Hyeonbeen (Edward) Lee

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EDUCATION

Virginia Tech, Blacksburg, VA, USA — Aug. 2026 — May 2031 (Expected)
Ph.D. in Mechanical Engineering (Advisor: Simon Stepputtis)
Research Focus: Robotics, Neurosymbolic AI, Physics-aware Robot Learning

Kyung Hee University, Seoul, South Korea — Mar. 2022 — Feb. 2024
M.Eng. in Mechanical Engineering (Advisor: Jin-Gyun Kim) — GPA: 3.93/4.0
Thesis: *'Composite neural network with differential propagation for modeling impulsive nonlinear dynamic systems'*

Kyung Hee University, Seoul, South Korea — Mar. 2015 — Feb. 2022
B.Eng. in Mechanical Engineering (Advisor: Jin-Gyun Kim, Shinkyu Jeong) — (Upper Div.: 3.88/4.0) GPA: 3.52/4.0
Thesis: *'Data-driven aerodynamic coefficient prediction using deep neural network and PARSEC airfoil parameterization'*
(∗ Leave of absence for military service: May 2017 — Feb. 2019)

RESEARCH INTERESTS

Robot Learning • Physics-aware ML • Contact-rich Dynamics • Force and Tactile Sensing • Sim-to-real Transfer

PUBLICATIONS

Journal Papers

4. **H. Lee**, M. Jung, T.K. Yeu, J.B. Han, D. Park, J.G. Kim (2026), "Frequency-aware decomposition learning for sensorless wrench forecasting on a vibration-rich hydraulic manipulator", submitted to *IEEE/ASME Transactions on Mechatronics.* [preprint]
3. B. Koo, M. Jung, **H. Lee**, T. Yeu, J.G. Kim, J.B. Han, Y. Lee, D. Park, "Buoyancy-integrated hybrid reaction force estimation method with real-time haptic feedback for underwater hydraulic manipulation", under review at *IEEE Robotics and Automation Letters (RA-L).*
2. **H. Lee**, S. Han, H.S. Choi, J.G. Kim (2024), "cNN-DP: Composite neural network with differential propagation for impulsive nonlinear dynamics", *Journal of Computational Physics (WoS IF Top 2.5% in Physics, Mathematical)*, 496, 112578. [link] [code]
1. S. Han*, G.E. Jeong*, **H. Lee**, W.S. Choi, J.G. Kim (2023), "Multi-body dynamics model for spent nuclear fuel transportation system under normal transport test conditions", *Nuclear Engineering and Technology (WoS IF Top 13.7% in Nuclear Science & Technology)*, 55(11), 4125-4133. (*Co-first authors) [link]

Conferences & Proceedings

5. J.H. Han, J.B. Han, S.S. Kim, M.H. Kim, Y.H. Kim, **H. Lee**, J.G. Kim, T.K. Yeu. "Digital twin model of underwater construction robot for real-time grinding simulation", *7th International Conference on Multibody System Dynamics*, Madison, WI, USA, Jun. 2024 [link]
4. **H. Lee**, J. Han, T.K. Yeu, J.G. Kim. "Real-time multi-horizon reaction force forecasting of marine robot using interpretable Transformer", *Korean Society of Mechanical Engineers* (Oral Presentation), Incheon, South Korea, Nov. 2023 [link]
3. **H. Lee,** S. Han, H.S. Choi, J.G. Kim. "Meta-modeling of nonlinear impulsive dynamics using composite neural network model with differential propagation", *Korean Society of Mechanical Engineers* (**Excellent Paper Award**, Oral Presentation, ∗ Extended works from IMAC 2023), Busan, South Korea, May 2023. [link]
2. **H. Lee,** S. Han, H.S. Choi, J.G. Kim. "Composite neural network framework for modeling impulsive nonlinear dynamic responses", *41st International Modal Analysis Conference (IMAC)* (Oral Presentation), Austin, TX, USA, Feb. 2023 [link]
1. **H. Lee**, J.G. Kim. "Development of multibody dynamics trailer model using normal transportation test data and DNN based surrogate model generation", *Korean Society for Noise and Vibration Engineering* (Oral Presentation), Jeju, South Korea, Dec 2022

AWARDS & SCHOLARSHIPS

- **Excellent Paper Award** — Korean Society of Mechanical Engineers, 2023
  - Awarded for a first-author presentation on physics-aware modeling of contact-rich dynamics.
- **Graduate Assistant Scholarship** — Graduate School, Kyung Hee University, 2022 — 2023
  - Appointed as lead departmental assistant and received additional funding for graduate studies.
- **Academic Superiority Scholarship** — Kyung Hee University, Spring 2021
  - Ranked 1st in the GPA-based departmental merit scholarship review and received a full tuition waiver.

