DO-GON KIM

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EDUCATION

Columbia University Sep 2023 – May 2025
Master of Science, Mechanical Engineering, **GPA: 4.065**
Relevant Coursework: Intro to Robotics, Computational Aspects of Robotics, Applied Robotics, Robot Learning, Intro to Control Theory, Digital Manufacturing, Mechatronics and Embedded Systems, Data Science, MS Projects in MechE

New York University Sep 2020 – Jan 2023
Bachelor of Science, Mechanical Engineering, **GPA: 3.823**
Relevant Coursework: Robotic Manipulation and Locomotion, Robotic Vision
Honors & Awards: Tau Beta Pi, National Society of Collegiate Scholars, Founder's Day Award, Dr. Morris Young Outstanding Project Design Award, Tandon Scholarship, Undergraduate Summer Research Program (UGSRP) Fellowship

RESEARCH INTERESTS

My past research can be categorized into three areas: **Finger Design integrated with Tactile Sensors**, **Signal Processing for Sensing**, and **Control Algorithm Development**. I have explored the design of systems that mimic the multiple sensory receptors of human touch. Moving forward, I aim to explore the design of tactile fingers and control systems that emulate human touch and realize sensing capabilities beyond the limits of human perception. Furthermore, I seek to investigate how these systems can help robots better understand and interact with their environment.

PUBLICATIONS

Peer-Reviewed Publications

[U.1] E. T. Chang*, P. Ballentine*, Z. He*, **D. Kim**, K. Jiang, H. Liang, J. Palacios, W. Wang, P. Piacenza, I. Kymissis, M. Ciocarlie, "SpikeATac: A Multimodal Tactile Finger with Taxelized Dynamic Sensing for Dexterous Manipulation," *Under Review*

[C.1] K. Zhang*, **D. Kim***, E. T. Chang*, H. Liang, Z. He, K. Lampo, P. Wu, I. Kymissis, M. Ciocarlie, "VibeCheck: Using Active Acoustic Tactile Sensing for Contact-Rich Manipulation," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2025*

Workshop Papers, Abstracts, and Posters

[P.1] E. T. Chang*, P. Ballentine*, Z. He*, **D. Kim**, K. Jiang, H. Liang, J. Palacios, W. Wang, P. Piacenza, I. Kymissis, M. Ciocarlie, "SpikeATac: A Multimodal Tactile Finger with Taxelized Dynamic Sensing for Dexterous Manipulation," *Northeast Robotics Colloquium (NERC) 2025, Cornell University*

RESEARCH EXPERIENCE

Robotic Manipulation and Mobility (ROAM) Laboratory, Columbia University May 2024 – Sep 2025
Graduate Researcher, advisor: Prof. Matei Ciocarlie

- *SpikeATac: A Multimodal Tactile Finger for Manipulation*
  - Designed experimental hardware platforms including parallel gripper and ATI sensor mounts for SpikeATac fingers, custom 3D-printed pokers, and PLA-, TPU-, or paper-based objects
  - Built a ROS2 data pipeline integrating PVDF, capacitive, and accelerometer sensors with a linear probe motion control for poking experiments to collect synchronized multimodal data and to characterize sensor sensitivity
  - Developed two real-time gripper stopping algorithms based on multimodal tactile sensing: a difference-based method using a 16-channel PVDF array, and a mean-difference threshold method using 7 capacitive sensors
  - Demonstrated stable grasping with a parallel gripper on deformable and fragile objects (egg, nori, raspberry, blueberry, strawberry, flower, origami cube), showcasing SpikeATac's capability for delicate manipulation
- *VibeCheck: Active Acoustic Sensing for Manipulation*
  - Designed hardware to enable active acoustic sensing, including gripper fingers integrated with piezoelectric sensors, isolated sensor housings for vibration damping, and PETG linkages for improved torque transmission
  - Developed an FFT-based signal processing framework involving frequency-domain analysis for feature extraction and sensor characterization using oscilloscopes and function generators to mitigate signal interference
  - Built a ROS2 control framework integrating the UR5 manipulator and parallel gripper with unified motion, grasp, and sensing control for automated data collection in classification and estimation tasks
  - Demonstrated a peg-in-hole insertion task using active acoustic sensing, achieving 90% success rates for in-distribution starting states and 50% for out-of-distribution using only acoustic tactile feedback

Nonlinear Controls Research Group, Columbia University May 2025 – Sep 2025
Graduate Researcher, advisor: Prof. Homayoon Beigi

