1. Record Nr. UNINA9910502655503321

Autore	Dalla Riva Matteo
Titolo	Singularly perturbed boundary value problems : a functional analytic approach / / Matteo Dalla Riva, Massimo Lanza de Cristoforis, Paolo Musolino
Pubbl/distr/stampa	Cham, Switzerland : , : Springer, , [2021] ©2021
ISBN	3-030-76259-9
Descrizione fisica	1 online resource (678 pages)
Disciplina	515.35
Soggetti	Boundary value problems Problemes de contorn Llibres electrònics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- Preface -- Contents -- 1 Introduction -- 1.1 An Example -- 1.2 A Selection of Problems -- 1.2.1 Perturbation Problems for the Riemann Map -- 1.2.2 Linear Elliptic Boundary Value Problems -- 1.2.3 Eigenvalues Problems -- 1.2.4 Nonlinear Boundary Value Problems -- 1.2.5 Problems in Periodic Domains -- 1.2.6 Different Boundary Perturbations -- 1.2.7 Perturbation Results for Integral Operators -- 1.3 Structure of the Book -- 2 Preliminaries -- 2.1 Basic Notation -- 2.2 Preliminaries of Linear Functional Analysis -- 2.3 Spaces of Classically Differentiable Functions -- 2.4 Distributions and Weak Derivatives -- 2.5 Real Analytic Functions and Spaces of Real Analytic Functions -- 2.6 Spaces of Hölder and Lipschitz Continuous Functions -- 2.7 Coordinate Cylinders and Local Strict Hypographs -- 2.8 Tangent Space to a Local Strict Hypograph -- 2.9 Lipschitz Subsets of Rn -- 2.10 Elementary Inequalities on the Boundary of a LipschitzSubset of Rn -- 2.11 Schauder Spaces in Open Subsets of Rn -- 2.12 Composition of Functions in Schauder Spaces -- 2.13 Local Strict Hypographs of a Schauder Class -- 2.14 Extendibility of Functions of Schauder Spaces on an Open Subset of Class Cm, -- 2.15 On the Extendibility of Continuous Functions to the Closure of Open Sets of Class C1 -- 2.16 A Consequence of the Rule of Change of

Variables for Diffeomorphisms -- 2.17 A Fundamental Inequality of the Unit Normal on the Boundary of a Set of Class C1, -- 2.18 Existence of Tubular Neighborhoods of the Boundary of Bounded Open Sets -- 2.19 A Sufficient Condition for the Hölder Continuity of Continuously Differentiable Functions, in the Wake of the Work of CarloMiranda -- 2.20 Schauder Spaces on a Compact Manifold and on the Boundary of a Bounded Open Subset of Rn -- 2.21 Tangential Derivatives -- 2.22 Schauder Spaces in Open Subsets of Rn, a Case of a Negative Exponent. 3 Preliminaries on Harmonic Functions -- 3.1 Basic Properties of Harmonic Functions -- 3.2 A Fundamental Solution for the Laplace Operator -- 3.3 Isolated Singularities of Harmonic Functions -- 3.4 Behavior at Infinity of Harmonic Functions -- 4 Green Identities and Layer Potentials -- 4.1 Green Identities for Bounded Domains -- 4.2 Green Identities for Harmonic Functions on Exterior Domains -- 4.3 Preliminaries on Singular Integrals and Layer Potentials -- 4.4 The Single Layer Potential -- 4.5 The Double Layer Potential -- 4.6 A Regularizing Property of the Double Layer Potential on the Boundary -- 5 Preliminaries on the Fredholm Alternative Principle -- 5.1 Fredholm Alternative -- 5.2 Fredholm Alternative in a Dual System -- 6 Boundary Value Problems and Boundary Integral Operators -- 6.1 The Geometric Setting -- 6.2 The Dirichlet and Neumann Boundary Value Problems -- 6.3 Uniqueness for the Interior and Exterior Dirichlet and Neumann Boundary… -- 6.4 The Boundary Integral Operators Associated to the Single and Double Layer Potentials -- 6.5 The Null Spaces of 12I+W and 12I+Wt -- 6.6 The Null Spaces of -12I+W and -12I+Wt -- 6.7 The Dirichlet Problem in -- 6.8 The Dirichlet Problem in - -- 6.9 The Neumann Problem in and - -- 6.10 Further Mapping Properties of V -- 6.11 A Mixed Boundary Value Problem -- 6.12 The Operators I+W and I+Wt -- 6.13 A Linear Transmission Problem -- 6.14 A Robin Problem -- 7 Poisson Equation and Volume Potentials -- 7.1 Preliminary Remarks on the Poisson Equation -- 7.2 Volume Potentials -- 7.2.1 Volume Potentials with Weakly Singular Kernels -- 7.2.2 Volume Potentials with Kernels Which are Weakly Singular Together with Their First OrderPartial Derivatives -- 7.2.3 Volume Potentials with Singular Kernels and with a Constant Density.
7.2.4 Volume Potentials with Kernels Which are Weakly Singular and Which Have a Strong Singularity in the First Order Partial Derivatives -- 7.2.5 The Newtonian Potential in Schauder Spaces -- 7.2.6 Volume Potentials in Roumieu Classes -- 7.3 Boundary Value Problems for the Poisson Equation in Schauder Spaces -- 7.3.1 The Interior Dirichlet Problem for the Poisson Equation in Schauder Spaces -- 7.3.2 The Interior Neumann Problem for the Poisson Equation in Schauder Spaces -- 7.3.3 The Interior Robin Problem for the Poisson Equation in Schauder Spaces -- 8 A Dirichlet Problem in a Domain with a Small Hole -- 8.1 The Geometric Setting -- 8.2 A Dirichlet Problem for the Laplace Equation -- 8.3 Analysis for n3 -- 8.4 Analysis for n=2 -- 8.4.1 Analysis of System (8.32) -- 8.4.2 Analysis of System (8.33) -- 8.4.3 Real Analytic Representation of the Map u. -- 8.4.4 Some Remarks on the Logarithmic Behavior -- 8.5 How to Compute the Coefficients (in Dimension 2) -- 8.5.1 Series Expansions of (i[],o[]) and (i[],o[]) -- 8.5.2 Series Expansion of u -- 8.5.3 Principal Terms in the Series Expansion of u -- 8.5.4 Series Expansion for the Energy of u -- 8.5.5 Series Expansions in a Circular Annulus -- 9 Other Problems with Linear Boundary Conditions in a Domain with a Small Hole -- 9.1 The Geometric Setting -- 9.2 A Mixed Boundary Value Problem for the Laplace Equation -- 9.3 A Mixed Boundary Value Problem for the Poisson Equation -- 9.4 A Steklov Eigenvalue Problem -- 9.4.1 Some Basic Facts on Steklov Eigenvaluesand Eigenfunctions --

