Shape morphing with photo responsive structures

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Abstract

We present the design and analysis of a mechanical structure composed of an array of beam elements fabricated using a photo-responsive polymer matrix infused with an azobenzene chromophore. This material generates light-induced strain upon illumination, enabling precise, remote control of structural behaviour. By inducing a buckled configuration in the beams through compression, the application of light-induced strain triggers a snap-through effect, transitioning the beams to a different stable state. This mechanism allows for dynamic shape morphing of the entire structure, with the resulting global configuration depending on both the number and sequence of snapped beams, enabling large overall deformation and a non-linear response.
This study demonstrates both numerically and experimentally the potential of photo-responsive materials to enable contactless control of shape-morphable structures. The ability to achieve structural transformations remotely using light opens avenues for advanced applications in soft actuators and elastic waveguides. Such lightweight systems enable flexible actuation and dynamic control of mechanical wave propagation, offering innovative solutions for adaptable and multifunctional applications.

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