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**A Cellular Automaton Model of Catastrophic Failure**[1] C. A. SERINO, W. KLEIN, Boston University — We introduce a two-dimensional cellular automaton model for studying the catastrophic failure of materials under stress. Our model is similar to the Olami-Feder-Christensen earthquake model [Z. Olami *et al.*, Phys. Rev. Lett. **68**, 1244 (1992)] except that after a site fails $f$-times, it no longer can receive stress from its neighbors. In the limit that the interaction range, $R$, goes to infinity, our model is equivalent to the global load sharing fiber bundle model of Pierce [F. T.Pierce, J. Text. Ind. **17**, 355 (1926)] and Daniels [H. E. Daniels, Proc. Roy. Soc. London A **183**, 405 (1945)]. By varying the interaction range, we observe two qualitatively different failure modes. For $R \gg 1$ catastrophic failure resembles a nucleation-like event which grows symmetrically from a single initiating site and fails every site in the lattice. In contrast, for $R \approx 1$ a percolating cluster of failed sites spans the system despite the many active sites that persist, even after catastrophic failure. We use the stress-fluctuation metric to study the ergodicity of our model and hence the validity of equilibrium descriptions of fracture.

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