A singularly perturbed nonlinear non-autonomous trasmission problem

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The study of the behaviour of the solutions of boundary value problems in domain with small holes or inclusions has attracted the attention of several pure and applied mathematicians. From an application point of view, boundary value problems in domains with small holes or inclusions can be the mathematical model of the heat conduction in bodies with small cavities and impurities and thus they are extensively studied in the theory of dilute composite materials. In particular, transmission conditions like the ones that we consider in this talk can be analytically derived in the case of a thin reactive heat conducting interphase situated between two different materials (see [2, 3]). In this talk we analyse a boundary value problem for the Laplace equation with nonlinear non-autonomous transmission conditions on the boundary of a small inclusion of size ϵ. We show that the problem has solutions for ϵ small enough and we investigate the dependence of a specific family of solutions upon ϵ. By adopting a functional analytic approach we prove that the map which takes ϵ to (suitable restrictions of) the corresponding solution can be represented in terms of real analytic functions (see [4]). Finally, for ϵ small enough, we show a local uniqueness result, which improves previously obtained uniqueness properties of the family of solutions (joint work with Dalla Riva and Musolino [1]).

Keywords: nonlinear non-autonomous transmission problem, singularly perturbed perforated domain, Laplace operator

References

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