

## Hyunseok Kim, Ph.D.

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### EDUCATION

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**Seoul National University (SNU)** 2013.09 – 2021.08  
Ph. D. in Mechanical Engineering (advisor: Professor Hyungmin Park)  
Thesis: *An Experimental and Theoretical Study on Turbulent Mixing Induced by Bubble Plume*

**Seoul National University (SNU)** 2009.03 – 2013.09  
B. S. in Nuclear Engineering

### RESEARCH EXPERIENCE

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**Max Planck Institute for Dynamics and Self-Organisation, Germany** 2024.09 – current  
Sejong Fellow (Supervisor: Dr. Claudia Brunner) 2024.09 – current  
☐ Development of a physics-based wind turbine erosion model

**EHS/Infra Technology Research Center, Samsung Electronics, South Korea** 2022.01 – 2024.07  
Staff Engineer 2022.01 – 2024.07  
Organizational Culture Agent 2023.01 – 2023.12  
☐ Global warming gas abatement system for a semiconductor factory  
▪ Powder Reduction TF (Researcher) 2023.11 – 2024.07  
▪ Bench-scale (100 L/min) Fluidized-bed Reactor (Co-PI) 2023.01 – 2024.07  
▪ Pilot-scale (1-10 m<sup>3</sup>/min) Microwave Facility (PI) 2023.01 – 2024.07  
▪ Bench-scale (70 L/min) Low-temperature Plasma Reactor (PI) 2022.01 – 2024.07  
▪ Commercial-scale (100 L/min) Plasma Scrubber (PI) 2022.01 – 2023.12

**Institute of Advanced Machines and Design, SNU, South Korea** 2021.09 – 2021.12  
Postdoctoral research fellow (Advisor: Prof. Hyungmin Park)  
☐ Turbulent Mixing Induced by Bubble Plume

**Multiphase Flow and Flow Visualization Lab, SNU, South Korea** 2013.09 – 2021.08  
Research Assistant (Advisor: Prof. Hyungmin Park)  
☐ Turbulent Mixing Induced by Bubble Plume 2019.06 – 2021.08  
☐ Diffusion of the Micro-air Layers Under Turbulent Flow 2015.02 – 2019.06  
☐ Uniform Wet Etching at The Wafer Surface with Bubbles 2016.04 – 2017.03  
☐ Turbulent External Flow Control with Superhydrophobic Surfaces 2013.09 – 2016.05

**Plasma Application Lab, SNU, South Korea** 2012.06 – 2013.01  
Research intern (Advisor: Prof. Gon Ho Kim)  
☐ Study on the Electrical Characteristics of the Dielectric Barrier Discharge (DBD)

**Plasma Laboratory for Advanced Research, SNU, South Korea**  
Research intern (Advisor: Prof. Yong-Su Na)  
☐ Current Driven Scenario of Fusion Plasma Heated by Neutral Beam Injection (NBI)

### TEACHING EXPERIENCE

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**Teaching Assistant:** Mechanical Engineering Lab 2 (Fall 2014)  
Applied Fluid Mechanics (Spring 2014, Spring 2015)  
Fluid Mechanics (Fall 2016)  
Inviscid Flow (Spring 2016, Spring 2017)  
Viscous Flow (Fall 2015, Fall 2017)

## HONORS & AWARDS

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2020	63th SNU Advanced Industrial Strategy Program Scholarship
2015-2017	Miraekukje Foundation The Good Talent Scholarship
2015-2016	LG YONAM Cultural Foundation Scholarship
2012	SINYANG Cultural Foundation Scholarship
2010-2011	Miraekukje Foundation Mentoring Scholarship
2010	SNU Foundation Scholarship
2009-2011	Scholarship for Excellence

## RESEARCH INTERESTS

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Multiphase Flows, Environmental Fluid Mechanics, Complex Fluids, Turbulent Flows, Heat Transfer, Fluid Mixing, Flow Visualization

## PROFESSIONAL SERVICE

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Member of American Physical Society, Reviewer of Physics of Fluids

## PUBLICATIONS

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Daehyun Choi\*, **Hyunseok Kim**\* & Hyungmin Park, Bubble velocimetry using the conventional and CNN-based optical flow algorithms. *Scientific Reports*, 12(1), 11879 (2022).

