Abstract Submitted
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Photo-Origami – Using Light to Bend, Fold, and Buckle[1] JENNIE RYU, University of Colorado, MATTEO D'AMATO, University of Trento, KEVIN LONG, Sandia National Laboratories, XIAODONG CUI, H. JERRY QI, MARTIN DUNN, University of Colorado — We describe photo-origami, a method to program spatially- and temporally-variable mechanical, chemical, and optical fields into a polymer that enable controllable, sequenced, macroscopic bending and folding to create three-dimensional structures. We combine mechanical and optical stimuli to locally rearrange the polymer's network topology which allows us to program a residual stress state into the film; upon release of mechanical constraints, we realize a wide variety of desired shapes. We demonstrate, through a combination of theory, simulation-based design, synthesis, and experiment, the operative phenomena and capabilities of photo-origami. We demonstrate architectures that rely on bending, folding, instabilities, and post-buckling behavior to achieve their three-dimensional form, starting from a flat sheet. We also describe a theory that couples the hereditary nature of photophysics, chemistry, and large-deformation mechanics and enables simulations of the fabricated structures that are in good agreement with the experiments.

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