Civil Engineering Graduate Seminar Invited Lecture Series

4:00 PM, Wednesday, January 26, Engineering Hall 0093

Estimating permeability and its scale dependence in porous media

by

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Abstract

A key property of soils and rocks is permeability (k) whose estimation has broad applications to various disciplines (e.g., civil, chemical, and petroleum engineering) as well as research areas (e.g., site remediation, contaminant migration, and hydrocarbon recover). Here, we mainly focus on the estimation of permeability at small scales (from several micrometers to centimeters). However, applications to large scales (several kilometers) are also discussed. To estimate k, we invoke an upscaling technique from statistical physics called critical path analysis (CPA). Using experimental measurements, we demonstrate that if pore-throat size distribution (or moisture characteristic curve) and electrical conductivity data are available, one would be able to accurately estimate k for a wide range of porous media from homogeneous sand packs to heterogeneous tight rocks. By comparison with pore-network simulations, we also show that the CPA approach can be successfully used to determine the scale dependence of permeability.

Speaker Bio

Behzad joined the Geology Department as an Assistant Professor of Engineering Geology in the fall of 2017. Before joining K-State, he worked as a Postdoctoral Research Fellow at the Petroleum and Geosystems Engineering, University of Texas at Austin, for two and half years. He also worked as a reservoir engineer at the Bureau of Economic Geology, Austin TX. Behzad received his B.S. in water engineering from Isfahan University of Technology in 2005 and a M.Sc. in irrigation and drainage from the University of Tehran in 2007. He received his Ph.D. in environmental sciences from Wright State University in 2014. His research area covers a wide range of topics in geology, hydrogeology, environmental sciences and engineering, and petrology. Behzad's main research focuses on applying fundamental theories from physics and math as well as multi-scale numerical techniques to model fluid flow and solute transport in heterogeneous porous rocks, fracture networks, soils and sediments. He also pursues unconventional methods to characterize physical and geomechanical properties of porous media using a combination of experiments, theories and numerical simulations.