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PROCEEDINGS

The Biomimetic Turing Machine

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ABSTRACT

Movements actuated by the moisture in plant tissues are prevalent in nature. Different microstructures of plants determine the various patterns of moisture-actuated movements. For instance, the graded lignin fraction of Selaginella lepidophylla leads to the a graded curvature morphology, while the fiber orientation angles determine the helical chirality of chiral seed pods. Inspired by these two types of plant microstructures, a theoretical framework for a biomimetic Turing machine is constructed. Similar to the Turing machine introduced by Alan Turing in 1936, the biomimetic Turing machine has a ribbon-like bilayer structure composed of numerous units, whose microstructures consist of fiber and matrix. By encoding the matrix volume fraction and fiber orientation angles of the units, we can regulate the biomimetic Turing machine morph to the desired shape. The theoretical framework for inverse design of arbitrary space curves is established, and the design criteria with geometrical restrictions are provided. The theoretical framework of the biomimetic Turing machine offers a novel strategy for design and fabrication of intelligent morphing materials.

KEYWORDS

Microstructure; plants; turing machine; inverse design

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