

# Changseob Song

PhD Candidate, Department of Mechanical Engineering, Carnegie Mellon University  
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## EDUCATION

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### Carnegie Mellon University

Ph.D. in Mechanical Engineering (Advisor: Inseung Kang)

- Kwanjeong Educational Foundation Scholarship

Pittsburgh, PA  
2024 – Present

### Korea University

M. S. in Mechanical Engineering (Advisor: Donghyun Hwang, Shinsuk Park)

Seoul, South Korea  
2021 – 2023

- Academic-research cooperative program at Korea Institute of Science and Technology (KIST)
- Thesis: Study on Magnetic Granular Jamming Module with Rapid Stiffness Tunability

### Korea University

B. S. in Mechanical Engineering

Seoul, South Korea  
2015 – 2021

- Graduated with great honor

## RESEARCH STATEMENT

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I study lower-limb exoskeleton to enhance human mobility. By leveraging computer vision, physics-based simulation, and machine learning, I aim to rapidly personalize exoskeleton control frameworks towards unique gait patterns of patient user groups, allowing them to minimize user effort across diverse locomotor tasks.

## PUBLICATIONS

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### FULL-LENGTH ARTICLES

**C. Song\***, B. Ivanyuk-Skulskyi\*, A. Krieger, K. Luo, I. Kang, “Personalization of Wearable Sensor-Based Joint Kinematic Estimation Using Computer Vision for Hip Exoskeleton Applications,” *2025 International Conference On Rehabilitation Robotics (ICORR)* [[Paper](#)] [[Project page](#)]

J. An, **C. Song**, E. Halilaj, I. Kang, “Optimizing Locomotor Task Sets in Biological Joint Moment Estimation for Hip Exoskeleton Applications,” *2025 International Conference On Rehabilitation Robotics (ICORR)* [[Paper](#)] [[Video](#)]

Y.-H. Chiu\*, U. H. Lee\*, **C. Song**, M. Hu, I. Kang, “Learning Speed-Adaptive Walking Agent Using Imitation Learning with Physics-Informed Simulation,” *2025 International Conference On Rehabilitation Robotics (ICORR)* [[Paper](#)] [[Video](#)]

**C. Song**, H.-S. Lee, S. Park, D. Hwang, “Stiffening Iron Particles to Modulate Physical Interactions,” *Nature Communications* [[Paper](#)]

T. Lee, H.-S. Lee, **C. Song**, D. Hwang, “On the Design of Fast-Response Variable-Stiffness Continuum Robot with Electro-Permanent Magnet-Based Ball Joints,” *2025 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* [[Paper](#)] ([Best Paper Award](#))

**C. Song\***, G. Yang\*, S. Park, N. Jang, S. Jeon, S. Oh, and D. Hwang, “On the Design of Integrated Tele-Monitoring/Operation System for Therapeutic Devices in Isolation Intensive Care Unit,” *IEEE Robotics and Automation Letters* [[Paper](#)] [[Video](#)]

### PEER-REVIEWED ABSTRACTS

**C. Song\***, B. Ivanyuk-Skulskyi\*, A. Krieger, K. Luo, I. Kang, “Personalization of IMU-Based Joint Kinematic Estimation Using Computer Vision,” *American Society of Biomechanics*, Pittsburgh, United States, 2025 (Poster)

A. Krieger, **C. Song**, I. Kang, “Toward Biomechanically Valid Synthetic Human Motion: An Initial Assessment,” *American Society of Biomechanics*, Pittsburgh, United States, 2025 (Poster)

N. Jang, **C. Song**, G. Yang, D. Hwang, “Experimental Reliability Assessment on the System to Tele-operate Medical Ventilators in Intensive Care Unit,” *The 45th Annual International Conference of the IEEE Engineering in Medicine & Biology Conference (EMBC)*, Sydney, Australia, 2023. (Poster)

**C. Song** and D. Hwang, "Stiffening Iron Powder to Grasp Objects," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) Late-Breaking Results Posters*, Kyoto, Japan, 2022. (Poster)

**C. Song** and D. Hwang, "Magnetic Granular Jamming-Based Tangible Display," *The 19th Korea Robotics Society Annual Conference (KRoC) RED Show*, Pyeongchang, Korea, 2024. (Poster)

