

Sangjoon “Joon” Lee, Ph.D.

CTR Postdoctoral Fellow at Stanford University

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EDUCATION

University of California, Berkeley – Berkeley, CA, United States	2019/08 - 2024/08
Ph.D. / M.S. in <i>Mechanical Engineering</i>	
• Designated emphasis: <i>Computational and Data Science and Engineering</i>	
Seoul National University – Seoul, South Korea	2012/03 - 2018/08

B.S. in *Mechanical and Aerospace Engineering & B.B.A. (Bachelor of Business Administration)*

- Honors: *Summa Cum Laude*

Seoul Science High School – Seoul, South Korea

2009/03 - 2012/02

RESEARCH EXPERIENCE

Postdoctoral Fellow , Stanford University Center for Turbulence Research (CTR) (<i>Faculty Sponsor: Dr. B. J. McKeon</i>)	2024/10 -
• Advanced analysis for physical insights into turbulence and related phenomena	
Graduate Student Researcher , University of California, Berkeley Computational Fluid Dynamics (CFD) Lab (<i>Advisor: Dr. P. S. Marcus</i>)	2020/01 - 2024/08
• Numerical examination of destabilizing aircraft wake vortices using both linear and non-linear analyses in association with spectral collocation methods	
• Data-driven topology optimization of hydro-/aerodynamic designs based on the Design-by-Morphing (DbM) technique	
Researcher , Seoul National University Energy & Environmental Flow Lab (<i>Director: Dr. W. Hwang</i>)	2017/07 - 2018/08
• Development of conjugate heat transfer codes analyzing heat convection and conduction simultaneously with an efficient interpolation scheme for thermal properties	
• Turbulent channel flow visualization via magnetic resonance velocimetry supplemented with large eddy simulations	
Research Intern , Seoul National University Turbulence, Flow Control & CFD Lab (<i>Director: Dr. H. Choi</i>)	2016/09 - 2017/12
• Large eddy simulations of flow around a small rotating vertical axis wind turbine	

RESEARCH INTERESTS

Thermofluids – High-Fidelity CFD coupled with AI/ML for Cost-Efficient, Physics-Based Optimization

- Pioneering new engineering designs in turbulent fluid and thermal systems through high performance computing and physically grounded data-driven techniques
- Advancing the understanding of flow physics for sustainability across multiple scales, from heat exchanger condensation and HVAC systems to turbines, aircraft, and contrails

GRANTS	NSF ACCESS Allocation: PHY250071 ACCESS by the U.S. National Science Foundation (NSF) <i>PI · 1,500,000 HPC core-hours</i> <ul style="list-style-type: none">• Surface topology optimization for thermally-efficient dropwise condensation	2025/03 - 2026/02
FELLOWSHIPS	CTR Postdoctoral Fellowship (\$100,000) Center for Turbulence Research (CTR) at Stanford University	2024/10 - 2025/12
	Departmental Graduate Fellowship (\$23,825) College of Engineering at the University of California, Berkeley	2023/08 - 2023/12
	Iiju Overseas Ph.D. Scholarship (\$120,000), Study Abroad Doctoral Program Iiju Academy & Culture Foundation <ul style="list-style-type: none">• Merit-based; selected as one of six recipients in 2019	2019/08 - 2023/07
	National Scholarship for Science and Engineering (Full-tuition) Korea Student Aid Foundation (KOSAF)	2012/03 - 2017/12
HONORS & AWARDS	Outstanding Graduate Student Instructor (OGSI) Award GSI Teaching & Resource Center at the University of California, Berkeley	2021
	Representative of the Engineering Class of 2018 , 72nd Summer Commencement Seoul National University	2018
	Student Paper Award: Bronze , 9th National Fluid Engineering Contest for Undergraduates Fluid Engineering Division of the Korean Society of Mechanical Engineers	2017
TEACHING & TUTORING	Teaching Assistant , University of California, Berkeley Introduction to Computer Programming for Scientists and Engineers (ENGIN 7)	2024 Sp
	Course Designer / Graduate Student Instructor , University of California, Berkeley Introduction to Aerospace Engineering Design (AERO ENG 10)	2022 Fa - 2023 Sp
	Graduate Student Instructor , University of California, Berkeley Experimentation and Measurements (MEC ENG 103)	2019 Fa - 2022 Sp
	Undergraduate Tutor , Seoul National University Basic Calculus 1, 2 & Basic Physics 1 (007.098A, 102 & 099A)	2013 Sp - 2013 Fa
PROFESSIONAL SERVICE	Peer Reviewer <ul style="list-style-type: none">• <i>Physics of Fluids</i> (AIP Publishing)• <i>Journal of Fluid Mechanics</i> (Cambridge University Press)	2024 - 2025 -
COMMUNITY OUTREACH	Stanford seeME & CTR² , Stanford University Volunteer (Teaching, Photographing & On-day Assistance) <ul style="list-style-type: none">• On-campus hands-on classes for young students to learn various aspects of engineering	2025
	SNU Tomorrow's Engineers Membership , Seoul National University Member & Head Manager <ul style="list-style-type: none">• Annual <i>Vision Mentoring</i> events for high school students interested in engineering and science	2016 - 2018

