
Plastically controlled deployable kirigami structures

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Abstract

Kirigami structures are very popular in a wide range of engineering applications such as stretchable electronics, bioengineering or architectural components. Their overall deployment under load relies on the local bending of beam elements defined by alternate cuts in a plate. Here, we are interested in 3D structures obtained with an azimuthal pattern of cuts actuated by a point force normal to the plate. In a previous study, we described how to program the cutting pattern to reach a target shape under load. A perfectly elastic structure recovers its initial flat state as the force is released. In contrast, using a plastic material (thermoplastic, metal) leads to a permanent 3D shape as local deformations exceed plastic strains. Knowing the plastic mechanical response of a given material, can we program the cuts to obtain the desired shape ?

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