The Advantages of Ribbed, Flexible Snake Robots

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Abstract

Usefulness of snake robots. Rough terrain, disaster-zone search and recovery, medical applications, etc.

While the vast majority of robotic snakes have used actuation-at-joints, a using an actuation-between-ribs approach carries with it a number of significant benefits. Such as cost, simplicity, biomimicry, and allowing a myriad of actuation options Also, using this approach allows us to ditch the concept of the U-joint entirely, using instead a flexible member as the "spine" of the robot – there are advantages here as well, such as simplicity, inherent elasticity, no need for lubrication. We built two successful snake robots as examples of this approach.

1 Introduction

The last 20 years have seen an explosion in research on "snake" or "serpentine" robotics. These devices are distinct from other robots in that they move though internal shape changes to exert forces on their environment, instead of relying on discrete legs or wheels for locomotion.

Due to their structure and, snake robots possess a number of advantages over their wheeled or legged cousins. As documented in [Dowling]¡ref¿1997 - Dowling Dissertation - "Limbless Locomotion: Learning to Crawl with a Snake Robot"¡/ref¿, these include stability, terrainability, traction, efficiency, size, redundancy, and sealing.

While such robots do also have disadvantages, including payload, speed, and the multitude of degrees of freedom that need to be controlled, their research has been motivated by a large number of potential applications, including exploration, inspection, routing, medical, hazardous environments, search & rescue operations, and reconnaissance.

2 Prior Work

Overview of prior work. Link to as many other snake designs as we can find.

List advantages of motorized U-joint designs. Power? Complete modularity? (can completely dissemble the snake into identical pieces).

List of disadvantages: * Limited in actuation possibilities (motors, other rotational drives). * Need for complex gearing using gears, cables, etc. * Not inherently elastic.

We introduce the flexible spine approach. Inherent series elasticity, cost, biomimicty, and ability to support a number of actuation techniques, including servos, cross-tendon drive, etc.

3 Disadvantages

* Buckling strength. * Not quite as modular * Power?

4 References