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Morphing Soft Robots

Soft robotics open up new opportunities to create devices with extraordinary functionalities. Although this is a rapidly growing field with constant advancements, there are still many challenges with designing, modelling and controlling soft robots which hinder their capabilities. For example, soft robotics have difficulty making morphological and gait adaptations on the fly, limiting their potential applications.

Researchers at Arizona State University have developed a new class of soft robots that are fully 3D printable and are able to make morphological and functional adaptations on the fly. Controlled interactions of embedded printable components allow parts of the robots to be pulled, pushed, bent or twisted, enabling smooth transitions and transformations on demand. Using a modified 3D printer, having coordinating custom print heads, multiple materials can be loaded simultaneously, and any type of soft robotic design can be printed. Further, the printer can have multiple attachments for different curing necessities (i.e. fans, UV lights, heat wings, etc.).

Because these soft robots can make numerous morphological and functional adaptions on the fly, they are able to effectively and efficiently perform unprecedented manipulation and locomotion tasks.

Potential Applications

- Soft robotics for medical, space, and additional applications
  - Minimally invasive surgeries, targeted drug delivery, etc.
- Tactile sensors – e.g. electronic skins
- Swarm robotics
- Wearable or implantable electronics/devices
- Point of care devices
- Soft bodied devices for search and rescue or exploratory operations

Benefits and Advantages

- Highly deformable and capable of altering their morphology
- Able to transform their gait
- Characteristics can be remotely fine-tuned within a desired range
- Enables simultaneous optimization of different characteristics – i.e. morphology, gait, sensing, actuation, etc.
- Multiple soft materials can be utilized simultaneously
- Rapid prototyping of soft sensors and actuators in any complex design can be realized

For more information about the inventor(s) and their research, please see

Dr. Marvi's departmental webpage