

RESEARCH INTERESTS

Industrial Physical AI for manufacturing; digital twins and robotic automation; cyber manufacturing; manufacturing capability representation; capability-aware supplier identification and production allocation; resilient production networks.

EDUCATION

Ph.D. Seoul National University Mechanical Engineering (Advisor: Prof. Sung-Hoon Ahn) Dissertation: <i>Digital Twin and Deep Reinforcement Learning–Driven Robotic Systems under Confined Spaces</i>	Seoul, Korea Feb. 2024
M.S. Pohang University of Science and Technology (POSTECH) Mechanical Engineering (Advisor: Prof. Jun Sang Doh) Thesis: <i>Two-Compartment Biochip Recapitulating Dendritic Cell Migration for T-Cell Priming</i>	Pohang, Korea Aug. 2019
B.S. Handong Global University Mechanical Engineering and Electrical Control Engineering (Double major) Honors: Magna Cum Laude	Pohang, Korea Feb. 2018

PROFESSIONAL APPOINTMENTS

Postdoctoral Fellow Georgia Tech, George W. Woodruff School of Mechanical Engineering Advisor: Prof. Shreyes N. Melkote	GA, USA June 2024 – Present
Postdoctoral Fellow Seoul National University, Institute of Advanced Machines and Design Advisor: Prof. Sung-Hoon Ahn	Seoul, Korea Feb. 2024 – Apr. 2024
Graduate Intern KT Corporation, Department of Robot Intelligence	Seoul, Korea July 2023 – Aug. 2023

EXTERNAL RESEARCH FUNDING

Automated Inspection System for Semiconductor Manufacturing Equipment (Upcoming), Georgia Tech TSMC Arizona Co-Principal Investigator Total Award: \$TBD Sept. 2026–Aug. 2028 Co-developed the proposal and lead the technical development of the automated inspection system.
Acoustic Digital Twin for Assembly Anomaly Detection, Georgia Tech Siemens Corporation Co-Principal Investigator Total Award: \$90,000 Sept. 2025–Aug. 2027 Co-developed the proposal and lead the development of the acoustic digital twin and anomaly detection framework.

RESEARCH EXPERIENCE

OpenWerks: AI-Powered Marketplace for On-Demand Manufacturing, Georgia Tech Role: Postdoctoral Researcher Sponsor: Georgia Research Alliance, Phase IA Developed multimodal manufacturing capability representations and LLM/RAG-based methods for supplier discovery and matching.	GA, USA Aug. 2025 – June 2026 (Follow-on Proposal Under Review)
---	--

Cyber Manufacturing: Data-Driven Methods for Future Cyber Manufacturing as a Service,
Georgia Tech

GA, USA
June 2024 – Present

Role: Postdoctoral Researcher

Sponsor: National Science Foundation (Future Manufacturing Research Grant, Award #2229260)

Developed data-driven methods for manufacturing capability representation, assembly-part retrieval, and capability-aware supplier identification for a resilient supplier mesh network.

Korea–Tanzania Innovative Technology and Energy Center Project, Seoul National University

Seoul, Korea

Role: Project Lead

Sept. 2019 – Feb. 2024

Sponsor: Ministry of Science and ICT (MSIT) and National Research Foundation of Korea (NRF)

Developed a mobile energy management system integrating electric motorcycles with a micro off-grid system for rural communities in Tanzania.

Development of digital-twin based reinforcement learning platform and the modular robot for the nuclear power plant, Seoul National University

Seoul, Korea

June 2021 – May 2023

Role: Project Lead

Sponsor: Korea Hydro & Nuclear Power Co., Ltd.

Led the development of a digital-twin and deep reinforcement learning-based modular robotic system for nozzle-dam replacement in confined nuclear power plant environments.

Safe Smart Factory Demonstration Program II, Seoul National University

Gyeonggi, Korea

Role: Team Lead

Sept. 2022 – Aug. 2023

Sponsor: Gyeonggi Industry-University Convergence Center

Led the development and on-site deployment of a real-time worker hand-monitoring system using synthetic data augmentation to prevent caught-in-machinery injuries at an electronics component manufacturer.

Safe Smart Factory Demonstration Program I, Seoul National University

Gyeonggi, Korea

Role: Team Lead

Sept. 2020 – Aug. 2021

Sponsor: Gyeonggi Industry-University Convergence Center

Led the development and on-site deployment of an IoT-based retrofit monitoring system that used three-phase current signals to track the real-time operating status of a legacy aluminum stamping press.

Korea-Germany Intelligent Manufacturing Systems Laboratory, Seoul National University

Seoul, Korea

Role: Project Lead

Sept. 2019 – Feb. 2024

Sponsor: Ministry of Science and ICT (Korean Government)

Led the development of a digital twin for optimizing multi-robot workcell operations.

