SANGJOON (JOON) LEE

Ph.D. Candidate at University of California, Berkeley

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EDUCATION

University of California, Berkeley – Berkeley, California, United States — Aug. 2019 - Jul. 2024 (Exp.)
Ph.D., Mechanical Engineering (Advisor: Dr. Philip S. Marcus)
M.S., Mechanical Engineering

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

Seoul National University – Seoul, South Korea — Mar. 2012 - Aug. 2018
** 2-year leave of absence for military service*
B.S., Mechanical & Aerospace Engineering
B.B.A., Business Administration

- Graduation representative of the Engineering Class of 2018 (*Summa cum laude*)

RESEARCH INTERESTS

Fluid Mechanics (Emphasis in CFD), Computational Science & Environmental Flows

- Modeling, computing and analyzing instabilities and turbulent motions in hydro-/aerodynamic flows (e.g., wake vortices) with concurrent scalar transfers
- Investigating environmental flow problems pertaining to sustainable energy (e.g., wind/gas turbines) and clean ocean/atmosphere (e.g., micro-particles & multi-phase flows)

SKILLS

Numerical Analysis & Parallel Programming

- Python, Fortran, MATLAB, C/C++, MPI, OpenMP, Bash, Git & CFD tools (OpenFOAM, Fluent)

Interdisciplinary Research & Communication

- Scientific writing, data visualization, academic presentation, problem solving & collaboration

RECENT PUBLICATIONS

1. 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.
2. 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.
3. Sheikh, H. M., Lee, S. (co-first), 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.

FELLOWSHIPS

Departmental Graduate Fellowship, College of Engineering — Aug. 2023 - Dec. 2023
University of California, Berkeley

- Selective departmental award offering stipends with full tuition and fee waivers

Overseas Ph.D. Scholarship, Study Abroad Doctoral Program — Aug. 2019 - Jul. 2023
Ilju Academy & Culture Foundation

- Merit-based financial aids of $120,000 for promising Ph.D. students studying out of Korea
- Selected as one of 6 recipients in 2019

National Scholarship for Science and Engineering — Mar. 2012 - Dec. 2017
Korea Student Aid Foundation (KOSAF)

- Full-tuition scholarship for undergraduates with strong academic performance

RESEARCH EXPERIENCE

Graduate Student Researcher, University of California, Berkeley — Jan. 2020 - Jul. 2024 (Exp.)
Computational Fluid Dynamics Lab *(Director: Dr. Philip S. Marcus)*

- Numerical examination of destabilizing aircraft wake vortices using both linear and non-linear analyses in association with spectral collocation methods
- Optimization of hydro-/aerodynamic designs with a Bayesian inference or a genetic algorithm using the Design-by-Morphing (DbM) technique

Researcher, Seoul National University — Jul. 2017 - Aug. 2018
Energy & Environmental Flow Lab *(Director: Dr. Wontae 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 with large eddy simulation

Research Intern, Seoul National University — Sep. 2016 - Dec. 2017
Turbulence, Flow Control & CFD Lab *(Director: Dr. Haecheon Choi)*

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

TEACHING EXPERIENCE

Teaching Assistant, University of California, Berkeley — Jan. 2024 - May 2024
Introduction to Computer Programming for Scientists and Engineers (ENGIN 7)

- Taught basic programming strategies and numerical methods for scientific computing

Course Designer / Graduate Student Instructor, University of California, Berkeley — Aug. 2022 - May 2023
Introduction to Aerospace Engineering Design (AERO ENG 10)

- Designed and instructed a course module for two-dimensional airfoil design with wind tunnel practices

Graduate Student Instructor, University of California, Berkeley — Aug. 2019 - May 2022
Experimentation and Measurements (MEC ENG 103)

- Run lab sessions on measurements and experimental techniques for mechanical engineering
- Received Outstanding Graduate Student Instructor (OGSI) Award in Apr. 2021

Undergraduate Tutor, Seoul National University — Mar. 2013 - Dec. 2013
Basic Calculus 1, 2 & Basic Physics 1 (007.098A, 102 & 099A)

- Tutored freshmen who have difficulty in studying university-level calculus and physics

COURSEWORK

Graduate Coursework, University of California, Berkeley

- Fluid Mechanics
  Advanced Fluid Mechanics, Engineering Aerodynamics,
  Experimental Methods in Single-and Multiphase Flows, Graduate Ocean Engineering Seminar,
  Hydrodynamic Stability and Instability, Oceanic and Atmospheric Waves,
  Teaching of Mechanical Engineering at the University Level, Topics in Fluid Mechanics - Vortex Dynamics
- Computational Science
  Applications of Parallel Computers, Numerical Solution of Differential Equations,
  Optimization Models in Engineering, Spectral Methods for Fluid Dynamics, Theoretical Statistics

