Nathan Willis

Curriculum Vitae

Department of AppliedMathematics
University of California, Merced
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nathan-willis.github.io

Research Interests

Applied Mathematics, Numerical Methods, Fluid Dynamics, Machine Learning and Equation Discovery

Employment

2022-present **Visiting Assistant Professor**, *University of California, Merced*, Merced, CA.

Education

2016–present **PhD in Mathematics**, *University of Utah*, Salt Lake City, UT. **GPA: 4.0** May 2022.
Advisor: Christel Hohenegger
Thesis: Confinement and Non-Newtonian Effects for Steady Streaming Flow and The Ice Fishing Problem with Surface Tension

2012-2016 **BS in Mathematics**, *University of Utah*, Salt Lake City, UT. **GPA: 3.492** May 2016.

Publications

N. Willis, C. H. Tan, C. Hohenegger, and B. Osting, High spots for the ice fishing problem with surface tension, *SIAM Journal on Applied Mathematics*, 82(4), 2022, pp. 1312-1335

N. Willis, C. Hohenegger, Quasi-three-dimensional viscous steady streaming in a rectangular channel past a cylinder, accepted to SIAM Journal on Applied Mathematics (June 2024)

N. Willis, F. Blanchette, Shallow-water simulations of colliding turbidity currents (in preparation)

Research Mentoring

2023-2024 Conor Olive
- Undergraduate applied math student at University of California, Merced

2019-2020 Emma Coates
- Undergraduate math student in ACCESS program at University of Utah

Teaching

Vector Calculus (MATH 023, University of California, Merced)
- Fall 2023, Fall 2024
- Taught two sections totaling 260 students. (Fall 2023)
- Managed 5 teaching assistants across 8 discussions. (Fall 2023)

Intermediate Differential Equations (MATH 125, University of California, Merced)
- Spring 2024

Linear Analysis 1 (MATH 141, University of California, Merced)
- Spring 2023

Differential Equations and Linear Algebra (MATH 2250, University of Utah)
- Summer 2023, Spring 2021 (flipped), Fall 2020 (flipped), Spring 2020, Spring 2018

Precalculus (MATH 1080, University of Utah)
- Spring 2019, Fall 2018

Calculus 1 (MATH 1210, University of Utah)
- Summer 2018, Summer 2017

Teaching Service

2021-2022 University Teaching Assistantship from the University of Utah
- Restructured the lab section of Differential Equations and Linear Algebra.
- Focused on problem-solving fluency, technical career skills, and programming in Python

2020-2021 Flipped Differential Equations and Linear Algebra (MATH 2250, University of Utah)
- Recorded lecture videos for the entire course for students to watch before lecture.
- Wrote lecture notes and daily worksheets for in class activities in collaboration with Chee Han Tan.

2019, 2020 TA training for incoming graduate students (University of Utah)
- Facilitated the TA training for incoming students in the math department.
- Presented on and led a discussion on *what it means to be a grad student* focusing on time management techniques and how to balance teaching and research expectations for new graduate students.
- Presented on and led a discussion on *interactive learning in the mathematics classroom*.

Talks

Nov. 2024 *Box model for colliding turbidity currents via equation discovery methods (upcoming)*
APS Division of Fluid Dynamics, Salt Lake City, Utah

Apr. 2024 *Shallow-water simulations of colliding turbidity currents*
Fluids in Yosemite, Yosemite National Park

Nov. 2023 *Shallow-water simulations of colliding turbidity currents*
APS Division of Fluid Dynamics, Washington D.C.

Feb. 2023 *Confinement and Non-Newtonian Effects for Steady Streaming Flow*
Energy and The Environment Seminar, University of California, Merced

Feb. 2022 *High Spots for the Ice-Fishing Problem with Surface Tension*
Applied Math Seminar, University of California, Merced

Nov. 2019 *Steady-State Streaming in Complex Fluids*
2nd Annual Meeting of the SIAM Texas Louisiana Section, Southern Methodist University

Mar. 2019 *Fun Fluid Facts*
Graduate Student Advisory Committee (GSAC) Colloquium, University of Utah

Mar. 2018 *Sloshing and the Two-Dimensional Ice-Fishing Problem*
Applied Math Collective Seminar, University of Utah

Computer Skills

Advanced Matlab, LaTeX, Python (Pandas, matplotlib, numpy),
Basic R, Unix, Git, Chebfun, Gurobi

Professional Affiliations

2023-present American Physical Society (APS)
2017-present Society for Industrial and Applied Mathematics (SIAM)
2016-present Mathematical Association of America (MAA)

Internships and Workshops

Summer 2020 NSF Mathematical Sciences Graduate Internship
US Army Corps of Engineers in Hanover, New Hampshire (completed virtually)
- Learned the fully nonlinear weakly irrotational Boussinesq-Type Equations and FUNWAVE-TVD (Fully Nonlinear Waves - Total Variation Diminising) model.
- Investigated inherent instabilities and possible corrections in the fully nonlinear weakly irrotational Boussinesq-Type Equations.

Summer 2019 IMA Math-To-Industry Boot Camp IV
University of Minnesota, Minneapolis, Minnesota
- Attended several mini-courses covering Python, statistic basics, R, stochastic modeling, optimization, Gurobi, and introduction to machine learning.
- Worked on a machine learning project posted by Kaggle on a team of 5.
- Modeled a time series analysis for Cargill Inc. on a team of 4 alongside a Cargill mentor.

Leadership and Service

Spring 2024 Reviewed journal article for Physical Review Fluids
Spring 2024 Co-organized Fluids in Yosemite Conference
Spring 2024 Co-organized Energy and the Environment Seminar
Spring 2023 Reviewed journal article for Physics of Fluids
2021-2022 GSAC mentor to Zhonggan Huang
2021-2022 Tutor for the Utah Refugee Center
Fall 2021 QSide Institute Datathon4Justice
Fall 2021 Participated in the University of Utah Math Modeling Workshop to prepare high school students for COMAP and SIAM M3 Challenge
2020-2021 GSAC mentor to Samantha Linn
2020-2021 GSAC mentor to Delaney Mosier
2020-2021 Vice President, University of Utah SIAM Student Chapter
Fall 2020 Directed Reading Program mentor to Payton Thomas
2019-2020 Organized Applied Math Collective Seminar
2018-2020 Secretary, University of Utah SIAM Student Chapter
Spring 2019 AWM graduate mentoring program
Fall 2018 Organized graduate student reading course on Sobolev Spaces, University of Utah
Apr. 2018 Initiated, organized, and hosted the first SIAM Wasatch Student Chapters Conference, University of Utah
Fall 2016 K-12 Science Fair Judge, Granite School District

Awards

Fall 2023 MAA Project NExT Fellow (green 2023 cohort)
Fall 2021 University of Utah University Teaching Assistantship
Summer 2020 University of Utah Department of Mathematics Summer Research Fellowship
May 2019 SIAM Student Chapter Certificate of Recognition
May 2018 Outstanding Graduate Student, University of Utah