MARVEL
NATIONAL CENTRE OF COMPETENCE IN RESEARCH

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Topological Metamaterials

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Abstract: The effect of constraints on a many-body system is a subject as deeply rooted in mechanical and robotic control theory as in modern theoretical physics. In this talk, we present prototypes of artificial structures, dubbed mechanical metamaterials, that harbor topologically protected states akin to electronic topological insulators. We show that the same constraint equations that, upon linearization, predict topological edge states give rise to solitons and other non-perturbative excitations. We derive non-linear elastic theories with a topological boundary term and use them to engineer metamaterials that break or fold in controlled and robust ways. Next, we discuss how to build mechanical topological insulators using active liquids that flow spontaneously without external drive. The active flow breaks time-reversal symmetry and gives rise to unidirectional sound along sample edges and domain walls, even when particle dynamics is overdamped. Such sound waves are topologically protected because they propagate past obstacles without any back-scattering and are immune to disorder.

Map:


La Méridienne
CM
ME C
ME B
ME A
MA A
MA B
MA C
ME D
ME D
ELB
ART LAB A
Route des Noyerettes
Chemin des Machines
Route des Noyerettes