Soo-Hwan Chae

Biorobotics Laboratory
School of Mechanical and Aerospace Engineering,
Seoul National University
Bldg. 301, Rm. 219, Gwanak Ro 1, Gwanak Gu, Seoul, Korea

phone: 82-10-8070-9760
email: justices@hanmail.net
ORCID: 0000-0002-4819-5746

Research Interests

- Bio-inspired robotics, Soft robotics
- Locomotive robots, Exploration robots
- Smart actuators & fabrications
- Dynamic modeling & Simulation

Experience

Jan. 2024-
Jun. 2024

Visiting Researcher in Collective Embodied Intelligence Laboratory
• Cornell University, Itaca, NY, USA.
• Research topic: Collective Manipulation of Small Mobile Robots through Elastic Membrane
• Advisor: Prof. Kirstin Hagelskjaer Petersen

Education

Mar. 2018-
Feb. 2026

Ph.D. in Mechanical Engineering
• Seoul National University, Seoul, Korea
• Dissertation: “A Jumping-Crawling Robot with Enhanced Agility and Energy Density via Functional Decoupling Mechanisms”
• Advisor: Prof. Kyu-Jin Cho

Mar. 2013 -
Aug. 2017

B.S. in Mechanical Engineering
• Seoul National University, Seoul, Korea
• Advisor: Prof. Noo-Li Jeon

PUBLICATIONS

Journals

1. **Soo-Hwan Chae**, Sang-Min Baek, Jongeun Lee, and Kyu-Jin Cho, “Agile and Energy-Efficient Jumping-Crawling Robot Through Rapid Transition of Locomotion and Enhanced Jumping Height Adjustment”, *IEEE/ASME Transactions on Mechatronics*, Vol. 27, No. 6, 2022.
2. Sang-Min Baek, Sojung Yim, **Soo-Hwan Chae**, and Kyu-Jin Cho, “Ladybird beetle-inspired compliant origami”, Science Robotics, Vol. 5, No. 41, 2020.

3. Jongeun Lee, Gwang-Pil Jung, Sang-Min Baek, **Soo-Hwan Chae**, Sojung Yim, Woongbae Kim, and Kyu-Jin Cho, “CaseCrawler: A Lightweight and Low-profile Crawling Phone Case Robot”, *IEEE Robotics and Automation Letters*, Vol. 5, No. 4, 2020.
4. Sojung Yim, Sang-Min Baek, Pilwoo Lee, **Soo-Hwan Chae**, Jongeun Lee, Seok-Haeng Suh, Gwang-Pil Jung, and Kyu-Jin Cho, “Development of the sub-10cm, sub-10g jumping-crawling robot” *Intelligent Service Robotics,* Vol. 17, page 19-32, 2024
5. Gwang-Pil Jung, Carlos S. Casarez, Jongeun Lee, Sang-Min Baek, So-Jung Yim, **Soo-Hwan Chae**, Ronald S. Fearing, and Kyu-Jin Cho, “JumpRoACH: A Trajectory-adjustable Integrated Jumping-Crawling Robot”, *IEEE/ASME Transactions on Mechatronics*, Vol. 24, No. 3, 2019.
6. **Soo-Hwan Chae**, Sang-Min Baek, Jongeun Lee, Sojung Yim, Jae-Kwan Ryu, Yong-Jin Jo, and Kyu-Jin Cho, “Effect of Leg Stiffness on the Running Performance of Milli-Scale Six-Leg Crawling Robot with Payload”, *The Journal of Korea Robotics Society*, Vol. 14, No. 4, 2019.

Conference

1. Mun Hyeok Chang, **Su Hwan Chae**, Hye Ju Yoo, Sang-Hun Kim, Woongbae Kim, and Kyu-Jin Cho, “Loco-sheet: Morphing inchworm robot across rough-terrain”, *2019 2nd IEEE International Conference on Soft Robotics (Robosoft),* April, 2019.

