Alen Alexanderian

Department of Mathematics
North Carolina State University, Raleigh, NC
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Citizenship: Naturalized US Citizen

Education

University of Maryland, Baltimore County, Baltimore, MD
PhD in Applied Mathematics, August 2010

- PhD advisors: Dr. Rouben Rostamian and Dr. Muruhan Rathinam
- PhD thesis: "Random composite media: Homogenization, modeling, simulation, and material symmetry"

University of Maryland, Baltimore County, Baltimore, MD
MS in Applied Mathematics, 2007

Hood College, Frederick, MD
BA in Mathematics with Minor in Computer Science, *summa cum laude*, 2005

Academic appointments

North Carolina State University (August 2022–)
Department of Mathematics
Associate Professor

North Carolina State University (August 2015–August 2022)
Department of Mathematics
Assistant Professor

The University of Texas at Austin (March 2015–August 2015)
Institute for Computational Engineering and Sciences
Research Associate

The University of Texas at Austin (August 2012–March 2015)
Institute for Computational Engineering and Sciences
Postdoctoral Fellow

- Mentor: Dr. Omar Ghattas
- Research topics: Inverse problems (deterministic and statistical); PDE-constrained optimization; optimal control of systems governed by PDEs with uncertain coefficients; optimal design of experiments for infinite-dimensional Bayesian inverse problems

The Johns Hopkins University (August 2010–August 2012)
Department of Mechanical Engineering
Postdoctoral Fellow

- Mentor: Dr. Omar Knio
- Research topics: Spectral methods for uncertainty quantification; stochastic preconditioners; chemical kinetics; integration of stiff ODEs with random coefficients; computational singular perturbation; ocean circulation modeling under uncertainty

Other professional experience

European Space Agency (2008–2009)
c/o NASA Goddard Space Flight Center

Worked as a member of the Helioviewer team, based on NASA Goddard Space Flight Center, on developing JHelioviewer [49], which is an efficient visualization software for solar images based on the JPEG 2000 compression standard and JPEG 2000 Interactive Protocol (JPIP). The software enables efficient viewing and processing of solar image data captured by space telescopes such as NASA's Solar Dynamics Observatory (SDO).

Center for Interdisciplinary Research and Consulting (CIRC) (2006–2007)
University of Maryland, Baltimore County

Collaborated on a number of multi-disciplinary projects brought to CIRC by on and off campus clients. Major projects included the research leading to publications [48, 63], and the implementation of numerical tests for validation of statistical properties of software used by Constellation Energy, Inc. for selection of subjects for drug screening. Also, designed and delivered mathematics software workshops (on Matlab) on and off campus.

Current Research Areas

General: Numerical analysis and scientific computing; numerical solution of ODEs and PDEs; inverse problems; PDE-constrained optimization; optimization under uncertainty; uncertainty quantification; applied probability and statistical methods

Specific: Methods for optimal design of experiments for Bayesian inverse problems governed by PDEs; optimal control of systems governed by PDEs with uncertain coefficient functions; Bayesian inference in infinite-dimensional Hilbert spaces; sensitivity analysis; uncertainty quantification; multiscale modeling;

Service

Service to Department
Gave a talk in First Year Seminar (Fall 2015)
Mentor of graduate student participants in SAMSI's modeling workIshop (2016, 2017)
Participant in the graduate student seminar (Fall 2015–)

Co-organizer of numerical analysis seminar (2016)
Presented a talk at SIAM Student Chapter at NCSU seminar (Fall 2016)
Gave a talk in First Year Seminar (Spring 2018)
Member of financial math hiring committee (2018)
Member mathematical biology hiring committee (2020)
Organized a career panel for mathematics graduate students (2021)
Departmental committee service: undergrad course and curriculum committee; computing committee; library committee; graduate recruitment committee; graduate program advisory committeee

Service to Profession

Reviewer services: Served as referee for Mathematical Reviews (MathSciNet); SIAM Journal on Scientific Computing; SIAM Journal on Uncertainty Quantification; Computational Geosciences; Applied Mathematics and Computation; Journal of Engineering Mathematics; Fluid Dynamics Research; Theoretical and Computational Fluid Dynamics; Journal of Computational and Graphical Statistics; ASCE-ASME Risk and Uncertainty in Engineering System; Optimization and Engineering (OPTE); Reliability Engineering & Systems Safety; Computer Methods in Applied Mechanics and Engineering (CMAME); Journal of Computational Physics

Organizing workshops/minisymposia Co-leader of Statistical Inverse Problems working group as a part of SAMSI's 2016-2017 program on optimization
Co-organizer of SAMSI Statistical Inverse Problems working group mid-year workshop
Organizer of the mini-symposium "Methods for inverse problems and optimization under uncertainty with engineering applications". 42nd SIAM Southeastern Atlantic Sectional Conference. 2018.
Co-organized a mini-symposium on global sensitivity analysis in SIAM UQ18 conference;
Co-organized a mini-symposium on global sensitivity analysis in SIAM CSE19 Conference.
Co-organized a mini-symposium on inverse problems and optimal experimental design in SIAM CSE21 Conference.
Co-organized a mini-symposium on inverse problems and optimal experimental design in SIAM CSE23 Conference.

Memberships:
Society for Industrial and Applied Mathematics (SIAM)
American Mathematical Society (AMS)

Grants and contracts

2022–2025. Ab Initio Visualization for innovative science (AIVIS) Funding Agency: US Department of Energy c/o Sandia National Labs. Design and sensitivity analysis of infinite-dimensional Bayesian inverse problems. Role: NCSU PI. (Lead PI is Dan Turner from Sandia, the rest of the PI team are Chris Johnson from University of Utah, and Sandia PIs Bart Van Bloemen Waanders, Timothy Shead Kelsey DiPietro, Phillip Reu.) Amount to NCSU: $300,000.

2021–2024. Design and Sensitivity Analysis of Infinite-dimensional Bayesian Inverse Problems. Funding Agency: National Science Foundations. Role: PI. Amount: $265,049.

2020–2023. Dimension Reduction for Nonlinear Stochastic Systems. Funding Agency: National Science Foundation. Role: Co-PI. Amount: $\$200{,}000$.

