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**This book focuses on
nonlinear boundary value
problems and the aspects
of nonlinear analysis which**

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are necessary to their study. The authors first give a comprehensive introduction to the many different classical methods from nonlinear analysis, variational principles, and

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**Morse theory. They then
provide a rigorous and
detailed treatment of the
relevant areas of nonlinear
analysis with new
applications to nonlinear
boundary value problems**

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**for both ordinary and
partial differential
equations. Recent results
on the existence and
multiplicity of critical
points for both smooth and
nonsmooth functional,**

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**developments on the
degree theory of monotone
type operators, nonlinear
maximum and comparison
principles for p-Laplacian
type operators, and new
developments on nonlinear**

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**Neumann problems
involving non-
homogeneous differential
operators appear for the
first time in book form. The
presentation is systematic,
and an extensive**

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bibliography and a remarks section at the end of each chapter highlight the text. This work will serve as an invaluable reference for researchers working in nonlinear analysis and

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partial differential equations as well as a useful tool for all those interested in the topics presented. Variational methods are applied to prove the

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**existence of weak solutions
for boundary value
problems from the
deformation theory of
plasticity as well as for the
slow, steady state flow of
generalized Newtonian**

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fluids including the
Bingham and Prandtl-
Eyring model. For perfect
plasticity the role of the
stress tensor is emphasized
by studying the dual
variational problem in

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**appropriate function
spaces. The main results
describe the analytic
properties of weak
solutions, e.g.
differentiability of velocity
fields and continuity of**

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stresses. The monograph addresses researchers and graduate students interested in applications of variational and PDE methods in the mechanics of solids and fluids.

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Methods For Boundary Value

**This book is devoted to the
mathematical analysis of
the numerical solution of
boundary integral
equations treating
boundary value,
transmission and contact**

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**problems arising in
elasticity, acoustic and
electromagnetic scattering.
It serves as the
mathematical foundation of
the boundary element
methods (BEM) both for**

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static and dynamic
problems. The book
presents a systematic
approach to the variational
methods for boundary
integral equations
including the treatment

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with variational inequalities for contact problems. It also features adaptive BEM, hp-version BEM, coupling of finite and boundary element methods - efficient computational tools that

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**have become extremely
popular in applications.
Familiarizing readers with
tools like Mellin
transformation and
pseudodifferential
operators as well as convex**

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**and nonsmooth analysis for
variational inequalities, it
concisely presents efficient,
state-of-the-art boundary
element approximations
and points to up-to-date
research. The authors are**

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**well known for their
fundamental work on
boundary elements and
related topics, and this
book is a major
contribution to the modern
theory of the BEM**

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**(especially for error
controlled adaptive
methods and for unilateral
contact and dynamic
problems) and is a valuable
resource for applied
mathematicians, engineers,**

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**scientists and graduate
students.**
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**A Unified Approach
Multiple Solutions Of
Boundary Value Problems:
A Variational Approach
Variational Methods for**

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Problems**

**Introduction to Numerical
Methods for Variational
Problems**

**Lectures at the University
Kaiserslautern Department**

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of Mathematics,
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This advanced graduate-level text examines variational methods in partial differential equations and illustrates their applications to a number of

Where To Download Variational Methods For Boundary Value Problems For Systems Of free-boundary problems.

Detailed statements of the standard theory of elliptic and parabolic operators make this treatment readable for engineers, students, and nonspecialists alike. The text's first two chapters

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can be used for a single-
semester graduate course in
variational inequalities or
partial differential
equations. The succeeding
chapters -- covering jets
and cavities, variational
problems with potentials,

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and free-boundary problems
not in variational form --
are more specialized and
self-contained. Readers who
have mastered chapters 1 and
2 will be able to conduct
research on the problems
explored in subsequent

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chapters. Bibliographic
remarks conclude each
chapter, along with several

problems and exercises.

This book introduces the
method of lower and upper
solutions for ordinary
differential equations. This

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method is known to be both
easy and powerful to solve
second order boundary value

problems. Besides an
extensive introduction to
the method, the first half
of the book describes some
recent and more involved

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results on this subject.

These concern the combined

use of the method with

degree theory, with

variational methods and

positive operators. The

second half of the book

concerns applications. This

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part exemplifies the method
and provides the reader with
a fairly large introduction
to the problematic of
boundary value problems.

