Learning to Grasp with Tactile Feedback

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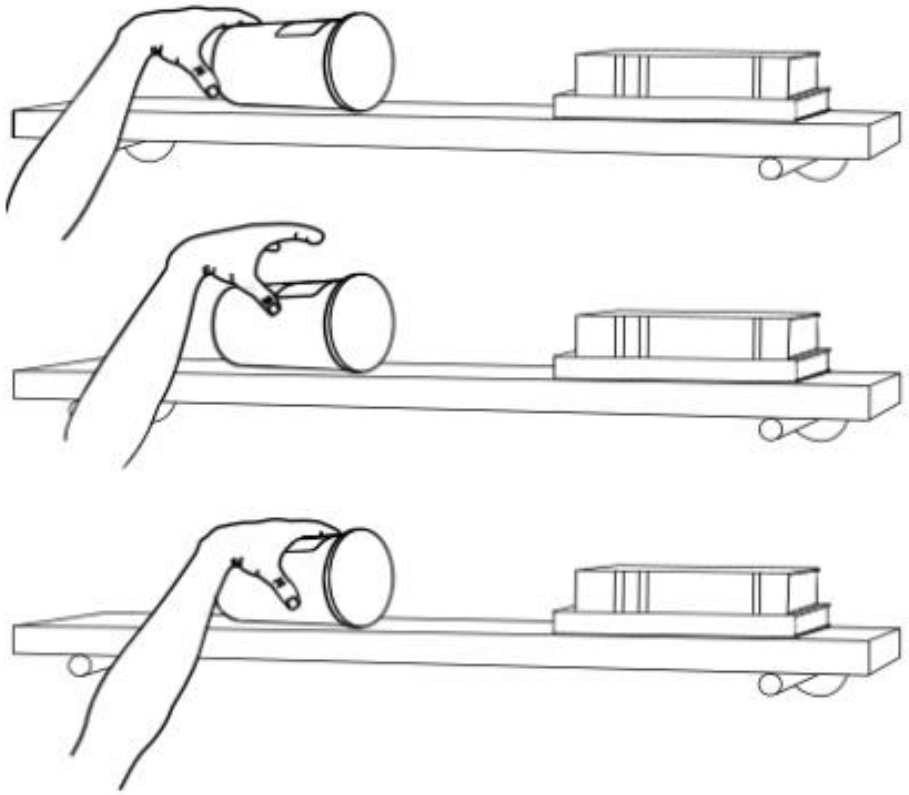
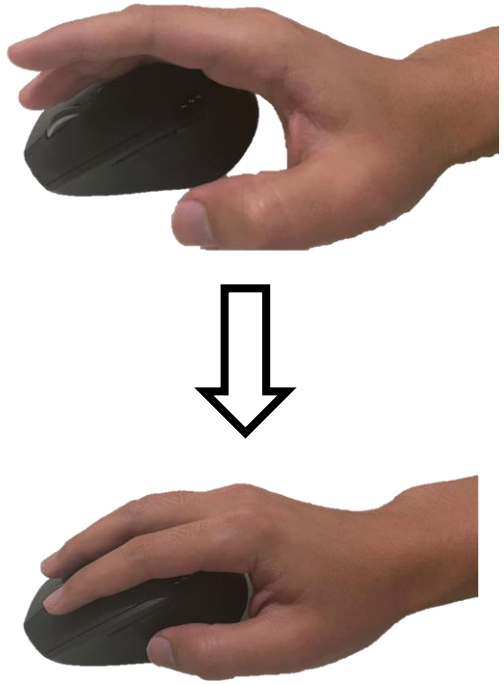
Current Work – Motivation



