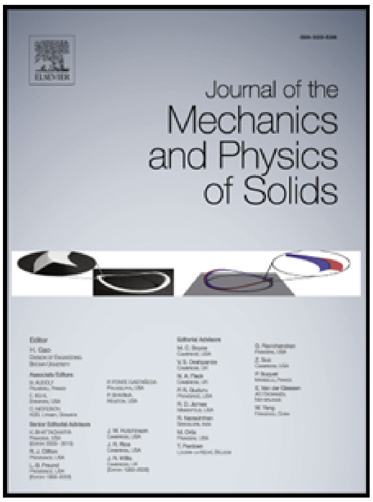

A study of topological effects in 1D and 2D mechanical lattices

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A study of topological effects in 1D and 2D mechanical lattices

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Abstract

Topological insulators are new phases of matter whose properties are derived from a number of qualitative yet robust topological invariants rather than specific geometric features or constitutive parameters. Their salient feature is that they conduct localized waves along edges and interfaces with negligible scattering and losses induced by the presence of specific varieties of defects compatible with their topological class. The paper investigates two lattice-based topological insulators in one and two spatial dimensions. In 1D, relevant background on topological invariants, how they arise in a classical mechanical context and how their existence influences the dynamic behavior within bandgaps, is provided in a simple analytical framework. In 2D, we investigate Kagome lattices based on an asymptotic continuum model. As an outcome, topological waves localized at the interface between two Kagome lattices are fully characterized in terms of existence conditions, modal shapes, decay rates, group velocities and immunity to scattering by various defects. The paper thus helps bridge a gap between quantum mechanical constructs and their potential application in classical mechanics by reinterpreting known results in 1D and deriving new ones in 2D.

Keywords: Kagome lattice, topological mechanics, Dirac cones, edge states, Stoneley waves

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