

DONGHOON BAEK

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Education

University of Illinois at Urbana-Champaign

Ph.D. in Mechanical Science and Engineering (Advisor: Prof. Joao Ramos)

Aug. 2021 – Current

Urbana, IL

Korea Advanced Institute of Science and Technology (KAIST)

M.S. in Robotics Program (Advisor: Prof. Dong-Soo Kwon, GPA: 3.68 / 4.0)

Sep. 2017 – Jun. 2019

Daejeon, Republic of Korea

University of Kwangwoon

B.S. in Robotics Program (Advisor: Prof. Whang Cho, GPA: 3.81/4.0)

Feb. 2011– Feb. 2017

Seoul, Republic of Korea

Areas of Expertise

Robotics, Machine Learning, Control, Sim-to-Real, Legged-Robot, Medical Robot, Computer Vision

Work Experience

ROEN Surgical Inc

Research Engineer

Sep. 2020 – Jun 2021

Daejeon, Republic of Korea

- Developed a software program (control, architecture, communication, and GUI) for a flexible surgical robot. (C++, ROS, Ethercat, Qt, OpenGL)
- Developed a GAN-based surgical instrument segmentation and a vision-based feed-forward controller.
- Developed a parameter optimization algorithm (PSO, GA, Scipy)
- Improved the control performance of a surgical robot for ureteroscopy using real-time smooth trajectory planning.
- Developed the optimization algorithm to find the optimal port placement for a laparoscopic surgical robot.
- Designed and manufactured a flexible surgical robot testbed system considering wire tension control.

MosQ Inc

Robotics Engineer

Mar 2020 – Aug 2020

Seoul, Republic of Korea

- Designed the automated intravenous blood collection robotic system (SolidWorks).
- Developed a control software architecture (GUI, multi-threads, motor control).

ROEN Surgical Inc

Research Intern

Sep 2019 – Feb 2020

Daejeon, Republic of Korea

- Developed software to control a flexible surgical robot. (C++, Python, ROS, OpenGL)
- Improved the control performance of a flexible surgical robot using a hysteresis reduction algorithm.

Korea Army

Tactical Assistant to a military officer

Oct 2011 – Jul 2013

Yeong-Cheon, Republic of Korea

Selected Publication

Learning Inertial Parameter Identification of Unknown Object with Humanoid Robot using Sim-to-Real Adaptation, D. Baek*, B Peng, S Gupta, J Ramos, In Submission to ICRA 2024.

A Study of Shared-Control with Bilateral Feedback for Obstacle Avoidance in Whole-body Telelocomotion of a Wheeled Humanoid, D. Baek*, J. Chang* and J. Ramos, In IEEE Robotics and Automation Letters, 2023.

Learning-based discrete hysteresis classifier using wire tension and compensator for flexible endoscopic surgery robots, Donggeol Lee, DongHoon Baek, Hansoul Kim, Joonhwan Kim, and Dong-Soo Kwon, In International Journal of Precision Engineering and Manufacturing, 2022.

Hands-free Telelocomotion of a Wheeled Humanoid, A Purushottam, Y Jung, K Murphy, D Baek, J Ramos, In IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022.

Hybrid LMC: hybrid learning and model-based control for wheeled humanoid robot via ensemble deep reinforcement learning, D. Baek, A. Purushottam, and J. Ramos, In IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022.

ViO-Com: Feed-forward compensation using vision-based optimization for high-precision surgical manipulation, D. Baek, Y. -H. Nho and D. -S. Kwon, In IEEE Robotics and Automation Letters, vol. 7, no. 1, pp. 263-270, Jan. 2022, doi: 10.1109/LRA.2021.3123375.

A novel encountered-type master device with precise manipulation for robot-assisted microsurgery, Kim, D.S., Yang, U.J., Cheon, B., **Baek, D.**, and Kwon, D.S., In the International Journal of Medical Robotics and Computer Assisted Surgery, 17(6), e2314.

