

Byung Joo Khym,

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EDUCATION

Sogang University, Seoul, South Korea

Feb 2019 – Feb 2026

B.S in Mechanical Engineering | GPA: 3.89/4.3

Research Interests: Assistive Robotics, Grippers, Motor Control, Biomimetic Design, Soft Robotics

RESEARCH EXPERIENCE

RIM Lab, Sogang University

Oct 2024 – Dec 2025

Research Assistant

- Project Title: *“An Attentive Koopman-based Framework for real-time, sensorless force control in robotic systems”*
- Led the end-to-end development from conceptualization and modeling to experimental validation.
- Benchmarked performance against LSTM, GRU, Kalman Filter, and Koopman methods on Lorentz and chaotic datasets, achieving 13% improvement in accuracy and latency.
- Proved the feasibility of a real-time analysis model for complex dynamics, combining the speed of traditional control algorithms with the accuracy of deep learning.
- Architected and implemented an Attentive Koopman framework in PyTorch, creating a 'virtual sensor' for robotic systems.
- The proposed framework outperformed baseline models in real-world hardware, achieving ~3 times higher prediction accuracy (compared to LSTM) and ~4 times greater efficiency.

Biorobotics Lab, Seoul National University

Jul 2024 – Mar 2025

Research Assistant

- Project Title: *“Design of a Lightweight, Compact Locking Mechanism for Soft Robotic Systems”*
- Invented a novel, non-invasive friction clamp (<25 g) to solve the critical shear force instability of deployable booms.
- Analyzed the weakness of the W&O-shaped plate to shear forces and conceptualized a friction-based locking mechanism to prevent plate slippage and enhance rigidity.
- Performed static analysis using SolidWorks finite element analysis (FEA) to validate the design.
- Simulated max shear stress and displacement to optimize material selection (e.g., 3D print infill density and strategic placement of metal parts).
- The final prototype experimentally demonstrated a 6 kg shear force resistance, validating a new approach to shape-locking for deployable structures.

RIM Lab, Sogang University

Nov 2024 – Jan 2025

Research Assistant

- Project Title: *“A Hybrid Robotic Gripper with Wire-Differential Exoskeleton and Suction Adhesion”*
- Initiated a project that enhanced the low gripping success rate (<50%) of existing vacuum grippers in an automated waste-sorting system ('Atron') to a target of 80%.
- Conceptualized and prototyped a novel hybrid gripper combining a passive suction pad with an underactuated, wire-differential exoskeleton to ensure uniform contact pressure on uneven surfaces.
- Designed the core mechanism based on a modified umbrella structure that enabled adaptive motion with a single actuator and fabricated a custom hemispherical silicone suction pad.

- Designed and validated an underactuated hybrid gripper that handles diverse objects, including irregular (dented cans) and porous (sponges) surfaces where traditional vacuum grippers fail.

Biometrics & Precision Device Lab, Sogang University

Dec 2023 – Mar 2024

Research Assistant

- Project Title: **“CHIPS: Chameleon Inspired Passive Soft Gripper”**
- Addressed the speed and efficiency limits of conventional grippers by reframing the problem as ‘control-free, instantaneous snatching.’
- Invented a novel passive mechanism combining a bio-inspired, snap-buckling cap with a lifting tong structure.
- The 60 g prototype demonstrated a 10 times payload-to-weight ratio, capturing various objects weighing up to 600 g.
- Project Title: **“Microbubble-Based Soft Actuator”**
- Fabricated a microbubble-based soft actuator using Ecoflex silicone and a custom microfluidic circuit.
- Utilized MATLAB for preliminary analysis of the actuator's potential vibration and acoustic response in bio-inspired applications.

WORK EXPERIENCE

WIPS Inc.

Mar 2021 – Jun 2021

Research Intern, Seoul, South Korea

- Conducted comprehensive patent trend analysis for national R&D reports on strategic technologies, including Blue Hydrogen and Industry 4.0-based remanufacturing.
- Developed an automated Excel program to efficiently classify and analyze over 100+ international patents sourced from the proprietary database of Worldwide Intellectual Property Service (WIPS ON), enhancing data processing speed and accuracy.
- Authored key sections of the 'Remanufacturing Industry Trends and Policy Proposals' report, covering in-depth analysis of technology trends (e.g., condition monitoring, predictive maintenance algorithms) and global market dynamics.
- Analyzed and classified circular economy business models, identifying the roles and value chains of key stakeholders, such as Original Equipment Manufacturer (OEM), IR, and CR, researching emerging Maintenance-as-a-Service (MaaS) models for predictive maintenance solution providers.

COMPETITIONS & PRIZE

Interdisciplinary Technology Competition, Sogang University – Grand Prize

Nov 2023

- Was awarded the Grand Prize for designing and prototyping a novel wire-driven differential pulley reducer, addressing the high cost, noise, and market monopoly issues of conventional precision reducers (e.g., harmonic drive).
- Innovated a compact mechanism by integrating the movable pulley into the end-effector and utilizing high-strength Dyneema wire to achieve zero backlash, significantly reducing size (8 x 10 x 3 cm), weight (110 g), and operational noise.
- Experimentally validated the prototype's superior performance, achieving 19.4 dB operational noise (33x quieter than typical reducers), 98.4% torque efficiency (3.6x higher than that of spur gears), and an estimated production cost of ~\$15 (a 6x reduction).
- Co-invented the core technology in a filed patent (P2025-0016KR) and demonstrated its applicability by integrating the reducer into an EMG-controlled wearable powered orthosis.

Korea Embedded Software Contest, Korea Ministry of Trade – Grand Prize

Oct 2022

- Led the entire project lifecycle of 'Sixth Sense,' a novel galvanic vestibular stimulation (GVS)-based navigation aid for the visually impaired, from initial concept and patent filing to hardware/software development and clinical testing.

- Designed and implemented a constant current circuit using an advanced Howland current pump, ensuring safe and precise vestibular stimulation maintained at 1.5 mA (under the 3.5 mA pain threshold) regardless of variations in skin resistance.
- Developed a non-blocking algorithm using the millis() function to concurrently process incoming sensor data and execute avoidance commands, minimizing real-time response latency.
- Secured two patents (KR-102313973) as the primary inventor, experimentally validating the core hypothesis that walking, as a product of balance shifts, can be intuitively controlled by artificially inducing those shifts via GVS—thus automating 'orientation' rather than merely assisting it.

Urban Management Competition, Goyang District of Korea – *Semi-Finalist*

Oct 2020

- Conceived 'PLAY CATS,' a gamification app to revitalize a local economy by connecting youth startups with traditional markets.
- Was awarded for a unique, data-driven business model in a competition typically focusing on architecture.

Kyeryong Student Aid Foundation Idea Competition – Bronze Award (3rd Place)

Dec 2020

- Proposed a low-cost, retrofittable 'Safe Elevator' system using existing sensors to reduce unnecessary social contact.
- Validated the social value of the concept via a survey, with 82% of residents confirming its effectiveness.

PATENTS

[1] Khym Byung Joo, “*Walking aid system for the visually impaired*”, KR-Registration No. 1023139730000

[2] Khym Byung Joo, “*Walking aid system and method for the visually impaired*”, KR-Registration No. 1020230066345, KR-Registration No. 1027913720000

[3] Khym Byung Joo, “*Exercise apparatus*”, KR-Registration No. 1022785300000

SKILLS

Language: English (TOFEL:112), Japanese(Fluent)

Software: 3D CAD Modeling – Fusion 360, Inventor, Blender, SolidWorks (Advanced), MATLAB Programming, Python, C++, Lua, HTML