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Author: Ms. Jinxiu Qiao
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology(CAST), China,
qiao-jinxiu@163.com

# THE WONDERS OF FOLDED METAMATERIALS AND ITS APPLICATION IN AEROSPACE

**Abstract**

As a kind of deployable structures, folded metamaterials have attracted increasing attentions and been widely used lately. Inspiried by origami, lots of basic patterns have been proposed, such as Miura pattern, Scheel pattern, Yoshimura pattern, Ron Resch pattern, waterbomb pattern and so on. The Miura pattern was applied in the solar panel in the 1980s shortly after the concept was proposed.

Folded metamaterials have promising applications not only in construction material, but also in intelligent structures and robot configurations. The reason is that, on the one hand, the geometric parameters of folded metamaterials are changeable, and there are many folding modes to choose from. These characteristics provide a broad space for the design of mechanical metamaterials. On the other hand, the existence of the bistable state during the process of folding makes the mechanical performance of metamaterial easier to be controlled.

The comprehensive application of folded metamaterials is based on origami kinetic and origami mechanics. Materials science, mechanical design and manufacturing, micro-nano-scale processing, electronic technology and other disciplinary methods are used to achieve a specific functional structure (such as origami robot, micro-scale device) preparation, self-assembly and practical application process. Taking the origami robot as an example, the transformation of the origami structure between the two-dimensional plane and the three-dimensional structure is the geometric basis of the design of the origami robot, and also makes the use of the special preparation method and preparation materials (such as 3D printing technology, planar preparation method, embedded shape memory alloy) possible. The origami robot with a variety of different motion patterns can also be made by this method.

The folded metamaterials possess not only the excellent mechanical properties of micro-nano lattice mechanical metamaterials, but also the advantages of relatively simple preparation technology, large design space, unique expandable, self-assembly, negative Poisson ratio, bistable state and other properties. In addition, its macro performance is also easier to be controlled. Precisely because of this, folded metamaterials are considered to be a great potential in the field of aerospace materials. As noted in the Science, their potential for application, especially for multifunctional integration, is 'scarcely imagined'