Kwanwoo Kim

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Summary

A curious and driven researcher passionate about discovery, problem-solving, and hands-on experimentation. Currently investigating emergent and collective behavior in soft robotic systems using link-bots – small, modular robots confined by simple steric interaction constraints – to understand how local interactions generate coordinated group behaviors. Research interests include emergent and collective behavior, bioinspired engineering, swarm robotics, soft robotics, and fluid dynamics. Skilled at integrating theory, simulation, and experimentation to uncover fundamental mechanisms and apply them to the design of adaptive, scalable robotic systems.

Education

M.S. in Mechanical Engineering, Seoul National University (SNU)
Sept 2024 – Present (Expected Aug 2026)

Seoul, Korea

B.S. in Mechanical Engineering, Seoul National University (SNU) – *Cum Laude*
Sept 2018 – Aug 2024

Seoul, Korea

Outreach

Graduate Mentor, Undergraduate Research Opportunities Program (SNU)
Jul 2025 – current

Seoul, Korea

Student Mentor, South Africa Vastfontein Program
Nov 2018

Pretoria, South Africa

Publications

Emergent functional dynamics of link-bots
Kyungmin Son, Kimberly Bowal, **Kwanwoo Kim**, L. Mahadevan, Ho-Young Kim.
Science Advances, 2025.

Investigation of the effects of nasal surgery on nasal cavity flow using magnetic resonance and velocimetry and computational fluid dynamics
Kyuho Han, Sung-Gwang Lee, **Kwanwoo Kim**, Baren Jeong, Muyoung Paek, Whal Lee, Wontae Hwang.
Physics of Fluids, 2023.

Skills Summary

Electromechanical design: SolidWorks/Fusion 360; rapid prototyping (3D print, laser cut); actuators & drivers (DC/servo/BLDC/solenoid), basic electronics (Arduino/Teensy).

Microfabrication & soft materials: Experience in spin coating, UV curing, micromolding (PDMS), injection mold, layer pour-coat, circuitry design & control of pneumatic actuators using pumps & valves, basic photolithography; hydrogel/LCE synthesis.

Controls & perception: PID tuning, system identification; vision-based multi-agent tracking (AprilTag/OpenCV); experiment automation.

Programming & simulation: MATLAB; Python; C/C++ (embedded); FEA (ABAQUS).

Languages: Korean (Native), English (Native-level fluency), Chinese (Upper-intermediate / conversational).

Experiences

Full-time researcher, Microfluids and Soft Matter Lab, Seoul National University
Feb 2024 – Present

- *Advisor: Ho-Young Kim*
- Participated in numerous projects including link-bots

Seoul, Korea

Undergraduate research intern, Human Genarlization Laboratory, KAIST
Jun 2023 – Feb 2024

- *Advisor: Beomjune Kim*
- Contributed to the development of a highly back-drivable 6-DOF robotic arm for delicate manipulation tasks

Seoul, Korea

Undergraduate research intern, Energy & Environmental Flow Laboratory, Seoul National University
Jun 2022 – Nov 2022

- *Advisor: Wontae Hwang*
- Assisted in experiments and analysis of 4D Velocimetry data for respiratory flow studies of patients before and after turbinoplasty (Paper Accepted).

Seoul, Korea

Army interpreter, United States Forces
Aug 2019 – Mar 2021

- Served the mandatory military service as a Korean-English interpreter for the Commander of 8th Army NCOA.

Camp Humphreys, Korea

Projects & Awards (Reverse Chronological Order)

Sequential soft bellows for wafer flattening *(KSME–SEMES Open Innovation Challenge, 2025)*
- Designed a **sequentially actuated soft-bellows** structure to distribute pressure and **mitigate stress concentrations** during wafer flattening; led prototyping and FEA.
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Buckle-driven, ultra-fast compliant tourniquet *(Capstone, 2025)*
- Designed and prototyped a **snap-through buckling** device for rapid hemostasis; validated via pressure/leakage tests and early usability feedback.

Retinol oxidation-resistant packaging — Team Lead *(COSMAX–Academia Joint Research, 2024)*
- Developed a **snap-through check valve** to prevent air ingress; delivered the final sponsor report.

Frost suppression on heat exchangers using macro-scale surface textures *(KSME-LG Home Technology Competition, 2024)*
- Built test rigs and demonstrated textured surfaces that **prevent frost formation** and improve defrost efficiency of heat exchangers.

DIY Protein Vending Machine *(Project, 2023)*
- Built an end-to-end dispensing system (mechanics + controls + sensors) for customizable protein servings; implemented reliability and safety interlocks. Secured a total funding of $20,000.

Biodegradable, water-soluble toilet-seat cover dispenser *(Capstone, 2022)*
- Originated concept and led hardware for a **roll-fed** sanitary dispenser using **water-soluble, biodegradable film** to reduce plastic waste.

*Refer to kwanwoo-kim.com for details on the project

Honors & Awards (Reverse Chronological Order)

Grand Prize, KSME–SEMES Open Innovation Challenge *(2025)* — Sequential soft bellows for wafer flattening

Silver Prize, KSME–LG Future Home Technology Competition *(2024)* — Frost suppression on heat exchangers

Bronze Prize, K-Startup MakerStar Competition *(2023)* — DIY Protein Vending Machine

Finalist, IDC 2022 RoboCON, Tsinghua University *(2022)*

References (Alphabetic order)

Amy Kyungwon Han, PhD
- Professor, Department of Mechanical Engineering, Seoul National University, Seoul, Korea
- Research fields: Soft robotics, Medical Robotic Devices
- Relationship: **Research advisor**
- E-mail: amyhan@snu.ac.kr

Ho-Young Kim, PhD
- Professor, Department of Mechanical Engineering, Seoul National University, Seoul, Korea
- Research fields: Soft Matter, Microfluidics, and Bio-inspired systems
- Relationship: **Masters advisor**
- E-mail: hyk@snu.ac.kr

Jeong-Yun Sun, PhD
- Professor, Department of Materials Engineering, Seoul National University, Seoul, Korea
- Research fields: Soft Matter, Hydrogels
- Relationship: **Research advisor**
- E-mail: jysun@snu.ac.kr

Wontae Hwang, PhD
- Professor, Department of Mechanical Engineering, Seoul National University, Seoul, Korea
- Research fields: Large-scale fluid dynamics, Flow visualization
- Relationship: **Undergraduate advisor / Research advisor**
- E-mail: wth@snu.ac.kr