Singular perturbation problems in perforated domains

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Abstract

The asymptotic behaviour of the solutions of boundary value problems in domains with small holes has been investigated by many authors with different approaches. In this talk, we consider a Dirichlet problem for the Laplace operator in a bounded domain Ω^o of $\mathbb{R}^n$ containing the origin, where we remove a small set whose size is determined by a parameter ϵ and which collapses to 0 for $\epsilon = 0$. Then for $\epsilon \neq 0$ we denote the solution to such a problem by u_ϵ. If $p \in \Omega^o$ and $p \neq 0$, then it makes sense to consider for $\epsilon \neq 0$ and 'small' the value of the solution u_ϵ at the point p. It is natural to ask what can be said on the map which takes ϵ small and positive to $u_\epsilon(p)$ around the degenerate value $\epsilon = 0$. One can try to answer to this question in several ways. By the approach proposed by Lanza de Cristoforis, one can show that, if $n \geq 3$, then there exist $\epsilon_p > 0$ and a real analytic function U_p from $]-\epsilon_p, \epsilon_p[$ to $\mathbb{R}$ such that $u_\epsilon(p) = U_p[\epsilon]$ for all $\epsilon \in]0, \epsilon_p[$, and one can then investigate the validity of such an equality for ϵ negative. After an introductory part on the case of dimension $n \geq 3$, we will turn to consider the two-dimensional case.

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