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Non-affine deformations and floppy modes in random fibrous networks C. HEUSSINGER, ERWIN FREY, Arnold-Sommerfeld Center for theoretical physics, University of Munich — We study the class of heterogeneous elastic networks composed of crosslinked fibers. These systems have recently been suggested as model systems for studying the mechanical properties of paper sheets or biological networks of semiflexible polymers. While these networks are known to have a rigidity percolation transition at low densities, we show here that even networks in the high-density regime in many ways resemble the behaviour of fragile matter, despite the fact that they are far away from the percolation threshold. In these networks highly non-affine deformations have been found, however, few is known about the actual nature of this non-affinity. This work tries to fill this gap by characterizing in detail the non-affine deformation field present in fibrous networks. By relating non-affinity to the low-energy excitations ("floppy modes") we can, starting from a microscopic picture, calculate the macroscopic elastic moduli both in a scaling theory and a self-consistent effective medium theory.

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