



Index Theory with Applications to Mathematics and Physics (International Press)

David D. Bleecker (University of Hawaii at Manoa), Bernhelm Boß-Bavnbek (Roskilde Universitet Denmark)

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Index Theory with Applications to Mathematics and Physics describes, explains, and explores the Index Theorem of Atiyah and Singer, one of the truly great accomplishments of twentieth-century mathematics whose influence continues to grow, fifty years after its discovery. The Index Theorem has given birth to many mathematical research areas and exposed profound connections between analysis, geometry, topology, algebra, and mathematical physics. Hardly any topic of modern mathematics stands independent of its influence.

In this ambitious new work, authors David Bleecker and Bernhelm Booss-Bavnbek give two proofs of the Atiyah-Singer Index Theorem in impressive detail: one based on K-theory and the other on the heat kernel approach. As a preparation for this, the authors explain all the background information on such diverse topics as Fredholm operators, pseudo-differential operators, analysis on manifolds, principal bundles and curvature, and K-theory--carefully and with concern for the reader. Many applications of the theorem are given, as well as an account of some of the most important recent developments in the subject, with emphasis on gauge theoretic physical models and low-dimensional topology.

The 18 chapters and two appendices of the book introduce different topics and aspects, often beginning from scratch without presuming full knowledge of all the preceding chapters. Learning paths, through a restricted selection of topics and sections, are suggested and facilitated. The chapters are written for students of mathematics and physics: some for the upper-undergraduate level, some for the graduate level, and some as an inspiration and support for researchers.

Index Theory with Applications to Mathematics and Physics is a textbook, a reference book, a survey, and much more. Written in a lively fashion, it contains a wealth of basic examples and exercises. The authors have included many discussion sections that are both entertaining and informative, which illuminate the thinking behind the more general theory. A detailed bibliography and index facilitate the orientation.

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