

## Research interests

**Fast algorithms for singular integral equations; GPU-accelerated scientific computing; Physics based simulation; Vortex methods for fluid–structure interaction.**

## Publications

- 2025 **Falling plates with leading edge separation**,  
*Physical Review Fluids* (10), “Editor’s Suggestion”,
- Developed a numerical framework using specialized quadrature and regularization that enables stable, continuous leading-edge vortex shedding in inviscid simulations.
  - Simulated fluttering and tumbling dynamics previously inaccessible to such models and predicted a flutter–tumble transition consistent with experiments and viscous simulations.
- Joint work with Silas Alben
- 2025 **Hölder regularity of the  $\bar{\partial}$ -equation on the polydisc**,  
*Complex Variables and Elliptic Equations*,
- Solved a classical open problem on Hölder-regular solution operators for  $\bar{\partial}$  in product domains and obtained optimal estimates for the singular integral solution operator.
- Joint work with Alexander Tumanov

## Selected computational projects

- 2024 **GPU accelerated entropic lattice Boltzmann solver with mixed precision (C++/CUDA)**, [Link to code](#),
- Implemented a 2D entropic LBM solver in CUDA/C++, with mixed-precision (FP16/FP64) arithmetic to balance stability and GPU throughput.
  - Designed GPU kernels for collision, streaming, precision conversion, and computing the entropic relaxation factor.
  - $\approx 500\times$  speed up from serial for moderate problem sizes.
  - Demonstrated  $\mathcal{O}(N)$  scaling with problem size on GPU.

## Computational skills

**Languages and frameworks :** C++, Python, Julia, Matlab, JAX.

**Parallel computing :** CUDA, MPI, OpenMP.

## Preprints and ongoing work

- 2025 **Tensor-train accelerated  $\mathcal{O}(N)$  vortex summation without tree structures**,  
*Manuscript in preparation*, (Submission planned Spring 2026),
- Developed a tensor-train-accelerated  $\mathcal{O}(N)$  vortex summation method independent of particle positions, providing a tree-free alternative to tree-codes and FMM.
- Joint work with Shravan Veerapaneni

- 2025 **Viscid and inviscid leading-edge vortex shedding from a zero-thickness plate**,  
*Manuscript in preparation*, (Submission planned Spring 2026),  
• A systematic comparison of our inviscid model with direct Navier Stokes simulation.  
Joint work with Silas Alben

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## Education

- 2022– **Ph.D. in Mathematics and scientific computing**,  
*University of Michigan, Ann Arbor*, GPA: 4.00.  
Advisor: Silas Alben  
Expected graduation: May 2027
- 2019–2022 **BSc. Mathematics**, *Summa cum laude with highest distinction in mathematics*  
*University of Illinois, Urbana-Champaign*, GPA: 4.00.  
Advisor: Alexander Tumanov

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## Awards and Fellowships

- 2025 **Rackham dissertation fellowship**, *University of Michigan*,  
Competitive dissertation fellowship supporting full-time research for a semester during the final years of the Ph.D..
- 2022 **Roy H. Brahana prize**, *University of Illinois at Urbana-Champaign*,  
Awarded to the student with the most exceptional undergraduate mathematics career.
- 2021 **Elizabeth R. Bennet scholarship**, *University of Illinois at Urbana-Champaign*,  
Awarded for academic excellence in mathematics.

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## Talks and conferences

- 2025 **DisCoVor 2025**, (*Accepted Talk*), “Leading edge vortex shedding induces fluttering and tumbling in falling plates”.
- 2025 **G2S3 2025**, (*Summer school*), Gene Golub SIAM summer school in pattern formation.

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## Professional service

- 2024– **Reviewer**, *Journal of Fluid Mechanics*, 4 manuscripts.

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## Teaching experience

- 2022– **Graduate student instructor**, *University of Michigan, Ann Arbor*,  
Calculus I-II; Differential equations.
- 2021–2022 **Advanced course grader**, *University of Illinois at Urbana-Champaign*,  
Honors category theory.