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Crack patterns in heterogeneous materials

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The distribution of elastic properties of oil and gas reservoirs follow the Fractional Brownian Motion (FBM), which characterized by a Hurst exponent, cut-off length, and stratification rate. Based on this information, we studied the propagation and the shapes of cracks in this kind of heterogeneous materials.

In our study, using Random Fuse Model (RFM), we simulated crack propagation in 2D triangular lattices with stratified and non-stratified FBM distribution of elastic module. We have shown that depending on the cut-off length in correlation between elastic constants and the type of their stratification, there is no universal value for roughness exponent of the shape of cracks; in contrast with several theoretical studies which have claimed that there is a universal exponent about 0.7, for all kinds of heterogeneous materials. We showed that if we exert a tension along (normal to) the stratification of a 2D system, the roughness exponent of crack will be greater (smaller) than the proposed universal exponent.

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