Dexterous Compliant Manipulation *using Delta Arrays*

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Motivation

- We are focusing on building dexterous manipulators consisting of arrays of three degrees-of-freedom parallel delta robots.
- We use compliant materials to fabricate parallel mechanisms for safety when assisting and interacting with humans.

Dexterous Manipulation with Deltas

- We built a new type of distributed dexterous manipulator consisting of 64 linearly-actuated delta robots with 3D-printed compliant linkages.
- With 192 DoF, this compliant robot is capable of performing translation, alignment, prehensile squeezing, lifting, and grasping.

Patil et al., ICRA 2023.

Planning for Dexterous Manipulation

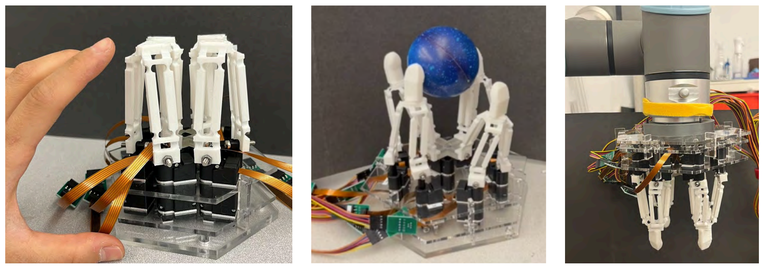
- We developed an algorithm that plans the object motions as well as robot contact locations given the start and goal poses of the object.
- We have successfully implemented this algorithm on the delta array, enabling automatic generation of in-hand (planar) manipulation and object passage skills.

- As a next step, we plan to integrate this algorithm into the design optimization process of the delta hand, further enhancing its dexterity and applicability.

Cheng et al., submitted, 2023

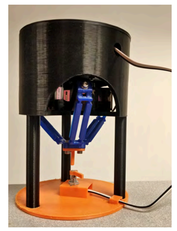
Dexterous Hand

- We designed dexterous hands consisting of four delta robots with combined actuator configurations.
- The design and fabrication is based on the desired force profiles and workspaces studies through simulations.
- Future work will focus on characterizing the hand and applying the results to health care applications.



DeltaZ

- We built a low-cost, educational manipulation platform for a broad range of capabilities and robust functionalities.



Patil et al., IROS 2022.

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