Texas Tech University - Department of Mathematics and Statistics

Seminar in Applied Mathematics

Models and Closures for Multiphase Porous Media Flows

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ABSTRACT. In this talk, the validity of commonly used models for multiphase flows in porous medium is reviewed. Model equations for these types of flows are obtained by specializing the averaged equations derived for multi-material interactions using the ensemble phase averaging method. The closure quantities in the equation set are directly related to pore scale fluid-fluid and fluid-solid interactions and can be calculated explicitly, if the information about the pore scale interactions is available. By studying a few simple examples using these explicit closure expressions, many concepts, such as capillary pressure and relative permeability, of multiphase flows in porous media are re-examined. The derived model equations contain an important fluid-fluid interaction term that is overlooked by classical theories for multiphase flows in a porous media. The existence of this term resolves many conceptual conflicts in the classical theories.

Such obtained model equations and a proposed closure relation are implemented into a numerical code called CartaBlanca and are applied to study an experiment of the steam assisted gravity drainage (SAGD) process. Numerical results are compared to the experimental data.