JOURNAL PAPERS

Park, S., & Melkote S. N. (2026). Manufacturing Capability-Aware Supplier Identification: How Representation Methods Affect Performance, Robustness, and Information Exposure. *Journal of Manufacturing Systems (Under Review)*.

(First & Corresponding Author)

Park, S., & Melkote, S. N. (2026). A manufacturing capability-aware supplier decision framework for resilient production allocation and disruption response. *Journal of Manufacturing Systems (Minor Revision)*.

(First & Corresponding Author)

Park, S., Yan, X., and Melkote S. (2026). Cyber Manufacturing Mesh Network: A manufacturing capability-aware supplier decision support framework, *Manufacturing Letters*, 49, 32–36.

(First & Corresponding Author)

Park, S., & Melkote, S. N. (2026). Deep unsupervised learning-based supplier selection and ranking for assembly manufacturing. *Journal of Manufacturing Systems*, 84, 173–188.

Journal metrics: Impact Factor 14.9.

(First & Corresponding Author)

Lee, H., Manongi, F. A., Song, H., **Park, S.,** Bhandari, B., Kim, H., ... & Ahn, S. H. (2025). Mobile Energy Management System for E-Motorcycle Integrated with Micro Off-Grid: A Case Study in Rural Tanzania. *International Journal of Precision Engineering and Manufacturing-Green Technology*.

Journal metrics: Impact Factor 6.6.

Park, S. Y., Kim, H., & Ahn, S. H. (2024). Hand-Monitoring System Using CutMix-Based Synthetic Augmentation for Safety in Factories. *IEEE Access*, 12, 27661-27672.

Journal metrics: Impact Factor 4.2.

(First Author)

Park, S. Y., Lee, C., Kim, H., & Ahn, S. H. (2024). Enhancement of control performance for degraded robot manipulators using digital twin and proximal policy optimization. *IEEE Access*, 12, 19569-19583.

Journal metrics: Impact Factor 4.2.

(First Author)

Park, S. Y., Lee, C., Jeong, S., Lee, J., Kim, D., Jang, Y., ... & Ahn, S. H. (2024). Digital twin and deep reinforcement learning-driven robotic automation system for confined workspaces: A nozzle dam replacement case study in nuclear power plants. *International Journal of Precision Engineering and Manufacturing-Green Technology*, 11(3), 939-962.

Journal metrics: Impact Factor 6.6.

(First Author)

Kim, H.J., Quan, Y.J., Jung, G. Y., Lee, K. W., Jeong, S. H., Yun, W. J., **Park, S. Y.** & Ahn, S.H., "Smart Factory Transformation Using Industry 4.0 toward ESG Perspective: A Critical Review and Future Direction" *International Journal of Precision Engineering and Manufacturing-Smart Technology*, vol.1, no.2, 2023 (Editor-in-Chief's Choice)

Min, S. H., Quan, Y.J., **Park, S. Y.**, Lee, G.Y., & Ahn, S.H., "Interoperable Nanoparticle Sensor Capable of Strain and Vibration Measurement for Rotor Blade Monitoring," *Sensors*, vol. 21, no.11, 2021

CONFERENCE PAPERS & PRESENTATIONS

Park, S., Rosen, D. W., and Melkote, S. N. (2025). Deep Learning-Based Multi-Level Retrieval of Assembly CAD Models. *ASME 2025 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC/CIE 2025)*, Anaheim, CA, USA, Aug. 2025.

(First & Corresponding Author)

Park, S. (2025). Toward future cyber manufacturing: Data-driven methods for future cyber manufacturing as a service. Poster presented at the 2025 National Academy of Engineering Regional Meeting, Georgia Tech, Atlanta, GA, USA, Apr. 2, 2025.

Park, S. Y., and Ahn, S. H. (2023). Pose Estimation of a Mobile Robot for Accurate Object Detection Using Digital Twin and Bayesian Optimization. ASPEN 2023, Hong Kong, Nov. 2023.

(First Author)

Kim, H. J., **Park, S. Y.**, Ahn, S. H., and Lee, C. H. (2023). Study on Optimal Robot Motion Generation in Confined Spaces Using Digital Twin and Reinforcement Learning. 2023 Summer Conference of the Society for Computational Design and Engineering, Jeju, Korea, Aug. 2023. *(Best Paper Award)*

(Co-Author)

Park, S. J., Kim, D., **Park, S. Y.**, and Ahn, S. H. (2023). A Deep Learning Approach for Automated Detection of Foreign Objects in Tire. PRESM 2023, Okinawa, Japan, July 2023. *(Outstanding Presenter Award)*

(Co-Author)

Park, S. Y., Kim, H. J., and Ahn, S. H. (2023). Automation of Manufacturing Equipment Arrangement Including Robotic Arm Using Bayesian Optimization. PRESM 2023, Okinawa, Japan, July 2023.

