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Differential Forms in Mathematical Physics

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"This is the first systematic textbook on methods of modern differential geometry in mathematical physics. The book gives a self contained detailed representation of analysis on manifolds and differential fibre bundles with applications in physics in the recent coordinate free formalism... The book is recommendable not only for self study but also as a base for a one-year course on the mathematics of non-quantum physics."

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During the past decade, the author of this volume has delivered lectures on differential forms and their applications in mathematical physics at various universities, to audiences consisting of mathematicians, mathematical physicists, theoretical physicists, mathematically inclined experimental physicists and engineers. This work constitutes an extended and improved version of the material presented in these lectures.

The main aim of the book is to develop an intuition and working knowledge of the subject "differential forms in mathematical physics" without insisting on an extremely high degree of mathematical rigour or precision. It shows the way in which new methods, i.e. intrinsic methods which derive from manifold theory, offer an alternative approach to mathematical physics.

This volume is designed as an introduction to research in mathematical physics and discusses how differential forms on manifolds provide a mathematical setting for classical and quantum mechanics, relativistic physics, electromagnetism, gravitational fields and unified field theories (weak and electromagnetic interactions, supergravitation). Due to the absence of literature in the area of gauge structures, the supplementary Chapter 14 of the revised and improved second edition fills this important gap.

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