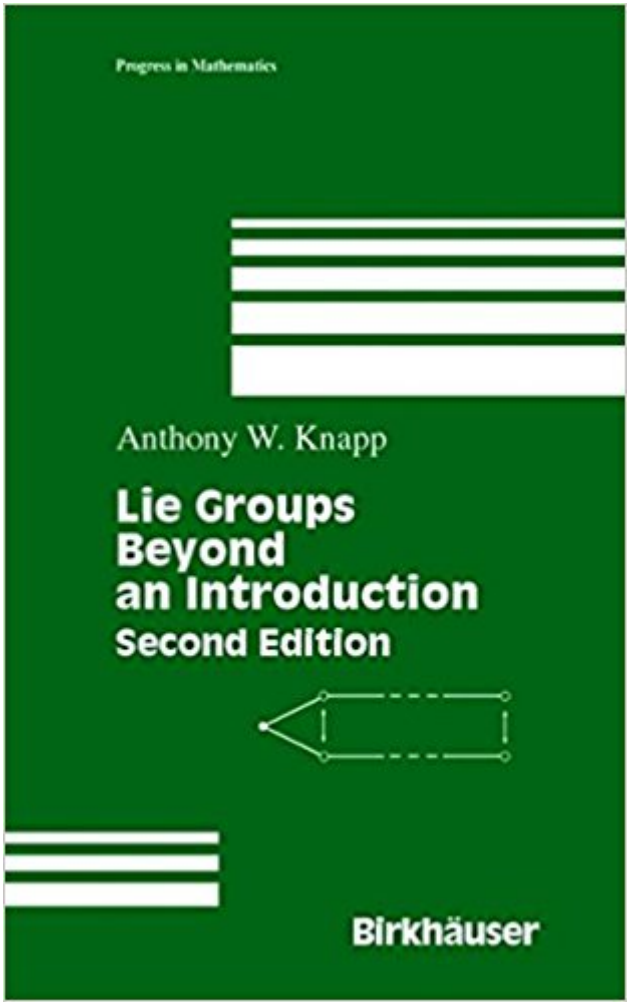
Lie Groups: Beyond An Introduction



Synopsis

This book takes the reader from the end of introductory Lie group theory to the threshold of infinite-dimensional group representations. Merging algebra and analysis throughout, the author uses Lie-theoretic methods to develop a beautiful theory having wide applications in mathematics and physics. The book initially shares insights that make use of actual matrices; it later relies on such structural features as properties of root systems.

Book Information

Hardcover: 812 pages

Publisher: BirkhÃƒÂ¤user; 2nd edition (August 21, 2002)

Language: English

ISBN-10: 0817642595

ISBN-13: 978-0817642594

Product Dimensions: 9.6 x 6.2 x 1.7 inches

Shipping Weight: 3 pounds (View shipping rates and policies)

Average Customer Review: 5.0 out of 5 stars 3 customer reviews

Best Sellers Rank: #698,703 in Books (See Top 100 in Books) #94 inÂ Books > Science & Math > Mathematics > Pure Mathematics > Group Theory #134 inÂ Books > Science & Math > Mathematics > Pure Mathematics > Algebra > Abstract #276 inÂ Books > Science & Math > Mathematics > Pure Mathematics > Algebra > Linear

Customer Reviews

"Anthony Knapp’s Lie Groups Beyond an Introduction, 2nd edition, is a beautiful introduction to this area of mathematics, appropriate for a variety different audiences.... The book is well-organized with concise, focused introductions to each chapter, a very thorough index of notation, and appendices.... In addition, there are hints to the hundreds of exercises, and a section on historical notes.... Knapp’s writing is clear, and he avoids excessive notation. The first few chapters comprise a standard introductory course in Lie theory, while numerous second courses could be taught out of the later chapters. Its breadth of coverage and extensive tables also make the book a valuable reference for researchers in representation theory."Â Â â •MAA ReviewsÂ (review of the second edition) "The first edition of the present book appeared in 1996, and quickly became one of the standard references on the subjectâ |. The present edition has been perfected even further, apart from straightening occasional errorsâ |and making various revisions throughout, by adding a new introduction and two new chapters [IX and X]â |. Chapter IX contains a treatment of induced

representations and branching theoremsâ |. Chapter X is largely about actions of compact Lie groups on polynomial algebras, pointing toward invariant theory and some routes to infinite-dimensional representation theoryâ |. This is an excellent monograph, which, as with the previous edition, can be recommended both as a textbook or for reference to anyone interested in Lie theory."Â Â â •Mathematical Bohemica (review of the second edition) "The important feature of the present book is that it starts from the beginning (with only a very modest knowledge assumed) and covers all important topics.... The book is very carefully organized [and] ends with 20 pages of useful historic comments. Such a comprehensive and carefully written treatment of fundamentals of the theory will certainly be a basic reference and text book in the future."Â Â â •Newsletter of the EMS (review of the first edition) "Each chapter begins with an excellent summary of the content and ends with an exercise section.... This is really an outstanding book, well written and beautifully produced. It is both a graduate text and a monograph, so it can be recommended to graduate students as well as to specialists."Â Â â •Publicationes Mathematicae (review of the first edition) "This is a wonderful choice of material. Any graduate student interested in Lie groups, differential geometry, or representation theory will find useful ideas on almost every page. Each chapter is followed by a long collection of problems [that] are interesting and enlightening [and] there are extensive hints at the back of the book. The exposition...is very careful and complete.... Altogether this book is delightful and should serve many different audiences well. It would make a fine text for a second graduate course in Lie theory."Â Â â •Bulletin of the AMS (review of the first edition)

