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Forum de Physique Statistique @ ENS

Mercredi 8 Décembre 2021, 14 :30
LPENS, L367(please inquire xiangyu.cao@ens.fr for a zoom link)
Domaines : cond-mat.stat-mech

Titre : *Energetic Rigidity : a unifying theory of mechanical stability*

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Résumé : *Rigidity regulates the integrity and function of many physical and biological systems. Depending on the type of system under study, different proxies are suitable for measuring the rigidity of a system. Here, we propose that "energetic rigidity," in which all non-trivial deformations raise the energy of a structure, is a more useful notion of rigidity in practice than two more commonly used tests : Maxwell-Calladine constraint counting (first-order rigidity) and second-order rigidity. We also show that there may be systems for which neither first nor second-order rigidity imply energetic rigidity. We apply our formalism to examples in two dimensions : random regular spring networks, vertex models, and jammed packings of soft disks. Spring networks and vertex models are both highly under- constrained and first-order constraint counting does not predict their rigidity, but second-order rigidity does. In contrast, jammed packings are over-constrained and thus first-order rigid, meaning that constraint counting is equivalent to energetic rigidity as long as prestresses in the system are sufficiently small. The formalism of energetic rigidity unifies our understanding of mechanical stability and also suggests new avenues for material design.*