

NRI:INT:COLLAB: Soft Active Contact Pads with Tunable Stiffness and Adhesion for Customizable Robotic Grasping

CMMI 1830362 • September 4, 2018 – August 31, 2021



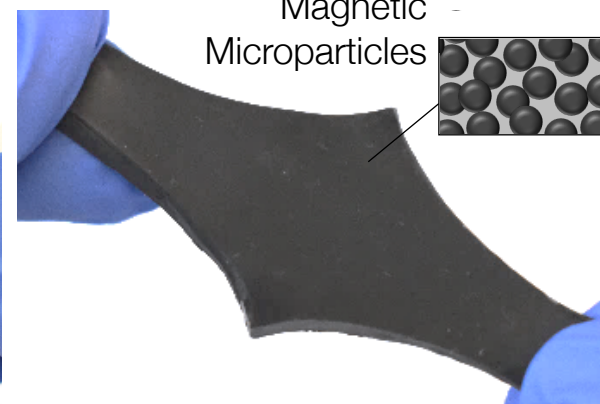
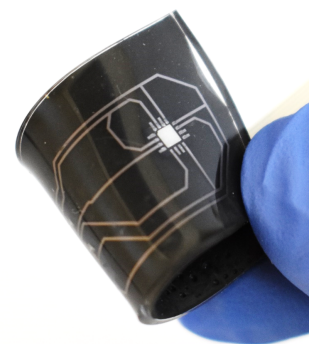
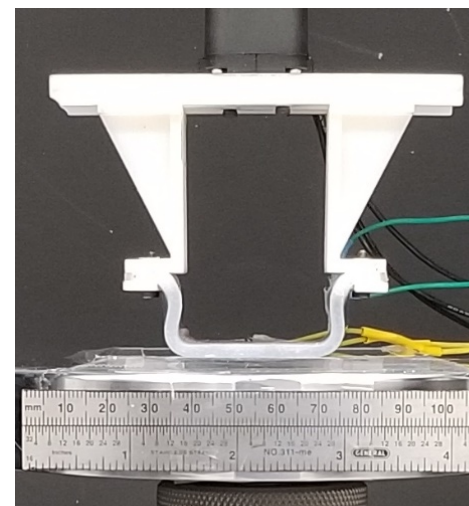
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Challenge

- Universal & Customizable Robot Grasping
- Match the versatility of natural grippers in handling a wide variety of objects.

Solution

- Polymer composites that dynamically change modulus and adhesion in response to electrical stimulation
- Soft sensing sticker for measuring interfacial forces



Scientific Impact

- Achieve electrically-controlled stiffness and adhesion tuning without bulky external hardware
- Create soft sensing sticker to remotely measure interfacial stresses without embedded electronics

Broader Impact

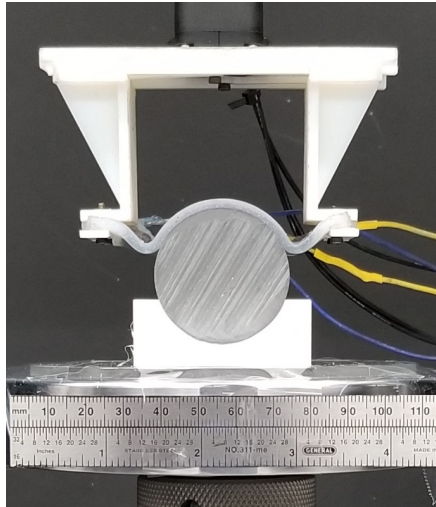
- Improve versatility of grippers used in mobile robots
- Middle-school outreach at CMU and Penn on soft materials and robotics
- Potential licensing of novel stiffness-tuning and sensing materials for commercial translation

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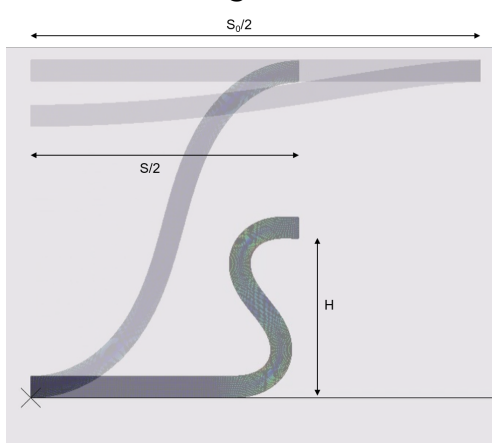
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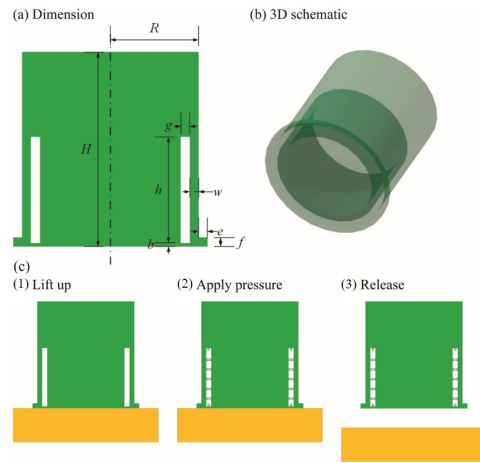
Adhesion/stiffness-tuning material mounted to parallel plate end effector



