Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Pore-scale Direct Numerical Simulation of Turbulent Flows through a Randomly-Packed Porous Medium[1] XIAOLIANG HE, MARSHALL RICHMOND, WILLIAM PERKINS, TIMOTHY SCHEIBE, Pacific Northwest National Laboratory, SOURABH APTE, Oregon State University — Turbulent flows through randomly-packed porous media are ubiquitous in both natural and engineered systems. It is of great value to understand the important turbulence characteristics in the randomly packed beds of relevance for heat transfer applications in chemical/nuclear reactors, as well as some environmental problems such as hyporheic exchange at the interface between free stream water and the underlying sediment. Currently, very few pore-scale direct numerical simulations (DNS) of high Reynolds number flows through packed beds have been conducted and almost all of these studies focused on structurally packed or dilute systems. In the present work, DNS are performed in a randomly-packed triply-periodic porous medium with a porosity of 0.37. The Eulerian and Lagrangian statistics of turbulence, TKE budget, anisotropy distribution in confined pore geometries are investigated. These observations are compared with our previous work on triple-periodic, face centered cubic (FCC), to understand the influence of the heterogeneity on the turbulent statistics. It is observed that the integral length scale in the random packing is larger than that from structured packing.

[1]The computation is performed using Cascade HPC at EMSL

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Date submitted: 31 Jul 2019 Electronic form version 1.4