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Fiber networks stabilized by cohesion: limits of stability and mechanical behavior[1] AHMED SENGAB, CATALIN PICU, Rensselaer Polytechnic Institute — Networks composed from nanofibers are controlled by strong cohesive forces acting between filaments. These include structures assembled from electrospun polymeric fibers, dense assemblies of carbon nanotubes and some biological networks. In all these cases, the cohesive energy of the system is comparable or larger than the strain energy stored in bending, torsion or axial deformation modes of the filaments. This leads to fiber bundling and complex structural reorganizations which, in turn, influence the mechanical behavior of such networks. In this study we determine the limits of stability of such structures and the resulting range of stochastic configurations, in terms of the parameters controlling fiber-fiber interactions and the fiber properties. Further, we explore the mechanical behavior of the resulting stable structures. These results provide guidelines for the design of materials made from nanoscale fibers such as high strength structural panels made from strongly aligned carbon nanotubes.

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