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Symmetry methods have long been recognized to be of great importance for the study of the differential equations arising in mathematics, physics, engineering, and many other disciplines. The purpose of this book is to provide a solid introduction to those applications of Lie groups to differential equations that have proved to be useful in practice, including determination of symmetry groups, integration of ordinary differential equations, construction of group-invariant solutions to partial differential equations, symmetries and conservation laws, generalized symmetries, and symmetry methods in Hamiltonian systems. The computational methods are presented so that graduate students and researchers in other fields can readily learn to use them.

Following an exposition of the applications, the book develops the underlying theory. Many of the topics are presented in a novel way, with an emphasis on explicit examples and computations. Further examples, as well as new theoretical developments, appear in the exercises at the end of each chapter.

This second edition contains a new section on formal symmetries and the calculus of pseudodifferential operators, simpler proofs of some theorems, new exercises, and a substantially updated bibliography.

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