Fracturing Ranked Surfaces

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When the sites of a lattice get a random ranking the number of possible configurations does grow faster than exponentially with the system size. This describes the limit of infinite disorder for a number of models including optimal paths and fuse networks. Interestingly the resulting critical behavior is the same as that of the watershed of random landscapes and that of the cuttings bonds of percolation in the limit of $p \to 0$ or of the bridges in the limit $p \to 1$. At the percolation threshold p_c tricritical behavior is obtained. Other realizations within the same universality class are the surfaces of various explosive percolation clusters at the transition point, including the Gaussian model and the largest cluster model. In dimensions above two and below the upper critical dimension six two different universality classes can be identified.