Zachary M. Miksis

Department of Mathematics
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Research Interests

- Numerical partial differential equations
- Scientific machine learning
- Numerical analysis
- High-order shock-capturing methods, particularly WENO schemes
- Applications in neuroscience, computer vision, fluid dynamics, and others
- Computational efficiency in scientific applications

Professional Appointments

Temple University, Philadelphia, PA
Research Assistant Professor — July 2023 - Present
Mentor: Gillian Quiesser

University of Notre Dame, Notre Dame, IN
Postdoctoral Research Associate — August 2022 - June 2023
Mentors: Jonathan Hauenstein and Walter Scheirer

Los Alamos National Laboratory, Los Alamos, NM
Graduate Research Assistant — Summer 2019

Argonne National Laboratory, Lemont, IL
Graduate Research Aide — June 2015 - September 2017

Education

PhD, Applied and Computational Mathematics and Statistics — 2022
Minor: Computational Science & Engineering
University of Notre Dame, *Notre Dame, IN*
Advisor: Yong-Tao Zhang

MS, Applied and Computational Mathematics and Statistics — 2019
University of Notre Dame, *Notre Dame, IN*

MS, Applied Mathematics — 2017
Illinois Institute of Technology, *Chicago, IL*
Advisors: Xiaofan Li (IIT) and Aleksandr Obabko (ANL)

BS, Mathematics — 2014
Concentration: Operations Research
Minors: Statistics, Leadership Studies
University of Illinois Urbana-Champaign, *Champaign, IL*

Publications

Submitted

1. **Z.M. Miksis** and G. Queisser, *A New Fick-Jacobs Derivation with Applications to Computational Branched Diffusion Networks*, arXiv:2501.08247v2 [math.NA].

Journal

1. **Z.M. Miksis** and Y.-T. Zhang, *Sparse-grid implementation of fixed-point fast sweeping WENO schemes for eikonal equations*, Communications on Applied Mathematics and Computation **6**, 3-29 (2024).

Conference

1. **Z.M. Miksis** and G. Queisser, *A physics-informed neural network for coupled calcium dynamics in a cable neuron*, International Conference on Scientific Computing and Machine Learning 2024, Kyoto, Japan, March 2024.

Workshop

1. **Z.M. Miksis** and G. Queisser, *A physics-informed neural network for coupled calcium dynamics in a cable neuron*, ICLR 2024 Workshop on AI4DifferentialEquations in Science, Vienna, Austria, May 2024.

2. S. Abraham, J. Kinnison, **Z.M. Miksis**, D. Poster, S. You, J. D. Hauenstein, and W. Scheirer, *Efficient hyperparameter optimization for ATR using homotopy parametrization*, in Automatic Target Recognition XXXIII, R. I. Hammoud, T. L. Overman, and A. Mahalanobis, eds., vol. 12521, International Society for Optics and Photonics, SPIE, 2023, p. 1252107. [*Best Student Paper Award to S. Abraham*]

Software

1. *Neuro-VISOR v 2.5.0*. Virtual reality visualization tool for real-time simulations of electrical signaling in neurons. Available from `https://github.com/c2m2/Neuro-VISOR`. M. Prifti, B. Hugger, R. Chinomona, **Z.M. Miksis**, B. Seibold, and G. Queisser.

Theses

1. **Z.M. Miksis**, *Sparse-grid implementation of fixed-point fast sweeping WENO schemes for Eikonal equations*, PhD dissertation, University of Notre Dame, 2022.

2. **Z.M. Miksis**, *An Accelerating Couette Flow in Nek5000: Applications in Oceanography and Magnetohydrodynamics*, MS thesis, Illinois Institute of Technology, 2017.

Presentations

Invited Talks

1. *Advances In Efficient Computational Modeling of Transcranial Magnetic Stimulation Towards Clinical Application*, Multiscale Brain Modeling and Beyond: A Focus on Biological Tissues, University of Glasgow, Glasgow, SCT, June 2025.

2. *Sparse-grid fast sweeping WENO methods for eikonal equaitons*, Applied Mathematics and Scientific Computing Seminar, Temple University, Philadelphia, PA, August 2023.

3. *Numerical solutions to Hamilton-Jacobi equations on sparse grids and a Stokes problem variant with Nek5000*, Virtual presentation, Sandia National Laboratory, Albuquerque, NM, June 2022.

Contributed Talks

1. *Unlocking the Brain: Exploring Transcranial Magnetic Stimulation (TMS) Through Computational Modeling*, Graduate Symposium, Temple University, Philadelphia, PA, April 2025.