Hysteresis Compensator With Learning-Based Hybrid Joint Angle Estimation for Flexible Surgery Robots, **D. Baek**, J. -H. Seo, J. Kim and D. -S. Kwon, In IEEE Robotics and Automation Letters, vol. 5, no. 4, pp. 6837-6844, Oct. 2020, doi: 10.1109/LRA.2020.2972821.

Hysteresis Compensator with Learning-based Pose Estimation for a Flexible Endoscopic Surgery Robot, **Baek, Donghoon**, Ju-Hwan Seo, Joonhwan Kim, and Dong-Soo Kwon, In 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 2983-2989. IEEE, 2019.

Effects of Flexible Surgery Robot on Endoscopic Procedure: Preliminary Bench-Top User Test, Joonhwan Kim, Minho Hwang, Dongho Lee, Hansoul Kim, Jeongdo Ahn, Jaemin You, **Baek, Donghoon**, Dong-Soo Kwon, In 2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN).

Image-based hysteresis compensator for a flexible endoscopic surgery robot, **Baek, Donghoon**, Ju-Hwan Seo, Joonhwan Kim, Dong-Soo Kwon, In 2019 16th International Conference on Ubiquitous Robots (UR) (*Best Paper Award*).

Path planning for automation of surgery robot based on probabilistic roadmap and reinforcement learning, **Baek, Donghoon**, Minho Hwang, Hansoul Kim, Dong-Soo Kwon, In 2018 15th International Conference on Ubiquitous Robots (UR)).

Robust trajectory tracking of Master-Slave surgery robot system based on PD with Integral Sliding Mode Control, Hansoul Kim, Minho Hwang, **Donghoon Baek**, and Dong-Soo Kwon, In 2018 15th International Conference on Ubiquitous Robots (UR)).

Shape-Locking Mechanism of Flexible Joint Using Mechanical Latch With Electromagnetic Force, D. G. Chung, J. Kim, **D. Baek**, J. Kim and D. -S. Kwon, In IEEE Robotics and Automation Letters, vol. 4, no. 3, pp. 2661-2668, July 2019, doi: 10.1109/LRA.2019.2897006.

A flexible endoscopic surgery robot K-FLEX and its feasibility validation in in-vivo animal trial, M. Hwang, J. H. Kim, D. H. Lee, J. Ahn, J. You, **D. Baek**, H. Kim, D. Son, D. S. Kwon, In the 14th Asian Conference on Computer Aided Surgery. (ACCAS 2018) (*Best Paper Award*).

Development of the rescue robot for earthquake zone, **DH Baek**, YT Kim, HS Kim, SY Lee, HS Lee, TM Hwang, GW Park, JH Back, In the 12th Korea Robotics Society Annual Conference. (KRoC2017) (*Best Student Paper Award*).

Selected Presentations

Hybrid LMC: hybrid learning and model-based control for wheeled humanoid robot via ensemble deep reinforcement learning, **D. Baek**, A. Purushottam, and J. Ramos, In IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Kyoto, Japan, 2022.

Hysteresis Compensator with Learning-based Pose Estimation for a Flexible Endoscopic Surgery Robot, **Baek, Donghoon**, Ju-Hwan Seo, Joonhwan Kim, and Dong-Soo Kwon, In 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 2983-2989. IEEE, MACAU, CHINA, 2019.

Image-based hysteresis compensator for a flexible endoscopic surgery robot, **Baek, Donghoon**, Ju-Hwan Seo, Joonhwan Kim, Dong-Soo Kwon, In 2019 16th International Conference on Ubiquitous Robots (UR), Jeju, Korea, 2019 (*Best Paper Award*).

Path planning for automation of surgery robot based on probabilistic roadmap and reinforcement learning, **Baek, Donghoon**, Minho Hwang, Hansoul Kim, Dong-Soo Kwon, In 2018 15th International Conference on Ubiquitous Robots (UR), Honolulu, HI, 2018).

