YINKAI DONG

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EDUCATION

Southern University of Science and Technology (SUSTech), China Sept. 2020 – June 2024
B.Eng. in Robotics Engineering, Dept. of Mechanical and Energy Engineering *Guangdong, China*

- Cumulative GPA: 3.81/4.0; Class Rank: 2/53

Massachusetts Institute of Technology, USA Sept. 2022 – May. 2023
MIT-SUSTech special student program (Non-degree) *Cambridge, MA, USA*

- Secured funding of 500,000 RMB (approximately 70,000 USD) for this program.

PUBLICATIONS

[1] **Dong, Y.**, Kim, J., Patel, V. V., Feng, H., and Dollar, A. M., "Model Q-II: An Underactuated Hand with Enhanced Grasping Modes and Primitives for Dexterous Manipulation," **submitted** to *IEEE International Conference on Robotics and Automation (ICRA)*, 19-23 May 2025, Atlanta, USA.

[2] **Dong, Y.**; Zhang, W. Multi-Mode Compound Grasping Robot Finger Driven by Linkage. *Appl. Sci.* **2023**, *13*, 5550.

[3] **Dong, Y.**, Zhang, W. (2019). "A Novel Coupled and Self-adaptive Anthropomorphic Robot Finger with a Dual-oblique-Belt Mechanism." *IEEE 4th International Conference on Advanced Robotics and Mechatronics (ICARM)*, Toyonaka, Japan, pp. 732-737.

RESEARCH EXPERIENCE

Research Fellow at Harvard Slade Lab July 2024 – Present
Supervised by Prof. ***Patrick Slade*** *Allston, MA, USA*

Human-in-the-loop Optimization for Hip Exoskeleton

- Built a hip exoskeleton using carbon fiber, machined parts, servos, and soft fabrics.
- Utilizing STM32 to control the exoskeleton and enable Bluetooth data transmission for real-time monitoring.
- Created a Python interface for the Delsys EMG sensor to enable real-time data streaming and processing.
- Developed HILO strategies with reinforcement learning to optimize assistive performance, reduce energy costs, and enhance task adaptability.

Optimizing Hip Exoskeleton with Passive Ankle Exoskeleton

- Assisted in collecting and processing metabolic, EMG, and motion data for **human-in-the-loop optimization**.
- Leveraged thigh IMU and ankle angle data for real-time gait state estimation, enhancing exoskeleton responsiveness and adaptability across different gait modes and speeds.
- Optimized torque profiles to achieve a balanced distribution of assistance between the hip and ankle, focusing on improving walking speed, gait cycle efficiency, and user-specific performance metrics, reducing metabolic cost by over **20%**.

Research Assistant at Yale GRAB Lab Aug. 2023 – Feb. 2024
Supervised by Prof. ***Aaron Dollar*** *New Haven, CT, USA*

Model Q-II: An Underactuated Hand with Enhanced Grasping Modes & Primitives for Dexterous Manipulation

- Designed and implemented the Model Q-II gripper, an advanced underactuated robotic gripper capable of multiple grasping primitives, including pinch, tripod, quadpod, and power grasping.
- Developed passive mechanisms enabling seamless transitions between grasping modes without additional actuators, enhancing dexterity and manipulation capabilities.
- Achieved a forward manipulation range of 60.18 mm and a lateral range of 26.96 mm, while reducing the minimum graspable object diameter by 46% through experimental validation.
- Demonstrated the gripper's effectiveness in precision tasks, power-driven operations, and complex in-hand manipulations.
- Submitted a first-author manuscript to **ICRA 2025**.

UROP at MIT Newman Lab for Bio-mechanics and Human Rehabilitation Sept. 2022 – May. 2023
Supervised by Prof. ***Neville Hogan*** *Cambridge, MA, USA*

Impedance Control Implementation on MuJoCo and Baxter Robot

- Implemented joint space, task space, and operational space impedance control on MuJoCo and the Baxter robot.
- Investigated issues related to redundancy, repeatability, and singularity in the context of impedance control.
- Conducted a comparative analysis of the impedance controller with the operational space controller.

Identifying Unknown Inertial Parameters of Robotics using Machine Learning

- Implemented impedance control on MuJoCo, and quantified sim-to-real differences.

