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Equations aux dérivées partielles non-linéaires, théorie spectrale et applications

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Title : Some recent results for a class of singular elliptic problems in perforated domains

Abstract : We present some uniqueness and regularity results for a weak solution of a quasilinear elliptic nonlinear problem posed in a domain perforated by one or more holes. The nonlinear term $h(u)$, is singular at $u=0$. On the boundary of the holes we impose a nonlinear Robin condition, while on the exterior boundary we prescribe a homogeneous Dirichlet condition. The difficulty here arises in dealing simultaneously with the quasilinear matrix field, the singular datum and the nonlinear Robin condition.

To show the existence of a solution we approximate the problem with a sequence of nonsingular problems for which the existence of a solution is proved via the Schauder fixed-point theorem. The main tool when passing to the limit in the approximate problem is to split the integral of the singular term into the sum of two integrals, one on the set where the solution is very close to the singularity and one where it is far from it. To obtain the uniqueness of the solution we need to require additional assumptions on the quasilinear term and a monotonicity property for the singular one. Under suitable stronger hypotheses on the data, we also prove the boundedness of the solution.