Fracture by Design of Topological Metamaterials

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Abstract

Architecting mechanisms of damage in mechanical metamaterials, by translating the target effective mechanical response to structural features of the lattice, poses a complex inversion problem. Of these metamaterials, Maxwell lattices, which are on the verge of mechanical stability, offer significant potential for advanced functionality. As a result of their robust topological and geometry-dependent properties that dominate the stress activation, simplified considerations may be used to more precisely design the damage evolution. Using continuum representations of these lattices, we set up a framework that allows us to explicitly engineer the stress concentration around discontinuities. This in turn offers robust pathways to manipulate the mechanisms of damage and the fracture propagation.

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