Chan-Eui Song

Research Interest: Mechanism design automation, optimization, and control systems with applications in robotics.

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Education

Seoul National University (SNU), Seoul, Korea — *Mar 2018 - Jun 2025 (Expected)*
Left for Mandatory Military Service, Aug 2019 - Mar 2021 — Overall GPA: 4.02/4.3
Fulfilled graduation requirements, left for Industrial Experience and Research, Jan 2024 - Present — Upper GPA: 4.24/4.3
- B.S. in Mechanical Engineering (ME, Major) — ME Major GPA: 4.14/4.3
- B.S. in Mathematics (Math, Double Major) — Math Major GPA: 4.16/4.3

RWTH Aachen University (RWTH), Aachen, Germany — *Apr 2023 - Sep 2023*
- Exchange Student at Faculty of Mechanical Engineering. — GPA: 1.0/5.0
- Studied Nonlinear control & Estimation methods, participated on a research project. — (equivalent to 4.0/4.0 CGPA)

Gyeonggi Science High School for the Gifted, Suwon, Korea — *Mar 2015 - Feb 2018*
- High school for the gifted in science and mathematics, 1 year Accelerated Admission via Exam.
- Conducted three research projects, including analyzing the movement of a cylinder with liquid.

Research Experiences

IDeAOcean, Seoul, Republic of Korea
Advisor: Prof. Yoon Young Kim (Distinguished professor from Department of Mechanical Engineering, SNU) — *Sep 2023 - Present*
- Developed a new automatic synthesis methodology using the Spring Block Model (SBM) to address practical design challenges in creating functional 1-DOF linkage mechanisms. [1]
- Expanded the synthesis methodology to 3D linkage mechanisms through the development of the 3D Joint-element-connected rigid Block Model (JBM). [2]
- Contributed to the development of METHEUS, an autonomous mechanism design software, by generating crucial linkage mechanism data, which led to winning the **CES 2024 Innovation Award**.
- Designed **3 novel linkage mechanisms** for automotive and industrial applications, with patents currently being prepared.
- Early member of a lab-based startup, focusing on the autonomous mechanism design using SBM and JBM models.

Transformative ARchitecture Lab, Department of Mechanical Engineering, SNU
Advisor: Prof. Jin-Kyu Yang — *Sep 2023 - Dec 2023*
- Developed a physics simulator for an origami robot with five Miura-Ori unit cells using the Pybullet library.
- Studied Miura-Origami structure and implemented python code for solving 1-DOF origami configuration.
- Explored the application of reinforcement learning-based control for origami robots.

UnRAVeL Group, Institute for Data Science in Mechanical Engineering, RWTH — *Apr 2023 - Aug 2023*
- Evaluated the calculation speed of Model Predictive Controller(MPC) on an STM32H723 microcontroller.
- Implemented C++ code for a QP solver and tested its performance on an embedded system to control a cart-pole pendulum.

Innovative Design and Integrated Manufacturing Lab, Department of Mechanical Engineering, SNU
Advisor: Prof. Sung-Hoon Ahn — *Jul 2022 - Aug 2022*
- Proposed new algorithm for image processing and controlled robot using ROS.
- Generated datasets for applying meta-learning to 6R robot, automizing robot task generation in assembly process.

Simulation-driven Structure Design Lab, Department of Mechanical Engineering, SNU
Advisor: Prof. Do-Nyun Kim — *Mar 2022 - Dec 2022*
- Analyzed beam deformation using the Deep Energy Method with various neural networks, comparing results with FEM.
- Implemented Physics-Informed Neural Networks (PINN) by applying Neural ODEs to the deep energy method; submitted as a graduation thesis.
- Enhanced understanding of machine learning theory and its applications in mechanics.

Interactive & Networked Robotics Lab, Department of Mechanical Engineering, SNU
Advisor: Prof. Dongjun Lee — *Jan 2022 - Feb 2022*
- Collaborated with Hyundai Steel to control a hot wind tunnel using Model Predictive Control (MPC).
- Studied control theory, applied parameter estimation to MPC, and implemented Q-learning using MATLAB.

Mathematics Undergraduate Research Thesis, Department of Mathematics, SNU
Advisor: Prof. Dano Kim — *Sep 2022 - Dec 2022*
- Submitted graduation thesis on reviewing the Gauss-Bonnet Theorem.

