1. Record Nr. UNINA9910454312903321

Autore	Lebedev L. P
Titolo	The calculus of variations and functional analysis [[electronic resource]] : with optimal control and applications in mechanics / / Leonid P. Lebedev, Michael J. Cloud
Pubbl/distr/stampa	Singapore ; ; River Edge, N.J., : World Scientific, c2003
ISBN	1-281-93546-8 9786611935467 981-279-499-9
Descrizione fisica	1 online resource (435 p.)
Collana	Series on stability, vibration, and control of systems. Series A ; ; v. 12
Altri autori (Persone)	CloudMichael J
Disciplina	515.7
Soggetti	Functional analysis Mechanics Electronic books.
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references (p. 415-416) and index.
Nota di contenuto	Foreword; Preface; Contents; 1. Basic Calculus of Variations; 1.1 Introduction; 1.2 Euler's Equation for the Simplest Problem; 1.3 Some Properties of Extremals of the Simplest Functional; 1.4 Ritz's Method; 1.5 Natural Boundary Conditions; 1.6 Some Extensions to More General Functionals; 1.7 Functionals Depending on Functions in Many Variables; 1.8 A Functional with Integrand Depending on Partial Derivatives of Higher Order; 1.9 The First Variation; 1.10 Isoperimetric Problems; 1.11 General Form of the First Variation; 1.12 Movable Ends of Extremals 1.13 Weierstrass-Erdmann Conditions and Related Problems1.14 Sufficient Conditions for Minimum; 1.15 Exercises; 2. Elements of Optimal Control Theory; 2.1 A Variational Problem as a Problem of Optimal Control; 2.2 General Problem of Optimal Control; 2.3 Simplest Problem of Optimal Control; 2.4 Fundamental Solution of a Linear Ordinary Differential Equation; 2.5 The Simplest Problem Continued; 2.6 Pontryagin's Maximum Principle for the Simplest Problem; 2.7 Some Mathematical Preliminaries; 2.8 General Terminal Control Problem; 2.9 Pontryagin's Maximum Principle for the Terminal Optimal Problem 2.10 Generalization of the Terminal Control Problem2.11 Small

Variations of Control Function for Terminal Control Problem; 2.12 A Discrete Version of Small Variations of Control Function for Generalized Terminal Control Problem; 2.13 Optimal Time Control Problems; 2.14 Final Remarks on Control Problems; 2.15 Exercises; 3. Functional Analysis; 3.1 A Normed Space as a Metric Space; 3.2 Dimension of a Linear Space and Separability; 3.3 Cauchy Sequences and Banach Spaces; 3.4 The Completion Theorem; 3.5 Contraction Mapping Principle; 3.6 Lp Spaces and the Lebesgue Integral; 3.7 Sobolev Spaces 3.8 Compactness3.9 Inner Product Spaces Hilbert Spaces; 3.10 Some Energy Spaces in Mechanics; 3.11 Operators and Functional; 3.12 Some Approximation Theory; 3.13 Orthogonal Decomposition of a Hilbert Space and the Riesz Representation Theorem; 3.14 Basis Gram-Schmidt Procedure Fourier Series in Hilbert Space; 3.15 Weak Convergence; 3.16 Adjoint and Self-adjoint Operators; 3.17 Compact Operators; 3.18 Closed Operators; 3.19 Introduction to Spectral Concepts; 3.20 The Fredholm Theory in Hilbert Spaces; 3.21 Exercises; 4. Some Applications in Mechanics
4.1 Some Problems of Mechanics from the Viewpoint of the Calculus of Variations the Virtual Work Principle; 4.2 Equilibrium Problem for a Clamped Membrane and its Generalized Solution; 4.3 Equilibrium of a Free Membrane; 4.4 Some Other Problems of Equilibrium of Linear Mechanics; 4.5 The Ritz and Bubnov-Galerkin Methods; 4.6 The Hamilton-Ostrogradskij Principle and the Generalized Setup of Dynamical Problems of Classical Mechanics; 4.7 Generalized Setup of Dynamic Problems for a Membrane; 4.8 Other Dynamic Problems of Linear Mechanics; 4.9 The Fourier Method
4.10 An Eigenfrequency Boundary Value Problem Arising in Linear Mechanics

Sommario/riassunto

This is a book for those who want to understand the main ideas in the theory of optimal problems. It provides a good introduction to classical topics (under the heading of "the calculus of variations") and more modern topics (under the heading of "optimal control"). It employs the language and terminology of functional analysis to discuss and justify the setup of problems that are of great importance in applications. The book is concise and self-contained, and should be suitable for readers with a standard undergraduate background in engineering mathematics.