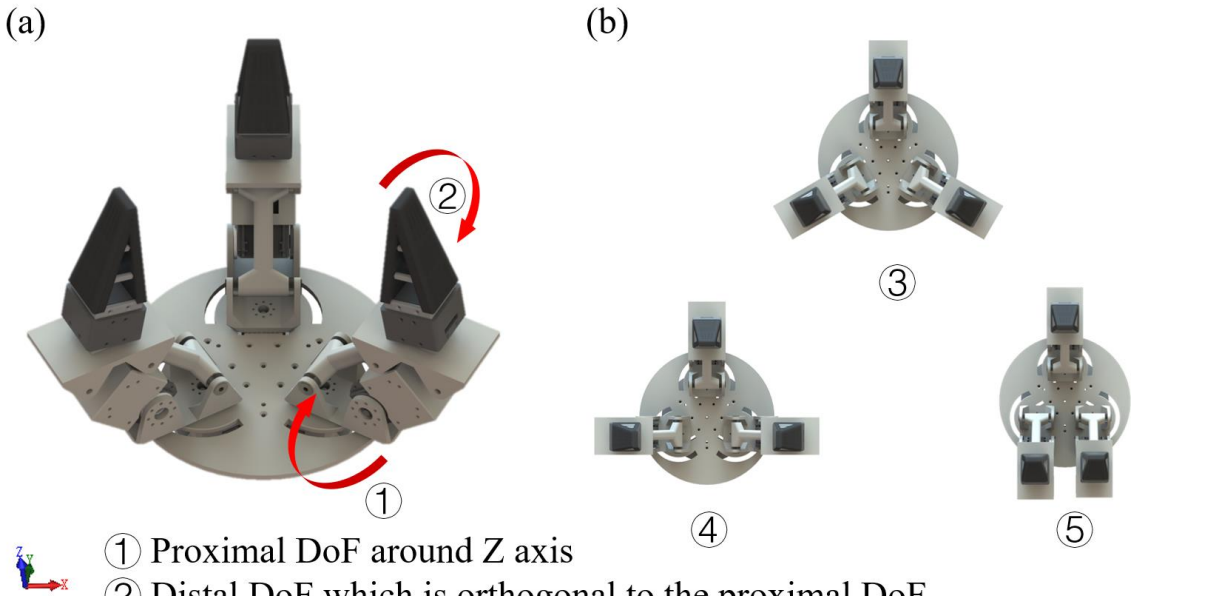
Grasp Position Adjustment



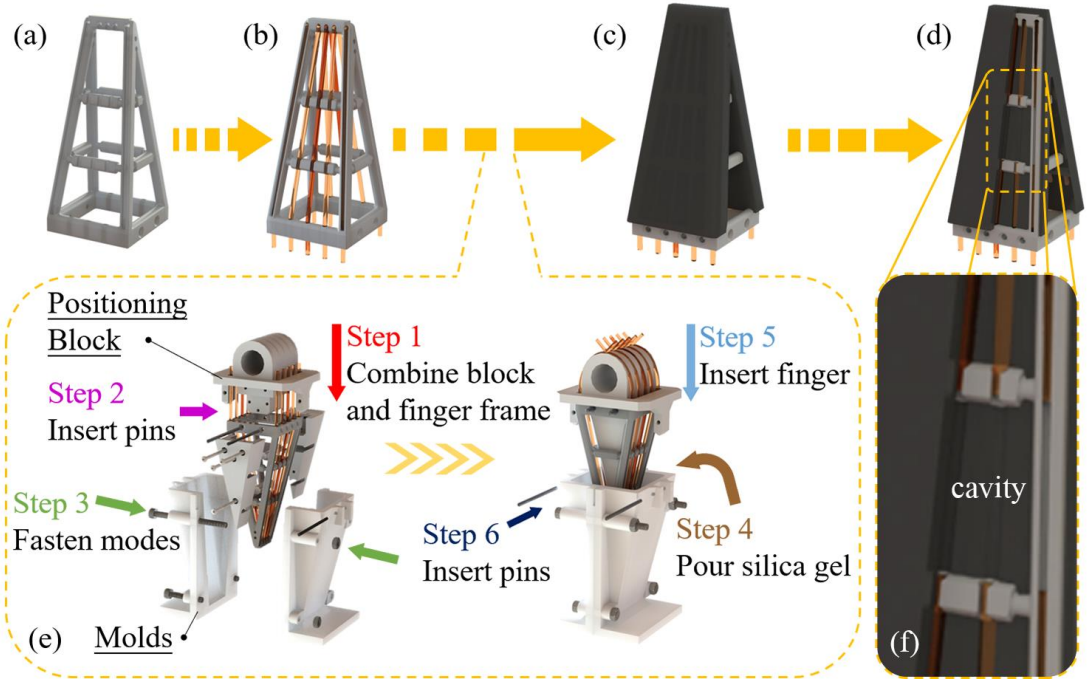
Grasp Configuration Adjustment

[1] Hogan F R, Bauza M, Canal O, et al. Tactile regrasp: Grasp adjustments via simulated tactile transformations[C]//2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). IEEE, 2018: 2963-2970.

