ORIGAMI-INSPIRED PNEUMATIC SOFT ROBOTIC GRIPPER

Master's Thesis Defense in Mechanical Engineering
Cal Poly SLO

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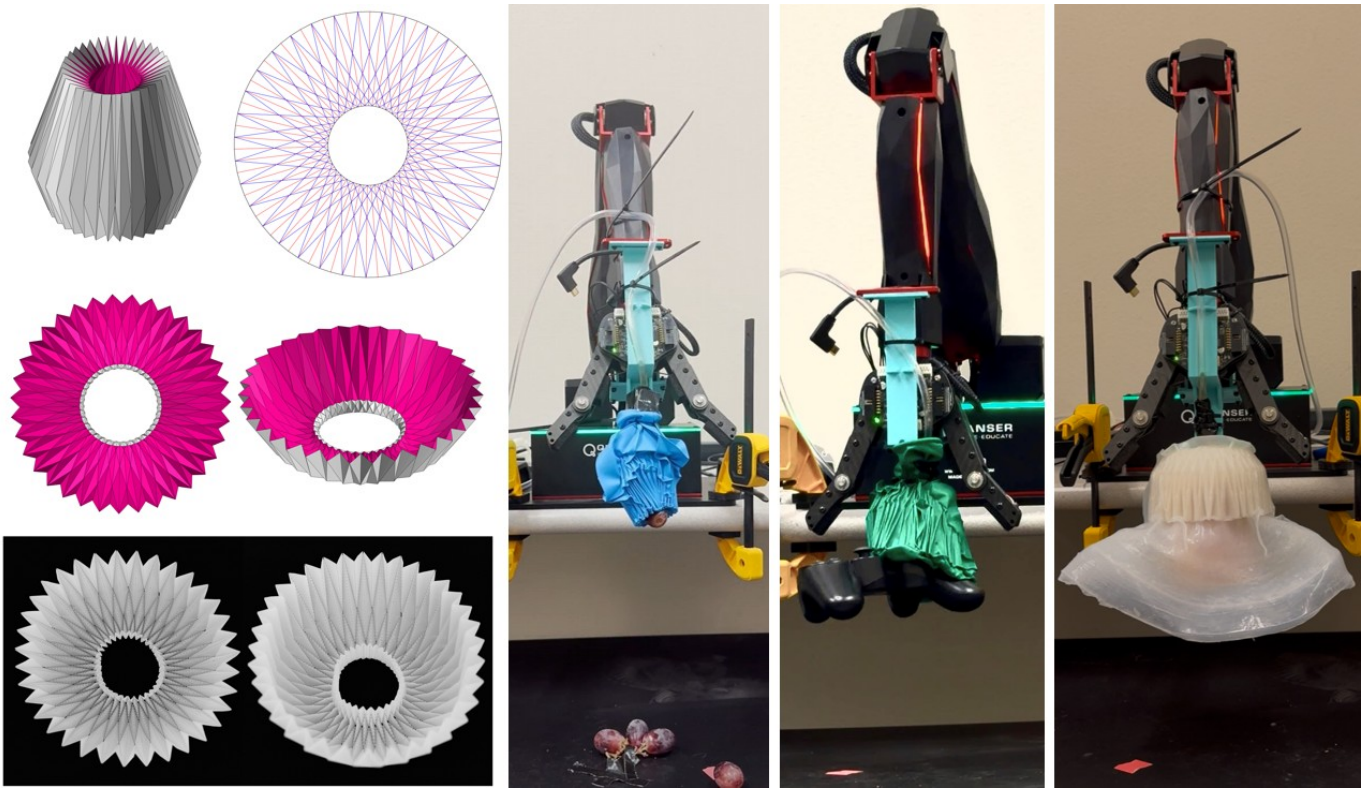
Tuesday, December 9th, 3–5 PM
Building 13, Room 124b
Zoom: https://calpoly.zoom.us/j/9252377637?omn=82620060108



Abstract

Soft robots benefit from compliant mechanisms that avoid rigid joints, yet many existing designs remain difficult to fabricate or customize. Origami geometry offers lightweight structure, scalable deformation, and predictable folding behavior that is well suited for soft pneumatic actuation. This thesis develops a low cost, rapidly manufactured, and customizable workflow for creating origami-inspired soft robotic grippers.

The gripper uses a custom Sea Urchin crease pattern laser cut from drafting film and enclosed in an airtight silicone-based membrane. Under a 10–50 kPa vacuum range, the folds of the origami core collapse inward to form a gentle, adaptive grasp. Three gripper designs were evaluated on a Quanser QArm robot: an origami core inside a latex balloon, an origami core with a thin silicone liner inside a balloon, and a fully molded 1.25 mm silicone enclosure. These designs were tested for object handling, pull-out force, and contact force. The silicone-lined balloon configuration produced the strongest and most reliable grasps, while delicacy tests demonstrated the ability to pluck grapes from a stem without visible damage. The workflow supports rapid iteration and provides a foundation for customizable, safe, and accessible soft robotic systems.