GRADUATE STUDENT RESEARCH SEMINAR SERIES (2019)

ANALYZING THE BI-DIRECTIONAL DYNAMIC MORPHING OF A BI-STABLE WATER-BOMB BASE ORIGAMI

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Shape morphing is one of the most appealing functions of the adaptive structures. Morphing structures can undergo significant shape reconfigurations to achieve optimal performance under different operational conditions, so they have tremendous potentials for aircraft and space applications. Among the various means of achieving shape morphing, origami-inspired folding is particularly advantageous. This is because folding is a powerful approach to induce three-dimensional and sophisticated shape changes. However, attaining large amplitude folding is still a challenge in origami engineering. While promising, the use of active materials as a folding activation strategy is limited due to the constant voltage supply that is required to maintain the desired configuration of the structure. One possible solution is to embed bi-stability into the structure. Bi-stability can play two significant roles: first, it can significantly reduce the actuation requirement to induce shape morning; and second, it can maintain the shape change without demanding sustained energy supply. In this study, we demonstrate the feasibility of using dynamic excitation to induce shape morphing (or folding) between the two stable states of water-bomb base. Via numerical simulations, we show that by harnessing the intra-well resonance of the water-bomb structure, one can achieve rapid bi-directional morphing using relatively low actuation magnitude.

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