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N-dimensional shape optimization under capacitary constraint. (English) Zbl 0847.49029

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The shape optimization problem

Minimize

$$J(\Omega)=\frac{1}{2}\int_B(u_\Omega-g)^2dx, \tag{1}$$

subject to

$$-\mathcal{A}u_\Omega=f \tag{2}$$

is considered. The following notations are chosen:

Let $B\subset\mathbb{R}^N$ be an open ball, $A\in M_{n\times n}(C^1(\overline{B}))$, $A=A^*$, $\alpha I\leq A\leq\beta I$, $0<\alpha<\beta$. Further, the associated operator $\mathcal{A}:H_0^1(B)\to H^{-1}(B)$ with $\mathcal{A}=\operatorname{div}(A\nabla)$ is defined. $f\in H^{-1}(B)$ and the open subset Ω of B are considered. The state equation (2) has to be understood in the variational sense.

The existence of extremal domains of problem (1)–(2) is investigated. Especially, relations between finding of *compact sets* in some topology on the space of domains and the *continuity* of the map $\Omega\mapsto J(\Omega)$ is discussed.

The authors obtain results for the N-dimensional case for classes of domains satisfying *capacity density conditions.*

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MSC:

49Q10 Optimization of shapes other than minimal surfaces

49J20 Existence theories for optimal control problems involving partial differential equations

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existence theory; capacity density conditions; shape optimization

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