2021–2024. REU Site: Directed Research for Undergraduates in Math and Statistics (DRUMS). Funding Agency: National Science Foundations. Role: Senior Personnel. Amount: $488,397.

2020–2025. Design of inverse problems and uncertainty quantification in systems governed by differential equations. Mathematics and Physical Sciences-Collaboration Grants for Mathematicians. Funding Agency: Simons Foundation. Role: PI. Amount: $42,000. *Grant Stopped in 2020, because of NSF grant.*

2018–2024. RTG: Randomized Numerical Analysis. Funding Agency: National Science Foundation. Role: Co-PI. Amount: $2,140,000.

2021 (one year contract). Mathematical support in the area of inverse, control, sensitivity, and uncertainty quantification problems. Funding Agency: Sandia National Labs. Role: PI. Amount: $17,092.

Students and postdocs

Work with postdoctoral researchers:
Ahmed Attia, SAMSI postdoc, (2016–2018)

Work with graduate students:

PhD Students:

1. Hayley Guy (PhD, 2020; first position: Senior Data Scientist, Brighthouse Financial)
2. Elizabeth Herman (PhD, 2020; co-advised with A.K. Saibaba; first position: Senior Professional Staff I, The Johns Hopkins University Applied Physics Laboratory)
3. Helen Cleaves (PhD, 2021; first position: Postdoc, Sandia National Labs)
4. Rebekah White (PhD, 2021; first position: Postdoc, Sandia National Labs)
5. Isaac Sunseri (PhD, 2022; first position: Teaching Assistant Professor, Penn State)
6. Michael Merritt (PhD 2022; co-advised with Pierre Gremaud; first position: Research Scientist, Teledyne Technologies)
7. John Darges (ongoing, co-advised with Pierre Gremaud)
8. Abhi Chowdhary (ongoing)
9. Madhusudan Madhavan (ongoing, co-advised with A.K. Saibaba)
10. Nick Neuberger (ongoing)

Member of PhD committees: Justen Geddes (ongoing, advisor M. Olufsen); Amanda Colunga (ongoing, advisor M. Olufsen); Kristen Windoloski (ongoing, advisor M. Olufsen); William Anderson (ongoing, advisor M. Farazmand); Brett Austin McCandless (ongoing, advisor Marie Muller, MAE NCSU); Chris Edwards (ongoing, advisor Ralph Smith); Robin Morillo (ongoing, advisor Pierre Gremaud); Hasnaa Alzahrani (PhD 2023, King Abdullah University of Science and Technology, advisor Omar Knio); Katherine Pearce (PhD 2022, advisor Mansoor Haider); Evan North (PhD 2022, advisor S. Tsynkov); Shohanuzzaman Shohan (PhD 2022, advisor R. Shirwaiker, ISE NCSU) Andrew Wright (PhD 2022, advisor M. Olufsen); Saja Almohammadi (PhD 2021, King Abdullah University of Science and Technology, advisor Omar Knio); Johnny Gillings (PhD 2021, advisor Negash Medhin); Zack Morrow (PhD 2021, advisor C.T. Kelley); Karina Koval (PhD 2021 from Courant Institute, advisor Georg Stadler) Mitchel Colebank (PhD 2021, advisor M. Olufsen); Suchit Mehrotra (PhD 2020, advisor A. Maity, Statistics); Micaela Mendlow (PhD 2020, advisor M. Haider); Christine Mennicke (PhD 2020, advisor M. Haider); Ryan Vogt (PhD 2020, advisor Z. Li); Sangeeta Warrier (PhD 2020, advisor K. Flores); Katrina Petroske (PhD 2020, advisor A.K. Saibaba); Jard Cook (PhD 2020, advisor R.C. Smith); Hailey Owen (PhD 2019, advisor H. Tran); Nikolas Bravo (PhD 2019, advisor R.C. Smith); Lucas Castle (PhD 2018, advisor L. Bociu); Joey Hart (PhD, 2018, P.A. Gremaud); Kathleen Schmidt (PhD 2016, advisor R.C. Smith);

Work with undergraduate students:

1. Lev Kakasenko, research mentor, 2023.
2. Matthew Hefferle, Mathematics Honors Reading and RTG mentor, 2022.
3. Madhusudan Madhavan, Mathematics Honors Reading and RTG mentor, 2021–2022.
4. Mason Stevens, Mathematics Honors Reading and RTG mentor, 2021–2022.
5. Ethan Dudley, Mathematics Honors Reading and RTG co-mentor, 2019–2020.
6. William Reese, Mathematics Honors Reading and independent study, 2016–2017.

Teaching

North Carolina State University (2015–)
Department of Mathematics

Course #	Subject	Semester
MA 782	Inverse Problems	Spring 2023
MA 580	Numerical Analysis I	Fall 2022
MA 225	Foundations of Advanced Mathematics	Fall 2022
MA 780	Numerical Analysis II	Spring 2022
MA 580	Numerical Analysis I	Fall 2021
MA 225	Foundations of Advanced Mathematics	Fall 2021
MA 798	Inverse Problems	Spring 2021
MA 580	Numerical Analysis I	Fall 2020
MA 225	Foundations of Advanced Mathematics	Fall 2020
MA 573	Mathematical Modeling I	Fall 2019
MA 225	Foundations of Advanced Mathematics	Fall 2019
MA 798	Inverse Problems	Spring 2019
MA 573	Mathematical Modeling I	Fall 2018
MA 341	Applied Differential Equations I	Fall 2018
MA 780	Numerical Analysis II	Spring 2018
MA 580	Numerical Analysis I	Fall 2017
MA 780	Numerical Analysis II	Spring 2017
MA 591	Inverse Problems	Fall 2016
MA 341	Applied Differential Equations I	Spring 2016
MA 341	Applied Differential Equations I	Fall 2015

The Johns Hopkins University (2010–2012)
Department of Mechanical Engineering

Course #	Subject	Semester
EN.530.766	Numerical Methods (graduate course)	Fall 2011

University of Maryland, Baltimore County (2005–2010)
Department of Mathematics and Statistics