REFEREED
PUBLICATIONS

* corresponding
† co-first

1. Hong, J., Lee, S.[†], Lee, D., Bae, J. & Hwang, W. (2026). **Experimental and Numerical Investigation of 3D Flow Structures in a Turbulent Channel Flow with Ripples**, In Preparation.
2. Lee, S., Nasr, A., Yıldızdağ, M. E. & Sheikh, H. M. (2026). **Topology Optimization of Dimpled Surfaces**. In Preparation.
3. Jung, J., Lee, S. & Gu, G. X. (2026). **Data-Driven Optimization of Novel Morphing Airfoil Designs for Enhanced Flutter Control**, In Preparation.
4. Duarte, C., Raftery, P., Lee, S., & Solmaz, A. S. (2026). **Effect of Elevated Air Movement on Radiant Cooling Systems**. *Journal of Building Performance Simulation*, Under Review.
5. Lee, S. & Sheikh, H. M. (2026). **Airfoil Optimization using Design-by-Morphing with Minimized Design-Space Dimensionality**. *Journal of Computational Design and Engineering*, <https://doi.org/10.1093/jcde/qwaf124>
6. Lee, S., Song, H., & Lele, S. K. (2025). **Global Stability Analysis for Multidimensional Flow using an Augmented State Vector Formulation**. In B. J. McKeon & P. Moin (Eds.), *Annual Research Briefs 2025*. Center for Turbulence Research, Stanford University.
7. Lee, S., Vijay, S. (2025). **Topology-Aware Permeability Modeling in Structured Porous Media for Passive Flow Control**. In B. J. McKeon & P. Moin (Eds.) *Annual Research Briefs 2025*. Center for Turbulence Research, Stanford University.
8. Lee, S., & Marcus, P. S. (2025). **Transient Growth of a Wake Vortex and its Initiation via Inertial Particles**. *Journal of Fluid Mechanics*, 1014, A16, <https://doi.org/10.1017/jfm.2025.253>.
9. Lee, S., Baek, S., Ryu, J., Song, M. & Hwang, W. (2025). **Flow in Ribbed Cooling Channels with Additive Manufacturing-Induced Surface Roughness**. *Physics of Fluids*, 37(6), 065118. <https://doi.org/10.1063/5.0268180>.
10. Lee, S.^{*}, Sheikh, H. M., Lim, D. D., Gu, G. X., & Marcus, P. S. (2024). **Bayesian-Optimized Riblet Surface Design for Turbulent Drag Reduction via Design-by-Morphing with Large Eddy Simulation**. *Journal of Mechanical Design*, 146(8), 081701. <https://doi.org/10.1115/1.4064413>.
11. Lee, S., & Marcus, P. S. (2023). **Linear Stability Analysis of Wake Vortices by a Spectral Method Using Mapped Legendre Functions**. *Journal of Fluid Mechanics*, 967, A2. <https://doi.org/10.1017/jfm.2023.455>.
12. Sheikh, H. M., Lee, S.[†], Wang, J. & Marcus, P. S. (2023). **Airfoil Optimization using Design-by-Morphing**. *Journal of Computational Design and Engineering*, 10 (4), 1443-1459. <https://doi.org/10.1093/jcde/qwad059>.
13. Lee, S., & Hwang, W. (2019). **Development of an Efficient Immersed-Boundary Method with Subgrid-Scale Models for Conjugate Heat Transfer Analysis using Large Eddy Simulation**. *International Journal of Heat and Mass Transfer*, 134, 198-208. <https://doi.org/10.1016/j.ijheatmasstransfer.2019.01.019>.
14. Baek, S., Lee, S., Hwang, W., & Park, J. S. (2019). **Experimental and Numerical Investigation of the Flow in a Trailing Edge Ribbed Internal Cooling Passage**. *Journal of Turbomachinery*, 141 (1), 011012. <https://doi.org/10.1115/1.4041868>.

