

# Sangwoon Kim

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## Education

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### MIT

Cambridge, MA, United States

PH.D. IN MECHANICAL ENGINEERING

2020 - 2024 (Exp.)

- GPA: **5.0/5.0**
- Thesis (tentative): **Active Object Manipulation with a Robot's Sense of Touch**
- Committee: **Alberto Rodriguez** (advisor), **John Leonard**, **Pulkit Agrawal**, **Sangbae Kim**

M.S. IN MECHANICAL ENGINEERING

2018 - 2020

- GPA: **5.0/5.0**
- Thesis: **Model-Free Tracking Control of an Optical Fiber Drawing Process Using Deep Reinforcement Learning**
- Advised by **Brian Anthony**

### Seoul National University (SNU)

Seoul, S.Korea

B.S. IN MECHANICAL AND AEROSPACE ENGINEERING

2012 - 2018

- GPA: **4.24/4.3** (*Summa Cum Laude*, rank: 1/139)
- Thesis: **Analysis of DNA's Mechanical Properties Using Molecular Dynamics Simulation and Principal Components Analysis**
- Two years of absence for military service (2014 - 2016)

## Experience

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### Amazon

Cambridge, MA, United States

APPLIED SCIENTIST INTERN – ROBOTICS AI STOW TEAM

May - Aug 2023

- Manager: Paul Birkmeyer ([paubirkm@amazon.com](mailto:paubirkm@amazon.com))
- Developed motion primitives for Amazon's fulfillment center.
- Contributed to the team's motion core codebase (C++).
- Recognized for exceptional performance and received strong team endorsement for a return offer.

### MIT

Cambridge, MA, United States

GRADUATE RESEARCHER – MANIPULATION AND MECHANISMS (MCUBE) LABORATORY

2020 - 2024 (Exp.)

- PI: Alberto Rodriguez ([albertor@mit.edu](mailto:albertor@mit.edu))
- Research Area: Robot Manipulation, Robot Perception, Reinforcement Learning, Tactile Sensing
- Developed algorithms for manipulating objects by reasoning about the physical interaction between a robot, objects, and environments, using factor graphs and reinforcement learning.

GRADUATE RESEARCHER, DEVICE REALIZATION LABORATORY

2018 - 2020

- PI: Brian Anthony ([banthony@mit.edu](mailto:banthony@mit.edu))
- Research Area: Smart Manufacturing, Machine Learning, Process Control
- Deployed reinforcement learning to control manufacturing processes with complex dynamics.

### Ecole Polytechnique de Montreal

Montreal, QC, Canada

UNDERGRADUATE INTERN, LABORATORY OF MULTI-SCALE MECHANICS

Jan. - May. 2017

- PI: Frederick Gosselin ([frederick.gosselin@polymtl.ca](mailto:frederick.gosselin@polymtl.ca))
- Research Area: Numerical Simulation, Structure-Fluid Interaction
- Developed a finite-difference numerical simulation to predict the self-induced flapping of a bio-inspired filament.

## Skills

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**Programming:** Python, C++, Matlab, Java

**Robotics/Machine Learning:** Robot Operating System (ROS), ML (PyTorch, Tensorflow), Computer Vision (OpenCV), Probabilistic Inference & Sensor Fusion (Factor Graph), Microcontroller/Microprocessor (Arduino, Raspberry Pi), Robot Arms (ABB, Universal Robots, Franka Emika), Tactile Sensing (GelSight)

**Others:** 3D Modeling/Analysis (SolidWorks, OnShape, CATIA, Auto-CAD, ANSYS), Manufacturing (CNC Milling, Lathe, 3D Printing, Waterjet, Laser Cutting), LaTeX

## Publications & Talks

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*\*equal contribution*

### JOURNAL

- [\\*S. Kim](#), [\\*D. Kim](#), and [B. Anthony](#). **Dynamic Control of a Fiber Manufacturing Process using Deep Reinforcement Learning**. IEEE/ASME Transactions on Mechatronics (TMech). 2021.
- [D. Kang](#), [D. Kim](#), [S. Kim](#), [D. Kim](#), [J. Cheon](#), [B. Anthony](#). **Homomorphic Encryption as a secure PHM outsourcing solution for small and medium manufacturing enterprise**. Journal of Manufacturing Systems. 2021.

