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# Variational Methods in Theoretical Mechanics

Universitext

2nd revised edition. 1982. XI, 309 pages.  
DM 48,-; approx. US\$19.20  
ISBN 3-540-11917-5

This textbook for graduate students of mathematics and engineering science covers the essential features of modern variational theory and demonstrates how this theory can be used to produce a unified theory of theoretical mechanics. The numerous revisions in this edition include not only corrections but also updates and deletions of certain sections.

By first laying down a broad mathematical basis for variational theory in terms of properties of functionals defined on Banach spaces and their differentials, the authors are able to construct a general theory for variational methods in theoretical mechanics. A complete account of the theory of dual and complementary variational principles of mechanics is developed which includes a number of new principles. Applications of the general theory to a variety of areas are given, including viscoelasticity, nonlinear elasticity, plastic flow, elastoplasticity, heat transfer, magnetohydrodynamics, and non-Newtonian fluids. A chapter on monotone operators and variational inequalities is also included which contains certain results on existence theory for some of the variational equations of mechanics. The final chapter deals with variational methods of approximation and includes a summary of recent work on the theory of finite elements.

**Contents:** Introduction. — Mathematical Foundations of Classical Variational Theory. — Mechanics of Continua — A Brief Review. Complementary and Dual Variational Principles in Mechanics. — Variational Principles in Continuum Mechanics. — Variational Boundary-Value Problems, Monotone Operators, and Variational Inequalities. — Variational Methods of Approximation. — References.



Springer-Verlag Berlin Heidelberg New York

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Berlin Heidelberg New York  
Brühlsche Universitätsdruckerei, Giessen  
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