Course #	Subject	Semester	
Math 151	Calculus and Analytic Geometry I	Spring 2010	TA
Math 152	Calculus and Analytic Geometry II	Fall 2009	TA
Math 151	Calculus and Analytic Geometry I	Summer 2009	Instructor
Math 290	Special Topics in Mathematics (foundations of math)	Summer 2009	TA
Math 152	Calculus and Analytic Geometry II	Spring 2009	TA
Math 151	Calculus and Analytic Geometry I	Fall 2008	Instructor
Math 151	Calculus and Analytic Geometry I	Summer 2008	Instructor
Math 290	Special Topics in Mathematics (foundations of math)	Summer 2008	TA
Math 151	Calculus and Analytic Geometry I	Spring 2008	TA
Math 426	Intro to Math Software Packages: Matlab	Winter 2008	Instructor
Math 426	Intro to Math Software Packages: Matlab	Fall 2007	Instructor
Math 426	Intro to Math Software Packages: Matlab	Summer 2007	Instructor
Math 426	Intro to Math Software Packages: Matlab	Winter 2007	Instructor
Math 152	Calculus and Analytic Geometry II	Summer 2006	TA
Math 152	Calculus and Analytic Geometry II	Spring 2006	TA
Math 151	Calculus and Analytic Geometry I	Fall 2005	TA

Frederick Community College (2001–2003)

Tutoring Center

Tutored students in the following subjects: College algebra; Calculus I, II, and III; Differential equations; Linear algebra

Publications

Peer-reviewed journal articles:

[1] John Darges, **Alen Alexanderian**, and Pierre Gremaud. Variance-based sensitivity of Bayesian inverse problems to the prior distribution In review, 2023. https://arxiv.org/abs/2310.18488

[2] Abhi Chowdhary, Shanyin Tong, Georg Stadler, and Alen Alexanderian. Sensitivity Analysis of the Information Gain in Infinite-Dimensional Bayesian Linear Inverse Problems. In review, 2023. https://arxiv.org/abs/2310.16906

[3] **Alen Alexanderian**, Ruanui Nicholson, and Noemi Petra. Optimal design of large-scale nonlinear Bayesian inverse problems under model uncertainty. In review. 2023. https://arxiv.org/abs/2211.03952

[4] Isaac Sunseri, **Alen Alexanderian**, Joseph Hart, Bart van Bloemen Waanders. Hyper-differential sensitivity analysis for nonlinear Bayesian inverse problems. *International Journal for Uncertainty Quantification*. 2023.

[5] **Alen Alexanderian**, Joseph Hart, and Mason Stevens. A new perspective on parameter study of optimization problems. *Applied Mathematics Letters*, 2023. https://arxiv.org/abs/2209.11580

[6] Michael Merritt, **Alen Alexanderian**, and Pierre Gremaud. Global sensitivity analysis of rare event probabilities using subset simulation and polynomial chaos expansions. *International Journal for Uncertainty Quantification*, 2023.

[7] R.D. White, **A. Alexanderian**, O. Yousefian, Y. Karbalaeisadegh, A. Kasali, H.T. Banks, M. Talmant, Q. Grimal, Marie Muller, and K. Bekele-Maxwell. Using Ultrasonic Attenuation in Cortical Bone to Infer Distributions on Pore Size. *Applied Mathematical Modeling*, 109:819–832, 2022.

[8] John Darges, **Alen Alexanderian**, Pierre Gremaud. Extreme learning machines for variance-based global sensitivity analysis. In review. 2022. https://arxiv.org/abs/2201.05586

[9] Mason Stevens, Isaac Sunseri, **Alen Alexanderian**. Hyper-differential sensitivity analysis for inverse problems governed by ODEs with application to COVID–19 modeling. *Mathematical Biosciences*, 351:108887, 2022.

[10] Helen Cleaves, **Alen Alexanderian**, and Bilal Saad. Structure exploiting methods for fast uncertainty quantification in multiphase flow through heterogeneous media. *Computational Geosciences*, 25(6):2167–2189. 2021.

[11] E. Benjamin Randall, Nicholas Z. Randolph, **Alen Alexanderian**, and Mette S. Olufsen. Global sensitivity analysis informed model reduction and selection applied to a Valsalva maneuver model. *Journal of Theoretical Biology*, 2021. https://arxiv.org/abs/2005.12879

[12] Ethan Dudley, Arvind Saibaba, and **Alen Alexanderian**. Monte carlo estimators for the Schatten p-norm of symmetric positive semidefinite matrices. *Electronic Transactions on Numerical Analysis*, 55:213–241. 2022. https://arxiv.org/pdf/2005.10174.pdf

[13] **Alen Alexanderian** Optimal Experimental Design for Infinite-dimensional Bayesian Inverse Problems Governed by PDEs: A Review. *Inverse Problems*, 2021. https://arxiv.org/abs/2005.12998

[14] **Alen Alexanderian**, Noemi Petra, Georg Stadler, and Isaac Sunseri. Optimal design of large-scale Bayesian linear inverse problems under reducible model uncertainty: good to know what you don't know. *SIAM/ASA Journal on Uncertainty Quantification*. 9(1):163–184, 2021. https://arxiv.org/abs/2006.11939

[15] Rebekah White, Omid Yousefian, H.T. Banks, **Alen Alexanderian**, and Marie Muller. Inferring pore radius and density from ultrasonic attenuation using physics-based modeling *The Journal of the Acoustical Society of America*, 149(1), 2021.

[16] Michael Merritt, **Alen Alexanderian**, and Pierre Gremaud. Multiscale global sensitivity analysis for stochastic chemical systems, *SIAM Journal on Multiscale Modeling and Simulation*, 19(1):440–59, 2021. https://arxiv.org/abs/2003.07842

[17] Isaac Sunseri, Joseph Hart, Bart van Bloemen Waanders, and **Alen Alexanderian**. Hyper-Differential Sensitivity Analysis for Inverse Problems Constrained by Partial Differential Equations. *Inverse Problems*, 36(12), 2020. https://arxiv.org/abs/2003.00978

[18] Karina Koval, **Alen Alexanderian**, and Georg Stadler. Optimal experimental design under irreducible uncertainty for inverse problems governed by PDEs. *Inverse Problems*, 7(36):075007, 2020.

