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Dense Random Fiber Networks Deform as Stochastic Fractal Objects. CATALIN PICU, HAMED HATAMI-MARBINI, Rensselaer Polytechnic Institute — The mechanical behavior of random fiber networks is essential in many biological and non-biological systems such as the cytoskeleton, tissue scaffolds and cellulose structures. Here we show that random fiber networks of densities much larger than that of the stiffness percolation threshold are stochastic heterogeneous elastic media with fractal distribution of elastic constants. The elasticity of these networks, both elastic constants and fields, while fluctuating significantly with position, is long-range correlated. The range of scales for stochastic self-similarity is bounded below by the mean fiber segment length and above, by the fiber length. This implies that no scale decoupling exists and no representative volume elements can be identified on scales below the upper cut-off scale, which provides an explanation for the observed delocalized effect of local mechanical perturbations in systems of semi-flexible fibers such as the cytoskeleton.

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