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Stochastic multiscale modeling of porous media

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Specific internal surface areas and other morphological descriptors of complex disordered systems can be estimated from threedimensional tomographics images using methods of stochastic geometry [1]. Often such data are unavailable for realistic media because these exhibit structural features on multiple length scales.
A method to reconstruct stochastic morphologies for multiscale media was developed in [2]. The method is particularly suited for modeling sedimentary rocks that exhibit porosity and grain structure covering several decades in length scales. It combines crystallite information from two-dimensional high-resolution images with sedimentary correlations from a three-dimensional low-resolution micro-CT image [3]. The mathematical model reproduces correlations with primordial depositional textures, scale dependent intergranular porosity over many decades, vuggy porosity, a percolating pore space, a percolating matrix space, and resolution dependence of both physical and morphological descriptors. In [3] the method has been applied to Fontainebleau sandstone. Synthetic micro-CT images of the reconstructed model match well with experimental micro-CT images at different resolutions. Specific surface area and other morphological descriptors are found to be in good agreement with experiment.

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