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Three-dimensional micro-scale flow simulation and colloid transport modeling in saturated soil porous media[1] CHARMAINE QIU, HUI GAO, DIMIN FAN, YAN JIN, LIAN-PING WANG, U. Delaware — Adequate understanding of the mechanism of colloid retention by soil porous media is essential to the prediction and monitoring of the transport of contaminants by groundwater in the subsurface environment. Preliminary studies reveal that pore-scale processes are governed by colloid-grain and colloid-colloid interactions. In this talk, we focus on the assessment of their effects using a computational approach. First, micro-scale viscous flow in a model porous medium, i.e., a square channel filled with spherical grains, is simulated by simultaneously applying a mesoscopic lattice Boltzmann equation and a Navier-Stokes based hybrid approach, for rigorous cross-validation of the simulated flow. Lagrangian tacking of individual colloids is then conducted by solving colloids equation of motion including local hydrodynamic effects and physicochemical forces. Analysis of colloid transport will encompass effects of flow straining, depth-dependent spatial distribution, and retention of colloids under different solution ionic strengths, flow speeds, and packing configurations. Comparison with parallel experimental results using confocal microscopy will be briefly discussed.

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Lian-Ping Wang
University of Delaware

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