Byung Chul Kim – Curriculum Vitae

Biorobotics Laboratory / Soft Robotics Research Center
School of Mechanical and Aerospace Engineering
Seoul National University
Bldg. 312, Rm. 402, Gwanak Ro 1, Gwanak Gu, Seoul, Korea

phone: 82-10-2503-6230
email: kbc1990@snu.ac.kr
ORCID: 0000-0002-4659-3310
web: bc-kim.github.io

Research Interests

- Soft wearable robotic system
- Hand wearable robot
- Tendon-driven actuator
- Prosthetic hand
- Simulation and control

Experience

Sep. 2020 - Present	**Senior Researcher** Soft Robotics Research Center (SRRC), Biorobotics Lab, Seoul National University Advisors: Prof. Kyu-Jin Cho Project: Soft wearable robots

Education

Mar. 2014 - Aug. 2020	**Ph.D. in Mechanical Engineering** Seoul National University, Seoul, Korea Dissertation: Tendon-Driven Hand Wearable Robot using Slider-Tendon Linear Actuator Advisor: Prof. Kyu-Jin Cho
Mar. 2012 - Feb. 2014	**M.S. in Mechanical and Aerospace Engineering** Seoul National University, Seoul, Korea Thesis: A user-friendly assistive glove for SCI people performing natural writing posture Advisor: Prof. Kyu-Jin Cho
Mar. 2008 - Feb. 2012	**B.S. in Mechanical and Aerospace Engineering** Seoul National University, Seoul, Korea Advisor: Prof. Minsu Kim

PUBLICATIONS (links to papers available at biorobotics.snu.ac.kr)

International Journals

1. **Byungchul Kim**, Useok Jeong, Brian Byunghyun Kang, Kyu-Jin Cho, "Slider-Tendon Linear Actuator with Under-actuation and Fast-connection for Soft Wearable Robots ", in ***IEEE/ASME Transactions on Mechatronics*** **(I.F 5.673, Top 5%)**, vol. 26, no. 6, pp. 2932-2943, Dec. 2021, doi: 10.1109/TMECH.2020.3048962.[video]
2. **Byungchul Kim**, Jiwon Ryu, Kyu-Jin Cho, "Joint Angle Estimation of a Tendon-Driven Soft Wearable Robot through a Tension and Stroke Measurement," in ***Sensors*** **(I.F 3.275, Top 25%)**, 20.10 (2020): 2852.
3. **Byungchul Kim**, Hyunki In, Daeyoung Lee, Kyu-Jin Cho, "Development and assessment of a hand assist device: GRIPIT", in ***Journal of NeuroEngineering and Rehabilitation*** **(I.F 3.519, Top 10%)**, 14.1 (2017): 15. [video]

Journals in Preparation / Under Review

4. **Byungchul Kim**, Useok Jeong, Kyu-Jin Cho, " Analysis and Design of Dual Tendon Routing for the Under-actuated Tendon-Driven Robotic Systems ", submitted, in ***IEEE Transactions on Robotics***.
5. **Byungchul Kim**, Kyubum Kim, Sejin Jeong, Kyu-Jin Cho, " Exo-Glove Shell: A Hybrid Exo-Glove for the Thumb Opposition with an Under-Actuated Tendon-Driven System," in preparation.

Patents

6. Kyu-Jin Cho, **Byungchul Kim**, Daeyoung Lee, “PEN HOLDER”, US 9522562, US.
7. Kyu-Jin Cho, Hyunki In, Kyuhan Cho, **Byungchul Kim**, “PASSIVE VARIABLE TRANSMISSION FOR WIRE DRIVEN JOINT MECHANISM”, 10-11600270-0000, KR. **** Technology transfer****
8. Kyu-Jin Cho, **Byungchul Kim**, Hyungmin Choi, “SLIDER TYPE TENDON DRIVEN ACTUATOR FOR UNDER-ACTUATION AND GLOVE TYPE WEARABLE ROBOT HAVING THE SAME ACTUATOR”, 2020/005275, Patent pending (PCT/KR).

Books

9. Myungjoon Lim, Jiyoung Park, Kuem Ju Lee, Hyosun Kweon, **Byungchul Kim**, Kyu-Jin Cho, Hyun Choi, "Usability of a New Writing Assistive Device for Persons with Cervical Spinal Cord Injury," in ***Studies in health technology and informatics**, 217 (2015): 710-717.*

