Active Elastic Skins for Soft Robotics
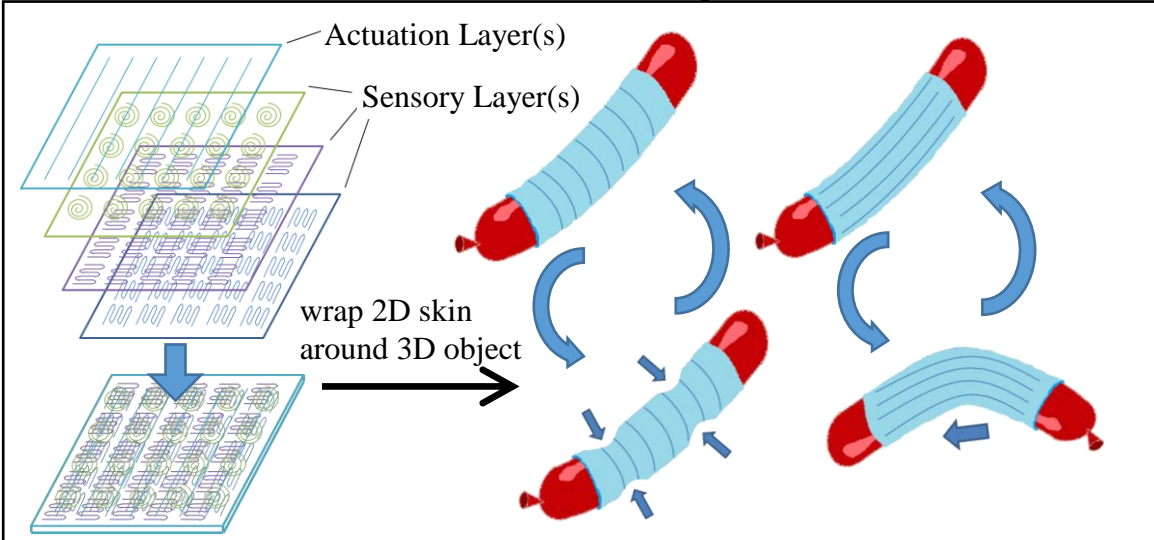
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Research Objectives

- Goal: enable a class of soft robots where all the functional elements are embedded in a removable and transferable skin.

- In contrast to constructing 3D soft robots with a tailored functionality, we will construct 2D active elastic skins that may be wrapped around 3D deformable objects.
- Start at TRL 1 (actuation and sensing technology research), end at TRL 3 (integrated active elastic skin demonstrations)

Actuation Layer(s)

Sensory Layer(s)

wrap 2D skin around 3D object

A 2D active elastic skin may be wrapped around any highly deformable 3D object (e.g. an inflatable balloon) to create a highly functional soft robot. By changing the orientation of the active elastic skin, different motions and functions may be achieved.

Approach

1. Design and fabrication of active elastic skins with controlled biaxial stresses (producing strains on the order of 50%)
2. Synthesis, characterization, and fusion of elastomer-based sensors
3. Development of efficient algorithms for state estimation
4. Integration and demonstration soft robotic locomotion using active elastic skins

Potential Impact

Active elastic skins will:

- Enable exploratory soft robots that are lightweight, low cost, compact during transport, and reconfigurable.
- Include flexible electronics that are less sensitive to vibrations, rendering them less sensitive to stressing mission environments.
- Be used in wearable applications, such g-suits that employ dynamic compression for aviators/astronauts who are subject to high levels of acceleration force.