[19] Elizabeth Herman, **Alen Alexanderian**, and Arvind K. Saibaba. Randomization and reweighted ℓ_l-minimization for A-optimal design of linear inverse problems. *SIAM Journal on Scientific Computing*, 42(3):A1714–A1740, 2020. https://arxiv.org/abs/1906.03791

[20] **Alen Alexanderian**, Pierre Gremaud, and Ralph C. Smith. Variance-based sensitivity analysis for time-dependent processes. *Reliability Engineering & System Safety.* 2020.

[21] Hayley Guy, **Alen Alexanderian**, and Meilin Yu. A distributed active subspace method for scalable surrogate modeling of function valued outputs. *Journal of Scientific Computing*, Accepted, 2020.

[22] Helen L. Cleaves, **Alen Alexanderian**, Hayley Guy, Ralph C. Smith, and Meilin Yu. Derivative based global sensitivity analysis for models with high-dimensional inputs and functional outputs. *SIAM Journal on Scientific Computing*. 41(6):A3524–A3551, 2019.

[23] Arvind Saibaba, Jonathan Bardsley, Andrew Brown, **Alen Alexanderian**. Efficient marginalization-based MCMC Methods for hierarchical Bayesian inverse problems *SIAM Journal on Uncertainty Quantification*. 7(3):1105–1131. 2019.

[24] **Alen Alexanderian**, William Reese, Ralph C. Smith, and Meilin Yu. Model input and output dimension reduction using Karhunen–Loéve expansions with application to biotransport. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems Part B: Mechanical Engineering*. (5)4:041014 (9 pages), 2019.

[25] Manav Vohra, **Alen Alexanderian**, Hayley Guy, and Sankaran Mahadevan. Active Subspace-based dimension reduction for chemical kinetics applications with epistemic uncertainty. *Combustion and Flame*, 204:152–161, 2019.

[26] Manav Vohra, **Alen Alexanderian**, Cosmin Safta, and Sankaran Mahadevan. Sensitivity-driven adaptive construction of reduced-space surrogates. *Journal of Scientific Computing*, 79(2):1335–1359, 2019.

[27] **Alen Alexanderian** and Arvind K. Saibaba. Efficient D-optimal design of experiments for infinite-dimensional Bayesian linear inverse problems. *SIAM Journal on Scientific Computing*, 40(5):A2956–A2985, 2018.

[28] Ahmed Attia, **Alen Alexanderian**, and Arvind K. Saibaba. Goal-oriented optimal design of experiments for large-scale Bayesian linear inverse problems. *Inverse Problems*, 34(9). 2018.

[29] Bilal Saad, **Alen Alexanderian**, Serge Prudhomme, and Omar Knio. Probabilistic modeling and global sensitivity analysis for CO_2 storage in geological formations: a spectral approach. *Applied Mathematical Modeling*. 53. 2018, Pages 584–601.

[30] **Alen Alexanderian**, Noemi Petra, Georg Stadler, and Omar Ghattas. Mean-variance risk-averse optimal control of systems governed by PDEs with random parameter fields using quadratic approximations. *SIAM Journal on Uncertainty Quantification*, 5(1):1166–1192. 2017.

[31] Joseph Hart, **Alen Alexanderian**, and Pierre Gremaud. Efficient computation of Sobol indices for stochastic models. *SIAM Jounral on Scientific Computing*. 39(4). 2017.

[32] **Alen Alexanderian** Liang Zhu, Maher Salloum, Ronghui Ma, Meilin Yu. Investigation of biotransport in a tumor with uncertain material properties using a non-intrusive spectral uncertainty quantification method. *ASME Journal of Biomechanical Engineering*. 139(9). 2017.

[33] Arvind K. Saibaba, **Alen Alexanderian**, and Ilse Ipsen. Randomized matrix-free trace and log-Determinant estimators. *Numerische Mathematik*. 137(2). 2017.

[34] Ben Crestel, **Alen Alexanderian**, Georg Stadler, and Omar Ghattas. A-optimal source encoding for inverse problems, with applications to seismic inversion. *Inverse problems*. 33(7). 2017.

[35] Craig Michoski, **Alen Alexanderian**, Charles Paillet, Clint Dawson, and Ethan Kubatko. Stability of Nonlinear Convection-Diffusion-Reaction Systems in Discontinuous Galerkin Methods. *Journal of Scientific Computing*, 70(2):516—550. 2017.

[36] **Alen Alexanderian**, Noemi Petra, Georg Stadler, and Omar Ghattas. A fast and scalable method for A-optimal design of experiments for infinite-dimensional Bayesian nonlinear inverse problems. *SIAM Journal on Scientific Computing*, 38(1):A243-A272. 2016.

[37] **Alen Alexanderian**, Philip Gloor, Omar Ghattas. On Bayesian A- and D-optimal experimental designs in infinite dimensions. *Bayesian Analysis*, 11(3):671-695. 2016.

[38] **Alen Alexanderian**. A primer on homogenization of elliptic PDEs with stationary and ergodic random coefficient functions. (Expository paper). *Rocky Mountain Journal of Mathematics*, 45(3):703–735, 2015.

[39] **Alen Alexanderian**, Noemi Petra, Georg Stadler, and Omar Ghattas. A-optimal design of experiments for infinite-dimensional Bayesian linear inverse problems with regularized ℓ_0-sparsification. *SIAM Journal on Scientific Computing*, 36(5), 2014.

[40] **Alen Alexanderian**, Francesco Rizzi, Muruhan Rathinam, Olivier Le Maître, and Omar M. Knio. Preconditioned Bayesian regression for stochastic chemical kinetics. *Journal of Scientific Computing*, 58(3):592–626, 2014.

[41] **Alen Alexanderian**. On spectral methods for variance based sensitivity analysis. *Probability Surveys*, 10, 2013.

[42] Ihab Sraj, Mohamed Iskandarani, Ashwanth Srinivasan, W. Carlisle Thacker, Justin Winokur, **Alen Alexanderian**, Chia-Ying Lee, Shuyi S. Chen, and Omar M. Knio. Bayesian Inference of Wind Drag Dependence on the Wind Speed using AXBT data during Typhoon Fanapi, *Monthly Weather Review*, 141(7):2347–2367, 2013.

