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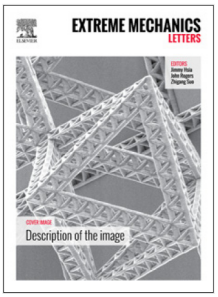

A soft active origami robot

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A soft active origami robot

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Abstract

Origami has emerged as a powerful methodology for developing intelligent transformable robots. Although there is considerable progress in origami techniques to enable the design of a broad range of geometries, there is a dearth of effective actuation mechanisms which can eliminate the complex process of assembling external actuators. This paper illustrates a soft active origami robot based on electrostatic attraction. The time-varying electrostatic forces induced by AC voltage can lead to vibration of the origami structure. Inertia forces induced by vibration will then result in a traction, which can overcome the friction and facilitate the robot's forward motion. This robot is composed of two paper strips coated with compliant electrodes which act as both the body (or skeleton) and the actuator, significantly simplifying the fabrication and decreasing the structural complexity, weight (~7g) and cost (~1US$). A theoretical model is developed to interpret the actuation mechanism and the simulations are qualitatively consistent with the experiments. This soft active origami robot exhibits interesting attributes such as robustness, scalability and adaptability. This robot also demonstrates its capability to perform surveillance tasks in a 2D plane. This work investigates a new actuating mechanism for driving an origami structure, which results in simple and rapid prototyping of a soft robot. Soft active origami structures are expected to offer inexpensive solutions to space and/or swarm robots, due to properties of simple structure, low weight, low volume and low cost.

Keywords: origami robot, soft active structure, electrostatic actuation