### CONFERENCE

- [\\*S. Kim](#), [\\*A. Bronars](#), [P. Patre](#), and [A. Rodriguez](#). **Simultaneous Tactile Estimation and Control for In-hand Object Manipulation**. International Conference on Robotics and Automation (ICRA). 2024. (submitted)
- [S. Kim](#), [D. Jha](#), [D. Romeres](#), [P. Patre](#), and [A. Rodriguez](#). **Simultaneous Tactile Estimation and Control of Extrinsic Contact**. International Conference on Robotics and Automation (ICRA). 2023.
- [J. Xu](#), [S. Kim](#), [T. Chen](#), [A. Rodriguez](#), [P. Agrawal](#), [W. Matusik](#), and [S. Sueda](#). **Efficient Tactile Simulation with Differentiability for Robotic Manipulation**. Conference on Robot Learning (CoRL). 2022.
- [S. Kim](#) and [A. Rodriguez](#). **Active extrinsic contact sensing: Application to general peg-in-hole insertion**. International Conference on Robotics and Automation (ICRA). 2022.
- [S. Dong](#), [D. Jha](#), [D. Romeres](#), [S. Kim](#), [D. Nikovski](#) and [A. Rodriguez](#). **Tactile-RL for Insertion: Generalization to Objects of Unknown Geometry**. International Conference on Robotics and Automation (ICRA). 2021.
- [J. Cuiff](#), [H. Wang](#), [J. Heim](#), [B. Anthony](#), [S. Kim](#), [D. Kim](#). **Factory 4.0 Toolkit for Smart Manufacturing Training**. ASEE Annual Conference & Exposition. 2021.

### WORKSHOP TALK

- [\\*S. Kim](#), [\\*A. Bronars](#), [P. Patres](#), and [A. Rodriguez](#). **Simultaneous Estimation and Control for Object Manipulation**. RoboTac Workshop at IROS. 2023.
- [S. Kim](#) and [A. Rodriguez](#). **An Active Extrinsic Contact Sensing for Generalizable Insertion Strategy**. RoboTac Workshop at IROS. 2021.
- [S. Kim](#) and [B. Anthony](#). **Deep Reinforcement Learning for Real-Time Control**. MIT MIMO Deep Learning Workshop. 2021.

### THESIS

- [S. Kim](#). **Model-free tracking control of an optical fiber drawing process using deep reinforcement learning**. MS Thesis. MIT. 2020.
- [S. Kim](#). **Analysis of DNA's Bending and Stretching Rigidities Using Molecular Dynamics Simulation and Principal Components Analysis by Changing The Number of Base Pairs and Concentration of  $MgCl_2$** . BS Thesis. SNU. 2018 (Outstanding BS Thesis Presentation Award)

### PATENT

- [B. Anthony](#), [D. Kim](#), [S. Kim](#). **Dynamic control of a manufacturing process using deep reinforcement learning**. US Patent. 2022. (pending)

## Honors & Awards

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Ascher H. Shapiro Fellowship, MIT	2018
Kwanjeong Educational Foundation Scholarship	2018
Outstanding BS Thesis Presentation Award, SNU	2017
Excellence Award in Undergraduate Student Paper Contest, SNU	2017
National Scholarship for Science and Engineering, Korea Government	2016
Eminence Scholarship, SNU	2013
SNU Development Fund Scholarship, SNU	2012
Silver Medal, International Olympiad on Astronomy and Astrophysics (IOAA)	2011

## Graduate Level Coursework

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**Robotics:** Robotic Manipulation (A), Underactuated Robotics (A+), Computer Vision (A), System Dynamics and Control (PE), Planning (A), Optimization (A), Inference (A)

**Others:** Manufacturing (A+), Heat Transfer (A+), Computational Engineering (A), Stochastic Systems (A)

## Other Experience

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- Reviewer, IEEE Robotics and Automation Letters (RA-L) 2023, 2024
- Reviewer, International Conference on Robotics and Automation (ICRA) 2022, 2023, 2024
- Board Member, MIT Korean Graduate Student Association 2019-2022
- Course Developer, Smart Manufacturing, MIT Professional Education 2019
- Teaching Assitant, Smart Manufacturing Leadership Program, MIT Professional Education 2018
- Naval Deck Operator (Petty Officer 2nd Class), Republic of Korea Navy (ROKN) 2014-2016
  - Defended the Northern Limit Line (NLL) on the frontline against North Korean threats
  - Awarded Crew of the Month, ROK ship JEJU 2014 Oct.
- Tutor, Undergraduate Peer-Tutoring Program, SNU 2013-2018
  - Tutored freshman/sophomore students Physics, Writing, and English