PREPRINTS

1. Wang, J., Lee, S., & Marcus, P. S. (2024). **Triadic Resonance in Columnar Vortices**. *arXiv Preprint*. <https://doi.org/10.48550/arXiv.2402.05287>.

1. Park, J., **Lee, S.**, Li, J. & Schiavon, S. (2026, May 18-22). **A Simulation Study on Condensation Risk in Radiant Cooling Panels with Elevated Airflow.** 12th International Conference on Indoor Air Quality, Ventilation & Energy Conservation in Buildings , Los Angeles, CA, United States. IAQVEC Association.
2. **Lee, S.**, & Vijay, S. (2025, Nov 23-25). **Topological Design of Porous Structures for Flow Control: A Design-by-Morphing Approach.** 78th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Houston, TX, United States (no. J32.3). American Physical Society.
3. Hong, J., **Lee, S.**, Lee, D., Bae, J. & Hwang, W. (2025, Sep 15-19). **Experimental and Numerical Investigation of 3D Flow Structures in a Turbulent Channel Flow with Riblets.** 16th International Symposium on Experimental and Computational Aerothermodynamics of Internal Flows (ISAIF), Prague, Czech Republic (no. C7.1). Institute of Thermomechanics, Czech Academy of Sciences.
4. **Lee, S.**, Wang, J. & Marcus, P. S. (2024, Nov 24-26). **Modernized and Parallelized Mapped Legendre Spectral Method Code for Unbounded Vortical Flow Simulations.** 77th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Salt Lake City, UT, United States (no. L16.7). American Physical Society.
5. Wang, J., **Lee, S.** & Marcus, P. S. (2024, Nov 24-26). **Stability Analysis of the Q-Vortex: Critical Swirling Parameter Determination via Perturbation Theories and Resonant Triadic Perturbations in the Sub-Critical Region.** 77th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Salt Lake City, UT, United States (no. J38.5). American Physical Society.
6. **Lee, S.**, & Marcus, P. S. (2024, Aug 25-30). **Particle-Initiated Transient Growth of a Wake Vortex in Consideration of Condensation Trails.** 26th International Congress of Theoretical and Applied Mechanics (ICTAM), Daegu, South Korea (pp. 2009-2010). International Union of Theoretical and Applied Mechanics.
7. **Lee, S.**, & Marcus, P. S. (2023, Nov 19-21). **Investigation of Triggering Vortex Instabilities with Inertial Particles.** 76th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Washington, DC, United States (no. ZC38.5). American Physical Society.
8. Wang, J., **Lee, S.**, & Marcus, P. S. (2023, Nov 19-21). **Three-Wave Resonance in Neutrally Stable Wake Vortices.** 76th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Washington, DC, United States (no. ZC38.2). American Physical Society.
9. **Lee, S.**, & Marcus, P. S. (2022, Nov 20-22). **Viscous Perturbation to Inviscid Wake Vortices - Perturbation Theory in Vortex Stability.** 75th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Indianapolis, IN, United States (no. Q11.7). American Physical Society.
10. Marcus, P. S., Wang, J. & **Lee, S.** (2022, Nov 20-22). **A General Framework for Destabilizing Neutrally-Stable Flows Applied to Aircraft Wake Vortices.** 75th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Indianapolis, IN, United States (no. L18.1). American Physical Society.
11. **Lee, S.**, & Marcus, P. S. (2021, Nov 21-23). **Linear Instability Analysis of Wake Vortices by a Spectral Method using Mapped Legendre Functions.** 74th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Phoenix, AZ, United States (no. E24.1). American Physical Society.
12. Wang, J., **Lee, S.**, & Marcus, P. S. (2021, Nov 21-23). **Destabilizing Neutrally Stable Wake Vortices Using Degenerate Eigenmodes.** 74th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Phoenix, AZ, United States (no. E24.3). American Physical Society.

