EMILY WILLIAMS

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SUMMARY

PhD candidate and research fellow in Computational Science & Engineering (MIT) specializing in machine learning and numerical methods for model reduction and control of multiscale chaotic dynamical systems. Research background in physics-informed and stochastic modeling toward improving traditional numerical methods. Extensive experience using modern high-performance computing (HPC) architectures for scientific computing applications across academia and industry.

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA
PhD, Computational Science and Engineering, 5.0/5.0, expected June 2026.
Thesis: Stochastic methods for model reduction of multiscale chaotic systems
Committee: Prof. David Darmofal, Dr. Amanda Howard, Dr. Panos Stinis, Prof. Themis Sapsis

Massachusetts Institute of Technology, Cambridge, MA
MS, Aeronautics and Astronautics, 4.9/5.0, June 2023.
Thesis: "Assessment of wall-modeled large-eddy simulation for high-speed flows and novel modeling strategies"
Advisor: Prof. Adrián Lozano-Durán

University of Illinois Urbana-Champaign, Champaign, IL
BS, Aerospace Engineering, with Highest Honors, 3.94/4.00, June 2021.
Minor: Atmospheric Sciences
Advisors: Prof. Andrés Goza and Prof. Marco Panesi

RESEARCH EXPERIENCE

Pacific Northwest National Laboratory, Seattle, WA
Visiting Graduate Research Intern, May 2024 to Present

- Developed JAX-based deep operator networks using transfer learning techniques and extracted custom, physics-informed spectral basis functions to enable efficient model reduction in multiscale simulations
- Building reduced-order models using Mori–Zwanzig formalism to model memory effects, exploring Markovian reformulations to improve stability and computational efficiency

Massachusetts Institute of Technology, Cambridge, MA
Department of Energy Computational Science Graduate Fellow, September 2022 to Present

- Implemented stochastic differential equation models in TensorFlow and physics-informed diffusion models in PyTorch for subgrid-scale modeling of chaotic systems
- Formulating and implementing stabilizations for linearized chaotic dynamics using stochastic parametric, diffusion-based, and stochastic optimal control frameworks

Massachusetts Institute of Technology, Cambridge, MA
Graduate Research Assistant, September 2021 to September 2022

- Conducted wall-modeled large-eddy simulations (WMLES) of Lockheed Martin X-59 QueSST, performing error-convergence studies across mesh configurations and estimating computational costs on GPU cluster
- Implemented machine-learning–based and information-preserving subgrid-scale models to improve simulation accuracy for high-speed turbulent channel flow

SELECTED PAPERS & PROCEEDINGS

1. Williams, E., and Darmofal, D., "Stochastic generative methods for stable and accurate closure modeling of chaotic dynamical systems," arXiv 2504.09750, April 2025.

2. Williams, E., Howard, A., Meuris, B., and Stinis, P., "What do physics-informed DeepONets learn? Understanding and improving training for scientific computing applications," arXiv 2411.18459, November 2024.

3. Williams, E., Arranz, G., Lozano-Duran, A., "Near-Field Wall-Modeled Large-Eddy Simulation of the NASA X-59 Low-Boom Flight Demonstrator," arXiv 2307.02725, July 2023.

4. Williams, E., and Lozano-Duran, A., "Information-Theoretic Approach for Subgrid-Scale Modeling for High-Speed Compressible Wall Turbulence," AIAA AVIATION Forum, June 2022.

(Full list: https://scholar.google.com/citations?user=YVWR1kIAAAAJ&hl=en)

PRESENTATIONS & INVITED TALKS

1. Williams, E., and Darmofal, D., "Generative modeling for closure and linearized stability of chaotic dynamical systems," APS Division of Fluid Dynamics, Interact Session, Houston, TX, November 2025.

2. Williams, E., Howard, A., and Stinis, P., "Machine-Learning-Based Spectral Methods Toward Reduced-Order Modeling for Partial Differential Equations," SIAM Computational Science & Engineering, Fort Worth, TX, March 2025.

3. Williams, E., Howard, A., Meuris, B., and Stinis, P., "Machine-Learning-Based Spectral Methods for Reduced-Order Modeling," MIT Center for Computational Science & Engineering (CCSE) Retreat, October 2024.

4. Williams, E., Howard, A., Meuris, B., and Stinis, P., "Machine-Learning-Based Spectral Methods Toward Reduced-Order Modeling for Partial Differential Equations," MIT Computational Science & Engineering (CSE) Community Seminar, October 2024.