[43] **Alen Alexanderian**, Justin Winokur, Ihab Sraj, Ashwanth Srinivasan, Mohamed Iskandarani, William C. Thacker, and Omar M. Knio. Global sensitivity analysis in an ocean general circulation model: a sparse spectral projection approach. *Computational Geosciences*, 16(3):757–778, 2012.

[44] Maher Salloum, **Alen Alexanderian**, Olivier Le Maître, Habib N. Najm, and Omar M. Knio. Simplified CSP analysis of a stiff stochastic ODE system. *Computer Methods in Applied Mechanics and Engineering*, 217-220:121–138, 2012.

[45] **Alen Alexanderian**, Olivier Le Maître, Habib Najm, Mohamed Iskandarani, and Omar Knio. Multiscale stochastic preconditioners in non-intrusive spectral projection. *Journal of Scientific Computing*, 50:306–340, 2012.

[46] **Alen Alexanderian**, Muruhan Rathinam, and Rouben Rostamian. Homogenization, symmetry, and periodization in diffusive random media. *Acta Mathematica Scientia*, 32(1):129–154, 2012.

[47] **Alen Alexanderian**, Muruhan Rathinam, and Rouben Rostamian. Irreducibility of a symmetry group implies isotropy. *Journal of Elasticity*, 102(2), 2011.

[48] **Alen Alexanderian**, Matthias K. Gobbert, K. Renee Fister, Holly Gaff, Suzanne Lenhart, and Elsa Schaefer. An age-structured model for the spread of epidemic cholera: Analysis and simulation. *Nonlinear Analysis: Real World Applications*, 12(6):3483–3498, 2011.

[49] Daniel Mueller, George Dimitoglou, Benjamin Caplins, Juan Pablo Garcia Ortiz, Benjamin Wamsler, Keith Hughitt, **Alen Alexanderian**, Jack Ireland, Desmond Amadigwe, and Bernhard Fleck. Jhelioviewer - visualizing large sets of solar images using JPEG 2000. *Computing in Science & Engineering*, 11(5):38–47, 2009.

Peer-reviewed proceedings

[50] Nick Neuberger, Bart Van Bloemen Waanders, and Alen Alexanderian. Computational aspects of optimal experimental design for large-scale Bayesian linear inverse problems. Computer Science Research Institute Summer Proceedings 2023, Sandia National Laboratories, 2023.

[51] Rebekah White, Omid Yousefian, Alen Alexanderian, and Marie Muller. Modeling Frequency Dependent Ultrasound Attenuation in Cortical Bone: Solving Direct and Inverse Problems. In 2020 IEEE International Ultrasonics Symposium (IUS) IEEE.

[52] **Alen Alexanderian**, William Reese, Ralph C. Smith, and Meilin Yu. Efficient uncertainty quantification for biotransport in tumors with uncertain material properties. ASME 2018 International Mechanical Engineering Congress and Exposition. 2018.

[53] Miao Lu, **A. Alexanderian**, Maher Salloum, Liang Zhu, Ronghui Ma, and M. L. Yu. Stochastic modeling of biotransport in a tumor with uncertain material properties. Summer Biomechanics, Bioengineering and Biotransport Conference. (SB3C2017). 2017.

PhD thesis:

[54] **Alen Alexanderian**. Random composite media: Homogenization, modeling, simulation, and material symmetry. PhD Thesis. University of Maryland, Baltimore County. 2010.

Technical reports, non-peer-reviewed proceedings, and abstracts:

[55] **Alen Alexanderian** A brief note on the Bayesian D-optimality criterion. 2023. https://arxiv.org/abs/2212.11466

[56] **Alen Alexanderian**. On Bayes risk of the posterior mean in linear inverse problems. 2023. https://arxiv.org/abs/2301.04270

[57] **Alen Alexanderian**. On the mean and variance of quadratic functionals of Gaussian random vectors. 2021.
https://aalexan3.math.ncsu.edu/articles/moments_quad.pdf

[58] Rebecca White, Omid Yousefian, **Alen Alexanderian** and Marie Muller. Modeling Frequency Dependent Ultrasound Attenuation in Cortical Bone: Solving Direct and Inverse Problems. 2020 IEEE International Ultrasonics Symposium (IUS). 2020.

[59] Isaac Sunderi and **Alen Alexanderian**, On marginals of Gaussian random vectors. 2018.
https://aalexan3.math.ncsu.edu/articles/gaussian_marginals.pdf

[60] **Alen Alexanderian** A brief note on the Karhunen–Loéve expansion. Technical report. 2015. http://arxiv.org/abs/1509.07526v1.

[61] Habib Najm, Bert Debusschere, Michael Eldred, Cosmin Safta, John Jakeman, David Higdon, James Gattiker, Roger Ghanem, Omar Knio, **Alen Alexanderian**, Youssef M. Marzouk, Tarek A. El Moselhy, Jinglai Li, Patrick R. Conrad, Tan Bui-Thanh, Omar Ghattas, James Martin, Robert Moser, Ernesto Prudencio, Georg Stadler. Quantification of Uncertainty in Extreme Scale Computations (QUEST). DOE Exascale Research Conference, 2012.

[62] Daniel Mueller, George Dimitoglou, **Alen Alexanderian**, Juan Pablo Garcia Ortiz, Ludwig Schmidt, Vincent K. Hughitt, Jack Ireland, Bernhard Fleck. A Novel Approach to Discovery and Image Access in the Petabyte Age. American Geophysical Union, Fall Meeting 2009.

[63] Vincent K. Hughitt, Jack Ireland, Daniel Mueller, George Dimitoglou, Juan Pablo Garcia Ortiz, Ludwig Schmidt, Benjamin Wamsler, Jaclyn Beck, **Alen Alexanderian**, Bernhard Fleck. Helioviewer.org: Browsing Very Large Image Archives Online Using JPEG 2000. American Geophysical Union, Fall Meeting 2009.

[64] **Alen Agheksanterian** and Matthias K. Gobbert. Modeling the spread of epidemic cholera: an age-structured model. Technical Report number TR20079, Department of Mathematics and Statistics, University of Maryland, Baltimore County, 2007.

