EuroSciCon

5th Edition of EuroSciCon Conference on

Environmental Science and Engineering

October 29-30, 2018
Budapest, Hungary

Expert Opin Environ Biol 2018 Volume: 7
DOI: 10.4172/2325-9655-C7-039

SIMULATION OF GROUNDWATER FLOW USING PIPE NETWORK MODEL

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In this paper, a new conceptual laboratory-scale model is introduced to simulate groundwater flow under steady state condition. The proposed model is constructed by a lattice of junctions connected by horizontal and vertical pipes, simplifications of throats and pores of a real porous media. By assuming flow through each pipe which is laminar, it is shown that the governing equation of the lattice follows steady saturated groundwater flow of a confined aquifer, Laplace equation. Then, using continuity equation for the model, a system of linear algebraic equation is achieved which is equivalent to transforming Laplace equation to a system of linear algebraic equations using numerical methods. The model is also a novel physical model. A great superiority of this model over physical models such as sand boxes is that porous characteristics like soil permeability or inner impermeable barriers can easily be assigned by changing pipes or closing corresponding valves. Finally, using this model, different examples are simulated. The results show good agreement with the analytical and numerical solutions. The flexibility and ease to change porous characteristics along with great visibility of how exactly water flows throughout the lattice makes it a great tool for simulating groundwater flow for educational and decision making purposes.

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