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Hadamard-type variational formulae for Green's kernels in singularly perturbed domains

In 1907 Hadamard submitted to the Academie des Sciences for the Prix Vaillant a paper [1] on the equilibrium of homogeneous thin elastic plates clamped at the boundary. The main purpose of his work was the investigation of Green's kernel, in particular, its dependence on a small variation of the domain occupied by the middle plane of the plate. Hadamard's formula and its applications published to date were related exclusively to the case of a regularly perturbed domain. In this lecture we address the case when the boundary of the domain is singularly perturbed. In particular, this may include the cases when the perturbed domain is smooth whereas the original domain may contain singular points, lines or surfaces. The monographs [2], [3], [4] give a comprehensive description of the asymptotic theory of boundary value problems in singularly perturbed domains. The derivation and analysis of new Hadamard-type formulae for Green's kernels of elliptic boundary problems in a class of singularly perturbed domains are discussed in this survey lecture. It is based on the results of the joint work with A. Movchan.

- [1] J. Hadamard, Sur le problème d'analyse relatif à l'équilibre des plaques élastiques encastrées, *Mémoire couronne en 1907 par l'Académie des Sciences* **33** 4, 515-629.
- [2] V. Kozlov and V. Mazya, Differential equations with operator coefficients, *Springer-Verlag*, (1999).
- [3] V. Mazya, S. Nazarov, B. Plamenevskij, Asymptotic theory of elliptic boundary value problems in singularly perturbed domains, Vols 1-2, *Birkhäuser*, (2000).
- [4] V. Kozlov, V. Mazya, A. Movchan, Fields in multi-structures, Asymptotic analysis, *Oxford University Press*, (1999).