5. Williams, E., Howard, A., Meuris, B., and Stinis, P., "Machine-Learning-Based Spectral Methods Toward Reduced-Order Modeling for Partial Differential Equations," MIT Computational Research in Boston and Beyond (CRIBB) Seminar, October 2024.

6. Williams, E., Trono-Figueras, R., and Darmofal, D., "Learning Diffusion for Stabilizing Linearized Chaotic Systems," SIAM Annual Meeting, Spokane, WA, July 2024.

7. Williams, E., Howard, A., and Stinis, P., "Deep Operator Networks for Reduced-Order Modeling," DOE Computational Science Graduate Fellowship Annual Program Review, Washington, D.C., July 2024.

8. Williams, E., and Darmofal, D., "Towards a stochastic subgrid-scale model for turbulence," Advances in Computational Mechanics, Oden Institute, UT Austin, October 2023.

9. Williams, E., and Darmofal, D., "Stochastic Integration for Chaotic Dynamical Systems," DOE Computational Science Graduate Fellowship Annual Program Review, Washington, D.C., July 2023.

10. Williams, E., Arranz, G., and Lozano-Duran, A., "Wall-Modeled Large-Eddy Simulation of the Lockheed Martin X-59 QueSST," APS Division of Fluid Dynamics, Indianapolis, IN, November 2022.

11. Williams, E., and Lozano-Duran, A., "Error Scaling of Wall-Modeled Large-Eddy Simulation of Compressible Wall Turbulence," APS Division of Fluid Dynamics, Phoenix, AZ, November 2021.

ADDITIONAL EXPERIENCE

The Boeing Company, Engineering Intern (Summer 2020 – Summer 2022)

Stanford Center for Turbulence Research, Visiting Graduate Researcher (Summer 2022)

Center for Hypersonics & Entry Systems Studies, Undergraduate Researcher, UIUC (Spring 2020 – Spring 2021)

Numerics & Unsteady Flows Group, Undergraduate Researcher, UIUC (Summer 2020 – Spring 2021)

Laboratory for Advanced Space Systems at Illinois, Undergraduate Researcher, UIUC (Summer 2019)

GE Aviation, Engineering Intern (Summer 2018)

TEACHING & MENTORSHIP

MIT Summer Research Program (MSRP) Graduate Mentor, MIT (Summer 2023)

Undergraduate Research Opportunities Program (UROP) Graduate Mentor, MIT (Spring 2022 – Fall 2022)

Head Engineering Learning Assistant, Engineering Orientation, UIUC (Spring 2019 – Spring 2021)

Course Developer & Instructor, Introduction to CubeSat Design & Development, UIUC (Spring 2020)

Teaching Assistant, Grainger First-Year Experience Leadership Scholars, UIUC (Spring 2020 to Spring 2021)

Course Assistant, Introduction to Programming for Engineers, UIUC (Fall 2018 – Spring 2021)

Lead Tutor, Center for Academic Resources in Engineering, UIUC (Fall 2019 – Spring 2021)

LEADERSHIP & OUTREACH

MIT Graduate Women in Aerospace Engineering (GWAE), President (Fall 2021 – Summer 2022)

MIT Aerospace Computational Design Lab (ACDL), Social Chair (Fall 2021 – Summer 2022)

UIUC Women in Aerospace (WIA), President (Fall 2017 – Spring 2021)

SELECTED HONORS & AWARDS

Graduate Student Leadership Award, MIT	2023
AIAA New England Community Award, MIT	2023
Vickie Kerrebrock Award, MIT	2022
DOE Computational Science Graduate Fellowship (CSGF)	2022
NSF Graduate Research Fellowship Program (GRFP) – Declined	2022
DOD National Defense Science and Engineering Graduate (NDSEG) Fellowship – Declined	2022
Gardner Fellowship, MIT	2022
AIAA Aviation Week Network 20 Twenties	2021
Grainger Engineering Knight of St. Patrick, UIUC	2021
University of Illinois Tutor of the Year	2021
University of Illinois Senior 100 Honorary	2021
Scott R. White Aerospace Engineering Visionary Scholarship, UIUC	2020
Illinois Engineering Achievement Scholarship, UIUC	2017

TECHNICAL SKILLS

Programming Languages : Python, MATLAB, C/C++, R, Shell scripting
Frameworks: JAX, PyTorch, TensorFlow/Keras, OpenMP/MPI
Computing Tools: Git, HPC, slurm, GPU