Current Work – Design of Gripper and Soft Sensor



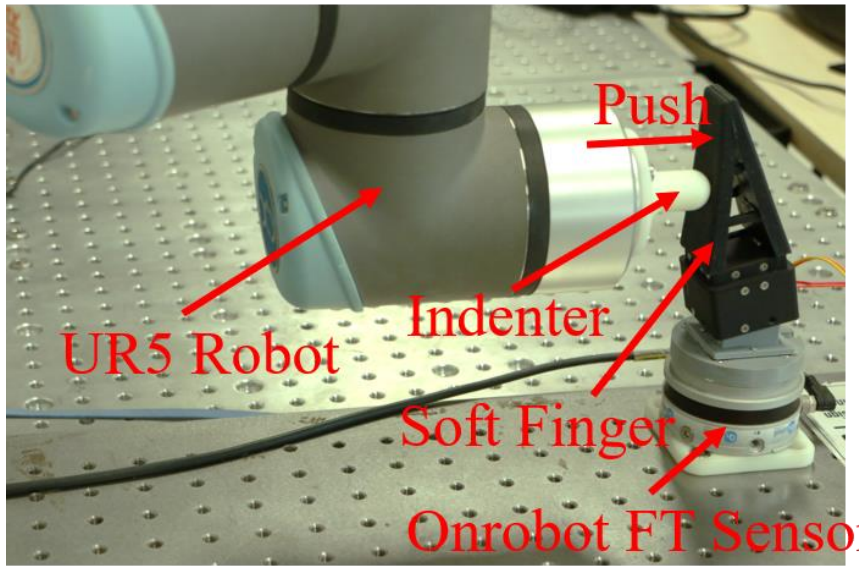
Reconfigurable Gripper

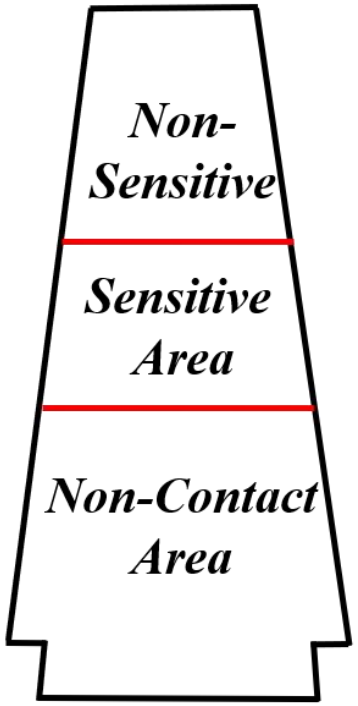


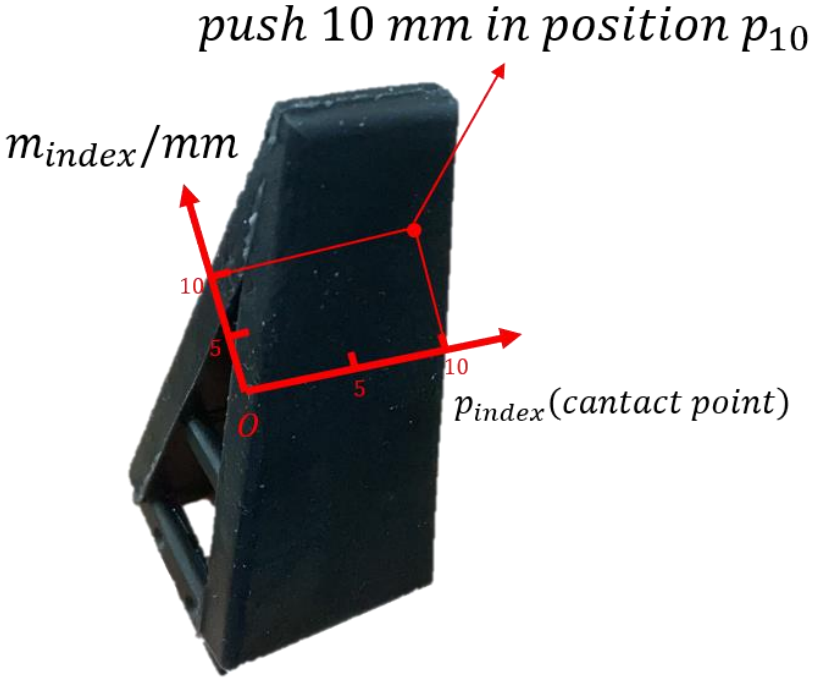
Soft Tactile Sensor with Embedded Optical Fibers

