When does matter matter with slender matter?

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Abstract

There has been considerable progress in understanding and modelling the many interesting behaviours of slender continua. Effects like buckling and localization are now routinely used in higher-order structures like metamaterials or crumpled matter. Much of this success has been predicated on linear-elastic (or slightly non-linear) theories roughly under the assumption that, to first order, geometry is dominant. On the other hand, because localized structures do form, material properties such as plasticity and viscoelastic loss must appear – particularly in higher order structures where many structures are in play. In this work, we experimentally examine the response of a large number of different materials, ranging from elastic to fragile in several different idealized localized structures. As an example higher-order structure, we focus on crumpled structures where the interplay between point localizations and sharp folds is known to dominate the large scale mechanical behaviour.

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