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Untangling the mechanics versus topology of overhand knots PEDRO REIS, MOHAMMAD JAWED, Massachusetts Institute of Technology, PETER DIELEMAN, Leiden University, BASILE AUDOLY, Sorbonne Universités, UPMC Univ Paris & CNRS — We study the interplay between mechanics and topology of overhand knots in slender elastic rods. We perform precision desktop experiments of overhand knots with increasing values for the crossing number (our measure of topology) and characterize their mechanical response through tension-displacement tests. The tensile force required to tighten the knot is governed by an intricate balance between topology, bending, friction, and contact forces. Digital imaging is employed to characterize the configuration of the contact braid as a function of crossing number. A robust scaling law is found for the pulling force in terms of the geometric and topological parameters of the knot. A reduced theory is developed, which predictively rationalizes the process.

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