

# Jeongmin Lee

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Ph.D., Robotics

My research focuses on developing intelligence for robotic manipulation involving contact interactions. During my Ph.D., I worked on theories of contact modeling and solvers for high-performance robotic simulators, as well as efficient algorithms for planning, estimation, and control related to contact dynamics. Currently, I am broadening my scope to explore the intersection of contact modeling, solvers, and machine learning. Additionally, I am actively involved in creating a software suite for robotic manipulation applications.

## EDUCATION

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|---|-----------------------|
| <b>Seoul National University</b>   <i>Seoul, S. Korea</i> | Mar. 2019 - Aug. 2024 |
| • M.S.-Ph.D. in Mechanical Engineering                    |                       |
| <b>Seoul National University</b>   <i>Seoul, S. Korea</i> | Mar. 2015 - Feb. 2019 |
| • B.S. in Mechanical and Aerospace Engineering            |                       |

## EXPERIENCE

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| <b>Postdoctoral Researcher, SNU INRoL</b>   <i>Seoul, S. Korea</i>                                | Sep. 2024 -           |
| • Mechanics & Control group leading (Supervisor: Dongjun Lee)                                     |                       |
| <b>Graduate Research Assistant, SNU INRoL</b>   <i>Seoul, S. Korea</i>                            | Mar. 2019 - Aug. 2024 |
| • Advisor: Dongjun Lee  |                       |
| • Research on developing high performance robot simulation and contact manipulation               |                       |
| <b>Research Intern, Korea Institute of Science and Technology (KIST)</b>   <i>Seoul, S. Korea</i> | May 2018 - Dec. 2018  |
| • Advisor: Sungkee Park   |                       |
| • Developed a Lidar localization algorithm based on CNN and ICP                                   |                       |
| <b>Teaching Assistant</b>   |                       |
| • Control System 1 (M2794.005300)   | Spring 2021           |
| • Mechanical System Modeling and Control (M2794.013500)   | Spring 2020           |

## AWARDS AND HONORS

- Outstanding Doctoral Thesis Award**
  - Efficient and Scalable Methods for Contact Manipulation: From Simulation to Estimation and Planning
- Runner-up Award of the Embracing Contacts Workshop in ICRA 2023**
  - A new type of geometric definition that provides differentiable contact features
  - An optimization algorithm for pose estimation during contact
- Best Manipulation Paper Award Finalist in ICRA 2021**
  - Flexible cable simulation algorithm and sim-to-real verification
- Outstanding BS Thesis Presentation Award**
  - Localization based on Lidar image using CNN and ICP

## PUBLICATIONS

### Journal Articles

- Jeongmin Lee**, Minji Lee, and Dongjun Lee, Large-Dimensional Multibody Dynamics Simulation using Contact Nodalization and Diagonalization, IEEE Transactions on Robotics 2022.

### Conference Proceedings

- Seoki An, Somang Lee, **Jeongmin Lee**, Sunkyung Park, Dongjun Lee, Collision Detection between Smooth Convex Bodies via Riemannian Optimization Framework, IEEE/RSJ IROS 2024.
- Jeongmin Lee\***, Minji Lee\*, and Dongjun Lee, Uncertain Pose Estimation during Contact Tasks using Differentiable Contact Features, RSS 2023.
- Jeongmin Lee**, Minji Lee, and Dongjun Lee, Modular and Parallelizable Multibody Physics Simulation via Subsystem-Based ADMM, IEEE ICRA 2023.
- Minji Lee, **Jeongmin Lee**, and Dongjun Lee. Differentiable Dynamics Simulation Using Invariant Contact Mapping and Damped Contact Force, IEEE ICRA 2023.
- Minji Lee, **Jeongmin Lee**, Jaemin Yoon, and Dongjun Lee, Real-Time Physically-Accurate Simulation of Robotic Snap Connection Process, IEEE/RSJ IROS 2021.
- Jeongmin Lee**, Minji Lee, Jaemin Yoon, and Dongjun Lee, A Parallelized Iterative Algorithm for Real-Time Simulation of Long Flexible Cable Manipulation, IEEE ICRA 2021. (**Best Manipulation Paper Award Finalist**)

