

Classical solutions of many-dimensional elliptic-parabolic free boundary problems, *Nonlinear Diff. Equ. Appl.*, 16 (2009), 421-443. (S.P. Degtyarev).

Abstract

We consider a many-dimensional elliptic-parabolic free boundary problem modeling fluid flow in a partially saturated porous medium. In that context, an unknown function u represents the pressure and satisfies the homogeneous Laplace equation in the saturated domain and a quasilinear parabolic equation in the unsaturated domain. The level set $\{u = 0\}$ specifies an unknown (free) boundary between domains of ellipticity and parabolicity.

Under the certain regularity assumptions on the initial and boundary data, the authors establish the classical solvability locally in time and prove that a free boundary can be represented as a function with spatial and time derivatives from Hölder classes.