Publications and Manuscripts

†: 1st author, *: corresponding author

[1] **C. Song**†, J. Kim, and Y.Y. Kim*, *"Automatic Synthesis of Linkage Mechanism Using SBM (Designed for Real World Constraints: Details to be disclosed upon acceptance)"*, Expected submission in 2024 at *Journal of Mechanical Design*.

[2] **C. Song**†, J. Kim and Y.Y. Kim*, *"A Novel Mechanism Synthesized Using the 3D JBM Model and Topology Optimization"*, Expected submission in 2025 at *Mechanism and Machine Theory*.
(Manuscript submission is scheduled for 2025 due to Hyundai Motors' project completion and internal conference schedule.)

Working Experiences

IDeAOcean | Researcher *Sep 2023 – Present*
Samsung Electronics | Intern *Jan 2023 – Feb 2023*

- 3D Modeling/Simulation for automation process of detaching cap from compressor using FANUC robot.
- Implemented deep learning based on ResNet56 model to investigate vision based tactile sensor DIGIT.

Selected Awards & Honors

Academic Merit Scholarship, $11,700 | College of Engineering, SNU *2018 - 2023*
Student Abroad Program Scholarship, $5,000 | Office of International Affairs, SNU *Feb 2023*
Contributed to IDeAOcean's CES 2024 Innovation Award | Consumer Technology Association *Jan 2024*
Excellence Award, Mechatronics Contest, $1,200 | SNU *Dec 2023*
2nd Place, Futsal Competition, $150 | College of Engineering, SNU *Nov 2022*
2nd Place, Excellence Book Review Contest, $150 | Faculty of Liberal Education, SNU *Feb 2022*
Grand Prize, Korean Mathematics Competition | Korean Society of Mathematical Education *Feb 2017*
Gold Prize, Korean Mathematics Competition | Korean Society of Mathematical Education *Jul 2017*

Leadership & Activities

STEM (SNU Engineers Honor Society) | College of Engineering, SNU *Sep 2021 - Present*
Graduated as an Honors Member for exceptional contributions as HR/PR Director and Chairman of SRT 2022.

- **Chairman, Student Round Table (SRT)**: Hosted and organized a successful four-day international conference uniting 50 delegates from 4 Asian countries. Led academic sessions and facilitated cultural exchanges.
- **Speaker, Tech Square Academic Seminar**: Presented on power systems regarding environmental regulations (May 2022) and Social Policy on Technology (Nov 2022).
- **Speaker, Vision Exhibition**: Presented on automatic linkage mechanism design methodology (SBM) to over 100 freshmen and sophomores (Feb 2024).
- **Major Snapshot**: Authored three articles introducing major courses in the ME department, achieving a top-ranked Google search result for the keyword 'Mechanics' in Korean with over 10,000 views.
- **Bi-Weekly Academic Seminars**: Regularly discussed recent engineering issues in various fields.

SENS (Engineering Education volunteer club) | College of Engineering, SNU *Mar 2018 - Jul 2019*

- **Executive Roles**: Operated the club as Daily Engineering class chair & vice-president.
- **Gong-Dream Camp**: Hosted 4-day mentoring camp for 120 students 2 times, planned and operated startup contest.
- **Education volunteer work**: Participated in 87.5 hours of engineering education volunteering such as introducing engineer majors or daily engineering class. Demonstrated a strong commitment to education and a passion for teaching.

Republic of Korea Air Force, Mandatory Military Service | Republic of Korea *Aug 2019 - May 2021*

Teaching Experiences

Undergraduate Tutor, Calculus | College of Engineering, SNU *Jan 2022 - Feb 2022*
Private Tutor, Mathematics/Physics | in total 8 students *Jan 2018 - Feb 2023*

Skills & Languages

- **Languages**: Korean (Native), English (Fluent, TOEFL 109), German (Elementary)
- **Programming**: MATLAB/Python (Advanced), C/R (Experienced)
- **Automatic Mechanism Design**: SBM, JBM (Advanced), 3D JBM (Self-Developed)
- **Control Systems**: MPC, Embedded Systems
- **Machine Learning**: Deep Learning (Pytorch, PINN), Meta-learning, Q-learning
- **Robotics**: ROS, Simulation (Pybullet)
- **3D Modeling/Fabrication**: Solidworks (Advanced), 3D Printing/Raspberry Pi/Arduino (Experienced)