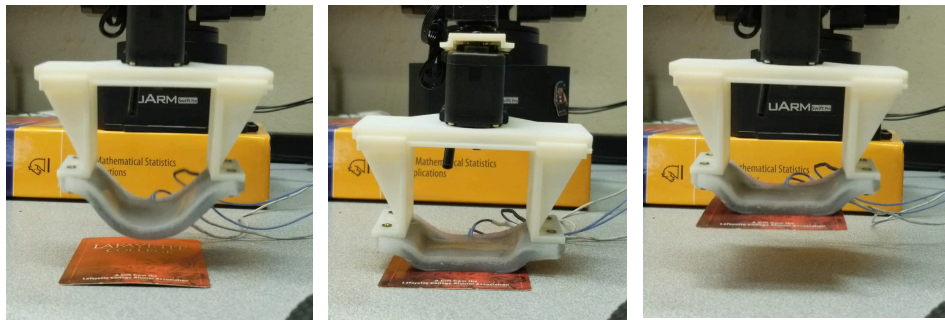
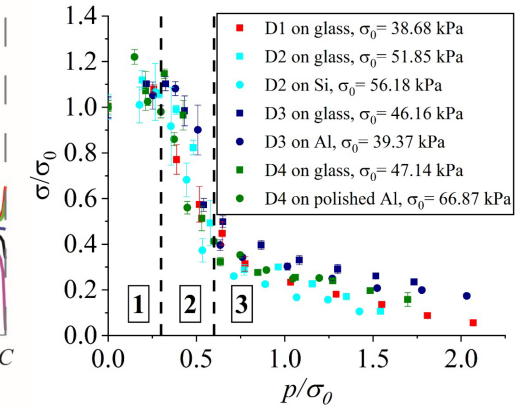
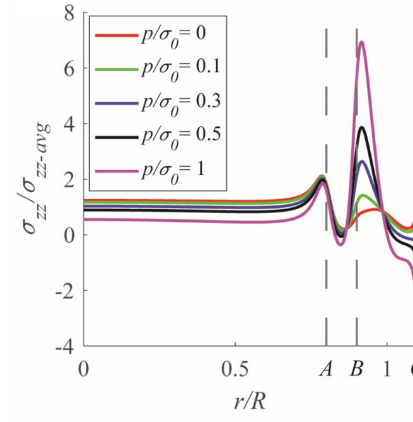
Theoretical study with FEA modeling



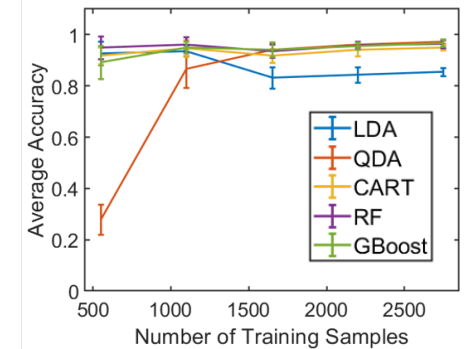
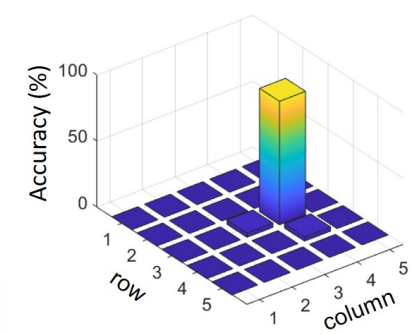
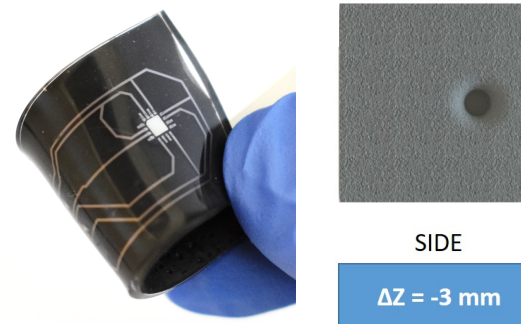
Adhesion-tuning subsurface pressure modulation



Tatari, Nasab, Turner, Shan, *Adv. Mater. Interfaces* 5 1800321 (2018).



In situ sensing with magnetic sensing skin



Hellebrekers, Kroemer, Majidi, *Advanced Intelligent Systems* 1 1900025 (2019).