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Seminar Numerische Mathematik und Mechanik

Hysteresis in porous media

Chiara Gavioli and Pavel Krejčí[1]

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We propose a model for fluid diffusion in partially saturated porous media that takes into account saturation-dependent permeability as well as hysteresis effects in the pressure-saturation relation, which are due to surface tension at the liquid-gas interface. The resulting mathematical problem leads to a diffusion equation for the pressure in a bounded N-dimensional domain with a Preisach hysteresis operator under the time derivative and in the diffusion coefficient. The problem is doubly degenerate in the sense that the saturation range is bounded independently of the evolution of the pressure, and no a priori control of the time derivative of the pressure is available at turning points. We discuss the conditions for existence and uniqueness of a solution to the problem in appropriate function spaces, as well as the question of bounded speed of propagation.

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