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Tunable Dynamic Walking via Soft Twisted Beam Vibration

Background

Actuation and transmission through soft robotic systems has been studied extensively in recent years. Soft actuators, unlike traditional rigid-body robotic systems, can be deformed to subsequently alter body shapes and drive robots by stimulating or deforming soft materials. While many soft actuators have been developed to drive soft robots in applications including human-robot interaction, bio-inspired robots, and wearable robotic systems, the power of these systems is typically low and the actuators are large and bulky. Also, dynamic modeling of powered soft systems is challenging due to the non-linearity of hyper-elastic materials and their complexity, and can be under-utilized during the design process.

Invention Description

Researchers at Arizona State University have developed a novel actuation mechanism that propagates vibration through soft twisted beams. This method uses dynamically-coupled anisotropic stiffness to simplify the actuation of walking robots. The coupled stiffness of twisted beams can be controlled to generate a variety of complex trajectories by changing the design parameters including twist angle, end-loading conditions, and frequency of input signal. This mechanism produces a tunable walking gait from a single vibrational input.

Potential Applications

- Soft robotic systems (e.g., wearables, locomotion, etc.)

Benefits and Advantages

- Actuation signals for generating complex motion can be consolidated & simplified
- Can generate tunable forward & backward walking by controlling input frequency and other design parameters (e.g., twist angle, end-loading conditions)
- Transforms simple, periodic input motion into complex, cyclic motions when contact is made with the ground

Related Publication: Tunable Dynamic Walking via Soft Twisted Beam Vibration