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Department of Civil and Environmental Engineering
Case Western Reserve University
Bingham Bldg. Room 208
10900 Euclid Ave
Cleveland, OH 44106

Civil and Environmental Engineering Department Seminar

Multiphysics coupled processes in porous media: toward resilient and sustainable future geosystems

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Date: Thursday Sep 9, 2021, 4:00 – 5:00 PM

Location: Nord 356

Abstract

Geoscientists and geotechnical engineers are being called on to address grand challenges related to energy, greenhouse gas emission mitigation and subsurface sequestration, and infrastructure. This talk introduces THMCB (Thermo-Hydro-Mechanical-Chemical-Bio) multiphysics coupled processes in porous media and its central role in addressing some of the grand challenges.

Geo-Energy: Advanced research tools such as pore-network model and multi-physical experimental devices for extreme conditions were developed to study the unique hydro-mechanical behaviors of hydrate-bearing sediments, including the absolute/relative permeability and soil-water characteristic curves to extract energy from ice-hydrates. The fundamental findings have been successfully implemented in the field and adopted by leading research institutes.

Geo-Environment: The multi-physical factors governing the CO₂ invasion patterns and displacement efficiency were studied at multiple scales. Potential advantages of a novel nanoparticle-stabilized CO₂-water foam for highly efficient geological CO₂ sequestration will also be discussed.

Geo-Infrastructure: The emerging bio-mediated and bio-inspired geotechnics offer unique solutions for infrastructure resilience and natural hazard mitigation. The multiphysics coupled processes involved in two recently developed technologies will be discussed: 1) Microbially Induced Desaturation and Precipitation (MIDP) via denitrification as a novel bio-mediated method to mitigate liquefaction of granular soils underneath existing structures; 2) Bio-inspired flow networks mimicking leaf venation for optimized drainage and mechanical stability.



Speaker Bio: Dr. Mahabadi is an assistant professor in the Department of Civil Engineering at the University of Akron. He received his PhD in geotechnical engineering from Arizona State University. Before joining the University of Akron, he worked as a research professor at the NSF Engineering Center for Bio-mediated and Bio-inspired Geotechnics (CBBG) at Arizona State University (ASU), and a visiting scholar at Stanford University. His research interests include multiphysics coupled processes in porous media with applications primarily in the areas of bio-geotechnical engineering, subsurface energy, geomechanics, and geo-environmental engineering.