(First Author)

Lee, G. H., **Park, S. Y.**, Kim, H. J., and Ahn, S. H. (2023). Optimization of Process Equipment Placement Using Bayesian Optimization Based on Digital Twins. 2023 Winter Conference of the Society for Computational Design and Engineering, Pyeongchang, Korea, Feb. 2023. *(Best Poster Presentation Award)*

(Co-Author)

Park, S. Y., Kim, H. J., Jeong, S. H., Lee, J. H., and Ahn, S. H. (2022). Digital Twin-Based Object Detection of Camera-Mounted Robot Arm Using Deep Reinforcement Learning. ASPEN 2022, Singapore, Nov. 2022.

(First Author)

Rhee, H., **Park, S. Y.**, Jung, W. K., Ha, B. R., Moon, J. H., and Ahn, S. H. (2020). Solar-Powered Agricultural Community Development by Innovative Technology and Energy Center (iTEC). 11th International Conference on Appropriate Technology 2020, Online, Dec. 2020. *(Best Paper Award)*

(Co-Author)

RESEARCH DATASETS

Park, S., & Melkote, S. N. “DFM-based Synthesized Component Dataset for ‘Manufacturing Capability-Aware Supplier Identification and Optimization.’” Georgia Institute of Technology, 2025. [DOI: 10.35090/gatech/79946](https://doi.org/10.35090/gatech/79946)

Park, S., & Melkote, S. N. “DFA-based Synthesized Assembly Dataset for ‘Deep Unsupervised Learning-Based Supplier Selection and Ranking for Assembly Manufacturing.’” Georgia Institute of Technology, 2025. [DOI: 10.35090/gatech/79931](https://doi.org/10.35090/gatech/79931)

TEACHING & INVITED LECTURES

Guest Lecturer , Arusha Technical College, Tanzania (Online) MMU 08203: <i>Intelligent Control and Robotics</i> (three lectures)	Aug. 2024
Research Advisory Seminar for Samsung SDI , hosted by SNU IDIM Lab (Online) “Deep Reinforcement Learning in Manufacturing Industries”	May 2024
One-on-one Tutor , Seoul National University, Korea Capstone Design I & II	Feb. 2022 – Jan. 2023
Head Teaching Assistant , Seoul National University, Korea Mechanical System Design I & II	Feb. 2020 – Feb. 2021
Teaching Assistant / Tutor , Handong Global University, Korea Calculus I; Engineering Mathematics; Digital Logic; Embedded Controller; App Programming	Feb. 2015 – June 2018

RESEARCH MENTORING

Reagan Cook , Ph.D. Student in Mechanical Engineering, Georgia Tech Mentoring research on a multi-agent LLM framework for capability-aware multi-tier supplier identification.	Aug. 2026 – Present
Bintang Farhan , M.S. Student in Mechanical Engineering, Georgia Tech Mentoring research on privacy-preserving methods for manufacturing capability representation and sharing within a cyber manufacturing framework.	Feb. 2026 – Present
Norrich Pongkeasorn , Undergraduate Research Assistant, Georgia Tech Mentored research on experimental infrastructure development and spatial acoustic data collection for a Siemens-sponsored acoustic digital twin.	Feb. 2026 – June. 2026
Ki-Hun Rhee , Undergraduate Researcher, Seoul National University Mentored his undergraduate thesis on digital-twin-based manufacturing equipment layout optimization using Bayesian optimization	Mar. 2022 – Jan. 2023

AWARDS & HONORS

Outstanding Graduate Research Intern , KT Corporation	Sept. 2023
Best Paper Award , Society for Computational Design and Engineering	Aug. 2023
Best Poster Presentation Award , Society for Computational Design and Engineering	Feb. 2023
Best Paper Award , Academic Society for Appropriate Technology	Dec. 2020
Magna Cum Laude , Handong Global University	Feb. 2018

PEER REVIEW ACTIVITIES

<i>Scientific Reports</i>	2026
<i>IEEE/ASME Transactions on Mechatronics</i>	2024-2025
<i>Knowledge-Based Systems</i>	2024
23 completed peer-review reports	

SCHOLARSHIPS

Joong-Gang Scholarship , Seoul National University Development Fund	Oct. 2020
National Scholarship for Science and Engineering , Korea Student Aid Foundation	Sept. 2016
Merit-Based Scholarships , Handong Global University	Mar. 2015 – Sept. 2016

SKILLS

Software: NVIDIA Omniverse and Isaac Sim, Python, C/C++, MATLAB, PyTorch, ROS, Fusion 360, Linux
Hardware: NVIDIA® Jetson Nano/AGX Xavier, Raspberry Pi, Arduino