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Existence and uniqueness of a solution for a class of parabolic equations with two unbounded nonlinearities

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SUMMARY

In this communication, we give an existence and uniqueness result of a renormalized solution for a class of nonlinear parabolic equations

$$\frac{\partial b(u)}{\partial t} - \operatorname{div}\Big(a(x,t,u,\nabla u)\Big) = f + \operatorname{div}(g) \quad \text{in } Q, \tag{1}$$

$$b(u)(t=0) = b(u_0) \quad \text{in } \Omega, \tag{2}$$

$$u = 0 \quad \text{on } \partial\Omega \times (0,T), \tag{3}$$

where the right side belongs to $L^1(Q)+L^{p'}(0,T;W^{-1,p'}(\Omega))$ and where $b(u)$ is a real function of u. Here $u \mapsto -\operatorname{div}(a(x,t,u,\nabla u))$ is a Leray-Lions type operator with growth $|\nabla u|^{p-1}$ in ∇u, but without any growth assumption on u.

As far as the uniqueness is concerned the main difficulties are to deal with the (x,t,u) dependance of the operator a and the term $\operatorname{div}(g)$. Under appropriate assumptions on b and on a (local Lipchitz with respect to u) we prove that the renormalized solution is unique.

Keywords: nonlinear parabolic equation, L^1 data, renormalized solution, uniqueness

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