Other Conferences

10. Kyubum Kim, **Byungchul Kim,** Kyu-Jin Cho, “Data-driven Inverse Kinematics for Human Hand”, International Conference on Control Automation and Systems, Korea, October 2021.
11. **Byungchul Kim,** Useok Jeong, Brian Byunghyun Kang, Kyu-Jin Cho, “Slider-Tendon Linear Actuator with Under actuation and Fast connection for Soft Wearable Robots”, International Conference on Advanced Intelligent Mechatronics, on-line, July 2021.
12. **Byungchul Kim**, Kyu-Jin Cho, “Wrist Anchor for Soft Hand Wearable Robot”, The Korean society of Mechanical Engineers, on-line, April 2021.
13. **Byungchul Kim**, Hyungmin Choi, Kyu-Jin Cho, “Wrist tendon anchor for soft wearable robot”, The Korean society of Mechanical Engineers, on-line, December 2020.
14. Sanghee Cheon, Brian Byunghyun Kang, **Byungchul Kim**, Hyungmin Choi, Kyubum Kim, Kyu-Jin Cho, "Exo-Glove Power: A Soft Wearable Hand Robot for Power Grasp Enhancement,", International Conference of Control Automation and Systems, Jeju Island, Korea, July 2019.
15. **Byungchul Kim**, Brian Byunghyun Kang, Sanghee Cheon, Hyungmin Choi, Kyubum Kim, Kyu-Jin Cho, "Wrist tendon anchor for soft wearable robot," International Conference of Control Automation and Systems, Jeju Island, Korea, July 2019.
16. **Byungchul Kim**, Kyu-Jin Cho, "Modeling of the relationship between wire tension and joint torque for force control of tendon driven hand assist wearable robot", International Conference of Control Automation and Systems, Pyeongchang, Korea, October 2018.
17. **Byungchul Kim**, Haemin Lee, Sanghoon Kim, Kyu-Jin Cho, “Tendon path design of robotic hand for natural hand motion, The Korean society of Mechanical Engineers, Daejeon, Korea, April 2017.
18. Jiyoung Park, Myungjoon Lim, Keumju Lee, Hyosoon Kweon, **Byungchul Kim**, Kyu-Jin Cho, Hyeon Choi, Usability assessment of a glove type writing assistive device for people with spinal cord injury, International Convention on Rehabilitation Engineering, and assistive technology, Midview city, Singapore, August 2015.
19. **Byungchul Kim,** Daeyoung Lee, Kyu-Jin Cho, Development of tendon maintain system for tendon-driven wearable device, The Korean Society of Precision Engineering, Jeju Island, Korea, May 2015.
20. **Byungchul Kim**, Hyunki In, Kyu-Jin Cho, Strap driven system for hand soft exoskeleton, International Biomedical Engineering Conference, Gwangju, Korea, November 2014.
21. **Byungchul Kim**, Daeyoung Lee, Jisuk Kim, Hyunki In, Kyu-Jin Cho, Usability assessment of a glove type writing assistive device for people with spinal cord injury, Rehabilitation Engineering and Assistive Technology Society of Korea, Jeonju, Korea, April 2012.

Theses and Dissertations

22. **Byungchul Kim**, “Tendon-Driven Hand Wearable Robot using Slider-Tendon Linear Actuator”, Doctoral Dissertation, Seoul National University, Seoul, Korea.
23. **Byungchul Kim**, “A user-friendly assistive glove for SCI people performing natural writing posture”, Master’s thesis, Seoul National University, Seoul, Korea.

Research

In Biorobotics Laboratory, Seoul National University, Seoul, Korea

2021 - Present **Rehabilitation robot system for untact self-training**
Funded by National Research Foundation of Korea, Ministry of Trade, Industry and Energy of Korea

- Upper limb rehabilitation robot system for untact self-training

Contributed the actuator design (Slider-Tendon Linear Actuator)

2020 - Present **SoFT meta-Human**

Funded by National Research Foundation of Korea, Ministry of Science, ICT and Future Planning

- Soft wearable robots for everyday use.

Contributed the design, prototyping, and experiments.

2020 - Present **GUI for the Hand Wearable Robot**

- GUI for the user to manipulate the hand wearable robot

Contributed the original idea, GUI design, coding

2020 - Present **Soft Hand Wearable Robot for Poliomyelitis**

Funded by National Rehabilitation Center of Korea

- Customized hand wearable robot design for the poliomyelitis

Contributed the design, control for the safety.

2017 - Present **Exo-Glove Thumb**

- Dissertation Topic for Ph. D
- Hand wearable robot that assists the thumb opposition with under-actuation mechanism.

Contributed the original idea, design, prototyping, experiments, and analyzing the data.

2020 - Present **POE Grasp**

- Tendon-driven robot simulation toolkit using Matlab

Contributed the original idea, coding, and validation

2017 - Present **Tendon-driven Actuators for the Soft Wearable Robots**

Funded by National Research Foundation of Korea, Ministry of Trade, Industry and Energy of Korea

- Slider-Tendon Linear Actuator (Dissertation Topic for Ph. D) **** Exhibited in 2020 CES / 2019 RoboSoft****

Contributed the original idea, design, prototyping, experiments, and analyzing the data.

