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3.1. Sobolev spaces in \mathbb{R}^d ; 3.1.1. Concentration-compactness principle; 3.1.2. Capacity, quasi-open sets and quasi-continuous functions; 3.2. Capacitary measures and the spaces H^1 ; 3.3. Torsional rigidity and torsion function; 3.4. PDEs involving capacitary measures; 3.4.1. Almost subharmonic functions; 3.4.2. Pointwise definition, semi-continuity and vanishing at infinity for solutions of elliptic PDEs
 Chapter 4 Subsolutions of shape functionals 4.1. Introduction; 4.2. Shape subsolutions for the Dirichlet Energy; 4.3. Interaction between energy subsolutions; 4.3.1. Monotonicity theorems; 4.3.2. The monotonicity factors; 4.3.3. The two-phase monotonicity formula; 4.3.4. Multiphase monotonicity formula; 4.3.5. The common boundary of two subsolutions. Application of the two-phase monotonicity formula.; 4.3.6. Absence of triple points for energy subsolutions. Application of the multiphase monotonicity formula; 4.4. Subsolutions for spectral functionals with measure penalization
 4.5. Subsolutions for functionals depending on potentials and weights

Sommario/riassunto

We study the existence and regularity of optimal domains for functionals depending on the spectrum of the Dirichlet Laplacian or of more general Schrödinger operators. The domains are subject to perimeter and volume constraints; we also take into account the possible presence of geometric obstacles. We investigate the properties of the optimal sets and of the optimal state functions. In particular, we prove that the eigenfunctions are Lipschitz continuous up to the boundary and that the optimal sets subject to the perimeter constraint have regular free boundary. We also consider spectral optimization problems in non-Euclidean settings and optimization problems for potentials and measures, as well as multiphase and optimal partition problems. .
