Minisymposium 8 - Homogenisierung und Anwendungen

Averaging of flows with capillary hysteresis in stochastic porous media

BEN SCHWEIZER (UNIVERSITY OF BASEL)

The fluid in an unsaturated porous medium is described by Darcy's law. Conservation of mass provides an evolution equation that couples the pressure p and the saturation u. A second relation between p and u is determined by the effects of capillarity. In general, the capillary pressure is a set-valued map and the second relation is of the form $p \in p_c(u, \partial_t u)$. The multi-valued function p_c leads to hysteresis effects of play-type. We construct weak and strong solutions to the hysteresis system and homogenize it for random distributions of the physical parameters. In the effective equations a new variable with the units of a pressure appears. This new variable encodes the history of the process. The averaged equations have irreversible scanning curves and reflect the properties of the physical system.