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Abstract

Mechanism of Motile Plants and Robots Inspired by Plants †

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Abstract: Plants are ideal for soft robot design due to their favourable ability to adapt and respond to the environment. Here, three different motile plants, bird of paradise (*Strelitzia reginae*), the waterwheel plant (*Aldrovanda vesiculosa*), and the Venus flytrap (*Dionaea muscipula*), are introduced. They may deform following the physics predetermined by the structure. As a decentralised species, plants respond under environmental stimulation without a controlling unit like a brain and motor-like muscles. The mechanism behind the movement of the plant should enlighten more intelligent robotics. In this study, movable plants are compared for their actuating principle, and, based on their deformation model, three pneumatic actuators are designed. The bird of paradise opens its petals when the sunbirds sit on another petal, which inspires the structure utilising the bending of the midrib to open lobes. Similarly, the waterwheel plant stores energy in the bending midrib and releases it when it closes. But, the Venus flytrap takes advantage of snapping to achieve rapid closure. Using three-dimensional (3D) printing, pneumatic actuators, which are ruled by the mechanism of plants with silicon rubber surfaces, are fabricated and tested. Under air pressure, the actuator deforms, mimicking the plant cells expanding under the turgor pressure. The hingeless actuator performs well while interacting with dedicated projects.

Keywords: plant-inspired robot; soft robot; pneumatic actuator

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