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Extending Origami: Crease Pre-stressing for Functional Adaptation

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Shape programmability has been proposed as a mechanism to provide in material systems and structures with dynamically adaptable properties and multifunctionality [1, 2, 3, 4]. In this work we explore the capabilities to program fast and efficient shape adaptation from introducing pre-stress in the folds of origami-like structures following bioinspiration from the insect order Dermaptera [1, 2]. In a recent paper, we showed how membrane pre-strain in the creases of Dermaptera wings introduces a bistable behaviour responsible of the remarkable fast self-folding and locking mechanisms exhibited by these insects. In this paper we explore the design space for functional applications translating bioinspired design principles into engineering structures.

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