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Characterization of Geology of, and Flow and Transport in, Field-scale Porous Media

Application of Fractal and Percolation Concepts

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I. INTRODUCTION

Field-scale porous media (FSPM), such as oil and gas reservoirs and groundwater aquifers, are highly heterogeneous at many length scales. Their heterogeneities manifest themselves at three different scales which are: (1) microscopic, which is at the level of pores and grains; (2) macroscopic, which is at length scales comparable with core plugs; (3) megascopic which includes the entire reservoir or aquifer. Modeling flow and transport in such porous media depends critically on accurate characterization of their structure, and in particular on the distribution of their heterogeneities. However, although characterization of laboratory-scale (macroscopic) porous media has been studied in great detail and reasonable understanding of such porous media has emerged (for recent reviews see, for example, Sahimi, 1993b, 1995b), the same is not true of FSPM, whose characterization is plagued by lack of sufficient data and hampered by the wide variations in the data that are collected at various locations throughout the system, e.g., along wells in oil or gas reservoirs.

Three important characteristics of FSPM are their porosity logs, often measured by in-situ methods, their permeability distributions, which are

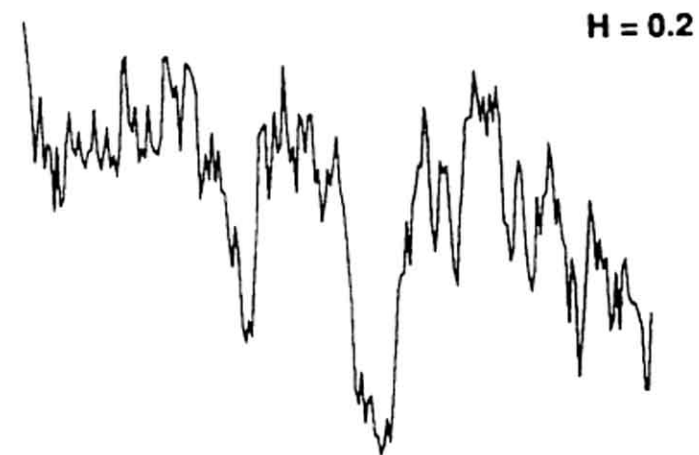
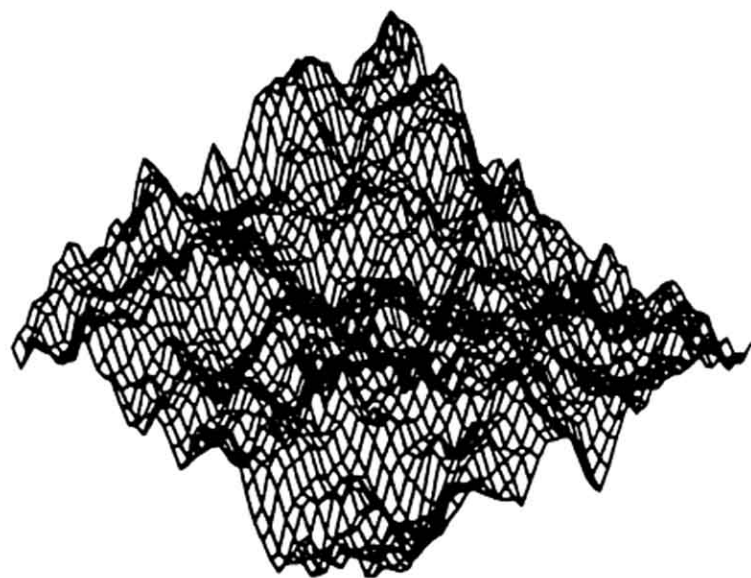
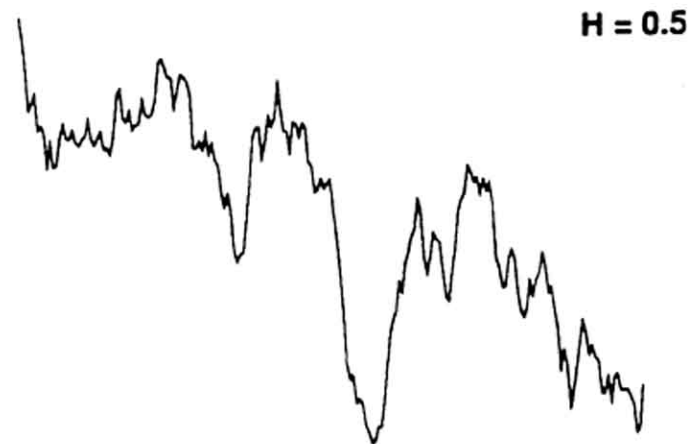
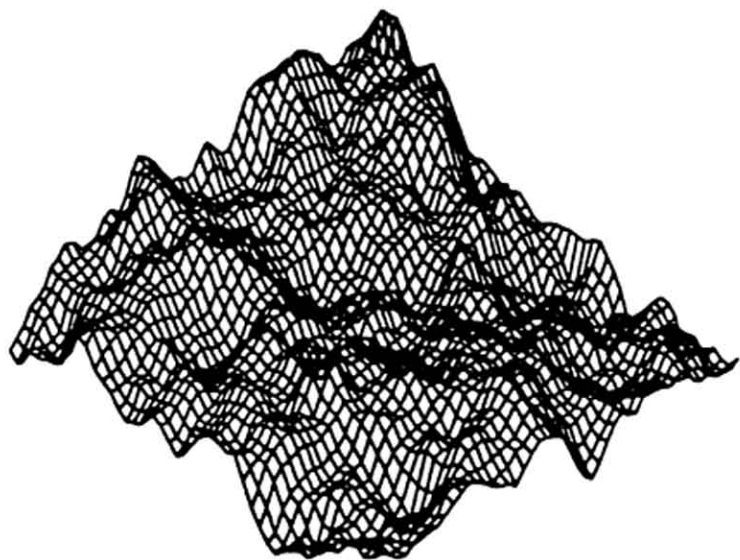
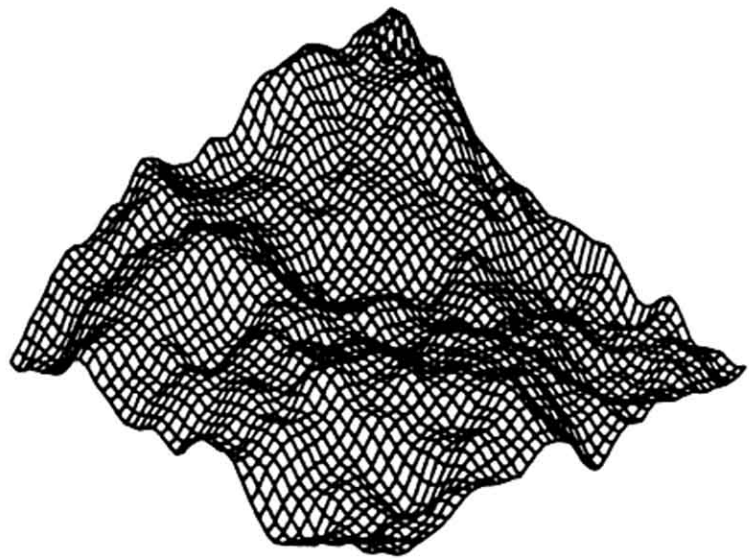


Figure 3. Examples of 1D and 2D fractional Brownian motion.