Topological mechanical metamaterials and nonlinearity

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Following the recent discovery of topological insulators in condensed matter physics, a new notion of topology has emerged in association with the intrinsic wave dispersion of a structure. This has led to a plethora of mechanical designs with non-trivial and robust energy localization - potentially offering new applications in energy harvesting, vibration isolation, and phononic wave guidance. In this talk, after a review of the different classes of topological mechanical metamaterials, we will present a new family of finite-frequency mechanical metamaterials that we have recently introduced [1]. Here, topological properties appear in deformation coordinates and topological edge waves appear for free boundaries. In the second part, we will focus our attention on the effect of nonlinearity. In particular, we will discuss our recent efforts to understand the interplay between nonlinearity and topology in mechanical systems. By choosing simple topological systems and including different types of nonlinearities, we will present various phenomena that we have observed, such as the amplitude-dependent topological transition [2], the formation of solitons [3] and the chaotic transition to thermalization [4].

Références

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