Current Work – Calibration

Sensor Calibration



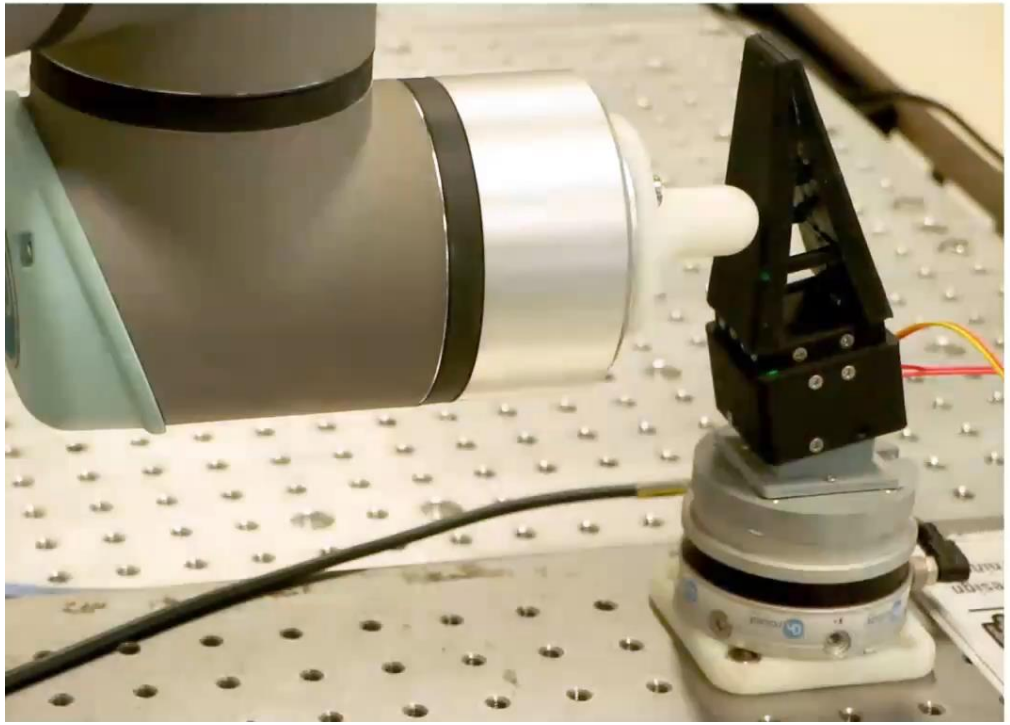


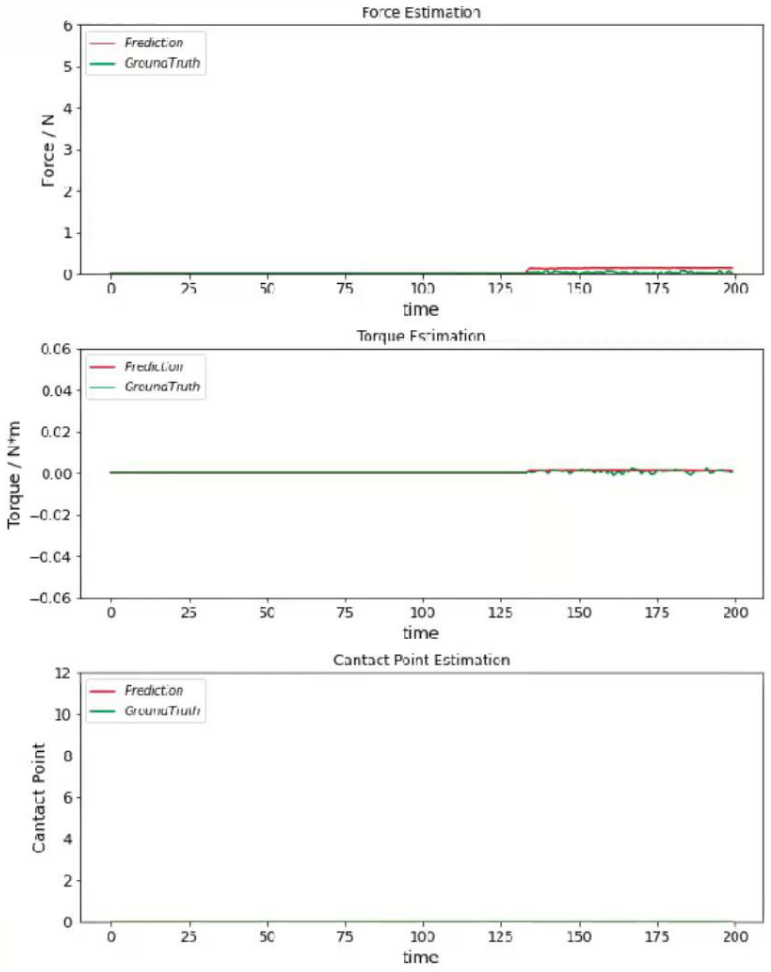


Finger Deformation → Trasimitted Light Intensity → Force and Torque Information

Current Work – Calibration Results

