GREEN'S FUNCTIONS AND BOUNDARY VALUE PROBLEMS

Second Edition

IVAR STAKGOLD Department of Mathematical Sciences University of Delaware Newark, Delaware



A Wiley-Interscience Publication JOHN WILEY & SONS, INC.

New York · Chichester · Weinheim · Brisbane · Singapore · Toronto

CONTENTS

• •	crace to the Octobal Edition	- 41
Pr	eface to the First Edition	xiii
0.	Preliminaries	1
1.	Heat Conduction, 3	
2	Diffusion, 10	
3.	Reaction-Diffusion Problems, 13	
4.	The Impulse-Momentum Law: The Motion of Rods and Strings, 21	
5.	Alternative Formulations of Physical Problems, 33	
6.	Notes on Convergence, 41	
7.	The Lebesgue Integral, 46	
ı.	Green's Functions (Intuitive Ideas)	53
1.	Introduction and General Comments, 53	
2	The Finite Rod, 62	
3.	Maximum Principle, 76	
4,	Examples of Green's Functions, 80	
2.	The Theory of Distributions	97
1.	Basic Ideas, Definitions, Examples, 97	
2.	Convergence of Sequences and Series of Distributions, 118	
3.	Fourier Series, 138	
4.	Fourier Transforms and Integrals, 158	
5.	Differential Equations in Distributions, 179	
3.	One-Dimensional Boundary Value Problems	201
1.	Review, 201	
2.	Boundary Value Problems for Second-Order Equations, 207	
3.	Boundary Value Problems for Equations of Order p. 219	

VIII	CONT	DH IN	r s

4. 5.	Alternative Theorems, 223 Modified Green's Functions, 234	
4.	Hilbert and Banach Spaces	242
1.	Functions and Transformations, 242	
2	Linear Spaces, 246	
3.	Metric Spaces, Normed Linear Spaces, Banach Spaces, 253	
4.	Contractions, 265	
5.	Hilbert Spaces, 283	
6. 7.	Separable Hilbert Spaces and Orthonormal Bases, 298 Linear Functionals, 312	
5.	Operator Theory	317
1.	Basic Ideas and Examples, 317	
2.	Closed Operators, 325	
3.	Invertibility—The State of an Operator, 329	
4.	Adjoint Operators, 335	
5.	Solvability Conditions, 341	
6.	The Spectrum of an Operator, 346	
7. 8.	Compact Operators, 357 Extremal Properties of Operators, 361	
٥.	Extremal Properties of Operators, 301	
6.	Integral Equations	370
1.	Introduction, 370	
2.	Fredholm Integral Equations, 379	
3.	The Spectrum of a Self-Adjoint Compact Operator, 392	
4.	The Inhomogeneous Equation, 401	
5.	Variational Principles and Related Approximation Methods, 419	
7.	Spectral Theory of Second-Order Differential Operators	435
1.	Introduction; the Regular Problem, 435	
2.	Weyl's Classification of Singular Problems, 461	
3.	Spectral Problems with a Continuous Spectrum, 474	
8.	Partial Differential Equations	491
1.	Classification of Partial Differential Equations, 491	
2.	Typical Well-Posed Problems for Hyperbolic and Parabolic	
-	Equations, 505	
3.	Elliptic Equations, 525 Variational Principles for Inhomogeneous Problems, 553	
4.	variational Principles for Innomogeneous Problems, 555	

9.	Nonlinear Problems	597
	1	

CONTENTS ix

- 1. Introductory Concepts, 597
- Branching Theory, 618
 Perturbation Theory for Linear Problems, 626
- 4. Techniques for Nonlinear Problems, 638
- 5. The Stability of the Steady State, 670

Index 683