H. Seo, **C. Song**, and D. Hwang, "Magnetic Granular Jamming-Based Gripper Capable of Delicate Manipulation," *The 19th Korea Robotics Society Annual Conference (KRoC)*, Pyeongchang, Korea, 2024. (Poster) (*Best Paper Award*)

**C. Song** and D. Hwang, "Magnetic Grain-Based Rapid Variable-Stiffness Mechanism," *The 18th Korea Robotics Society Annual Conference (KRoC)*, Pyeongchang, Korea, 2023. (Poster)

**C. Song**, G. Yang, S. Park, N. Jang, S. Jeon, S. Oh, and D. Hwang, "Development of Master-Slave System for Tele-Monitoring/Operating Mechanical Ventilators in Isolation Intensive Care Unit," *The 17th Korea Robotics Society Annual Conference (KRoC)*, Pyeongchang, Korea, 2022. (Oral)

N. Jang, **C. Song**, G. Yang, S. Park, and D. Hwang, "Tele-Monitoring/Operation System for Therapeutic Devices in Isolation Intensive Care Unit," *The 17th Korea Robotics Society Annual Conference (KRoC) RED Show*, Pyeongchang, Korea, 2022. (Oral)

## PATENTS

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D. Hwang and **C. Song**, "Magnetic Jamming Mechanism," US Patent Application No. 18/423,759, Jul 2024.

D. Hwang and **C. Song**, "Magnetic Jamming Mechanism," Korea Patent Application No. 10-2023-0046420, Apr 2023.

D. Hwang, **C. Song**, G. Yang, S. Park, and N. Jang, "Remote Monitoring and Remote Operation System for Therapeutic Devices," Korea Patent Application No. 10-2023-0002485, Jan 2023.

## AWARDS AND HONORS

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**IROS Best Paper Award on Robot Mechanisms and Design** Hangzhou, China, Oct. 2025.

**Kwanjeong Educational Foundation Scholarship** Jul. 2024 - May. 2029

**Best Paper Award** Korea Robotics Society Annual Conference (KRoC), Feb. 2024.

**KIST Student Excellence Award** KIST, Republic of Korea, Aug. 2023.

**AIR Paper Award** AI and Robotics Institute, KIST, Dec 2022.

**Great Honor** Korea University, Feb 2021.

## SERVICES

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### Reviewer

- IEEE Transactions on Robotics (TRO), 2025
- PLOS One, 2025
- IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE), 2025
- IEEE/RAS-EMBS International Conference on Rehabilitation Robotics (ICORR), 2024

## TALKS

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### Seminar

- Locomotion seminar, Carnegie Mellon University, Mar 2025

## **EXHIBITIONS AND DEMONSTRATIONS**

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Integrated Tele-monitoring and Tele-operation Systems for Therapeutic Medical Devices in Isolation ICU

- **Arab Health 2024**
- **K-Hospital+Health Tech Fair**
- **Korea Science & Technology Fair**

Dubai World Trade Centre, Dubai, UAE, Jan 2024.  
COEX, Seoul, Korea, Sep 2023.  
KINTEX, Goyang-si, Korea, Dec 2021.

Barista Robot System with Robotic Hand Capable of Somatosensory Feedback

- **ROBOTWORLD 2023 – International Robot Exhibition**
- **KIST Roboteria Barista Robot Service**

KINTEX, Goyang-si, Korea, Oct 2023.  
KIST, Seoul, Korea, Jun 2023 - Jul 2024.

## **REFERENCES**

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**Dr. Inseung Kang** | PhD advisor

Assistant Professor, Department of Mechanical Engineering, Carnegie Mellon University

**Dr. Owen Beck** | Collaborator

Assistant Professor, Department of Kinesiology and Health Education, University of Texas at Austin

**Dr. Donghyun Hwang** | Master advisor, Research scientist advisor

Principal Researcher, Center for Humanoid Research, Korea Institute of Science and Technology

**Dr. Shinsuk Park** | Master advisor

Professor, Dept. of Mechanical Engineering, Korea University

**Dr. Sungwook Yang** | Collaborator

Principal Researcher, Center for Humanoid Research, Korea Institute of Science and Technology

**Dr. Sehyuk Yim** | Collaborator

Principal Researcher, Center for Humanoid Research, Korea Institute of Science and Technology