Sze Chai Leung (Mickey)

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EDUCATION

California Institute of Technology (Caltech) September 2022 - present
Ph.D. Candidate in Mechanical Engineering
M.S. in Mechanical Engineering (June 2024)

- Research Advisor: H. Jane Bae, Assistant Professor of Aerospace
- Primary Research Topic: Data-Driven Flow Control and Sensing of Airfoils in Turbulent Gusts

University of Illinois at Urbana-Champaign (UIUC) August 2018 - May 2022
B.S. in Mechanical Engineering with a Minor in Computer Science

- **GPA:** 3.98/4.00

PUBLICATIONS & PREPRINTS

1. **Leung, S. C.**, Zhou, D., & Bae, H. J. (2025). Smart sensor placement: a correlation-aware attribution framework (CAAF) for Real-world Data Modeling. *Under review at Communications AI & Computing*. https://arxiv.org/abs/2510.22517
2. Liu-Schiaffini, M., Singer, C. E., Kovachki, N., **Leung, S. C.**, Schneider, T., Bae, H. J., Azizzadenesheli, K., & Anandkumar, A. (2025). Tipping point forecasting in non-stationary dynamics on function spaces. *Under review at Proceedings of the National Academy of Sciences (PNAS)*. https://arxiv.org/abs/2308.08794
3. Huang, X., **Leung, S. C.**, & Bae, H. J. (2026). Consistency requirement of data-driven subgrid-scale modeling in large-eddy simulation. *Physical Review Fluids*, 11(1), 014602. https://doi.org/10.1103/yykb-6rvf
4. **Leung, S. C.**, Zhou, D., & Bae, H. J. (2024). Integrated gradients for optimal surface pressure sensor placement for lift prediction of an airfoil subject to gust. *AIAA Aviation Forum and ASCEND 2024* (p. 4148). https://doi.org/10.2514/6.2024-4148
5. Huang, X., **Leung, S. C.**, Whitmore, M. P., Elnahhas, A., & Bae, H. J. (2024). Consistent data-driven subgrid-scale model development for large-eddy simulation. *Proceedings of the Summer Program (pp. 395–404).* Center for Turbulence Research, Stanford University. https://web.stanford.edu/group/ctr/ctrsp24/v04_HUANG.pdf
6. Ha, J., Kim, Y. S., Li, C., Hwang, J., **Leung, S. C.**, Siu, R., & Tawfick, S. (2023). Polymorphic display and texture integrated systems controlled by capillarity. *Science Advances*, *9*(26), eadh1321. https://doi.org/10.1126/sciadv.adh132

RESEARCH EXPERIENCE

Bae Research Group (https://bae.caltech.edu/) Pasadena, CA
Graduate Research Assistant September 2022 – present
Advisor: H. Jane Bae, Assistant Professor of Aerospace

Project 1: Data-driven Flow Control and Sensing for Airfoils in Gusty Conditions Using Large-Eddy Simulations (LES)

- Applied deep reinforcement learning to design onboard active control strategies for mitigating lift fluctuations on UAVs in gusty conditions
- Proposed a machine learning-based attribution framework to optimize sensor placement for predictions of quantities of interest across real-world dynamical systems
- Conducted LES of cylinder–airfoil geometries to explore blowing and suction actuation mechanisms

Project 2: Consistent Data-driven Subgrid-scale (SGS) Model Development for LES

- Developed SGS stress models via sparse regression coupled with a neural network to correct residuals and numerical errors, enhancing LES accuracy.

Ewoldt Research Group (https://ewoldt.mechanical.illinois.edu/) Urbana, IL
Undergraduate Research Assistant May 2021 – July 2022
Advisor: Randy H. Ewoldt, Alexander Rankin Professor
Software Development for Training Neural Networks to Learn the Constitutive Model of Non-Newtonian Fluids

- Formulated and fine-tuned neural network architectures to learn rheological constitutive models from simulated non-viscometric flow fields

Kinetic Materials Research Group (https://tawfick.mechse.illinois.edu/) Urbana, IL
Undergraduate Research Assistant May 2021 – October 2021
Advisor: Sameh Tawfick, Professor; Ralph A. Andersen Faculty Scholar
Experimenting and Modeling of the Single-fin Elastocapillary Behavior

- Conducted experiments and modeling of polymer-elastocapillary morphing with single- and multi-fin geometries under varying drain rates and feature dimensions
- Designed and fabricated 3D-printed molds and polymer samples with high-aspect-ratio fins

WORK EXPERIENCE

Department of Mechanical and Civil Engineering, Caltech Pasadena, CA
Graduate Teaching Assistant, Fluid Mechanics September 2023 – December 2023

- Led review lectures and held office hours to support student learning
- Assisted in preparing and grading homework assignments and exams

Mindray Medical International Limited Shenzhen, China
Mechanical Development Engineering Intern June 2020 - August 2020

- Led the design project of a single-person loading device for more convenient transportation of ultrasound machines
- Conducted mechanical testing on ultrasound prototypes and constructed engineering drawings

CONFERENCE PRESENTATIONS

1. **Leung, S. C.**, Zhou, D., & Bae, H. J. (2025). Optimizing sensor placement in turbulent flows: a correlation-aware attribution framework. *The 78th Annual Meeting of the APS Division of Fluid Dynamics*.
2. **Leung, S. C.**, Zhou, D., & Bae, H. J. (2024). Integrated gradients for optimal surface pressure sensor placement for lift prediction of an airfoil subject to gust. *AIAA Aviation Forum and ASCEND 2024.*
3. Huang, X., **Leung, S. C.**, & Bae, H. J. (2024). Numerical error of explicitly filtered large-eddy simulation for consistent data-driven modeling. *The 77th Annual Meeting of the APS Division of Fluid Dynamics*.

SKILLS

- Python, Fortran, MATLAB, C/C++, JavaScript and Java programming
- High-fidelity numerical simulations, parallel computing on HPCs, mesh generation
- ProE/Creo, Solidworks and Fusion 360 modeling
- Media editing with OriginLab, Adobe Premiere, Illustrator and Photoshop
- Fluent in English, Mandarin, and Cantonese