Patents

1. Kyu-Jin Cho, Sang-Min Baek, Sojung Yim, **Soo-Hwan Chae**, Dae-Young Lee, “Deployable Wing Module for Multi-modal Locomotion and Wing Fusion Type Robot”, 10-2276602-0000, KR
2. Jae-Kwan Ryu, Yongjin Cho, Jihoon Ku, Kyu-Jin Cho, Sang-Min Baek, Sojung Yim, Jongeun Lee, **Soo-Hwan Chae**, “Directional Locomotion Robot”, 10-2337275-0000, KR

Research Projects

2024 - Present

Jumping-Crawling Robot with Enhanced Energy Density

- Reliable energy release under high spring force
- Two-step clutch design: decoupling two functions - power transmission and spring latching

Contributed the original idea, design, prototyping, experiments

2024 - Present

Jumping Robot with Bi-Articular Springs

- Effectiveness of the bi-articulation on jumping robot

Contributed the design, prototyping, experiments

2024 - Present

Collective Manipulation of Small Mobile Robots through Elastic Membrane

- Robots manipulate and launch the small object without vision, enabled by elastic membrane: tension, vibration, and elastic potential energy

Contributed the original idea, design, prototyping, experiments

2022 - 2024

Climbing Robot Adaptable to Various Surfaces (Microspine, Electroadhesion)

- Utilizing both microspine and electro-adhesion enables the robot to climb rough

and smooth surfaces.
Contributed the original idea, design, prototyping, experiments

2018 - 2022 **Jumping-Crawling Robot with Enhanced Agility**

- Rapid transition of locomotion and jumping height adjustment
- Clutch design: decoupling the spring and the linkage

Contributed the original idea, design, prototyping, experiments

2018 - 2022 **Jumping-Gliding Robot with Deployable Gilder**

- Ladybird beetle inspired compliant origami: rapid self-deployable and self-locking ability
- Gilder is lightweight, compactly foldable, rapidly deployable, and bearing aerodynamic forces

Contributed the prototyping, experiments

2020 - 2022 **Jumping-Crawling Robot with Small Form Factor (sub 100g, and 10cm)**

- Miniaturizing the jumping and crawling mechanism

Contributed the design, prototyping

2018 - 2020 **Crawling Robot with High Payload Capacity**

- Low-profile crawling robot with high payload capacity based on the slider-crank mechanism

Contributed the prototyping, experiments

2018 - 2019 **Jumping-Crawling Robot with Trajectory Adjusting Capability**

- Adjusting the trajectory by controlling the crawling and jumping speed
- Height adjustable jumping mechanism: active triggering clutch

Contributed the experiments

2018 - 2019 **Effectiveness of the Leg Stiffness on Crawling Robot**

- Experimental evaluation of leg stiffness effect on crawling robot

Contributed the original idea, design, prototyping, experiments

2018 - 2019 **S-Shape Crawling Robot with High Obstacle Overcoming Capability**

- Large deformation shape morphing allows the robot to overcome obstacles

Contributed the prototyping, experiments

Technical Skills

Robot Design & Manufacturing, System Design, Modeling

- Various prototyping skills and experiences (3D printer, Laser machining, CNC, Mold casting, *etc.*)
- CAD design (SOLIDWORKS, Auto CAD)
- Robot Modeling, Simulation, and Analysis (MATLAB, SIMULINK, C)
- Embedded controller hardware design (STM, KiCAD)

Honor and Awards

Mar. 2022	Outstanding TA Award in Creative Engineering Design Course, College of Engineering, Seoul National University
Apr. 2019	1st prize winner, RoboSoft Locomotion Challenge, 2019 IEEE International Conference on Soft Robotics
May 2018	2nd prize winner, RoboSoft Locomotion Challenge, 2018 IEEE International Conference on Soft Robotics

Teaching Experiences

Fall 2021
Fall 2020

Teaching Assistant

- Creative Enginnering Design (Prof. Kyu-Jin Cho)
- Seoul National University

2025 - present
2020 - 2022

Tutoring UROP

- Led the multiple students for the Undergraduate Research Opportunities

References

Dr. Kyu-Jin Cho, Ph.D.
Professor
Department of Mechanical Engineering
Seoul National University
Rm. 1402, Bldg. 301, Gwanak-ro 1, Gwanak-gu, Seoul 08826, Republic of Korea
E-mail: kjcho@snu.ac.kr

Dr. Gwang-Pil Jung, Ph.D.
Associate Professor
Department of Mechanical Engineering
Seoul National University of Sceince and Technology
Rm. 309, Dasan Hall, Gongneung-ro 232, Nowon-gu, Seoul 01811, Republic of Korea
E-mail gpjung@seoultech.ac.kr

Dr. Sang-Min Baek, Ph.D.
Postdoctoral Researcher
Department of Mechanical Engineering
Seoul National University
Rm. 219, Bldg. 301, Gwanak-ro 1, Gwanak-gu, Seoul 08826, Republic of Korea
E-mail: bsm6656@snu.ac.kr