Development of the rescue robot for earthquake zone, **DH Baek**, YT Kim, HS Kim, SY Lee, HS Lee, TM Hwang, GW Park, JH Back, In the 12th Korea Robotics Society Annual Conference. (KRoC2017), Phoenix Pyeongchang Snow Park, Korea, 2017 (*Best Student Paper Award*).

Projects / Competition

Control of an epiduroscopy robotic system and develop a navigation system 2018 – 2019

- Developed a software to control an epiduroscopy robotic system.
- Motor control, teleoperation control, Aurora Sensor, GUI.

Mine removal training system using IoT and App 2018

- Proposed an idea to develop the mine removal training system using IoT and App.

Torque-based control of the smart robotic grasper 2017

- Developed a safe torque-controller for a robotic grasper to grab unknown objects.
- Control motors using an embeded system.

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| Developed a rescue robot, ROSA | 2016 |
| <ul style="list-style-type: none"> • Designed a robotic manipulator and Developed a task-space manipulator controller. • Dynamixel motor control, Numerical Inverse kinematics, GUI | |

Awards / Honors

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| Top 10 Mechanical Technology Award, KFMES, Korea | 2019 |
| <ul style="list-style-type: none"> • Designed a master device system for a flexible surgical robot. | |
| Best Paper award, the 16th International Conference on Ubiquitous Robots (UR 2019) | 2019 |
| <ul style="list-style-type: none"> • Image-based hysteresis compensator for a flexible endoscopic surgery robot, | |
| Best Application Award and Overall Winner, Hamlyn Surgical Robot Challenge, London, UK | 2018 |
| <ul style="list-style-type: none"> • Designed a master device system for a flexible surgical robot. | |
| Minister of National Defense Award, Military defense start-up competition, Korea | 2018 |
| <ul style="list-style-type: none"> • Mine removal training system using IoT and App. | |
| Best Paper award, the 14th Asian Conference on Computer Aided Surgery. (ACCAS 2018) | 2018 |
| <ul style="list-style-type: none"> • A flexible endoscopic surgery robot K-FLEX and its feasibility validation in in-vivo animal trial | |
| Best Paper award, the 12th Korea Robotics Society Annual Conference. (KRoC2017) | 2017 |
| <ul style="list-style-type: none"> • Development of the rescue robot for earthquake zone | |
| Excellent Paper award, University of Kwangwoon, Korea | 2016 |
| <ul style="list-style-type: none"> • Development of the rescue robot for earthquake zone. | |
| Second Prize, University of Kwangwoon, Korea | 2016 |
| <ul style="list-style-type: none"> • KwangWoon IT eXhibition (KWIX). | |
| Second Prize, International Robot Contest, Korea | 2015 |
| <ul style="list-style-type: none"> • Mini DARPA Robotics Challenge. | |
| Scholarships for the highest academic results, University of Kwangwoon, Korea | 2013–2016 |
| Robocup final competition, Robocup, Germany | 2016 |
| <ul style="list-style-type: none"> • Disaster rescue robot. | |
| Robot Demonstration, IEEE-RAS humanoids 2015, Korea | 2015 |
| <ul style="list-style-type: none"> • Disaster rescue robot. | |

Programming Experience

Python, C, C++, Matlab, Pytorch, Tensorflow, OpenCV

Reference

Prof. Joao Ramos Assistant Professor in the Mechanical Science and Engineering Electrical & Electrical and Computer Engineering at the University of Illinois at Urbana Champaign, Illinois, United States. Email: jlramos@illinois.edu

Prof. Saurabh Gupta Assistant Professor in Computer Science & Electrical and Computer Engineering at the University of Illinois at Urbana Champaign, Illinois, United States. Email: saurabhg@illinois.edu

Prof. Dong-Soo Kwon

Professor in the School of Mechanical Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea. Email: kwonds@kaist.ac.kr