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- 13. Lee, S., & Hwang, W. (2018, Jul 4-6). **Validation of a Conjugate Heat Transfer Code with Subgrid-scale Models for Turbulent Flow**. KSFM 2018 Summer Conference, Jeju, South Korea (pp. 197-198). Korean Society for Fluid Machinery.
 - 14. Baek, S., Lee, S., Hwang, W. & Park, J. S. (2018, Jun 11-15). **Experimental and Numerical Investigation of the Flow in a Trailing Edge Ribbed Internal Cooling Passage**. ASME 2018 Turbo Expo: Turbomachinery Technical Conference and Exposition, Lillestrøm, Norway (no. GT2018-76741). American Society of Mechanical Engineers. <https://doi.org/10.1115/GT2018-76741>. *Journal-Quality Appraisal and Transferred to J. Turbomach.*
 - 15. Lee, S. (2017, Nov 1-3). **2D Simulation of an Unsteady Flow around a Small Vertical Axis Wind Turbine Using an Immersed Boundary Method**. KSME 2017 Annual Conference, Jeju, South Korea (pp. 741-745). Korean Society of Mechanical Engineers. *Student Paper Award: Bronze.*
 - 16. Baek, S., Lee, S. & Hwang, W. (2017, Nov 1-3). **Investigation of Fully Developed Turbulent Pipe Flow Using Magnetic Resonance Velocimetry (MRV) and Large Eddy Simulation (LES)**. KSME 2017 Annual Conference, Jeju, South Korea (pp. 581-583). Korean Society of Mechanical Engineers.

INVITED
TALKS &
SEMINARS

- 1. Lee, S. (2025, Aug 19). **Topology Optimization of Complex Nonlinear Systems Using High-Performance Simulations and Data-Driven Approaches**. GTR Technical Research Society Seminar, Suwon, South Korea. Global Technology Research, Samsung Electronics.
- 2. Lee, S. (2025, Jan 10). **Unmasking Hidden Physics and Bridging Data Sparsity: Two Paths to Tackling Fluid Problems**. CTR Tea Seminar, Stanford, CA, United States. Center for Turbulence Research, Stanford University.
- 3. Lee, S. (2024, Sep 10). **Physics-Based Computation in the Modern Era of Data-Driven Fluid Mechanics**. SNU Mechanical Engineering Seminar, Seoul, South Korea. Department of Mechanical Engineering, Seoul National University.
- 4. Lee, S. (2023, Aug 8). **Design-by-Morphing (DbM): A Novel Design Methodology for Aerodynamic Optimization**. 2023 Hyundai Vision Conference, Seoul, South Korea. Hyundai Motor Company.
- 5. Lee, S. (2022, Nov 16). **Modern Applications of Computational Fluid Dynamics (CFD)**. 2022 Online Special Lecture Series: Research Reinforcement for Sustainable Buildings and Urban Systems in Future, Online. Department of Architectural and Urban Systems Engineering, Ewha Womans University.
- 6. Lee, S. (2018, Aug 8). **An Introduction to In-House LES - Applications to Turbine Internal Cooling and Recent Improvements for Conjugate Heat Transfer Analysis**. KARI Computational Fluid Dynamics Seminar, Daejeon, South Korea. Korea Aerospace Research Institute.

SOFTWARE &
CODES

- 1. Lee, S., Wang, J. (2025). **MLegS: Modernized and Parallelized Mapped Legendre Spectral Method Code** (v1.0.2). <https://github.com/ucbCFD/MLegS>.
- 2. Lee, S. (2025). **roughSurfaceGen: Artificial Rough Surface Generator that Fits Prescribed Surface Roughness Parameters** (v1.0.1). <https://github.com/jun9303/roughSurfaceGen>.

DISSERTATION

- 1. Lee, S. (2024). **Linear Stability of a Wake Vortex and its Transient Growth: Numerical Analysis in Light of Critical-Layer Eigenmodes and Spectra** (Publication No. 31483920) [PhD Dissertation, University of California, Berkeley]. *ProQuest Dissertations & Theses*.