Although the book concerns
mainly ordinary differential
equations, some attention is

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given to other settings such
as partial differential
equations or functional

differential equations. A
detailed history of the
problem is described in the
introduction. · Presents the
fundamental features of the

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method · Construction of
lower and upper solutions in
problems · Working

applications and illustrated
theorems by examples ·

Description of the history
of the method and

Bibliographical notes

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The last few decades have seen a spectacular growth in the use of variational methods, one of the most classic and elegant methods in physical and mathematical sciences, as powerful tools of optimization and

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numerical analysis. The
tremendous accumulation of
information on the use of
variational methods in the
area of the geosciences,
which includes meteorology,
oceanography, hydrology,
geophysics and seismology,

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On Mathematics
Variational Methods in
Geosciences to be organized
and held in Norman on
October 15-17, 1985. The
value of this symposium was
enhanced by the number of

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stimulating and informative
papers presented.
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Problems

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linear Boundary-value

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Authorized Translation from
the Russian

Variational Methods for
Solving Electromagnetic
Boundary Value Problems
Approximation of Elliptic
Boundary-Value Problems

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**Variational methods and their
generalizations have been**

**verified to be useful tools in
proving the existence of
solutions to a variety of
boundary value problems for
ordinary, impulsive, and**

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partial differential equations as well as for difference equations. In this monograph, we look at how variational methods can be used in all these settings. In our first chapter, we gather the basic

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notions and fundamental theorems that will be applied in the remainder of this monograph. While many of these items are easily available in the literature, we gather them here both for the

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**convenience of the reader and
for the purpose of making this
volume somewhat self-
contained. Subsequent
chapters deal with the Sturm-
Liouville problems, multi-point
boundary value problems,**

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**problems with impulses,
partial differential equations,
and difference equations. An
extensive bibliography is also
included.**

**This textbook teaches finite
element methods from a**

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**computational point of view. It
focuses on how to develop
flexible computer programs
with Python, a programming
language in which a
combination of symbolic and
numerical tools is used to**

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**achieve an explicit and
practical derivation of finite
element algorithms. The finite
element library FEniCS is used
throughout the book, but the
content is provided in
sufficient detail to ensure that**

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**students with less
mathematical background or
mixed programming-language
experience will equally
benefit. All program examples
are available on the Internet.
Variational Methods for**

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Equations Courier Dover
Publications
Variational Methods**

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**Open Problems, Recent
Progress, and Numerical
Algorithms : June 5-8, 2002,
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Flagstaff, Arizona
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Methods for Elliptic Boundary**

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**Variational Methods for Elliptic
Boundary Value Methods
Variational and Non-
variational Methods in
Nonlinear Analysis and
Boundary Value Problems**

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This book presents a unified theory of the Finite Element Method and the Boundary Element Method for a numerical solution of second order elliptic boundary value problems. This includes the solvability, stability, and error analysis as well as

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efficient methods to solve the
resulting linear systems.

Applications are the potential
equation, the system of linear
elastostatics and the Stokes system.

While there are textbooks on the
finite element method, this is one of

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the first books on Theory of
Boundary Element Methods. It is
suitable for self study and exercises
are included.

This book develops a variational
method for solving linear equations
with B -symmetric and

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\mathbb{S} -positive operators and
generalizes the method to nonlinear
equations with nonpotential

operators. The author carries out a
constructive extension of the
variational method to

"nonvariational" equations

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(including parabolic equations) in
classes of functionals which differ
from the Euler-Lagrange

functionals. In this connection, some
new functions spaces are considered.

Intended for mathematicians
working in the areas of functional

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analysis and differential equations,
this book would also prove useful for
researchers in other areas and

students in advanced courses who
use variational methods in solving
linear and nonlinear boundary value
problems in continuum mechanics

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and theoretical physics.

In the rapidly developing area of
nonlinear theory of differential
equations, many important results
have been obtained by the use of
nonlinear functional analysis based
on topological and variational

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methods. The survey papers presented in this volume represent the current state of the art in the subject. The methods outlined in this book can be used to obtain new results concerning the existence, uniqueness, multiplicity, and

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bifurcation of the solutions of
nonlinear boundary value problems
for ordinary and partial differential
equations. The contributions to this
volume are from well known
mathematicians, and every paper
contained in this book can serve both

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as a source of reference for
researchers working in differential
equations and as a starting point for
those wishing to pursue research in
this direction. With research reports
in the field typically scattered in
many papers within various journals,

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this book provides the reader with
recent results in an accessible form.

