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This book provides an introduction to and survey of recent developments in pseudo-Riemannian geometry, including applications in mathematical physics, by leading experts in the field. Topics covered are: Classification of pseudo-Riemannian symmetric spaces Holonomy groups of Lorentzian and pseudo-Riemannian manifolds Hypersymplectic manifolds Anti-self-dual conformal structures in neutral signature and integrable systems Neutral Kahler surfaces and geometric optics Geometry and dynamics of the Einstein universe Essential conformal structures and conformal transformations in pseudo-Riemannian geometry The causal hierarchy of spacetimes Geodesics in pseudo-Riemannian manifolds Lorentzian symmetric spaces in supergravity Generalized geometries in supergravity Einstein metrics with Killing leaves The book is addressed to advanced students as well as to researchers in differential geometry, global analysis, general relativity and string theory. It shows essential differences between the geometry on manifolds with positive definite metrics and on those with indefinite metrics, and highlights the interesting new geometric phenomena, which naturally arise in the indefinite metric case. The reader finds a description of the present state of the art in the field as well as open problems, which can stimulate further research.