Kwanwoo Kim

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Summary

Experienced mechanical engineering 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 biofluids. 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

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); Adobe Illustrator/Premiere Pro.

Microfabrication & soft materials: Experience in spin coating, UV curing, micromolding (PDMS), injection molding, layer pour-coating, 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, COMSOL).

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

Experiences (Reverse Chronological Order)

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

- *Advisor: Ho-Young Kim*
- Co-led first and second link-bot projects; paper from the first project published.
- Designed airtight soft check valves and built a custom evaluation test apparatus for retinol-containing cosmetic containers (COSMAX-funded project).
- Developed responsive soft valves and conducted performance characterization.
- Won multiple prizes in academic idea competitions.

Seoul, Korea

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

- *Advisor: Beomjoon 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*
- Conducted experiments and analysis of 4D Velocimetry data for respiratory flow studies of patients before and after turbinoplasty; paper published.
- Built the experimental setup; visualized and interpreted data for presentations.

Seoul, Korea

Army interpreter, United States Forces
Aug 2019 – Mar 2021

- Completed mandatory service as a Korean-English interpreter for the Commander of the Eighth Army NCO Academy; collaborated with senior U.S. Army NCOs and ROK Army officers.

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 array to distribute pressure and mitigate stress concentrations during wafer flattening; led pneumatic experiments and FEA.
- Honorable mention (Finalist) in the competition.

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.
- Integrated a water absorbent hydrogel layer to improve blood uptake and assist hemostasis.

Retinol oxidation-resistant packaging — Team Lead *(COSMAX–Academia Joint Research, 2024)*
- Built an evaluation apparatus to quantify oxygen/air ingress and identify weaknesses in conventional containers resisting retinol oxidation.
- Analyzed existing soft valves using FEA and conducted parametric study to minimize air ingress.
- Developed a snap-through check valve that outperforms the existing solutions; 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 delay frost formation and improve defrost efficiency of heat exchangers.
- Presented at the The Korean Society of Mechanical Engineers (KSME) Autumn Conference 2024.
- Awarded the Silver Prize in the competition.

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.
- Pitched business models and working prototypes to venture capital firms.
- Awarded the 3rd Place Prize in K-Startup Makerstar Competition (hosted by Korea Institute of Startup & Entrepreneurship Development).

Biodegradable, water-soluble toilet-seat cover dispenser *(Capstone, 2022)*
- Originated the concept and led hardware development for a roll-fed sanitary dispenser using water-soluble, biodegradable film to reduce plastic waste.
- Awarded the 2nd Place Prize in SNU Creative Engineering Design Fair, received departmental sponsorship to attend CES.

IDC RoboCON using Unity (2022)
- Hosted by Tsinghua University; held virtually due to the pandemic.
- Developed a virtual robot in Unity capable of obstacle avoidance and debris collection across varied terrains.
- Honorable mention (Finalist) in the competition.

*Refer to kwanwoo-kim.com for more details on past and ongoing research projects

Outreach

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

Seoul, Korea

IB Course Tutor, IB Physics, English Language & Literature, Mathematics (Zoom)

Sept 2018 – Aug 2019

Seoul, Korea

Student Mentor, South Africa Vastfontein Program
Nov 2017

Pretoria, South Africa

References (Alphabetic order)

Amy Kyungwon Han, PhD

- Assistant 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, Collective behavior and Bio-inspired systems
- Relationship: **Masters advisor / Research 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: Respiratory Flow, Gas Turbine
- Relationship: **Undergraduate advisor / Research advisor**
- E-mail: wth@snu.ac.kr