seen in our largest lateral systems, as illustrated in Fig. 3. (In Fig. 1d the transverse (horizontal) size was fixed so that meandering did not play an increased role as system size was varied.) As described above, our second simulation system (from which the data in Fig. 3 is obtained) is based on adding cross-braces to a square lattice. Thus varying Δz controls not only the intrinsic width of a crack by modifying its rigidity, but also changes the amount of disorder. Upon increasing Δz even more, the cross braces are more uniformly distributed throughout the material and the disorder again decreases. Thus, meandering becomes less important at asymptotically high Δz.

We have found that similar diffuse failure at low rigidity also occurs in simulations performed under shear as well as under tension. Due to the small system sizes available in experiments, we are unable to distinguish between meandering and crack-width broadening during material failure. However, our metric for w (standard deviation in broken bonds) allows us to compare simulations and experiment and show the similar behavior in all the systems we have studied. Sufficiently close to the rigidity transition, failure naturally occurs in a diffuse manner and will encompass the entire system. The crossover between diffuse failure due to rigidity loss and the meandering due to effects of disorder will be explored further in a separate study.

III. A FAILURE PHASE DIAGRAM

Shekhawat et al. [7] have previously considered the transition from crack nucleation to damage percolation in a random fuse network with a distribution of burning thresholds x extracted from a probability distribution $F(x) = x^\beta$ with $\beta > 0$. In the strong disorder limit, $\beta \to 0$, damage percolation (e.g., diffusive failure) takes place, while in the weak disorder limit, $\beta \to \infty$, crack formation occurs.

In the phase diagram of Fig. 4, we extend that work to include the effects of material rigidity. In addition to β (inversely proportional to disorder), and L (the system size), we include an axis, r, to represent the material rigidity. As a system becomes less and less rigid, the manner in which it fails changes smoothly from a narrow straight crack, to broad and diffuse failure. The smooth crossover between regimes is represented schematically where the vertical axis of rigidity is parameterized by r and the horizontal axis of sample length by L. In the limit $L \to \infty$, cracking always wins over diffuse failure except right at the point