Real-time Prediction of Force, Torque and Contact Point

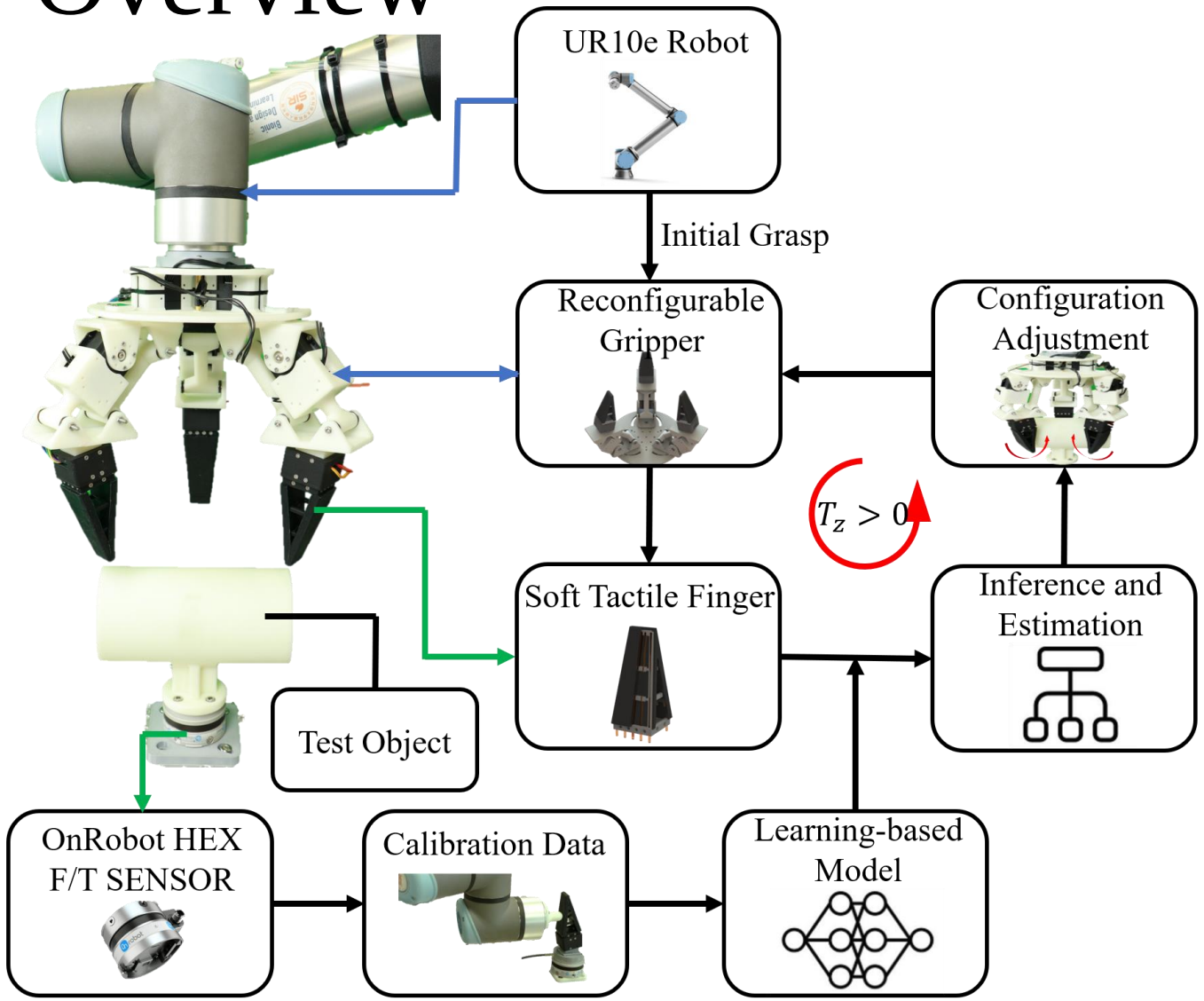




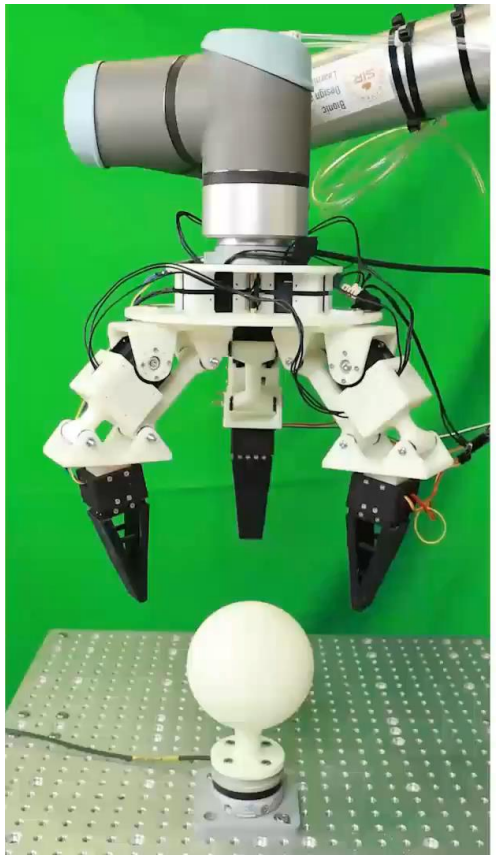
Current Work – Overview

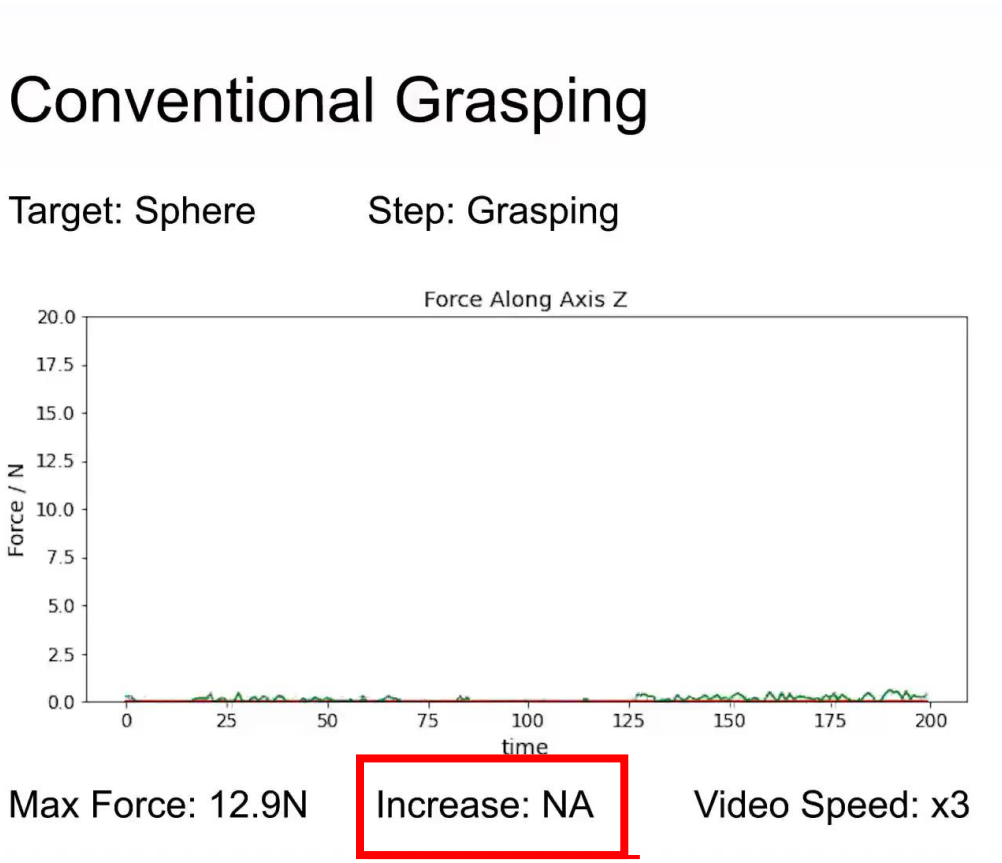
Goal: Achieve a more robust grasp

Grasp Quality Metric: The maximum of resisting external forces.



