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Lattice Boltzmann modeling of transient well hydraulics in highly permeable confined aquifer

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Lattice Boltzmann (LB) model is used to simulate flow in porous media at scales much larger than pore size. LB-based models for such macroscopic scale porous media flow simulations are an extension of standard LB models. The local velocity is altered during the collision step by incorporating an external force, F, equivalent to the damping effect of solid particles in porous media. The porous media can be permeable or impermeable depending upon the external forcing term. The ability to simulate impermeable portions of a domain is validated using the Poiseuille equation for flow between parallel plates. A sink term is introduced in LB model to simulate a pumping well and this model is further applied to solve steady state ground water well problems for confined aquifers. Non-dimensional numbers are used to convert LB model results in physical units.The simulated results show an accurate match with analytical solutions of the transient ground water flow equation. The model is verified against field data. The model is further applied to solve inertial effect on drawdown in highly permeable aquifer. This model can be coupled with solute transport or geochemical reaction model to investigate pump and treat method for groundwater remediation.

Biography

Anwar has completed his PhD in 2008 from Florida International University Miami and postdoctoral studies from University of Florida Gainesville and University of South Florida Tampa. He is currently a tenure track faculty member in Geological Engineering. His research interest is focused on lattice Boltzmann methods, groundwater hydrology, multiphase flow model, carbon sequestration and geochemical modeling.

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