[65] **Alen Agheksanterian** and George Dimitoglou. Algorithms paradigms and case studies as a problem-solving methodology. ASEE Mid-Atlantic Section Spring 2005 Conference, Fairleigh Dickinson University Teaneck, NJ April 15-16, 2005.

Invited talks and presentations

Names in bold indicate the speaker.

1. *Invited Talk*. **Alen Alexanderian**. Optimal experimental design for infinite-dimensional Bayesian inverse problems under model uncertainty. The 13th model-oriented data analysis and optimum design (mODa13). July 11, 2023. Southampton, UK.

2. *Invited Talk*. **Alen Alexanderian**. Sensitivity analysis and uncertainty quantification in inverse problems governed by epidemic models. The 13th AIMS Conference on Dynamical Systems, Differential Equations and Applications. May 31, 2023. Wilmington, NC.

3. *Invited Talk*. **Alen Alexanderian**. Optimal Design of Large-Scale Bayesian Inverse Problems under Model Uncertainty. 6th International Conference on Design of Experiments. May 10, 2023. Memphis, TN.

4. *Invited Minisymposium Talk*. **Alen Alexanderian** and Pierre Gremaud. RTG: Randomized Numerical Analysis. SIAM Conference on Applied Mathematics Education. July 11, 2022. Pittsburgh, PA.

5. *Seminar talk*. **Alen Alexanderian**. Design of large-scale Bayesian inverse problems governed by PDEs under uncertainty. Hybrid seminar on Uncertainty Quantification, RWTH Aachen University. May 10, 2022. Talk delivered remotely.

6. *Invited minisymposium talk*. **Alen Alexanderian**. Optimal Design of Infinite-Dimensional Bayesian Inverse Problems under Uncertainty. SIAM Conference on Uncertainty Quantification. April 14, 2022. Atlanta, GA.

7. *Invited talk*. **Alen Alexanderian**. Optimal design of inverse problems governed by PDEs. Fall Western Virtual Sectional Meeting: Special Session on Theoretical and Applied perspectives in Machine Learning. October 23, 2021. Virtual meeting (originally scheduled in University of New Mexico).

8. *Invited minisymposium talk*. **Alen Alexanderian**. Optimal experimental design for inverse problems with additional model uncertainties. IFIP TC7 Conference on System Modelling and Optimization. September 3, 2021. Virtual conference (originally scheduled in Quito, Ecuador).

9. *Invited minisymposium talk*. **Alen Alexanderian**. Multiscale global sensitivity analysis for stochastic chemical reaction networks. 16th U.S. National Congress on Computational Mechanics. July 29, 2021. Virtual conference.

10. *Invited minisymposium talk*. **Alen Alexanderian**. Structure exploiting methods for fast uncertainty quantification with application to multiphase flow in porous media. Uncertainty Quantification in Computational Sciences and Engineering. June 29, 2021. Virtual conference (originally scheduled in Athens, Greece).

11. *Invited minisymposium talk*. **Alen Alexanderian**. Optimal data acquisition for Bayesian inverse problems under model uncertainty. SIAM Conference on Mathematical & Computational Issues in the Geosciences. June 23, 2021. Virtual conference (originally scheduled in Milan, Italy).

12. *Seminar talk*. **Alen Alexanderian**. Optimal experimental design for inverse problems governed by PDEs with reducible model uncertainty. Research and teaching in statistical and data sciences seminar. May 14, 2021. University of Glasgow, talk delivered remotely.

13. *Invited minisymposium talk*. **Alen Alexanderian**. Optimal design of large-scale Bayesian linear inverse problems under reducible model uncertainty. SIAM Conference on Computational Sciences and Engineering. March 3, 2021. Virtual Conference (originally scheduled in Fort Worth, TX).

14. *Seminar talk*. **Alen Alexanderian**. Optimal data acquisition for inverse problems under model uncertainty, with application to subsurface flow. Argonne National Laboratory. Feb 24, 2021. Talk delivered remotely.

15. *Workshop presentation*. **Alen Alexanderian**. Sensitivity analysis for forward and inverse uncertainty quantification. SAMSI Numerical Analysis in Data Science Program Opening Workshop. Aug 26, 2020. Virtual Meeting.

16. *Invited talk*. **Alen Alexanderian**. Optimal design of inverse problems under model uncertainty, with application to subsurface flow. RICAM Workshop on optimization and inversion under uncertainty. Nov 14, 2019. Johann Radon Institute for Computational and Applied Mathematics (RICAM); Linz, Austria.

17. *Seminar talk*. **Alen Alexanderian**. Optimal data acquisition for inverse problems under model uncertainty, with application to subsurface flow. United States Naval Academy. Oct 10, 2019. Annapolis, MD.

18. *Colloquium talk*. **Alen Alexanderian**. Optimal design of inverse problems under model uncertainty, with application to subsurface flow . Applied Math Colloquium, University of Maryland, Baltimore County. Oct 11, 2019. Baltimore, MD.

19. *Invited minisymposium talk*. **Alen Alexanderian**. Optimal design of PDE-based linear inverse problems under model uncertainty. Applied Inverse Problems (AIP) Conference. July 11, 2019. Grenoble, France.

20. *Invited minisymposium talk*. **Alen Alexanderian**, Ahmed Attia, Noemi Petra, Arvind K. Saibaba, and Georg Stadler. Goal Oriented Sensor Placement for Large-scale Inverse Problems Under Model Uncertainty. SIAM Conference on Computational Sciences and Engineering. March 2019. Spokane, WA.

21. *Seminar talk*. **Alen Alexanderian**. Efficient methods for optimal sensor placement in infinite-dimensional Bayesian linear inverse problems. Applied Mathematics Seminar, University of North Carolina, Greensboro. November 2018. Greensboro, NC.

22. *Invited minisymposium talk*. **Alen Alexanderian**, Elizabeth, Herman, and Arvind K. Saibaba. Efficient randomized methods for D-Optimal sensor placement for infinite-dimensional Bayesian linear inverse problems governed by PDEs. SIAM Conference on Uncertainty Quantification. April 2018. Anaheim, CA.

23. *Invited minisymposium talk*. **Alen Alexanderian**. Scalable algorithms for D-optimal design of experiments for large-scale Bayesian linear inverse problems. Mathematical Congress of Americas (MCA). July 2017. Montreal, Canada.