Current Work – Experiments





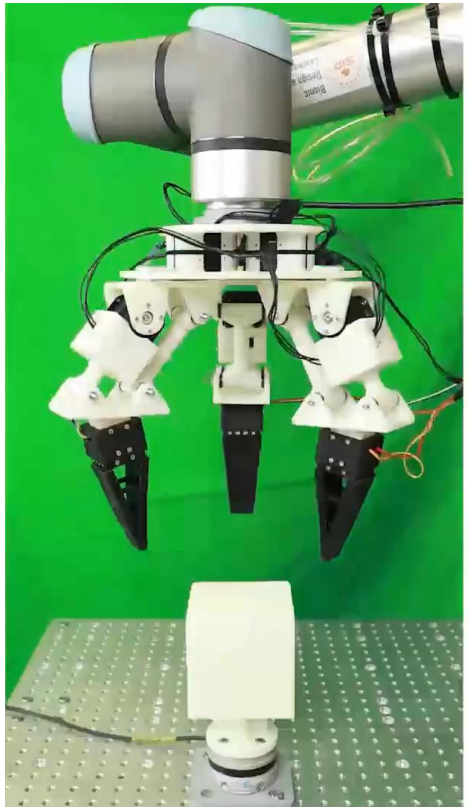
Target Object: Sphere

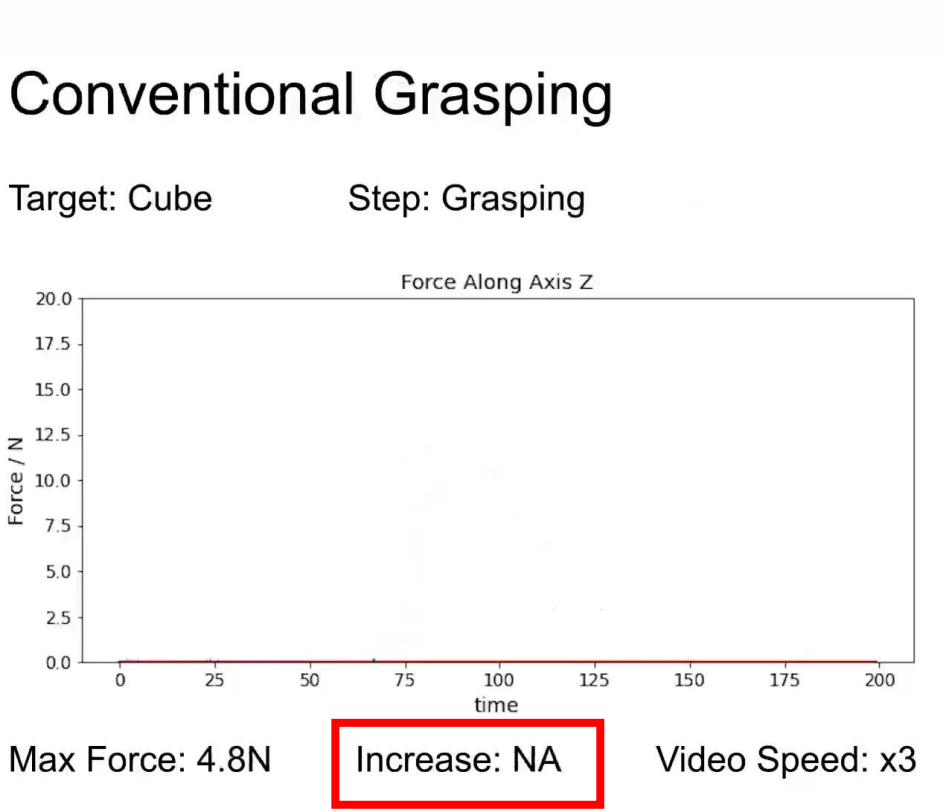
Configuration Transition: None

Grasp Quality Metric: The maximum of resisting external forces.

