (2025, March 3-7) **An information field theory framework for model-form error detection.** SIAM Conference on Computational Science and Engineering (CSE25). Fort Worth, Texas
6. Alberts, A.*, Bilionis, I.; (2024, Feburary 27-March 1) **Detection of model-form error through information field theory with physics-informed priors**. SIAM Conference on Uncertainty Quantification (UQ24). Trieste, Italy
7. Holt, W.*, Alberts, A., Bilionis, I.; (2023, July 23-27) **Physics-informed information field theory for diffusion.** 17th U.S. National Congress on Computational Mechanics. Albuquerque, New Mexico
8. Alberts, A.*, Bilionis, I.; (2023, June 12-14) **Physics-informed information field theory for modeling physical systems with uncertainty quantification.** 5th International Conference on Uncertainty Quantification in Computational Science and Engineering. Athens, Greece
9. Alberts, A.*, Bilionis, I.; (2022, April 12-15) **An Information Field Theory Interpretation of Physics-informed Neural Networks.** SIAM Conference on Uncertainty Quantification (UQ22). Atlanta, Georgia
10. Alberts, A.*, Bilionis, I.; (2021, March 1-5) **Bayesian Estimation of a System's Lagrangian from Data.** SIAM Conference on Computational Science and Engineering (CSE21). Virtual Conference

Invited Talks

(* denotes speaker)

1. Alberts, A.*; (2025, October 17) **An information field theory approach to physics-based inverse problems.** Advanced Modeling & Simulations Seminar Series. Texas A&M University at Kingsville, Kingsville, Texas
2. Alberts, A.*; (2025, June 27) **Information field theory for solving Bayesian inverse problems.** CRUNCH Seminar. Brown University, Providence, Rhode Island: https://www.youtube.com/watch?v=-OmazfkfNAY
3. Alberts, A.*, Bilionis, I.; (2024, March 28) **Bayesian reconstruction of unobserved states in dynamical systems.** Bayes Forum. Max Planck Institute for Astrophysics, Munich, Germany

Teaching Experience

1. Instructor – Purdue University, School of Mechanical Engineering
   ME 539 – Introduction to Scientific Machine Learning, Fall 2024, 2025

2. Teaching Assistant – Purdue University, School of Mechanical Engineering
   ME 539 – Introduction to Scientific Machine Learning
   ME 297 – Introduction to Data Science for Mechanical Engineers

3. Teaching Assistant – University of Akron, Department of Mechanical Engineering
   MECE:260 – Engineering Analysis I
   MECE:310 – Fluid Mechanics I
   MECE:340 – Systems Dynamics & Response
   MECE:431 – Fundamentals of Mechanical Vibrations

4. Tutor, Sylvan Learning Center, Fairlawn Ohio
   K-12 Mathematics