Variational Methods for a Class of
Boundary Value Problems Exterior
to a Thin Domain

Variational Methods, for Boundary
Value Problems, for Systems of

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by J.R.M. Radok

Variational Methods in
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Energy Principles and Variational
Methods in Applied Mechanics

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Operators, and Variational Methods
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**The first edition (in
German) had the prevailing
character of a textbook
owing to the choice of
material and the manner of**

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its presentation. This
second (translated,
revised, and extended)

edition, however, includes
in its new parts
considerably more recent
and advanced results and

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thus goes partially beyond
the textbook level. We
should emphasize here that

the primary intentions of
this book are to provide
(so far as possible given
the restrictions of space)

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a selfcontained
presentation of some
modern developments in the
direct methods of the cal
culus of variations in
applied mathematics and
mathematical physics from

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a unified point of view
and to link it to the
traditional approach.

These modern developments
are, according to our
background and interests:

(i) Thomas-Fermi theory

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and related theories, and

(ii) global systems of

semilinear elliptic

partial-differential

equations and the

existence of weak

solutions and their

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regularity. Although the
direct method in the
calculus of variations can
naturally be considered
part of nonlinear
functional analysis, we
have not tried to present

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our material in this way.
Some recent books on
nonlinear functional

analysis in this spirit
are those by K. Deimling
(Nonlinear Functional
Analysis, Springer, Berlin

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Heidelberg 1985) and E.

Zeidler (Nonlinear

Functional Analysis and

Its Applications, Vols.

1-4; Springer, New York

1986-1990).

A conference was organized

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to discuss research in
variational methods as
applied to nonlinear
elliptic PDE. This volume
resulted from that
gathering. Included in
this title are both survey

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and research papers that
address important open
questions and offer

suggestions on analytical
and numerical techniques
for solving those open
problems. It is suitable

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for graduate students and
research mathematicians

interested in elliptic
partial differential
equations.

Introduction to

Variational Methods in

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Control Engineering
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focuses on the design of
automatic controls. The
monograph first discusses
the application of
classical calculus of
variations, including a

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generalization of the
Euler-Lagrange equations,
limitation of classical
variational calculus, and
solution of the control
problem. The book also
describes dynamic

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programming. Topics
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include the limitations of
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dynamic programming;
general formulation of
dynamic programming; and
application to linear
multivariable digital

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control systems. The text
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also underscores the
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continuous form of dynamic
programming; Pontryagin's
principle; and the two-
point boundary problem.
The book also touches on

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inaccessible state
variables. Topics include
the optimum realizable
control law; observed data
and vector spaces; design
of the optimum estimator;
and extension to the

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continuous systems. The book also presents a summary of potential applications, including complex control systems and on-line computer control. The text is

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recommended to readers and
students wanting to
explore the design of
automatic controls.

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Engineering

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Variational Methods for
Boundary Value Problems
Global Solutions of
Hamilton-Jacobi Boundary

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Variational Methods in
Mathematical Methods in
Physics

This is a textbook written for use in
a graduate-level course for students
of mechanics and engineering

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Problems For Systems Of
science. It is designed to cover the
essential features of modern
variational methods and to

demonstrate how a number of basic
mathematical concepts can be used
to produce a unified theory of
variational mechanics. As

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prerequisite to using this text, we
assume that the student is equipped
with an introductory course in
functional analysis at a level roughly
equal to that covered, for example,
in Kolmogorov and Fomin

(Functional Analysis, Vol. I,

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Graylock, Rochester, 1957) and
possibly a graduate-level course in
continuum mechanics. Numerous

references to supplementary
material are listed throughout the
book. We are indebted to Professor
Jim Douglas of the University of

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Chicago, who read an earlier version of the manuscript and whose detailed suggestions were extremely helpful in preparing the final draft. He also gratefully acknowledge that much of our own research work on variational theory was supported by

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the U.S. Air Force Office of
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Scientific Research. He are indebted
to Mr. Ming-Goei Sheu for help in
proofreading. Finally, we wish to
express thanks to Mrs. Marilyn
Gude for her excellent and pains
taking job of typing the manuscript.

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J. T. ODEN J. N. REDDY Table of
Contents PREFACE 1.

