From Soft Matter to Topological Mechanical Metamaterials

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Abstract

The study of soft matter systems is critically important in physics and chemistry, and is particularly essential for understanding the mechanical, electrical, and optical properties. Recent advances in applying concepts of topological band theory to soft matter systems have led to the burgeoning new field of "topological mechanics", where nontrivial topologies of the phonon bands give rise to exotic mechanical and acoustic properties. These topologically robust soft-matter systems possess unique properties distinct from acoustic, electronic, and optical topological structures: topological mechanical 'floppy modes' exhibit low boundary elasticity, governing mechanical failure, while topological "states of self-stress" manifest high elastic stability, preventing catastrophic failure. Such topologically robust soft matter systems are ubiquitous in nature, including cytoskeletons, biological fibers, myosin filaments, and jamming processes. In this talk, we will provide an overview of topological soft mechanics, and focus on our latest contributions to this exciting new field.

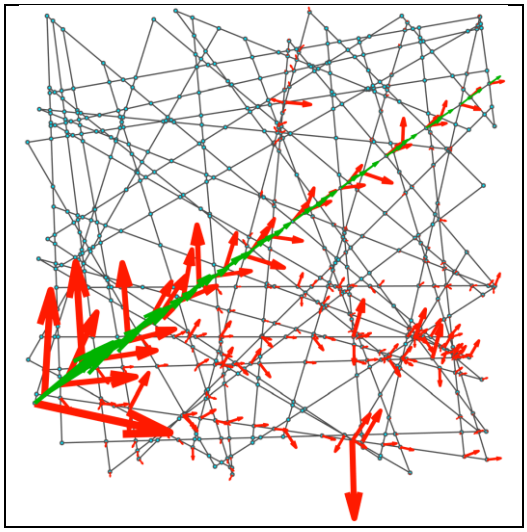

Fig. 1, topological mechanical floppy modes in completely disordered fiber networks.

Bibliography

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