- Slack Enabling Actuator

Stabilized the actuator performance and reduced the actuator size.

- Series/Parallel Elastic Actuator

Designed series/parallel elastic actuator for the tendon-driven soft wearable robot.

2020 - 2021 **Exo-Index**

- Hand wearable robot generating three different postures using machine learning technic.

Contributed the original idea, design, prototyping, experiments, and analyzing the data.

2020 - 2021 **Exo-Glove Poly II ** Exhibited in 2020 CES ****

Funded by National Rehabilitation Center of Korea

- Hand wearable robot generating three different postures using machine learning technic.

Contributed the actuator design.

2015 - 2017 **Development of Biomimetic Bionic Hand Mechanism**

Funded by National Research Foundation of Korea, Ministry of Science, ICT and Future Planning

- Prosthetic hand for the amputee

Contributed the design of tendon-driven actuators, tendon routings, and electric circuit.

2014 - 2015 **Under-actuated bionic arm system ** Technology transfer****

Funded by National Research Foundation of Korea, Ministry of Science, ICT and Future Planning

- Under-actuated Prosthetic hand for the amputee

Contributed the under-actuated tendon routing design.

2013 - 2017 **GRIPIT ** Minister`s Prize, 16th Industrial Technology Award of the Month ****

Funded by National Research Foundation of Korea, Ministry of Industry and Energy

(Co-work with SMT Inc.)

- Active Hand Assist Device for the People with Spinal Cord Injury

Contributed the original idea, design, prototyping, experiments, and analyzing the data.
Received $2,000 investment through social funding (KaKao Story Funding)

2013 - 2014 **Development of an Embedded Control Module for Rehabilitation Devices**
Funded by National Rehabilitation Center of Korea
(Co-work with National Rehabilitation Center of Korea and NT Research Inc.)
- Rehabilitation devices for the stroke people

Participated in clinical trials with muscular disease patients and SCI patients

2012 - 2015 **Exo-Glove**
Funded by National Rehabilitation Center of Korea
Funded by National Research Foundation of Korea, Ministry of Education and Science Technology
- Hand wearable robot for the spinal cord injury

Participated in clinical trials with muscular disease patients and SCI patients (Co-work with National Rehabilitation Center of Korea)

Technical Skills

Design & Manufacturing, Embedded system, Control, Clinical test

- *Various prototyping experiences* (Exo-Glove, Bionic arm, GRIPIT, embedded control module for rehabilitation devices, experimental setups)
- *Actuator design and control* (Tendon-driven actuators for the soft wearable robots, low-level control, CAN open communication)
- *Clinical test experiences* (Clinical test of Exo-Glove, GRIPIT, Bionic arm, rehabilitation devices for the stroke patient, etc.)
- *Controller design and simulation* (MATLAB, Labiew, QT creator, etc.)
- *Control system prototyping* (ROS, CompactRIO, FPGA, STM, Arduino, etc.)
- *Analysis* (MATLAB, Working model 2D, etc.)
- *CAD design* (SOLIDWORKS, CARTIA, etc.)
- *Manufacturing* (CNC milling, laser cutter, 3D printing, etc.)
- *Circuit design, Artworks* (KiCAD)

Scholarship

Sep. 2016 - Dec. 2016 **Brain Korea 21 Research Scholarship**
Sep. 2012 - Dec. 2012 *Funded by National Research Foundation of Korea*
Mar. 2012 - Jun. 2012

Mar. 2014 - Jun. 2014 **Lecture & Research Scholarship**
Funded by Seoul National University

Sep. 2011 - Dec. 2011 **Superior Academic Performance**
Sep. 2010 - Dec. 2010 *Funded by Seoul National University*
Sep. 2009 - Dec. 2009

Honor and Awards

Dec. 2016 Excellence award, Government 3.0 National Participation and Collaboration Contest, Ministry of Health and Welfare
Nov. 2012 Excellence award, Creative design competition, Seoul National University
Nov. 2012 Bronze prize, International Co-Creative Design Competition, Bronze prize

Teaching Experience

Mar. 2017 - Jun. 2017 **Teaching Assistant**
Introduction for soft robotics (Prof. Kyu-Jin Cho)
Seoul National University

Mar. 2012 - Jun. 2012 **Teaching Assistant**
Mechanical System Modeling and Control (Prof. Kyu-Jin Cho)
Seoul National University

Mar. 2020 - Dec. 2020 **B.S Thesis/UROP Tutoring**
Mar. 2019 - Jun. 2019 Led the B.S. Thesis of three undergraduate students (Prof. Kyu-Jin Cho)
Mar. 2018 - Dec. 2018 Led four students for the Undergraduate Research Opportunities (Prof. Kyu-Jin Cho)
Mar. 2017 - Dec. 2017 *Seoul National University*
Mar. 2012 - Dec. 2012