Quality Increase: 0

Current Work – Experiments





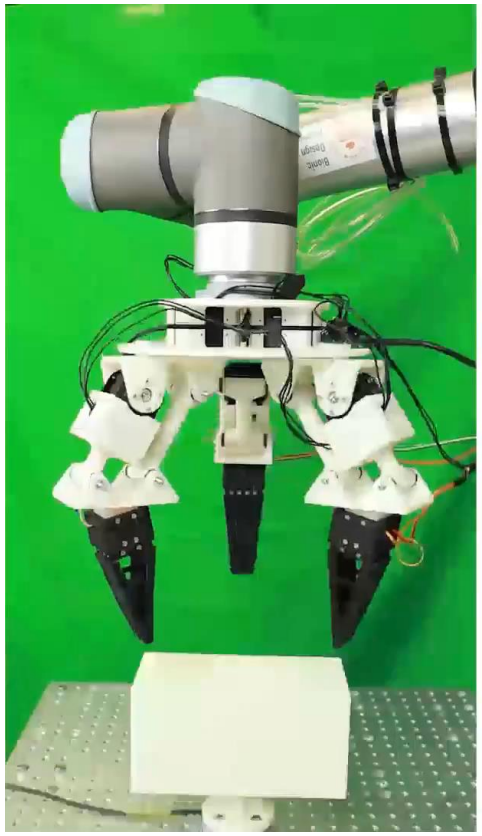
Target Object: Cube

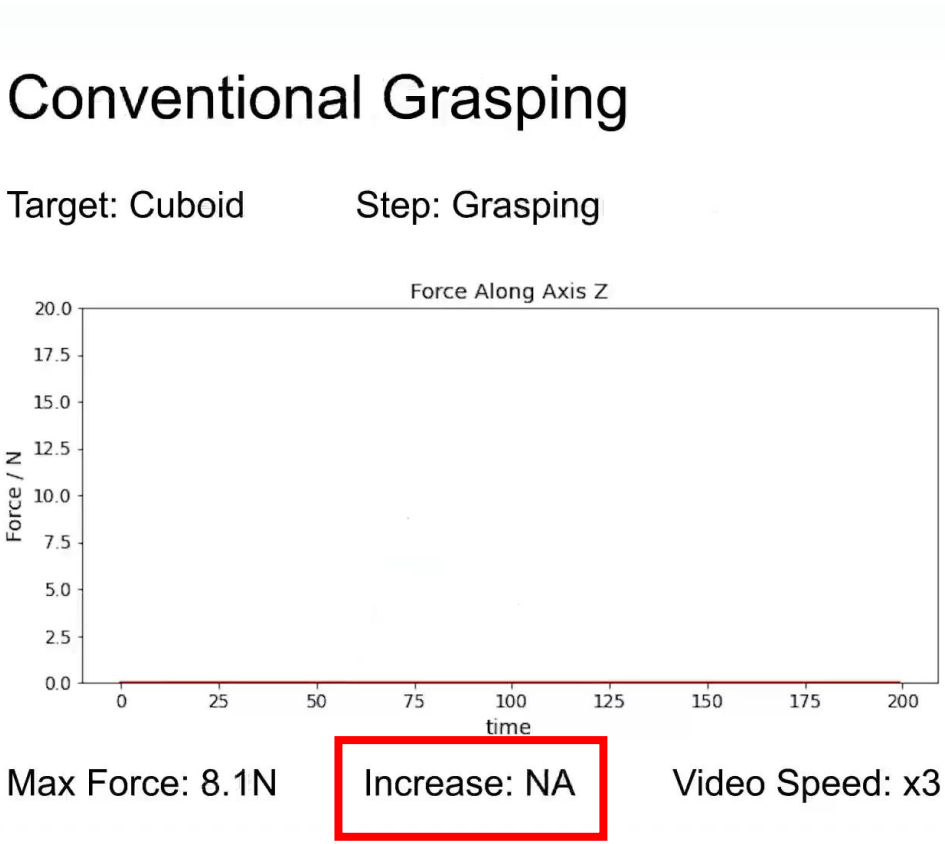
Configuration Transition: Circular Configuration to Lateral Configuration

Grasp Quality Metric: The maximum of resisting external forces.