24. *Plenary talk*. **Alen Alexanderian**. Scalable Methods for Optimal Design of Experiments for Large-Scale Bayesian Inverse Problems Governed by PDEs. Workshop on Optimal Experimental Design & Inverse Problems, The Alan Turing Institute. March 2017. London, UK.

25. *Invited minisymposium talk*. **Alen Alexanderian**, Noemi Petra, Georg Stadler, and Omar Ghattas. Scalable Methods for Optimization of Systems Governed by PDEs with Random Parameter Field. SIAM Conference on Computational Sciences and Engineering. March 2017. Atlanta, GA.

26. *Seminar talk*. **Alen Alexanderian**. Optimal sensor placement for Bayesian linear inverse problems governed by PDEs. SAMSI Undergraduate Workshop. February 2017. Research Triangle Park, Durham, NC.

27. *Invited minisymposium talk*. **Alen Alexanderian** and Arvind K. Saibaba. Scalable algorithms for D-optimal design of experiments for large-scale Bayesian linear inverse problems. Joint Mathematics Meetings. January 2017. Atlanta, GA.

28. *Colloquium talk*. **Alen Alexanderian**. Optimal sensor placement for Bayesian linear inverse problems governed by PDEs. Applied Math Colloquium, University of Maryland, Baltimore County. October 2016. Baltimore, MD.

29. *Invited minisymposium talk*. **Alen Alexanderian** and Arvind K. Saibaba. D-optimal design of experiments for infinite-dimensional Bayesian linear inverse problems. European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS). June 2016. Crete Island, Greece.

30. *Invited minisymposium talk*. **Alen Alexanderian**, Noemi Petra, Georg Stadler, and Omar Ghattas. Scalable methods for optimal experimental design for systems governed By PDEs with uncertain parameter fields. SIAM Conference on Uncertainty Quantification. April 2016. Lausanne, Switzerland.

31. *Seminar talk*. **Alen Alexanderian**. Quantification of uncertainties in systems governed by PDEs with random parameters. Department of Mathematics. First Year Seminar, NCSU Math Department. October 2015. Raleigh, NC.

32. *Invited minisymposium talk*. **Alen Alexanderian**, Noemi Petra, Georg Stadler, and Omar Ghattas. Scalable Algorithms for Optimal Control of Systems Governed by PDEs under Uncertainty. SIAM Conference on Computational Sciences and Engineering. March 2015. Salt Lake City, UT.

33. *Seminar talk*. **Alen Alexanderian**. Inversion, design of experiments, and optimal control in systems governed by PDEs with random parameter functions. Georgia Institute of Technology. February 2015. Atlanta, GA.

34. *Colloquium talk*. **Alen Alexanderian**. Inversion, design of experiments, and optimal control in systems governed by PDEs with random parameter functions. University of Houston. January 2015. Houston, TX.

35. *Colloquium talk*. **Alen Alexanderian**. Inversion, design of experiments, and optimal control in systems governed by PDEs with random parameter functions. North Carolina State University. January 2015. Raleigh, NC.

36. *Colloquium talk*. **Alen Alexanderian**. Inversion, design of experiments, and optimal control in systems governed by PDEs with random parameter functions. University of Colorado, Denver. January 2015. Denver, CO.

37. *Seminar talk*. **Alen Alexanderian**. Quantification of uncertainties in mathematical models governed by differential equations. Sandia National Lab. June 2014. Albuquerque, NM.

38. *Invited minisymposium talk*. **Alen Alexanderian**, Noemi Petra, Georg Stadler, and Omar Ghattas. A Scalable MAP-Based Algorithm for Optimal Experimental Design for Large-Scale Bayesian Inverse Problems. SIAM Conference on Uncertainty Quantification. April 2014. Savannah, GA.

39. *Conference presentation*. Alen Alexanderian, **Omar Ghattas**, Tobin Isaac, James R. Martin, Noemi Petra, and Georg Stadler. Scalable Algorithms for Bayesian Inverse Problems and Optimal Experimental Design with Applications to Large-scale Complex Systems. SIAM Conference on Uncertainty Quantification. April 2014. Savannah, GA.

40. *Seminar talk*. **Alen Alexanderian**. Uncertainty quantification in models governed by partial differential equations. United States Naval Academy. March 2014. Annapolis, MD.

41. *Colloquium talk*. **Alen Alexanderian**. Uncertainty Quantification in Computationally Intensive Mathematical Models. Florida State University. February 2014. Tallahassee, FL.

42. *Seminar talk*. **Alen Alexanderian**. Optimal experimental design for infinite-dimensional Bayesian inverse problems. Florida State University. February 2014. Tallahassee, FL.

43. *Invited minisymposium talk*. **Alen Alexanderian**, Noemi Petra, Georg Stadler, and Omar Ghattas. Optimal design of experiments for infinite-dimensional Bayesian linear inverse problems. 12th US National Congress in Computational Mechanics. July 2013. Raleigh, NC.

44. *Invited minisymposium talk*. **Alen Alexanderian**, Noemi Petra, Georg Stadler, and Omar Ghattas. Optimal Experimental Design under Uncertainty. SIAM Conference on Computational Sciences and Engineering. March 2013. Boston, MA.

45. *Conference presentation*. **Olivier P. Le Maitre**, Alen Alexanderian, Francesco Rizzi, Muruhan Rathinam, and Omar M. Knio. Preconditioned Bayesian Regression for Stochastic Chemical Kinetics. SIAM Conference on Computational Sciences and Engineering. March 2013. Boston, MA.

46. *Conference presentation*. Justin Winokur, Patrick R. Conrad, Ihab Sraj, Alen Alexanderian, Mohamed Iskandarani, Ashwanth Srinivasan, Youssef M. Marzouk, **Omar Knio**. A Priori Testing of Adaptive Sampling and Sparse PC Representations for Ocean General Circulation Models. SIAM International Conference on Data Mining. April 2012. Anaheim CA.