Undergraduate Coursework, Seoul National University

- Engineering
  Applied Fluid Mechanics, Creative Engineering Design, Digital Computer Concept and Practice,
  Digital Fabrication and Manufacturing, Dynamics, Engineering Mathematics, Fluid Mechanics,
  Heat Transfer, Introduction to Electrical and Computer Engineering,
  Management in Mechanical Engineering, Manufacturing Processes, Mechanical Drawing,
  Mechanical Engineering Lab, Mechanical System Design Project, Mechanics and Design,
  Solid Mechanics, Thermodynamics, Writing in Science and Technology
- Business
  Capital Markets and Accounting, Corporate Strategy, Fundamentals of Economics,
  Human Resource Management, International Business Management,
  Management Information System, Management Science, Managerial Accounting,
  Marketing Management, Mathematics for Economics, Operations Management,
  Principles of Accounting, Principles of Management

FULL LIST OF PUBLICATIONS & TALKS

JOURNAL ARTICLES

1. Lee, S., & Marcus, P. S. (2024). **Transient Growth of a Wake Vortex and Its Initiation via Inertial Particles**. [Under Preparation].

2. Wang, J., Lee, S., & Marcus, P. S. (2024). **Perturbation Theory for the Resonant Triad Instability in Columnar Vortices with Axial Flow**. [Under Preparation].

3. Solmaz, A. S., Raftery, P., Lee, S., & Duarte, C. (2024). **Effect of Elevated Air Movement on Radiant Cooling Systems**. [Under Preparation].

4. 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.

5. 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.

6. Sheikh, H. M., Lee, S. (co-first), 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.

7. 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.

8. 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.

CONFERENCE PAPERS & PRESENTATIONS

1. Lee, S., & Marcus, P. S. (2023, Nov 19-21). **Investigation of Triggering Vortex Instabilities with Inertial Particles.** In *Abstr. 76th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Washington, DC, USA* (no. ZC38.5). American Physical Society.

2. Wang, J., Lee, S., & Marcus, P. S. (2023, Nov 19-21). **Three-Wave Resonance in Neutrally Stable Wake Vortices.** In *Abstr. 76th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Washington, DC, USA* (no. ZC38.2). American Physical Society.

3. Lee, S., & Marcus, P. S. (2022, Nov 20-22). **Viscous Perturbation to Inviscid Wake Vortices - Perturbation Theory in Vortex Stability.** In *Abstr. 75th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Indianapolis, IN, USA* (no. Q11.7). American Physical Society.

4. Marcus, P. S., Wang, J. & Lee, S. (2022, Nov 20-22). **A General Framework for Destabilizing Neutrally-Stable Flows Applied to Aircraft Wake Vortices.** In *Abstr. 75th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Indianapolis, IN, USA* (no. L18.1). American Physical Society.

5. Lee, S., & Marcus, P. S. (2021, Nov 21-23). **Linear Instability Analysis of Wake Vortices by a Spectral Method using Mapped Legendre Functions.** In *Abstr. 74th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Pheonix, AZ, USA* (no. E24.1). American Physical Society.

6. Wang, J., Lee, S., & Marcus, P. S. (2021, Nov 21-23). **Destabilizing Neutrally Stable Wake Vortices Using Degenerate Eigenmodes.** In *Abstr. 74th Annual Meeting of the APS Division of Fluid Dynamics (APS-DFD), Pheonix, AZ, USA* (no. E24.3). American Physical Society.

7. Lee, S., & Hwang, W. (2018, Jul 4-6). **Validation of a Conjugate Heat Transfer Code with Subgrid-scale Models for Turbulent Flow.** In *Proc. KSFM 2018 Summer Conference, Jeju, South Korea* (pp. 197-198). Korean Society for Fluid Machinery.

8. 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.** In *Proc. ASME 2018 Turbo Expo: Turbomachinery Technical Conference and Exposition, Lillestrøm, Norway* (no. GT2018-76741). American Society of Mechanical Engineers. doi:10.1115/GT2018-76741. *Journal-Quality Appraisal and Transferred to J. Turbomach.*

9. Lee, S. (2017, Nov 1-3). **2D Simulation of an Unsteady Flow around a Small Vertical Axis Wind Turbine Using an Immersed Boundary Method.** In *Proc. KSME 2017 Annual Conference, Jeju, South Korea* (pp. 741-745). Korean Society of Mechanical Engineers. *Student Paper Award: Bronze Prize*.

10. 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).** In *Proc. KSME 2017 Annual Conference, Jeju, South Korea* (pp. 581-583). Korean Society of Mechanical Engineers.

INVITED TALKS & SEMINARS

1. Lee, S. (2023, Aug 7-9). **Design-by-Morphing (DbM): A Novel Design Methodology for Aerodynamic Optimization.** *Hyundai Vision Conference 2023, Seoul, South Korea*. Hyundai Motors.

2. 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.

3. 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.