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Interlocked Fragmented Continua: A Stochastic Metamaterial

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Interlocked fragmented continua: a stochastic metamaterial

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We study the mechanical behavior of two [1] and three-dimensional [2] randomly microcracked continua for crack densities up to and above the transport percolation threshold. 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 in 2D and 3D, including the upper limit, which represents the stiffness percolation threshold.

References

[1] Picu, R.C., Pal, A., Lupulescu, M., 2016. Interlocking-induced stiffness in stochastically microcracked materials beyond the transport percolation threshold, *Phys. Rev. E*, *93*, pp. 043005
[2] Pal, A., Picu, R.C., 2017. Stiffness percolation in stochastically fragmented continua, *Phys. Rev. Lett., 119*, pp. 085502.
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