2. *A New Fick-Jacobs Derivation with Applications to Computational Diffusion Networks*, Mid-Atlantic Numerical Analysis Day, Temple University, Philadelpia, PA, November 2024.

3. *A New Fick-Jacobs Derivation with Applications to Computational Diffusion Networks*, 2^{nd} Annual SIAM-NNP Meeting, Rochester Institute of Technology, Rochester, NY, November 2024.

4. *A New Convergent Fick-Jacobs Derivation: Applications in Computational Neurophysiology*, Sayas Numerics Day, George Mason University, Arlington, VA, May 2024.

5. *A Cross-Species Computational Study of rTMS Protocol Effects on Calcium Dynamics*, 1^{st} Annual SIAM-NNP Meeting, New Jersey Institute of Technology, Newark, NJ, October 2023.

6. *Parallel implementation of a sparse grid fast sweeping WENO method for Eikonal equations*, Midwest Numerical Analysis Day, University of Michigan, Ann Arbor, MI, May 2022.
7. *A sparse grid fast sweeping WENO method for Eikonal equations*, Midwest Numerical Analysis Day, Missouri University of Science and Technology, Rolla, MO, October 2021.
8. *An accelerating Couette flow with MHD in Nek5000*, Summer Argonne Student Symposium, Argonne National Laboratory, Lemont, IL, August 2016.
9. *MHD with Nek5000*, Nek5000 Users and Developers Meeting, Massachusetts Institute of Technology, Cambridge, MA, August 2016.
10. *Verification of a Stokes problem variant*, Graduate Student Colloqium, Illinois Institute of Technology, Chicago, IL, March 2016.

Posters

1. **Z.M. Miksis** and G. Queisser, *Towards Simulating rTMS Induced Calcium Dynamics at Clinically Relevant Timescales with Neural Networks*, 2024 CRCNS PI Meeting, University of Minnesota, Minneapolis, MN, August 2024.
2. **Z.M. Miksis** and G. Queisser, *A physics-informed neural network for coupled calcium dynamics in a cable neuron*, ICLR 2024 Workshop on AI4DifferentialEquations in Science, Vienna, Austria, May 2024.
3. **Z.M. Miksis** and G. Queisser, *A physics-informed neural network for coupled calcium dynamics in a cable neuron*, International Conference on Scientific Computing and Machine Learning 2024, Kyoto, Japan, March 2024.

Professional Affiliations & Service

Department of Energy, Office of Science, Grant reviewer

Society for Industrial and Applied Mathematics (SIAM)

Previous Positions

ACMS Graduate Student Organization, Vice President: Dec. 2017 - June 2019

Teaching

Temple University, Philadelphia, PA
Department of Mathematics
MATH 3042: Numerical Analysis I (Fall 2024, Fall 2025)
MATH 1042: Calculus II (Spring 2025)
MATH 1041: Calculus I (Spring 2024, Fall 2023)

University of Notre Dame, Notre Dame, IN
Department of Applied and Computational Mathematics and Statistics
ACMS 10145: Statistics for Business (Spring 2020, Summer 2021)

Northwestern University, Evanston, IL
School of Professional Studies
MATH 220: Differential Calculus of One-Variable Functions (Summer 2017)

Teaching Assistant

University of Notre Dame, Notre Dame, IN
Department of Applied and Computational Mathematics and Statistics
Applied Linear Algebra (Fall 2017 and Spring 2018), Mathematical Modeling (Spring 2018), Scientific Computing (Fall 2018, Fall 2019, Fall 2020), Advanced Scientific Computing (Fall 2019), Artificial Neural Networks (Spring 2021), Numerical Analysis II: Numerical PDEs (Spring 2021), Statistics for Life Sciences (Fall 2021), Numerical Analysis I: Numerical ODEs and Linear Algebra (Fall 2021, Spring 2022), Intro to Stochastic Modeling (Spring 2022)

Pedagogical Training

Pedagogy & Practice in the College Classroom, University of Notre Dame, 2020

ACMS Teaching Seminar, University of Notre Dame, 2018

Department of Applied Mathematics TA Training, Illinois Institute of Technology, 2016

Awards & Scholarships

NSF Graduate Student Travel Support ($1,000) Oct. 2021
Missouri University of Science & Technology NSF grant DMS-2023264 for MWNADay 2021

Graduate Student Professional Development Award ($500) Oct. 2021
ACMS Department at the University of Notre Dame for MWNADay 2021

Graduate Student Professional Development Award ($500) Aug. 2018
ACMS Department at the University of Notre Dame for ICERM Topical Workshop

GRE Graduate Scholarship ($8,000) Aug. 2015
Department of Applied Mathematics at IIT