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Drawing on a wide range of mathematical disciplines, including geometry, analysis, applied mathematics, and algebra, this book presents an innovative synthesis of methods used to study problems of equivalence and symmetry which arise in a variety of mathematical fields and physical applications. Systematic and constructive methods for solving equivalence problems and calculating symmetries are developed and applied to a wide variety of mathematical systems, including differential equations, variational problems, manifolds, Riemannian metrics, polynomials, and differential operators. Particular emphasis is given to the construction and classification of invariants and reductions of complicated objects to simple canonical forms. Specific applications include Lie groups and Lie algebras, differential invariants, quantum mechanics, computer vision, Hamiltonian mechanics, elasticity, representation theory, differential geometry, prospective geometry, classical invariant theory, and the calculus of variations. A self-contained introduction to the Cartan equivalence method and theory of exterior differential systems is included.

This book will be a valuable resource for students and researchers in geometry, analysis, algebra, mathematical physics, and related fields.

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