## Under Review/In Preparation

- **Jeongmin Lee**, Minji Lee, and Dongjun Lee, Differentiable Support Functions: Theory and Application to Contact State Estimation during Manipulation, In Preparation.
- **Jeongmin Lee**, Minji Lee, Sunkyoung Park, Jinhee Yun, and Dongjun Lee, Variations of Augmented Lagrangian for Robotic Multi-Contact Simulation, Under review in IEEE Transactions on Robotics.
- Jeongseob Lee, Doyoon Kong, Hojun Cha, **Jeongmin Lee**, Dongseok Ryu, Hocheol Shin, Dongjun Lee, Wrench Control of Dual-Arm Robot on Flexible Base with Supporting Contact Surface, Under review in IEEE Transactions on Robotics.
- **Jeongmin Lee**, Minji Lee, Sunkyoung Park and Dongjun Lee, Efficient Gradient-Based Inference for Manipulation Planning in Contact Factor Graphs, Under review in IEEE ICRA 2025.
- Minji Lee, **Jeongmin Lee**, and Dongjun Lee, Narrow Passage Path Planning using Collision Constraint Interpolation, Under review in IEEE ICRA 2025.
- Harim Ji, Hyunsu Kim, **Jeongmin Lee**, Somang Lee, Seoki An, Jinuk Heo, Youngseon Lee, Yongseok Lee, and Dongjun Lee, GPU-Accelerated Subsystem-Based ADMM for Large-Scale Interactive Simulation, Under review in IEEE ICRA 2025.
- Sunkyoung Park, **Jeongmin Lee** and Dongjun Lee, Shape Abstraction via Marching Differentiable Support Functions, Under review in CVPR 2025.

## Workshops

- Minji Lee\*, **Jeongmin Lee\***, and Dongjun Lee, Assembly Path Planning via Variable Lifting and Physics Simulation, Robot Assembly Workshop in RSS 2023
- **Jeongmin Lee\***, Minji Lee\*, and Dongjun Lee, A Differentiable Formulation for Uncertain Pose Estimation during Contact, Embracing Contacts Workshop in ICRA 2023. **(Runner-up Award)**
- Minji Lee, **Jeongmin Lee**, and Dongjun Lee, Interactive Real-time Simulation of Robotic Snap Connection Process, Representing and Manipulating Deformable Objects in ICRA 2021.

## GOVERNMENT AND INDUSTRIAL PROJECTS

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<b>Development of a Digital Twin Platform for Precision Assembly Tasks</b>	Apr. 2024 -
<ul style="list-style-type: none"><li>• Ministry of Trade, Industry and Energy (MOTIE)</li><li>• Developing precise geometric and physical models and solvers for contact interactions</li></ul>	
<b>Virtual Environment and Contact Manipulation Module for Nuclear Power Plants</b>	Mar. 2022 -
<ul style="list-style-type: none"><li>• Ministry of Science and ICT (MSIT)</li><li>• Developing motion planning algorithms through contact for different emergency tasks</li></ul>	
<b>Autonomous Dish Placing Framework using Robot Manipulator</b>	Jan. 2022 - Oct. 2022
<ul style="list-style-type: none"><li>• Samsung Research</li><li>• Designed dish motion planning and state estimation module utilizing sensor data</li></ul>	
<b>High Speed &amp; Accurate Simulator for Robot Manipulation</b>	Jan. 2020 - Dec. 2021
<ul style="list-style-type: none"><li>• Ministry of Trade, Industry and Energy (MOTIE)</li><li>• Developed contact solver and sim-to-real framework of deformable object manipulation</li></ul>	
<b>Development of Remote Control Technology for Nuclear Power Plant Maintenance</b>	Jan. 2019 - Dec. 2019
<ul style="list-style-type: none"><li>• Ministry of Trade, Industry and Energy (MOTIE)</li><li>• Implemented on-board state estimation module for a dual-arm robot working at heights</li></ul>	

## ACTIVITIES

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<b>Consumer Electronics Show(CES)   Las Vegas, USA</b>	Jan. 2022
<ul style="list-style-type: none"><li>• Developed and exhibited a virtual environment platform integrated with haptic glove and physics simulation (Link)</li></ul>	

## SKILLS

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<b>Programming</b>	C/C++, MATLAB, Python
<b>Tools</b>	Simulation(MuJoCo, Bullet, Isaac Sim), Optimization(NLopt, Ipopt, Knitro, Gurobi), Robotics(ROS, Drake), Learning(Tensorflow, Stable Baselines), OpenGL, Solidworks, LaTeX
<b>Robots</b>	Franka Panda, KUKA iiwa