- Developed an adaptive control-based machine learning model to identify unknown friction and inertia parameters by leveraging sim-to-real differences.

College Students' Innovative Project at SUSTech April 2022 - Present

*Supervised by Prof. **Jian S. Dai*** *Guangdong, China*

- Secured research funding of 10,000 RMB (approximately 1,500 USD) for the project.

Adaptive Friction and Origami-based Underactuated End-effector

- Investigated a biomimetic surface for autonomous friction adjustment, using the Miura-ori origami mechanism.
- Combined the biomimetic surface with the underactuated gripper for enhanced adaptability and friction control.

Research Intern at Tsinghua University Sept. 2018 – August 2023

*Supervised by Professor **Wenzeng Zhang*** *Beijing, China*

- Selected as one of 20 undergraduate students from SUSTech for a research internship.

Under-actuated Active Adaptive Parallel Robotic Hand with Linear Trajectory

- Designed a parallel grasping gripper using the Watt linkage mechanism for an approximated linear trajectory.
- Selected as a candidate for the 2023 ASME Student Mechanism and Robot Design Competition.

Multi-Mode Compound Grasping Robot Finger Driven by Linkage

- Explored methods for combining multiple grasping modes, including parallel, coupling, and self-adaptive grasping.
- Published work in Applied Sciences.

Coupled and Self-adaptive Prosthetic Hand

- Developed a prosthetic hand with a tension mechanism to grasp objects using human-like motion.
- Selected for the International Science and Engineering Fair 2020 China Delegation.

GRANTED PATENTS

[1] **Y. Dong**, W. Zhang. "Sliding groove double-transmission-belt linear parallel clamping self-adaptive robot finger device."
[2] **Y. Dong**, W. Zhang. "Series-parallel hybrid connecting rod linear parallel clamping self-adaptive robot finger device."
[3] **Y. Dong**. "Connecting rod type three-path parallel linear parallel clamping self-adaptive robot finger device."
[4] **Y. Dong**, W. Zhang. "Three-joint linear parallel clamping self-adaptive under-actuated robot finger device."
[5] **Y. Dong**, W. Zhang. "Parallel-connection-rod double-shifting-block linear parallel clamping self-adaptive robot finger device."
[6] **Y. Dong**, W. Zhang. "Multi-path differential linear parallel clamping double-finger-section self-adaptive robot finger device."
[7] **Y. Dong**, W. Zhang. "The connecting rod cooperatively drives multi-mode composite grabbing robot finger device."

AWARDS AND HONORS

Top 10 Undergraduate Graduate for exceptional performance in the SUSTech June 2024

The Excellence Award of the "Guo Xie Birong Scholarship" at SUSTech | *$ 1500* May 2024

Excellent Undergraduate Thesis Award June 2024

Chinese University Students' Star of Perseverance | *National Awards* Oct. 2022

- Honoring college students who have overcome hardships, embody the spirit of resilience, and inspire their peers.

MIT 2.12 Most Valuable Engineering Award May 2023

ASME Student Mechanism and Robot Design Competition | *Third Place winner* May 2023

College Students' Outstanding Art Troupe Performance | *First Prize, Provincial Award* Sept. 2022

First prize of excellent scholarship | *$1000* Nov. 2021, Nov. 2022

- Reward the top 5% of undergraduate students in comprehensive evaluation.

International Science and Engineering Fair (ISEF) | *Third Place winner* May 2020

- Represented China as part of the delegation at the world's premier pre-college STEM competition.

19th Awarding Program for Future Scientists | *Second Prize, National Awards* Nov. 2019

EXTRACURRICULAR

Bass Section leader, SUSTech Chorus Fall 2021 – Spring 2022

Presidium Member, Minghang Education Support Society Spring 2021 – Spring 2022

Campus Ambassador for the *Teach for China* Program Spring 2021 – Spring 2024

Community Service Engagement Fall 2020 – Present

- Accumulated over **120 hours** of dedicated volunteer service.

TECHNICAL SKILLS

Programming Languages: Python, Java, MATLAB, MuJoCo
Developer Tools: VS Code, AutoCAD, Solidworks, ABAQUS, Qualysis, Visual 3D, Delsys EMG