Quality Increase: 108%

Current Work – Experiments





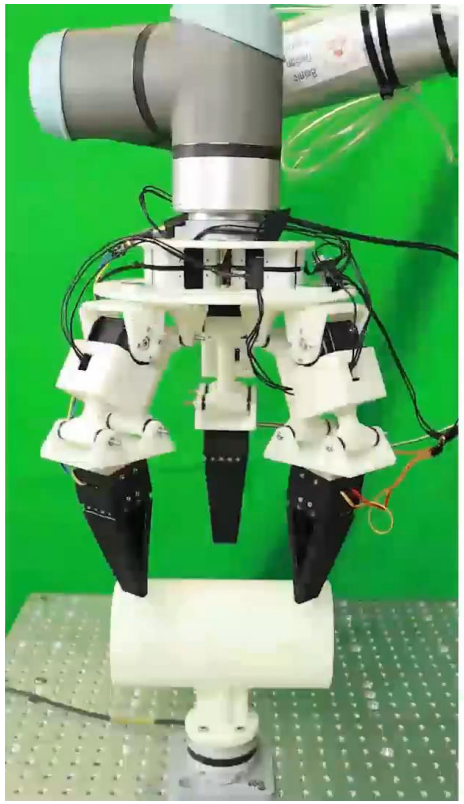
Target Object: Cuboid

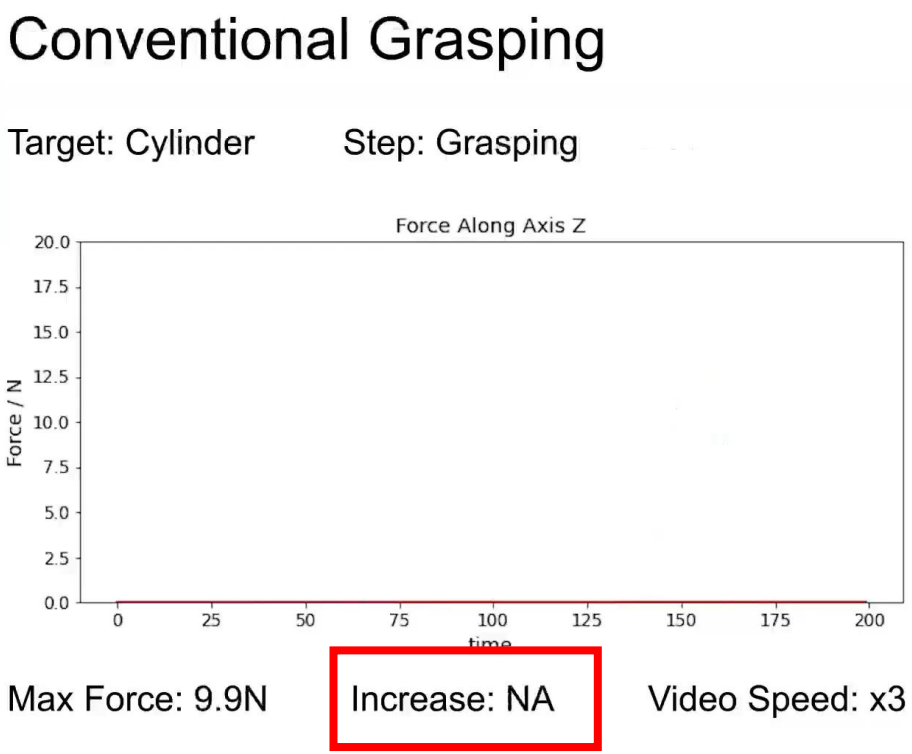
Configuration Transition: Circular Configuration to Parallel Configuration

Grasp Quality Metric: The maximum of resisting external forces.

Quality Increase: 61.7%

Current Work – Experiments





Target Object: Cylinder

Configuration Transition: Circular Configuration to Parallel Configuration

Grasp Quality Metric: The maximum of resisting external forces.

Quality Increase: 59.6%

Course Project – Background

Idea: Sort recycling by detecting object size and stiffness

Method: LSTM for sequence detection

[1] https://news.mit.edu/2019/mit-robots-can-sort-recycling-0416

Course Project – Related Work

Some Related Work to Preview

- Zhao H, O'Brien K, Li S, et al. Optoelectronically innervated soft prosthetic hand via stretchable optical waveguides[J]. Science robotics, 2016, 1(1): eaai7529.
  - A soft hand with optical waveguides; Similar method to our fingers for tactile sensing

- Van Meerbeek I M, De Sa C M, Shepherd R F. Soft optoelectronic sensory foams with proprioception[J]. Science Robotics, 2018, 3(24).
  - A soft foams with proprioception based on optical fibers; Similar method to our fingers for tactile sensing

- Chin L, Lipton J, Yuen M C, et al. Automated recycling separation enabled by soft robotic material classification[C]//2019 2nd IEEE International Conference on Soft Robotics (RoboSoft). IEEE, 2019: 102-107.
  - Using soft finger to sort recycling; Course project related.