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Actuated 3D origami-like structures with tunable volume and stiffness JOHANNES OVERVELDE, TWAN DE JONG, JAMES WEAVER, CHUCK HOBERMAN, KATIA BERTOLDI, Harvard University — Recent years have seen an uprise of new materials with interesting and unusual properties that result from their regular periodic microstructure. Origami-based metamaterials based on the Miura fold pattern have recently gained a lot of attention for their ability to drastically change their shape and therewith creating a programmable metamaterial. In this work, we propose a completely new class of actuated 3D foldable materials with three degrees of freedom that can drastically change their shape and volume by folding. These materials do not only change their shape, but also have a tunable stiffness that can vary two orders of magnitude by making use of contact interaction between different parts of the material. We experimentally show their effectiveness by building a metamaterial consisting of 64 unit cells and by incorporating local inflatable actuators in the material to enable large on demand changes in shape and stiffness.

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