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Mesoscopic Random Lattice Models of Rupture in Rubber[1]
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— In an earlier work, Marder illustrated how rupture in rubber differs from conventional fracture. Dissipation and toughening of the back edges of ruptures are critical for the propagation of stable ruptures. In this earlier work, mesoscopic models were arrived at by approximating the Mooney-Rivlin theory of rubber by a finite difference scheme on a triangular lattice. From this perspective, qualitatively the lattice sites are considered to be crosslinkers and the bonds are polymers. We extend this work by considering the crosslinkers to be randomly distributed throughout the material rather than being ordered. For both random and ordered lattices, without rupture, there are many different ways to construct free energy functionals that reproduce the continuum theory. However, not all of the constructions are numerically stable. We explore the physical consequences of the disorder and the physical interpretations of the observed numerical instabilities.

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