- Established a control framework in C++ within ROS2 to develop learning-apdaptive controller for Jetcobot

- Developed a PD controller which executes simultaneous commands across multiple joints
- Built safety stop mechanisms to prevent collisions between JetCobot arm links

Data and innovative technology-driven Transportation Laboratory, Columbia University Jan 2024 – Sep 2024
Graduate Researcher, advisor: Prof. Sharon Di

- Spearheaded the development of a simulation framework using ROS2 and PyBullet for AWS DeepRacer, enabling ML model testing without physical hardware and fostering a dynamic environment for autonomous vehicle research
- Developed simulation tools for LIDAR data visualization and obstacle detection in simulation
- Built a ArUco marker detection system to accurately determine the orientation, and speed of the physical vehicle

Control/Robotics Research Laboratory, New York University Jun 2022 – Dec 2022
Undergraduate Research Assistant (UGSRP), advisor: Prof. Farshad Khorrami

- Researched how to utilize ROS to read sensors from a robot and how to integrate data to build a map of an environment using gmapping algorithm, one of the Simultaneous Localization and Mapping algorithms
- Enabled Turtlebot3 Burger to detect obstacles and navigate autonomously with LIDAR, encoder, and IMU
- Investigated the accuracy of a map created by gmapping

TEACHING EXPERIENCE

MECE E4601 Digital Control Systems, Columbia University Jan 2025 – May 2025
Teaching Assistant, advisor: Prof. Homayoon Beigi

- Topics: Sampling Theorem, z-Transform, Stability, Root Locus, Frequency Response, Controller Design

MECE E4602 Introduction to Robotics, Columbia University Sep 2024 – Dec 2024
Teaching Assistant, advisor: Prof. Sunil Agrawal

- Topics: Homogeneous Transformations, Forward and Inverse Kinematics, Jacobians, Dynamics, Joint Control

EEME E6601 Introduction to Control Theory, Columbia University Sep 2023 – Dec 2023
Note Taker, advisor: Prof. Nicolas Chbat

- Topics: Transfer Functions, Root Locus, Bode and Nyquist Plots, State-Space, Stability, z-Transform, LQR

OUTREACH

Outreach and Engagement with Student Groups

- Guest speaker for the *Jeju Office of Education's "Global University Exploration for High School Students."* Presented research projects and mentored high school students from Jeju on research and study abroad pathways, July 2025
- Guest speaker for *Re'Generation Movement*, a non-profit organization empowering youth leadership. Presented research projects and discussed the importance of being part of an encouraging community, July 2025

PROJECTS

Introduction to Robotics Project – *Cable Driven Parallel Robot* Sep 2023 – Dec 2023

- Developed an adaptive velocity controller for a 4-cable-driven parallel robot, enabling dynamic speed adjustments based on the different objects to enhance safe handling
- Optimized the cable-driven system design by reducing number of cables to minimize collision issues
- Built 3D simulations in MATLAB to demonstrate motion planning in industrial settings like distribution warehouses

Robotic Vision Project – *Sheet Music Sight-Reader* Feb 2022 – May 2022

- Created a Colab-based CV pipeline that takes in the image of a sheet of music and outputs a playable music file
- Trained a model to detect a position of each note in sheet music using the YOLO algorithm with 90% accuracy
- Utilized Canny Edge Detector to find five lines in sheet music and applied a vertical slice on across the five lines to calculate an accurate position of five lines

Senior Design Project – *SYDRAULIC* Sep 2021 – May 2022

- Managed five student engineers for design, development, and testing of a hydraulic jack which allows individuals to escape safely from vehicles during flooding
- Conducted finite element modeling and analysis of a hydraulic jack–assisted car door escape system using ANSYS, evaluating deformation, stress distribution, and harmonic response of piston, cylinder, and door
- Achieved 850N of maximum force from piston, and 30 seconds for piston to be fully extended in any condition

SKILLS

Programming Language: Python, Arduino (C/C++), MATLAB, G-code, LaTex, HTML
Software/OS: SOLIDWORKS, Onshape, ROS2, micro-ROS, PlotJuggler, Gazebo, PyBullet, MATLAB, ANSYS, Linux
Machining/Tools: 3D printing (FDM, SLA), Laser cutting, Soldering, Silicone molding, Vertical bandsaw
Language: English (Native or bilingual proficiency), Korean (Native or bilingual proficiency)