\*Equally contributed

Jun Ho Lee, **Hyunseok Kim**, Jubeom Lee & Hyungmin Park, Scale-wise analysis of upward turbulent bubbly flows: an experimental study. *Physics of Fluids* 33, 053316 (2021)

Chunguang Piao, Xiongwei Yang, Joshua Minwoo Kweun, **Hyunseok Kim**, Hyungmin Park, Seung Hyun Cho & Yoon Young Kim, Ultrasonic flow measurement using a high-efficiency longitudinal-to-shear wave mode-converting meta-slab wedge. *Sensors and Actuators A: Physical* 310, 112080 (2020)

**Hyunseok Kim** & Hyungmin Park, Diffusion characteristics of air pockets on hydrophobic surfaces in channel flow: Three-dimensional measurement of air-water interface. *Physical Review Fluids* 4, 074001 (2019)\*

\*Selected as an *Editor's Suggestion*

Jungjin Lee, **Hyunseok Kim** & Hyungmin Park, Effects of superhydrophobic surfaces on the flow around an NACA0012 hydrofoil at low Reynolds numbers. *Experiments in Fluids* 59, 111 (2018)

Nayoung Kim, **Hyunseok Kim** & Hyungmin Park, An experimental study on the effects of rough hydrophobic surfaces on the flow around a circular cylinder. *Physics of Fluids* 27, 085113 (2015)

## Manuscript in preparation

**Hyunseok Kim** & Hyungmin Park, Mixing in stably stratified fluids by bubble plume.

**Hyunseok Kim** & Hyungmin Park, Turbulence characteristics of bubble plume with two regimes.

**Hyunseok Kim** & Hyungmin Park, On the analytical framework to characterize the bubble-induced turbulence.

## CONTRIBUTED PRESENTATIONS

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**Hyunseok Kim** & Hyungmin Park, An experimental study on stratified fluid mixing induced by bubble plume. KSME Annual Meeting 2021, 03-05 Nov 2021, Kim Dae-jung Convention Center, Gwangju, Korea.

Hyungmin Park & **Hyunseok Kim**, Fluid mixing by bubble plume. The 2021 Spring conference of the Korean Society of Mechanical Engineers Fluid Engineering Division, 18-19 Aug 2021, Online.

**Hyunseok Kim** & Hyungmin Park, Analytical description on the relation between bubble-induced turbulence and gas phase characteristic parameters. The 2021 Spring conference of the Korean Society of Mechanical Engineers Fluid Engineering Division, 18-19 Aug 2021, Online.

**Hyunseok Kim** & Hyungmin Park, Unsteady dynamics of bubble plume. The 11th International Symposium on Cavitation, 10-13 May 2021, Online.

**Hyunseok Kim** & Hyungmin Park, An experimental study on the unsteady characteristics of a bubble plume. 73rd Annual Meeting of the APS Division of Fluid Dynamics, 22-24 November 2020, Online.

**Hyunseok Kim** & Hyungmin Park, Dynamics of bubble plume: effect of bubble size distribution. The 11th National Congress on Fluids Engineering, 12-14 August 2020.

**Hyunseok Kim** & Hyungmin Park, Three-dimensional visualization of air-water interface on hydrophobic surfaces in turbulent flows: diffusion characteristics. The 15th Asian Symposium on Visualization, 25-28 September 2019.

**Hyunseok Kim** & Hyungmin Park, Diffusion characteristics of air-pockets trapped on superhydrophobic surfaces in channel flows. 12th European Fluid Mechanics Conference, 09-13 September 2018.

