

# Sangjoon “Joon” Lee

Ph.D. Candidate at University of California, Berkeley

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## EDUCATION

**University of California, Berkeley** – Berkeley, CA, USA

Aug. 2019 - Jul. 2024 (exp)

*Ph.D. in Mechanical Engineering*

*M.S. in Mechanical Engineering*

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

**Seoul National University** – Seoul, South Korea

Mar. 2012 - Aug. 2018

*B.S. in Mechanical & Aerospace Engineering*

*\* 2-year leave of absence for military service*

*B.B.A. in Business Administration*

- Honors: *Summa cum laude*
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## RESEARCH INTERESTS

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

- Modeling, computing and analyzing instabilities and turbulent motions in hydro-/aerodynamic flows with concurrent scalar transfers
  - Investigating environmental flow problems pertaining to sustainable energy (e.g., gas/wind turbines) and clean atmosphere (e.g., particle-laden flows)
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## RESEARCH EXPERIENCE

**Graduate Student Researcher**, University of California, Berkeley

2020 - 2024

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 using a Bayesian inference or a genetic algorithm in association with Design-by-Morphing (DbM)

**Researcher**, Seoul National University

2017 - 2019

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

2016 - 2017

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

- Large eddy simulations of flow around a small rotating vertical axis wind turbine
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1. Lee, S., & Marcus, P. S. (2024). **Transient Growth of a Wake Vortex and Its Initiation via Inertial Particles**. [In Preparation].
2. Wang, J., Lee, S., & Marcus, P. S. (2024). **Perturbation Theory for the Resonant Triad Instability in Columnar Vortices with Axial Flow**. [In Preparation].
3. Solmaz, A. S., Raftery, P., Lee, S., & Duarte, C. (2024). **Effect of Elevated Air Movement on Radiant Cooling Systems**. [In 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.

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), Phoenix, 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), Phoenix, 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.*
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.

#### TEACHING & TUTORING

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| <p><b>Teaching Assistant</b>, University of California, Berkeley</p> <p>Introduction to Computer Programming for Scientists and Engineers (ENGIN 7)</p> <ul style="list-style-type: none"> <li>• Essential programming strategies and numerical methods for scientific computing</li> </ul> <p><b>Course Designer / Graduate Student Instructor</b>, University of California, Berkeley</p> <p>Introduction to Aerospace Engineering Design (AERO ENG 10)</p> <ul style="list-style-type: none"> <li>• Computer-aided two-dimensional airfoil design modules with wind tunnel practices</li> </ul> <p><b>Graduate Student Instructor</b>, University of California, Berkeley</p> <p>Experimentation and Measurements (MEC ENG 103)</p> <ul style="list-style-type: none"> <li>• Measurements and experimental techniques for mechanical engineering</li> </ul> <p><b>Undergraduate Tutor</b>, Seoul National University</p> <p>Basic Calculus 1, 2 &amp; Basic Physics 1 (007.098A, 102 &amp; 099A)</p> <ul style="list-style-type: none"> <li>• Review of basics of university-level calculus and physics</li> </ul> | <p>2024</p> <p>2022 - 2023</p> <p>2019 - 2022</p> <p>2013</p> |
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FELLOWSHIPS	<b>Departmental Graduate Fellowship</b> College of Engineering at University of California, Berkeley	2023
	<ul style="list-style-type: none"> <li>• Selective departmental award offering stipends with full tuition and fee waivers</li> </ul>	
	<b>Overseas Ph.D. Scholarship</b> , Study Abroad Doctoral Program Ilju Academy & Culture Foundation	2019 - 2023
	<ul style="list-style-type: none"> <li>• Merit-based financial aids of \$120,000 for promising Ph.D. students studying out of Korea</li> <li>• Selected as one of 6 recipients in 2019</li> </ul>	
	<b>National Scholarship for Science and Engineering</b> Korea Student Aid Foundation (KOSAF)	2012 - 2017
	<ul style="list-style-type: none"> <li>• Full-tuition scholarship for undergraduates with strong academic performance</li> </ul>	
HONORS & AWARDS	<b>Outstanding Graduate Student Instructor (OGSI) Award</b> GSI Teaching & Resource Center at University of California, Berkeley	2021
	<b>Representative of the Engineering Class of 2018</b> , 72nd Commencement Ceremony Seoul National University	2018
	<b>Student Paper Award: Bronze</b> , 9th National Fluid Engineering Contest for Undergraduates Fluid Engineering Division of Korean Society of Mechanical Engineers	2017
COMMUNITY SERVICE	<b>SNU Tomorrow's Engineers Membership (STEM)</b> , Seoul National University Member & Head Manager	2016 - 2018
	<ul style="list-style-type: none"> <li>• Annual <i>Vision Mentoring</i> for high school students interested in engineering and science</li> <li>• Student-driven regular intercollegiate academic exchange sessions</li> </ul>	
LANGUAGES	<b>English, Korean</b> Native/Bilingual	