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Existence and homogenization of the solution of the problem

$$-\operatorname{div} A(x) D u_\varepsilon = \frac{f(x)}{u_\varepsilon^\gamma} + g(x) \text{ in } \Omega_\varepsilon, \quad u = 0 \text{ on } \partial\Omega_\varepsilon,$$

when Ω_ε is a perforated domain "à la Cioranescu-Murat"

Abstract

In this recent joint work with Daniela Giachetti (Università di Roma La Sapienza) and Pedro J. Martínez-Aparicio (Universidad Politécnica de Cartagena), we consider a nonnegative solution of the homogeneous Dirichlet problem obtained by the perturbation of a second order linear equation by a nonnegative term which is singular when the solution vanishes (see the title for the prototype of this problem).

We first introduce an "ad hoc" definition of the solution of this problem. For any given open set Ω_ε , we then prove the existence, uniqueness, and stability of the solution defined in this sense. We finally perform the homogenization of this singular homogeneous Dirichlet problem posed on a sequence of domains with many small holes "à la Cioranescu-Murat" in which a "strange term" of zeroth order appears at the limit.