Lie Groups Beyond an Introduction takes the reader from the end of introductory Lie group theory to the threshold of infinite-dimensional group representations. Merging algebra and analysis throughout, the author uses Lie-theoretic methods to develop a beautiful theory having wide applications in mathematics and physics. A feature of the presentation is that it encourages the reader’s comprehension of Lie group theory to evolve from beginner to expert: initial insights make use of actual matrices, while later insights come from such structural features as properties of root systems, or relationships among subgroups, or patterns among different subgroups. Topics include a description of all simply connected Lie groups in terms of semisimple Lie groups and semidirect products, the Cartan theory of complex semisimple Lie algebras, the Cartan-Weyl theory of the structure and representations of compact Lie groups and representations of complex semisimple Lie algebras, the classification of real semisimple Lie algebras, the structure theory of noncompact reductive Lie groups as it is now used in research, and integration on reductive groups. Many problems, tables, and bibliographical notes complete this comprehensive work, making the text

suitable either for self-study or for courses in the second year of graduate study and beyond.

I can’t recommend this book highly enough. I have learned a lot of Lie theory from the book and I continue to use the book as a reference.I first used this book to learn about Lie groups while I was a graduate student studying Riemannian geometry. Before starting this book I had taken a first course in Lie groups and had read Humphrey’s Lie algebras book. I am unsure how well it would serve as an introduction to Lie groups, but with my background I found the book to be very accessible. The book provides complete proofs and rarely skips any steps in arguments, making it a great book to learn from. I also really liked the fact that all the results about Lie algebras are proved only for the real and complex numbers. This made those sections worth reading, even if you know these results and their proofs for more general fields.Over the past year, I have also used the book as a reference book and it works great in this sense to. Many chapters start with recalling the notation from the previous chapters or recalling what results were needed to prove these results. This is a really great feature that is surprisingly missing from a lot of math books. Knapp is also very careful about citing the previous lemmas he uses and so it is painless to pick up the book and start reading anywhere.

This book is extremely good. Although the title and the size of the book suggest a very advanced treatment, I think that it is actually very well suited to those who have some basic practical exposure to Lie groups and algebras, as any theoretical physicist has. However, I recommend to read also the review written by Knapp himself about two introductory books (www.math.sunysb.edu/~aknapp/pdf-files/BakerRossmann.pdf). Reading that review helped me a lot to understand what Knapp means by "Introductory Lie theory" and in particular to understand the idea of Section I.10 "Elementary theory of Lie groups", whose motivation was a bit hard to grasp for me the first time.

The short version: this is a superbly written and conceived book; if I had to learn this material (the basic theory ofstructure and representation of Lie algebras and groups,especially semimsimple ones) from a single book, this isthe one I’d choose, among those I’ve seen. If you know thebasics of abstract algebra and some very basic concepts fromtopology and manifolds, and you want to learn this material,use this book. It would be a good reference, too, as it iseasy to find things in it, and takes a fairly modern, sophisticated approach (without sacrificing motivation andintuition).The long version, if you want more convincing or details:I have used several books recently in learning the structure andrepresentation theory of Lie algebras and groups (especially Humphreys’ Introduction

to Lie algebras and representation theory, Fultonand Harris' "Representation Theory," Varadarajan's "Lie groups,Lie algebras, and their representations.") Although I came to Knapp's book with a decent background from the others, I think it's the best pedagogically, for someone with a modicum of mathematical sophistication and some basics like abstractalgebra and an idea of what a smooth manifold is), and a smattering of Lie theory. Some examples of the book's strength:Elementary but potentially confusing concepts (like complexification, real forms, field extensions)are explained thoroughly but in a sophisticated way, ratherthan viewed as obvious. Carefully chosen examples motivate andclarify the general theory; consequently even though the bookis completely rigorous, and carefully delineates lemmas, proofs,remarks, definitions, and the like, it seems less dry then someothers (e.g. Varadarajan, from my point of view). But the pointof the examples, and their relation to the general theory, ismade clear, so they do not provide an overload of detail or bobscure the main structure. Thought is always given to thereader's understanding, not just to logical correctness, thoughthe author also takes the point of view, with which I concur,that logical clarity and sufficient detail are essentialto understanding. Relations between ideas, alternativeproofs, and the structure of the theory to come are discussedthoroughly, but such discussion is clearly demarcated fromthe main structure of the argument, so that the latter is neverobscured. This is a fantastic book, and exactly what I waslooking for. Whether you are learning the material for thefirst time, or want to review it or refer to, it is a superbsource.

Point Groups and Space Groups (Oxford Classic Texts in the Physical Sciences) Infinity: Beyond the Beyond the Beyond The Connecting Church 2.0: Beyond Small Groups to Authentic Community Introduction to Lie Algebras and Representation Theory (Graduate Texts in Mathematics) (v. 9) An Introduction to Old Order: and Conservative Mennonite Groups An Introduction to the Representation Theory of Groups (Graduate Studies in Mathematics) Quantum Theory, Groups and Representations: An Introduction