9.4.2 Formulation of the Steklov Problem (9.31) in Terms of Integral Equations -- 9.4.3 Real Analytic Representations for the Simple Steklov Eigenvalues and Eigenfunctions -- 10 A Dirichlet Problem in a Domain with Two Small Holes -- 10.1 The Geometric Setting -- 10.2 A Dirichlet Problem in (1,2).
10.3 Close and Moderately Close Holes in Dimension n3 -- 10.3.1 Moderately Close Holes in Dimension n3 -- 10.3.2 Close Holes in Dimension n3 -- 10.4 Moderately Close Holes in Dimension n=2 -- 10.4.1 Integral Representation of the Solution -- 10.4.2 Analysis of System (10.39) -- 10.4.3 Analysis of System (10.40) -- 10.4.4 The Auxiliary Functions H1, H2, and Hox -- 10.4.5 Representation of u1,2 in Terms of Analytic Maps -- 10.4.6 Asymptotic Behavior of u1,2 as (1,2)(0,0) -- 11 Nonlinear Boundary Value Problems in Domains witha Small Hole -- 11.1 The Geometric Setting -- 11.2 A Nonlinear Robin Problem -- 11.2.1 Formulation of a Nonlinear Robin Problem in Terms of Integral Equations -- 11.2.2 Formulation of Problems (11.1) and (11.2) in Terms of Integral Equations -- 11.2.3 Analytic Representation for the Family { u(,·)}]0,'[-- 11.2.4 Local Uniqueness of the Family { u(,·)}]0,0[-- 11.2.5 Analytic Representation for the Energy Integral of the Family { u(,·)}]0,'[-- 11.3 A Nonlinear Transmission Problem -- 11.3.1 Formulation of the Nonlinear Transmission Problem in Terms of Integral Equations -- 11.3.2 Analytic Representation for the Family of Solutions {(ui(,·),uo(,·))}]0,'[-- 11.3.3 A Property of Local Uniqueness for the Family of Solutions {(ui(,·),uo(,·))}]0,'[-- 11.3.4 Analytic Representation for the Energy Integrals of the Family of Solutions {(ui(,·),uo(,·))}]0,'[-- 12 Boundary Value Problems in Periodic Domains, a Potential Theoretic Approach -- 12.1 A Periodic Analog of the Fundamental Solution -- 12.2 Periodic Layer Potentials for the Laplace Equation -- 12.2.1 Geometric Setting -- 12.2.2 Definition and Properties of the Periodic Layer Potentials -- 12.3 Uniqueness Results for Periodic Boundary Value Problems -- 12.4 Mapping Properties of 12I+Wq, Q and 12I+Wtq, Q.
12.5 Existence Results for Periodic Boundary Value Problems -- 13 Singular Perturbation Problems in Periodic Domains -- 13.1 Introduction -- 13.2 The Geometric Setting -- 13.3 Perturbed Problems in Periodic Domains -- 13.4 Preliminaries and Notation -- 13.5 Asymptotic Behavior of the Longitudinal Flow -- 13.5.1 Asymptotic Behavior of II[] -- 13.6 A Singularly Perturbed Non-ideal Transmission Problem -- 13.6.1 Transmission Problems with Non-ideal ContactConditions -- 13.6.2 Formulation of the Singularly Perturbed Transmission Problem in Terms of Integral Equations -- 13.6.3 A Functional Analytic Representation Theorem for the Solutions of the Singularly Perturbed TransmissionProblem -- 13.6.4 A Functional Analytic Representation Theorem for the Effective Conductivity -- 13.7 Series Expansion for the Effective Conductivity -- 13.7.1 Preliminaries -- 13.7.2 Power Series Expansion for ()1/r# -- 13.7.3 Power Series Expansions for ()/r# -- 13.8 A Quasilinear Heat Transmission Problem -- 13.8.1 Introduction -- 13.8.2 An Equivalent Formulation of Problem (13.132) -- 13.8.3 Formulation of Problem (13.135) in Terms of Integral Equations -- 13.8.4 A Representation Theorem for the Family of Solutions of Problem (13.132) -- Appendix A -- A.1 The Homomorphism Theorem -- A.2 The Inductive Topology -- A.3 Lebesgue Number of an Open Cover -- A.4 Perforated Connected Domains Are Connected -- A.5 Measure Theory -- A.6 Calculus in Banach Spaces and the Implicit Function Theorem -- A.7 Composition Operators -- A.8 Integral Operators with Real Analytic Kernel -- A.9 Sard's Theorem -- A.10 Theorem of Invariance of Domain -- A.11