RESEARCH EXPERIENCES

Kyung Hee University — Postgraduate Researcher
Modeling & Simulation Lab., advised by *Jin-Gyun Kim* — Mar. 2024 — Present

- Accelerated and improved the force model for real-time deployment in the control loop for KRISO. Independently secured the project for a year.
- **Ongoing:** Extended the frequency-aware probabilistic force estimation model as a generalizable framework. Finalizing a manuscript for a first-author publication.

KAIST Graduate School of AI — Research Engagement
Cognitive Learning for Vision & Robotics Lab., advised by *Joseph J. Lim* — Sep. 2023 — Nov. 2023

- Conducted a two-month intensive literature review on skill prior regularized reinforcement learning (SPiRL) and delivered a 90-minute technical presentation to lab members and faculty.
- Received a formal internship offer from the lab director following the presentation (offer later declined).

Kyung Hee University — Master's Student
Modeling & Simulation Lab., advised by *Jin-Gyun Kim* — Mar. 2022 — Feb. 2024

- Proposed a novel neural network architecture for learning complex dynamics from multi-order derivatives. Resulted in a first-author publication in *Journal of Computational Physics*.
- Developed a neural metamodel of real-world vehicle dynamics with high-fidelity physics simulation for the Korea Atomic Energy Research Institute (KAERI). Resulted in a co-authored publication in *Nuclear Engineering and Technology*.
- Designed a generative frequency-aware model to forecast contact-rich force dynamics of a marine excavation robot in real time for the Korea Research Institute of Ships and Ocean Engineering (KRISO). Independently and successfully secured the project for two years.
- Actively explored and implemented methods from diverse ML domains including time-series forecasting, computer vision, physics-informed learning, and system identification.

Kyung Hee University — Undergraduate Researcher
Modeling & Simulation Lab., advised by *Jin-Gyun Kim* — Jan. 2021 — Feb. 2022

- Investigated data-driven methods for flexible multibody dynamics as part of a government-funded research project on vehicle dynamics simulation.

SKILLS

- **Programming Languages:** Python · MATLAB · C++ · LaTeX
- **Software & Frameworks:** PyTorch · Git · Docker · ROS · RecurDyn · Gazebo · MuJoCo · OpenAI API
- **Scientific Computing:** Flexible multibody dynamics · Finite element methods · Numerical analysis
- **Natural Languages:** Korean (Native) · English (TOEFL iBT 111) · Japanese (Advanced proficiency)

SELECTED PROJECTS

- Segment-Anybody, at *Kyung Hee University Dept. of AI.* [code]
  - Fine-tuned Meta's Segment-Anything Model (SAM) for detailed human body parts segmentation in human-robot interaction.
- Deep seq2seq from scratch, *Personal project.* [code]
  - Scratch-implemented deep sequence-to-sequence models, from RNN to Transformer variants.
- ROS SLAM on Apple Silicon devices, *Personal project.* [code]
  - Addressed ROS TurtleBot3 SLAM and Gazebo compatibility issues on the Apple Silicon MacOS devices.
- cNN-DP, at *Modeling & Simulation Lab.* [code]
  - Official implementation of the *Journal of Computational Physics* paper.
- RecurDyn ProcessNet with Python, at *Modeling & Simulation Lab.* [code]
  - Automated and parallelized flexible multibody dynamics (FMBD) simulations of RecurDyn.

TEACHING & MENTORSHIP

Research Mentor — Modeling & Simulation Lab., Kyung Hee University
— Guiding a junior graduate student (Minjae Jung) on neural network design and sequential modeling. — Mar. 2025 — Present

Teaching Assistant, ME380 Systems Dynamics — Dept. of Mechanical Eng., Kyung Hee University
— Lectured on multibody dynamics with theoretical derivation and its computational implementation. — Mar. 2022 — Jun. 2023

COMMUNITY SERVICE

Lead Administrative Assistant — Dept. of Mechanical Engineering, Kyung Hee University, 2022 — 2024
College of Engineering 48th Student Council — Kyung Hee University, Feb 2019 — Jan. 2020
U.S.-R.O.K. Combined Marine Corps Interpreter — 1st Marine Div., ROKMC, Sep 2017 — Feb. 2019

REFERENCES

- **Jin-Gyun Kim**, Ph.D.

  Associate Professor at Department of Mechanical Engineering, Kyung Hee University (jingyun.kim@khu.ac.kr)

- **Hee-Sun Choi**, Ph.D.

  Assistant Professor at Department of Artificial Intelligence and Robotics, Sejong University (heesunchoi@sejong.ac.kr)

- **Seongji Han**, Ph.D.

  Assistant Professor at Department of Mechatronics Engineering, Chungnam National University (seongji.han@cnu.ac.kr)