UTSA Geological Sciences

And

Institute of Water Research, Sustainability and Policy (IWRSP)

Seminar Presentation

By

Behzad Ghanbarian, Ph.D.
Department of Geology, Kansas State University,
Manhattan, KS

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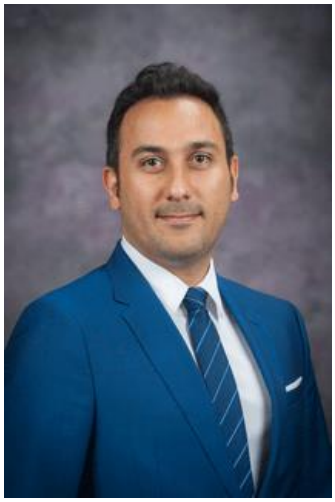
"The scale dependence of hydraulic and electrical conductivities in porous media"

Behzad Ghanbarian
Department of Geology, Kansas State University

Abstract
Understanding porous media properties and their scale dependence have been an active subject of research in the past several decades in hydrology, geosciences and petroleum engineering. The scale dependence of flow in porous media is attributed to small- and large-scale heterogeneities, such as pore size distribution, pore connectivity, long-range correlations, fractures and faults orientations, and spatial and temporal variations. The main objective of this study was to investigate how hydraulic and electrical conductivities vary with sample dimension at small scales. For this purpose, we use a combination of pore-network modeling and percolation theory. Hydraulic and electrical conductivities are simulated in twelve three-dimensional pore networks with different levels of pore-scale heterogeneities. Simulations are carried out at five different network sizes, i.e., 1130, 2250, 3380, 4510 and 6770 microns (μm). Theoretical models are developed based on percolation theory to estimate the scale dependence of hydraulic and electrical conductivities from the pore-throat radius distribution. Furthermore, two other theoretic scale-dependent models are proposed to estimate hydraulic conductivity at different scales from the pore-throat radius distribution and electrical conductivity. Comparing theoretical estimations with numerical simulations show that the proposed models estimate the scale dependence of hydraulic and electrical conductivities reasonably well.



Dr. Behzad Ghanbarian is an assistant professor of engineering geology at Kansas State University. Before his current position, he worked as a post-doctoral-degree research fellow at the Center for Petroleum and Geosystems Engineering, University of Texas at Austin, for 2.5 years. Dr. Ghanbarian also worked as a reservoir engineer at the Bureau of Economic Geology, Austin, Texas. He is the author of more than 70 peer-reviewed journal articles and two books. Dr. Ghanbarian's research interests are unconventional reservoirs, upscaling techniques, and fluid flow and contaminant transport in heterogeneous porous media. He is a member of AGU, GSA and SSSA and received the 2015 Donald L. Turcotte Award in nonlinear geophysics from the American Geophysical Union and the 2020 Soil Physics and Hydrology Early Career Award from the Soil Science Society of America.