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Prediction of velocity distribution in simple 3D porous media MOHAMMAD ALADWANI, Massachusetts Inst of Tech-MIT, PIETRO DE ANNA, University of Lausanne, RUBEN JUANES, Massachusetts Inst of Tech-MIT — Fluid flow and particle transport through porous media are determined by the geometry of the host medium itself. Despite the fundamental importance of the velocity distribution in controlling early-time and late-time transport properties (e.g., early breakthrough and superdiffusive spreading), direct relations linking velocity distribution with the statistics of pore structure in 3D porous media have not been established yet. High velocities are controlled by the formation of channels, while low velocities are dominated by stagnation zones. Recent studies have proposed phenomenological models for the distribution of high velocities including stretched exponential and power-exponential distributions but without an underlying mechanistic or statistical physics theory. Here, we investigate the relationship between the structure of the host medium and the resulting fluid flow in random dense spherical packs. We simulate flow at low Reynolds numbers by solving the Stokes equations and imposing a no-slip boundary condition at the boundary of each sphere. We show that the distribution of low velocities in 3D porous media is described by a Gamma distribution, which is robust to variations in the geometry of the porous media.

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