Non-interpenetration of rods derived by Γ-limits

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Abstract

Ensuring non-interpenetration is a fundamental prerequisite when modeling the deformation response of solid materials. In this contribution, we thoroughly examine how this requirement, equivalent to injectivity within bulk structures, manifests itself in dimensional-reduction problems. Specifically, we focus on the case of rods embedded in a two-dimensional plane. Our results focus on Γ-limits of energy functionals that enforce an admissible deformation to be a homeomorphism. These Γ-limits are evaluated along a passage from the bulk configuration to the rod arrangement. The proofs rely on the equivalence between the weak and strong closures of the set of homeomorphisms from $\mathbb{R}$ to $\mathbb{R}^2$, a result that is of independent interest and that we establish in this paper too.

This is a joint work with B. Benešova, S. Hencl and M. Kružík.