**Hyunseok Kim** & Hyungmin Park, Visualization of an air-water interface on superhydrophobic surfaces in turbulent channel flows. 70th Annual meeting of the division of fluid dynamics, 19-21 November 2017.

**Hyunseok Kim** & Hyungmin Park, Study on three-dimensional profile of an air-water interface on superhydrophobic surfaces immersed in turbulent channel flow. The 2016 Fall Annual Meeting of the Korean Society of Mechanical Engineers, 14-16 December 2016.

Junho Lee, **Hyunseok Kim** & Hyungmin Park, Scalewise investigation of two-phase flow turbulence in upward turbulent bubbly pipe flows. The 68th Annual Meeting of the Division of Fluid Dynamics, American Physical Society, 22-24 November 2015.

**Hyunseok Kim** & Hyungmin Park, Direct measurement of an air-water interface profile on immersed superhydrophobic surfaces. The 2015 Fall Annual Meeting of the Korean Society of Mechanical Engineers, 10-14 November 2015.

Nayoung Kim, **Hyunseok Kim** & Hyungmin Park, Effect of rough hydrophobic surfaces on the flow around a circular cylinder. ASME-JSME-KSME Joint Fluids Engineering Conference 2015, 26-31 July 2015.

**Hyunseok Kim**, Nayoung Kim & Hyungmin Park, Effect of superhydrophobic surfaces on the flow over a hydrofoil at low Reynolds number. American Physical Society 67th Annual Meeting Division of Fluid Dynamics, 23-25 November 2014.

Nayoung Kim, **Hyunseok Kim** & Hyungmin Park, Control of the near wake behind a circular cylinder using superhydrophobic surfaces. American Physical Society 67th Annual Meeting Division of Fluid Dynamics, 23-25 November 2014.

**Hyunseok Kim**, Nayoung Kim & Hyungmin Park, Analysis of the circular cylinder wake using discrete wavelet transform. The 8th National Congress on Fluids Engineering (NCFE8), 27-29 August 2014.

Hyeonju Jeong, **Hyunseok Kim** & Hyungmin Park, Investigation of the bubble dynamics in the vicinity of a wall using high-speed imaging and two-phase PIV. The 16th International Symposium on Flow Visualization (ISFV16), 24-27 June 2014.

Nayoung Kim, **Hyunseok Kim** & Hyungmin Park, Control of the turbulent wake behind a circular cylinder using superhydrophobic surfaces. The 2014 Spring Annual Meeting of the Korean Society of Mechanical Engineers, Fluid Engineering Division, 15-16 May 2014.

**Hyunseok Kim**, Nayoung Kim & Hyungmin Park, Scale decomposition of the turbulent wake behind a circular cylinder using discrete wavelet transform. The 2014 Spring Meeting of the Korean Society of Visualization, 25 April 2014.

Hyeonju Jeong, **Hyunseok Kim** & Hyungmin Park, Experimental investigation of the interactions between a rising bubble and the solid wall. The 2013 Fall Annual Meeting of the Korean Society of Mechanical Engineers, 18-20 December 2013.

## **PATENTS**

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**Hyunseok Kim**, Bongju Lee, Mukyeong Kim, BALUE YANNICK KUMONA, Hyunmin Jeong, Sejin Park, Dajeong Lim, Il Jeong Heo, GAS TREATING APPRATUS, KR Patent, 10-2024-0069333, Filed May. 2024.

**Hyunseok Kim**, Bongju Lee, DZEYEWIR DIVINE NYUYKI, Mukyeong Kim, Dajeong Lim, Sejin Park, Hyunmin Jeong, Il Jeong Heo, GAS TREATING APPRATUS, KR Patent, 10-2024-0069331, Filed May. 2024.

**Hyunseok Kim**, Mukyeong Kim, Kyeongmin Baek, Hyunmin Jeong, Il Jeong Heo, Gas treating apparatus, KR Patent, 10-2024-0048930, Filed Apr. 2024.