INTRODUCTION 1.1 The Role of
Variational Theory in Mechanics. 1

1.2 Some Historical Comments

..... . 2 1.3 Plan of Study

. 5 7 2. MATHEMATICAL

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FOUNDATIONS OF CLASSICAL
VARIATIONAL THEORY 7 2.1

Introduction

Physics has long been regarded as a
wellspring of mathematical
problems. Mathematical Methods in
Physics is a self-contained

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presentation, driven by historic motivations, excellent examples, detailed proofs, and a focus on those parts of mathematics that are needed in more ambitious courses on quantum mechanics and classical and quantum field theory. Aimed

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primarily at a broad community of graduate students in mathematics, mathematical physics, physics and engineering, as well as researchers in these disciplines.

This IMA Volume in Mathematics
and its Applications

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VARIATIONAL AND FREE
BOUNDARY PROBLEMS is based
on the proceedings of a workshop
which was an integral part of the
1990- 91 IMA program on "Phase
Transitions and Free Boundaries. "

The aim of the workshop was to

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highlight new methods, directions
and problems in variational and free
boundary theory, with a

concentration on novel applications
of variational methods to applied
problems. We thank R. Fosdick, M.
E. Gurtin, W. -M. Ni and L. A.

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Peletier for organizing the year-long program and, especially, J. Sprock for co-organizing the meeting and co-editing these proceedings. We also take this opportunity to thank the National Science Foundation whose financial support made the

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workshop possible. Avner Friedman
Willard Miller, Jr. PREFACE In a
free boundary one seeks to find a
solution u to a partial differential
equation in a domain, a part r of its
boundary of which is unknown.

Thus both u and r must be

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determined. In addition to the standard boundary conditions on the un known domain, an additional condition must be prescribed on the free boundary. A classical example is the Stefan problem of melting of ice; here the temperature sat isfies

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the heat equation in the water
region, and yet this region itself (or
rather the ice-water interface) is

unknown and must be determined
together with the temperature
within the water. Some free
boundary problems lend themselves

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to variational formulation.

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Topological and Variational
Methods with Applications to
Nonlinear Boundary Value
Problems

Introduction to Variational Methods
in Control Engineering

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Variational Methods in Theoretical
Mechanics

Notes on a Series of Lectures Given
by Harold Levine Under the
Sponsorship of the Electronic
Defense Laboratory

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One of the clearest available introductions to variational methods, this text requires only a minimal background in calculus and linear algebra. Its self-contained treatment explains the application of theoretic notions to the kinds of physical problems

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that engineers regularly
encounter. The text's first half
concerns approximation theoretic
notions, exploring the theory and
computation of one- and two-
dimensional polynomial and other
spline functions. Later chapters
examine variational methods in

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the solution of operator equations, focusing on boundary value problems in one and two dimensions. Additional topics include least squares and other Galerkin methods. Many helpful definitions, examples, and exercises appear throughout the

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book. A classic reference in spline theory, this volume will benefit experts as well as students of engineering and mathematics. A marriage of the finite-differences method with variational methods for solving boundary-value problems, the

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finite-element method is superior
in many ways to finite-differences
alone. This self-contained text for
advanced undergraduates and
graduate students is intended to
imbed this combination of
methods into the framework of
functional analysis and to explain

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its applications to approximation
of nonhomogeneous boundary-
value problems for elliptic

operators. The treatment begins
with a summary of the main
results established in the book.

Chapter 1 introduces the
variational method and the finite-

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difference method in the simple
case of second-order differential
equations. Chapters 2 and 3

concern abstract approximations
of Hilbert spaces and linear
operators, and Chapters 4 and 5
study finite-element
approximations of Sobolev

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spaces. The remaining four chapters consider several methods for approximating nonhomogeneous boundary-value problems for elliptic operators. This book reflects a significant part of authors' research activity during the last ten years. The

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structure of this work. The book is mainly addressed to researchers and scholars in Pure and Applied Mathematics, Mechanics, Physics and Engineering. We are greatly indebted to Viorica Venera Motreanu for the careful reading of the manuscript and helpful

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comments on important issues.

We are also grateful to our Editors
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their professional assistance. Our
deepest thanks go to our
numerous scientific collaborators
and friends, whose work was so
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several classes of boundary value problems. Our framework includes multivalued elliptic problems with discontinuities, variational inequalities, hemivariational inequalities and evolution problems. The treatment relies on variational

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The impulse which led to the writing of the present book has emerged from my many years of lecturing in special courses for selected students at the College of Civil Engineering of the Technical University in Prague, from experience gained as supervisor

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and consultant to graduate students-engineers in the field of applied mathematics, and - last but not least - from frequent consultations with technicians as well as with physicists who have asked for advice in overcoming difficulties encountered in

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that the book should be of
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