Numerical modelling of multiphase immiscible flow in double-porosity featured groundwater systems

Abstract:

A numerical model describing the flow of multiphase, immiscible fluids in a deformable, double-porosity featured soil has been developed. The model is focused on the modelling of the secondary porosity features in soil, which is more relevant to groundwater contamination problems. The non-linear saturation and relative permeabilities were expressed as functions of the capillary pressures. The governing partial differential equations in terms of soil displacement and fluid pressures were solved numerically. Galerkin's weighted-residual finite element method was employed to obtain the spatial discretization whereas temporal discretization was achieved using a fully implicit scheme. The model was verified against established, peer-reviewed works, and the assumption that the immiscible fluids (non-aqueous phase liquids) will flow preferentially through the secondary porosity features in soil was validated.