

Variational Inequalities: Theory and Applications

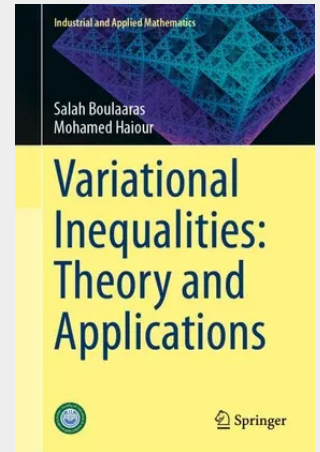
This book provides a comprehensive and unified treatment of variational inequalities, quasi-variational inequalities, and related impulse control problems, combining rigorous mathematical analysis with effective numerical methods and practical applications. Such models arise naturally in constrained partial differential equations, free boundary problems, optimal control, reliability engineering, and mathematical finance.

The main objective of the book is to develop a coherent framework that connects functional analytic foundations, qualitative properties, numerical approximation, and long-time behavior. Particular attention is given to the analysis of existence, uniqueness, and regularity of solutions for elliptic and parabolic variational inequalities, as well as to quasi-variational problems involving solution-dependent constraints.

The book also presents robust and convergent numerical schemes, with a focus on finite element methods, penalty techniques, and approximation strategies that preserve the qualitative features of the continuous models. Special emphasis is placed on applications to free boundary problems, impulse control, and non-smooth phenomena, which play a central role in reliability modeling and American option pricing.

This volume is intended for graduate students, researchers, and practitioners in applied mathematics, numerical analysis, and related fields who are interested in both the theoretical and computational aspects of variational inequalities.

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