47. *Invited minisymposium talk*. **Alen Alexanderian**, Justin Winokur Ihab Sraj, Ashwanth Srinivasan, Mohamed Iskandarani, William Thacker, and Omar Knio. A Spectral Uncertainty Quantification Approach in Ocean General Circulation Modeling. SIAM Conference on Uncertainty Quantification. April 2012. Raleigh, NC.

48. *Conference presentation*. Alen Alexanderian, Justin Winokur Ihab Sraj, Ashwanth Srinivasan, **Mohamed Iskandarani**, William Thacker, and Omar Knio. Uncertainty Analysis and Quantification of the HYCOM SST Response to Hurricane Ivan Using Polynomial Chaos Expansions. Ocean Sciences Meeting. February 2012. Salt Lake City, Utah.

49. *Invited minisymposium talk*. **Alen Alexanderian**, Olivier Le Maître, Habib Najm, Mohamed Iskandarani, and Omar Knio.. Multiscale Stochastic Preconditioners in Non-Intrusive Spectral Projection. International Congress on Industrial and Applied Mathematics (ICIAM). July 2011. Vancouver, BC, Canada.

50. *Seminar talk*. **Alen Alexanderian**, Justin Winokur, Mohamed Iskandarani, Ashwanth Srinivasan, Carlisle Thacker, and Omar Knio. Uncertainty Quantification in Gulf of Mexico: A Spectral Approach. Graduate Seminar in Fluid Mechanics. April 2011. Mechanical Engineering Department, Johns Hopkins University.

51. *Invited minisymposium talk*. **Alen Alexanderian**, Maher Salloum, Olivier Le Maître, Habib Najm, Mohamed Iskandarani, and Omar Knio. Recent experiences with stochastic preconditioners and random eigenvalues. Workshop on Uncertainty Quantification for Multiphysics and Multiscale Systems. March 2011. University of Southern California, Los Angeles, CA.

52. *Conference presentation*. Alen Alexanderian, Maher Salloum, Olivier Le Maître, Habib Najm, and **Omar Knio**. Simplified CSP Analysis of a Stochastic Chemical System. SIAM Conference on Computational Science and Engineering. March 2011. Reno, Nevada.

53. *Conference presentation*. **Mohamed Iskandarani**, Ashwanth Srinivasan, Carlisle Thacker, Omar Knio, Alen Alexandrian, and Justin Winokur. Uncertainty Quantification with HYCOM in Gulf of Mexico. SIAM Conference on Computational Science and Engineering. March 2011. Reno, Nevada.

54. *Seminar talk*. **Alen Alexanderian**. Multiscale stochastic preconditioners in non-intrusive spectral projection. Graduate Seminar in Fluid Mechanics. Oct 2010. Mechanical Engineering Department, Johns Hopkins University.

55. *Conference presentation*. **Alen Alexanderian**, Muruhan Rathinam, and Rouben Rostamian. Effective Properties of Random Elastic Media and Their Isotropy. SIAM conference on mathematical aspects of materials science. May 2010. Philadelphia, PA.

56. *Conference presentation*. **Alen Alexanderian**, Muruhan Rathinam, and Rouben Rostamian. Homogenization and symmetry in random media. South-eastern Atlantic Mathematical Sciences Workshop (Cha-Cha Days). November 2009. University of Central Florida.

57. *Seminar talk*. **Alen Alexanderian**. Averaging of differential operators with rapidly oscillating coefficients. Mathematics and Statistics Graduate Student Seminar. September 2008. UMBC.

58. *Conference presentation*. **Alen Alexanderian**, Muruhan Rathinam, and Rouben Rostamian. Effective properties of media with inhomogeneous microstructure. Graduate Research Conference. April 2008. UMBC.

59. *Seminar talk*. **Alen Alexanderian**. Diffusion in media with random microstructure. Differential Equations Seminar. October 2008. UMBC.

60. *Invited lecture*. **Alen Alexanderian**. A half-day MATLAB course. Hood College Department of Computer Science Invited Talk. Fall 2007. Hood College.

61. *Invited talk*. **Alen Alexanderian**. Modeling the spread of epidemic cholera. College of Natural and Mathematical Sciences Dean Advisory Board Meeting. January 2007. UMBC.

62. *Seminar talk*. **Alen Alexanderian**. Inexact line search methods in unconstrained optimization: a modified Armijo rule. Mathematics and Statistics Graduate Student Seminar. Fall 2006. UMBC.

63. *Seminar talk*. **Alen Alexanderian**. Discontinuous Galerkin Methods for Elliptic Problems. Mathematics and Statistics Graduate Student Seminar. Spring 2006. UMBC.

Honors and Awards

- LeRoy and Elva Martin Award for Teaching Excellence, NCSU, College of Sciences, 2019.
- Keynote speaker, Workshop on Optimal Experimental Design & Inverse Problems, The Alan Turing Institute, 2017
- College of Natural and Mathematical Sciences award for outstanding graduate research in Applied Mathematics, UMBC, 2010
- SIAM Student Chapter certificate of recognition for outstanding service and contribution to the SIAM Student Chapter at UMBC, 2009
- First prize, Mathematics, Engineering, and Computer and Information Sciences section, Graduate Research Conference, UMBC, 2008
- Academic achievement prize for top graduating senior, Hood College, 2005
- Pi Mu Epsilon Book Prize, Hood College, 2005
- Pi Mu Epsilon, Member
- Honorable Mention in MCM: The Mathematical Contest in Modeling, 2005
- Commencement speaker, Frederick Community College, 2003

Leadership Experience

- Co-leader of Statistical Inverse Problems working group as a part of SAMSI's 2016-2017 program on optimization
- Co-organizer of SAMSI Statistical Inverse Problems working group mid-year workshop
- President and co-founder of SIAM Student Chapter at UMBC, 2008–2010
- Co-organizer of the 1st Chesapeake SIAM Student Chapter Conference, UMBC, 2010
- Vice President of Mathematics & Statistics Graduate Student Association, UMBC, 2007
- Graduate student member of promotion and tenure committee for new faculty members in the department of mathematics and statistics, UMBC, 2008

Computer Skills

- Programming languages: Java, C, C++, FORTRAN, Visual Basic, Python
- Mathematical packages: Matlab, Maple, Mathematica, Comsol Multiphysics, FEniCS
- Operating systems: Linux, Windows, Mac OS