

Yu Jun Loo

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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

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

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.

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.

Professional service

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

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.