Measure-Valued Solutions to a Class of Nonlinear Parabolic Equations with Degenerate Coercivity and Singular Initial Data

Authors : Flavia Smarrazzo

Abstract : Initial-boundary value problems for nonlinear parabolic equations having a Radon measure as initial data have been widely investigated, looking for solutions which for positive times take values in some function space. On the other hand, if the diffusivity degenerates too fast at infinity, it is well known that function-valued solutions may not exist, singularities may persist, and it looks very natural to consider solutions which, roughly speaking, for positive times describe an orbit in the space of the finite Radon measures. In this general framework, our purpose is to introduce a concept of measure-valued solution which is consistent with respect to regularizing and smoothing approximations, in order to develop an existence theory which does not depend neither on the level of degeneracy of diffusivity at infinity nor on the choice of the initial measures. In more detail, we prove existence of suitably defined measure-valued solutions to the homogeneous Dirichlet initial-boundary value problem for a class of nonlinear parabolic equations without strong coerciveness. Moreover, we also discuss some qualitative properties of the constructed solutions concerning the evolution of their singular part, including conditions (depending both on the initial data and on the strength of degeneracy) under which the constructed solutions are in fact unction-valued or not.

Keywords : degenerate parabolic equations, measure-valued solutions, Radon measures, young measures

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