# Zachary T. Hilliard

*Department of Mathematics, North Carolina State University*
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## Education

**North Carolina State University** — Raleigh, NC
*Ph.D., Applied Mathematics* — *Aug. 2021 – Jul. 2025 (Exp.)*
*Thesis: Data Driven Methods for Nonlinear PDEs with Conserved Quantities and Observational Data*
*Advisor: Prof. Mohammad Farazmand*

**The College of Charleston** — Charleston, SC
*M.Sc., Mathematical Sciences* — *Aug. 2019 – May. 2021*
*Thesis: Quaternion-Valued Solutions to the KdV Equation: Non-Uniqueness and Tail Behavior of 1-Soliton Solutions*
*Advisor: Prof. Alex Kasman*

**University of California, Santa Barbara** — Santa Barabara, CA
*B.S., Mathematics* — *Sept. 2014 – Jun. 2018*
*Thesis: Viral Dynamics of Apis Mellifera Colonies Infested with Varroa Destructor Carrying the Acute Bee Paralysis Virus*
*Advisor: Prof. Björn Birnir*

## Research Interests

Partial differential equations, dynamical systems, data-driven methods, data assimilation, reduced-order modeling

## Awards and Honors

National Science Foundation, Research Training Group Fellow — **N.C. State University** *May 2022 - Pres.*

Simon F. Gallagher Fellowship — **College of Charleston** *Aug. 2019 - May 2021*

Graduated with Distinction in Mathematics — **U.C. Santa Barbara** *June 2018*

## Grants

Charleston Cultural and Scientific Education Fund, Amount: $4,000 — *2020-2021*

Charleston Cultural and Scientific Education Fund, Amount: $4,000 — *2019-2020*

## Publications & Preprints

1. Z. T. Hilliard, M. Farazmand, and A. Chabchoub. Full state estimation of deep-water waves from sparse measurements: Predicting rogue waves from experimental data. (In preparation, Exp. 2025)
2. Z. T. Hilliard and M. Farazmand. Sequential data assimilation for PDEs using shape-morphing solutions. *Journal of Computational Physics*, vol. 533, pp. 113994, 2025 link
3. Z. T. Hilliard and M. Farazmand. Enforcing conserved quantities in Galerkin truncation and finite volume discretization. *Nonlinear Dynamics*, 112(16):14051–14069, 2024. link

## Presentations

**NCSU NSF Research Training Group Seminar** — Raleigh, NC
*Full State Estimation of Deep-Water Waves from Sparse Measurements: Predicting Rogue Waves from Experimental Data* — *April 2025*

**Illinois Institute of Technology MMAE Seminar** — Chicago, IL
*Sequential data assimilation for PDEs using shape-morphing solutions.* — *January 2025*

**NCSU NSF Research Training Group Seminar** — Raleigh, NC
*Shape-morphing solutions for PDEs with Conserved Quantities and Observational Data* — *September 2024*

**2nd IACM Mechanistic Machine Learning and Digital Engineering for Computational Science Engineering and Technology** — El Paso, TX
*Shape-morphing modes for solving PDES with conserved quantities* — *November 2023*

**SIAM Conference on Applications of Dynamical Systems (DS23)** — Portland, OR
*Enforcing conserved quantities in Galerkin truncation via Rons* — *May 2023*

**NCSU NSF Research Training Group Seminar** — Raleigh, NC
*Enforcing conserved quantities in Galerkin truncations* — *September 2022*

**Joint Mathematics Meeting** — Virtual
*Tail behavior and non-uniqueness of Quaternion-valued KdV 1-solitons* — *January 2021*

## Teaching

Adjunct Instructor, ILC Tutoring Center, Wake Technical Community College. — *Spring 2022-Fall 2022*

Teaching Assistant, Calculus II (MA 142), NCSU — *Spring 2022*

Teaching Assistant, Calculus III (MA 143), NCSU — *Fall 2021*

Instructor, College Algebra (MATH 110), CofC — *Spring 2021*

Instructor, College Algebra (MATH 110), CofC — *Fall 2020*

Teaching Assistant, College Algebra (MATH 110), CofC — *Spring 2020*

Teaching Assistant, Precalculus (MATH 111), CofC — *Fall 2019*

## Service

NCSU prospective students' weekend volunteer, February 2024

- Graduate student panelist: "Graduate student life at NCSU and in Raleigh"
- Research at NCSU presentations: "Shape-morphing solutions and data assimilation"
- Campus tour for prospective students

NCSU "Thursdays at the Bureau", department introductions to the dean of the College of Sciences, informal presentation: Shape-morphing modes and conserved quantities, October 2023

Session chair, SIAM DS23, CP30 Reduced-Order Nonlinear Models and Solutions, May 2023

## Skills

MatLab, Python, Mathematica, C++, Machine Learning