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A random connection model for pore network modeling

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Pore network models have been applied for predicting petrophysical properties at pore scale. From a geometry point of view, basically a pore network and pore and throat size distributions are required for pore network modeling. Although different pore network models have been constructed using data extracted mainly from images, it is not always possible to count on the necessary information, and working with a unique extracted network could generate non-representative results. Therefore, a statistical analysis of the data offers the advantage of generating different realizations of the network and its geometry. Building statistically representative networks require analysis of the image to extract size distributions of pores, throats and their connectivity. The last is relevant for percolation properties of the pore system.
In this work a random connection model (RCM) for network modeling is proposed. In a random connection model the critical density is a connection function g. A connection function defined as g: Rd⟶ [0, 1] is chosen, where a pair of points (x,y) are connected with probability g(|x - y|), independently of all other pairs of points, here |.| denotes Euclidean distance in Rd. In general, if unbounded connected components arise, we say that percolation occurs.
The RCM is applied to a case of study for pore network modeling of a carbonate rock sample. In particular, from multiple realizations of the RCM the effect on fluid flow properties is investigated.

References

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