

Continuum Robots with Sensing Capabilities to Adapt Structure

Summary

Vanderbilt researchers have developed a continuum robot with the ability to adapt both its length and diameter of its segments. This could help expand the usability and effectiveness of continuum robots.

Addressed Need

Continuum robots have high degrees of freedom which allow the arm to move freely. They are typically used within confined spaces that humans may not be able to reach with other methods. Continuum robots are designed with fixed parameters such as constant diameter and segment length. Previous developments have determined ways to allow the arm length of the robot to be adjusted. Vanderbilt researchers have built upon these new developments to also include an adaptable diameter for the robot. Having the ability to change the diameter and arm length would allow continuum robots to be able to push surrounding material or to maintain the opening of a passageway. This unique aspects of the continuum robot could greatly increase their versatility and performance.

Technology Description

Multi-backbone continuum robots (MBCRs) use several extendible backbones for its basic structure. These designs have been researched extensively and allow the robots to have a variable segment length. Building upon the already existent MBCRs, the robots can gain the ability to adjust their diameters as well. Using an angulated scissors mechanism as seen in Fig. 1 (a), the spacer disks within the backbone of the robot can change the diameter. A wire loop passes through the backbone and controls the

diameter. When the loop is shortened, points a-b are pulled together, and the diameter expands. When the wire is released, the robot shrinks as the springs recoil. The diameter extremes can be seen in Fig. 1 (b,c).

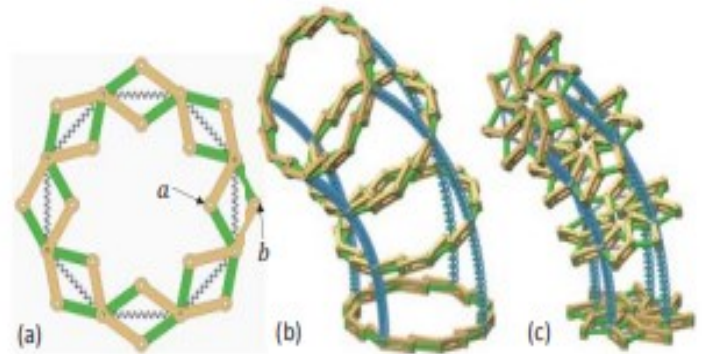


Figure 1

Unique Features

- ◇ Ability to change diameter
- ◇ Ability to change segment length
- ◇ Expands payload carrying capacity
- ◇ Potential expanded abilities to sense forces acting along its length

Technology Development Status

A simple prototype of the adaptable geometry has been created. Further development of the complete device is ongoing.

Intellectual Property Status

A patent application has been filed. Publication: C. Abah, A.L. Orekhov, N. Simaan. IEEE International Conference on Robotics and Automation, May 2018. "Design Considerations and Redundancy Resolution for Variable Geometry Continuum Robots" (<https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&number=8460722&tag=1>)

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