INTERLOCKED FRAGMENTED CONTINUUM: A STOCHASTIC METAMATERIAL

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We study the mechanical behavior of three-dimensional, randomly microcracked continua for crack densities up to and above the transport percolation threshold in both two-dimensions[1] and three-dimensions.[2] We show the existence of a fully fragmented material state in which stiffness is preserved due to topological interlocking of fragments. This material state is different from both the continuum and granular states as the structure becomes a random metamaterial. In this regime, the mechanical behavior is controlled by the contacts between fragments and becomes non-linear. The range of system parameters in which the material is found in this state is identified, including the upper limit, which represents the stiffness percolation threshold. The variation of the effective material stiffness for crack densities ranging from zero to the stiffness percolation threshold is reported.

REFERENCES

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