**Hyunseok Kim**, Mukyeong Kim, Sejin Park, Il Jeong Heo, Scrubber and processing method of semiconductor process gas. KR Patent, 10-2024-0047923, Filed Apr. 2024.

Mukyeong Kim, **Hyunseok Kim**, Sejin Park, Hong Jae Kang, Dae Hoon Lee, Jeong An Choi, Gwan Take Kim, Yoo Na Kim, Ho Hyun Song, Hee Su Lee, Young Hun Song, Il Jeong Heo, Scrubber, substrate processing system including the same, and substrate process method using the same. KR Patent, 10-2024-0042772, Filed Mar. 2024.

Wonsu Lee, **Hyunseok Kim**, Jungdae Park, Kimun Lee, Jong-San Chang, Semiconductor process system and gas abatement method. KR Patent, 10-2023-0008163, Filed Jan. 2023. US Patent, US18/368422, Filed Oct. 2023.

Wonsu Lee, **Hyunseok Kim**, Jungdae Park, Kimun Lee, Jong-San Chang, Gas abatement system, semiconductor process system including the same and gas abatement method exploiting the same. KR Patent, 10-2023-0006371, Filed Jan. 2023. US Patent, US18/230880, Filed Aug. 2023.

Taeheon Kim, **Hyunseok Kim**, Hyungmin Park, Jini Lee, Yongsun Ko, Kyunghyun Kim, Bubble generating device and system including the same. KR Patent, 10-2020-0043155, Filed Apr. 2020. Registered Jun. 2023.

## **OTHER EXPERIENCE**

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### **Undergraduate Research Advisees (Bachelor's degree thesis)**

2014 Kim, Investigation on the optical technique to measure air-water interface on superhydrophobic surface under flow.

2015 Hong, Development of RICM algorithm to measure air-water interface on a superhydrophobic surface

2016 Kim, An experimental study on the separation delay due to superhydrophobic surface on hydrofoil

2018 Kim, Observation of flow structure induced by vortex generator on a torpedo.

2019 Ahn, Mixing in T-tube coated with superhydrophobic surface.

2019 Khan, Development of the two-phase PIV technique for bubble plume measurement.

## SKILLS

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### Flow Measurement

LDA, Two-phase PIV, Stereoscopic PIV, PTV

### Computer Vision

Optical flow, Image filtering, Feature detection

### Software

MATLAB, Python, ANSYS (CFX and Fluent)

### Optical Measurement Technique

Interferometry, High-speed imaging

### Signal Processing Technique

Wavelet transform

## PRESS

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[“Performance and longevity of superhydrophobic surface for the control of flow around the water vehicle”](#), MERRIC, April 6, 2021

## RESEARCH FUNDING

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NRF-RS-2024-00352760 ‘The Sejong Fellowship’, Recipient, ~€47k (\$53k), 2024.09.01 ~ 2025.08.31

NRF-2020R1A2C2014510, Lead Researcher, ~€540k (\$600k), 2020.03.01 ~ 2024.02.29

SAMSUNG ELECTRONICS, Lead Researcher, ~€40k (\$45k), 2016.06.01 ~ 2017.05.31

NRF-2013R1A1A1008373, Lead Researcher, ~€200k (\$230k), 2013.06.01 ~ 2016.05.31

NRF-2012M2A8A4055647, Researcher, ~€675k (\$750k), 2012.12.6 ~ 2015.11.30

NRF-2011-0021689, Fellowship Recipient, ~€5k (\$6k), 2011.07.01 ~ 2012.06.30

## REFERENCES

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### Professor Hyungmin Park

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### Professor Haecheon Choi

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### Professor Dongjoo Kim

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Kumoh National Institute of Technology, Korea  
[kdj@kumoh.ac.kr](mailto:kdj@kumoh.ac.kr)

### Doctor Linfeng Piao

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The University of Manchester, UK  
[piaolinfeng@gmail.com](mailto:piaolinfeng@gmail.com)