


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 *Mechanical Engineering*

- Designated emphasis: *Computational and Data Science and Engineering*

Seoul National University – Seoul, South Korea

2012/03 - 2018/08

B.S. in *Mechanical and Aerospace Engineering &*

(involving 21-month military leave)

B.B.A. (Bachelor of *Business Administration*)

- Honors: *Summa Cum Laude*

RESEARCH EXPERIENCE

Postdoctoral Fellow, Stanford University 2024/10 -

Center for Turbulence Research (CTR) (*Faculty Sponsor: Dr. B. J. McKeon*)

- Advanced analysis for physical insights into turbulence and related phenomena

Graduate Student Researcher, University of California, Berkeley

2020/01 - 2024/08

Computational Fluid Dynamics (CFD) Lab (*Advisor: Dr. P. S. Marcus*)

- 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

2017/07 - 2018/08

Energy & Environmental Flow Lab (*Director: Dr. W. Hwang*)

- 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

2016/09 - 2017/12

Turbulence, Flow Control & CFD Lab (*Director: Dr. H. Choi*)

- Large eddy simulations of flow around a small rotating vertical axis wind turbine

RESEARCH INTERESTS

Fluid Mechanics – *High-Fidelity CFD with ML for Cost-Efficient, Physics-Based Fluid System Optimization*

- Modeling and analyzing fundamental fluid instabilities and turbulent phenomena
- Pioneering new designs in nonlinear aero-/hydrodynamic systems through high-performance computing and physically reliable data-driven techniques
- Advancing flow solutions with respect to sustainability and clean environment, across scales (from droplet condensation to wind/gas turbines to aircraft contrails)

1. Hong, J., Lee, S.[†], Lee, D., Bae, J. & Hwang, W. (2025). **Experimental and Numerical Investigation of 3D Flow Structures in a Turbulent Channel Flow with Riblets**, In Preparation.
2. Lee, S. & Shilpa, V. (2025). **Structured Porous Media Design and its Application to Passive Wall-Bounded Turbulence Control**. In Preparation.
3. Jung, J., Lee, S. & Gu, G. X. (2025). **Data-Driven Optimization of Novel Morphing Airfoil Designs for Enhanced Flutter Control**, In Preparation.
4. Duarte Roa, C., Raftery, P., Lee, S., & Solmaz, A. S. (2025). **Effect of Elevated Air Movement on Radiant Cooling Systems**. *Journal of Building Performance Simulation*, In Preparation.
5. Lee, S. & Sheikh, H. M. (2025). **Airfoil Optimization using Design-by-Morphing with Minimized Design-Space Dimensionality**. *Journal of Computational Design and Engineering*, Submitted.
6. Lee, S., & Marcus, P. S. (2025). **Transient Growth of a Wake Vortex and its Initiation via Inertial Particles**. *Journal of Fluid Mechanics*, 1014, A16, doi:10.1017/jfm.2025.253.
7. 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. doi:10.1063/5.0268180.
8. Wang, J., Lee, S., & Marcus, P. S. (2024). **Triadic Resonance in Columnar Vortices**. *arXiv Preprint*. doi:10.48550/arXiv.2402.05287.
9. 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. doi:10.1115/1.4064413.
10. 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. doi:10.1017/jfm.2023.455.
11. 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. doi:10.1093/jcde/qwad059.
12. 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. doi:10.1016/j.ijheatmasstransfer.2019.01.019.
13. 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. doi:10.1115/1.4041868.

1. 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. N/A). American Physical Society.
2. 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. Institute of Thermomechanics, Czech Academy of Sciences.

3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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.
9. 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.
10. 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.
11. 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.
12. 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.
13. 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. [doi:10.1115/GT2018-76741](https://doi.org/10.1115/GT2018-76741). *Journal-Quality Appraisal and Transferred to J. Turbomach.*
14. 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.*
15. 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.

1. Lee, S. (2025, Aug 19). **Topology Optimization of Complex Nonlinear Systems Using High-Performance Simulations and Data-Driven Approaches**. GTR Research Association 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.

1. Lee, S. (2025). **roughSurfaceGen: Artificial Rough Surface Generator that Fits Prescribed Surface Roughness Parameters** (v1.0.1). <https://github.com/jun9303/roughSurfaceGen>.
2. Lee, S., Wang, J. (2024). **MLegS: Modernized and Parallelized Mapped Legendre Spectral Method Code** (v1.0.1). <https://github.com/ucbCFD/MLegS>. [doi:10.5281/zenodo.14976470](https://doi.org/10.5281/zenodo.14976470).