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Fabric-Reinforced Textile Actuators (FRTAs) for a Soft Robotic Hand

Background

Soft pneumatic actuators (SPAs) have been a cornerstone of soft robotics for various applications such as mobile and assistive devices. SPAs are generally lightweight with a high power-to-weight ratio, inexpensive to fabricate, compliant, and can safely interact with the user and surrounding environment. Motions enabled by SPAs include combinations of bending, twisting, extending, and contracting. Recent trends in SPA design have seen the introduction of textile or fabric-based actuators. Textiles have the advantageous properties of being naturally lightweight, conformable, collapsible, high-strength, stretchable, and intrinsically anisotropic. Hence, further integration of textiles in SPA design can advance possibilities in mechanical programming and lead to new commercial applications.

Invention Description

Researchers at Arizona State University have developed a new class of textile-based soft actuators, known as fabric-reinforced textile actuators (FRTAs), that can be mechanically programmed to perform not only bending, but a combination of axial extension, radial expansion, and twisting along its central axis. Multi-segmented actuators can be created by tailoring different sections of fabric-reinforcements together in order to generate a desired set of motions for specific tasks. The fabrication method of these FRTAs eliminates the need for wrapping Kevlar threads or adding rings around actuators. Instead, the laser-cut reinforcements are added along the actuator using a single-step lamination and layering process. With these design methods, an anthropomorphic soft robotic hand was developed, capable of grasping objects of various shapes and sizes.

Potential Applications

- Manipulation assistance for daily living tasks
- Soft robotic systems

Benefits and Advantages

- Enables new complex deformation of actuators
- Economical fabrication process
- Eliminates need for wrapping of Kevlar threads and adding rings around actuators

Related Publication

Laboratory Homepage of Professor Wenlong Zhang