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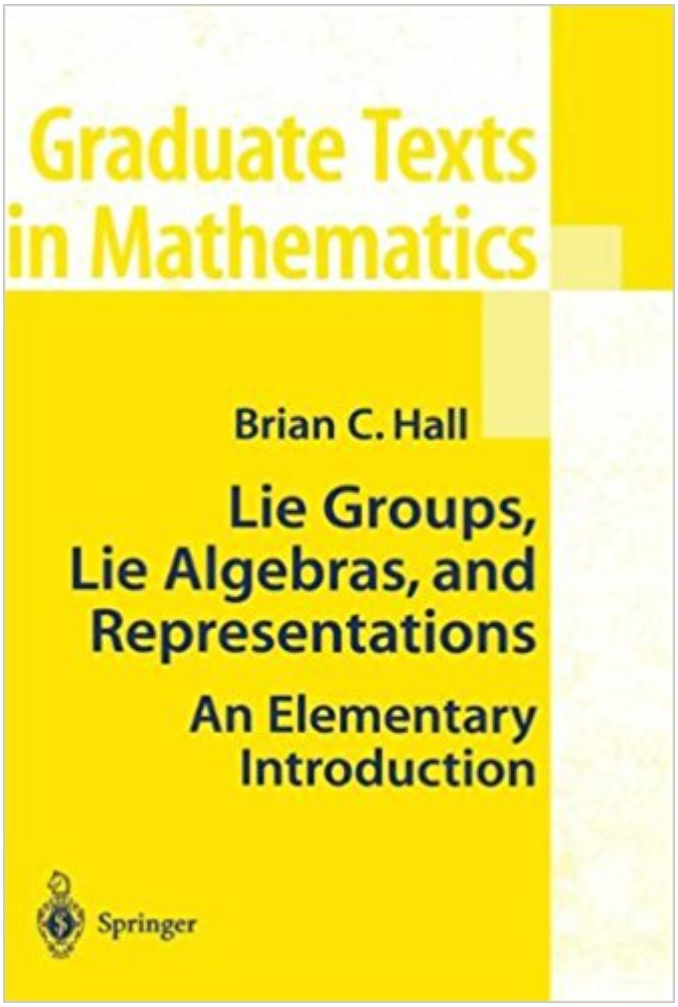
# Lie Groups, Lie Algebras, And Representations: An Elementary Introduction

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## Synopsis

Lie groups, Lie algebras, and representation theory are the main focus of this text. In order to keep the prerequisites to a minimum, the author restricts attention to matrix Lie groups and Lie algebras. This approach keeps the discussion concrete, allows the reader to get to the heart of the subject quickly, and covers all of the most interesting examples. The book also introduces the often-intimidating machinery of roots and the Weyl group in a gradual way, using examples and representation theory as motivation. The text is divided into two parts. The first covers Lie groups and Lie algebras and the relationship between them, along with basic representation theory. The second part covers the theory of semisimple Lie groups and Lie algebras, beginning with a detailed analysis of the representations of SU(3). The author illustrates the general theory with numerous images pertaining to Lie algebras of rank two and rank three, including images of root systems, lattices of dominant integral weights, and weight diagrams. This book is sure to become a standard textbook for graduate students in mathematics and physics with little or no prior exposure to Lie theory. Brian Hall is an Associate Professor of Mathematics at the University of Notre Dame.

## Book Information

Hardcover: 354 pages
Publisher: Springer; 1st ed. 2003. Corr. 2nd printing 2004 edition (August 27, 2004)
Language: English
ISBN-10: 0387401229
ISBN-13: 978-0387401225
Product Dimensions: 6.1 x 0.9 x 9.2 inches
Shipping Weight: 1.1 pounds
Average Customer Review: 3.9 out of 5 starsÂ Â See all reviewsÂ (10 customer reviews)
Best Sellers Rank: #1,278,170 in Books (See Top 100 in Books) #69 inÂ Books > Science & Math > Mathematics > Matrices #182 inÂ Books > Science & Math > Mathematics > Pure Mathematics > Group Theory #217 inÂ Books > Science & Math > Mathematics > Pure Mathematics > Algebra > Abstract

## Customer Reviews

This is an excellent book on a difficult subject.When learning Group Theory from the viewpoint of physics, one can miss out completely on some of the important mathematical aspects.Halls book solved that problem for me. But, I can imagine that it also works in the reverse;If one studies Group Theory from a pure mathematical viewpoint, one can miss out on a multitude of computational

techniques and some important results.The paramount example of Halls book is the handling of the representations of the group SU(3).To gain even more insight into that group one can use Halls book together with Quantum Mechanics: Symmetries.There one can see "Groups, Algebras and their Representaions in Action", especially SU(3),in numerous solved excercises and problems displaying a multitude of relevant computational techniques.The two books begin at about the same point (groups, algebras, representations, the exponential map),and end at about the same point (classification of the classical groups).Halls book provides the correct mathematical setting and Greiners book the solved examples.The two books together add up to a lot of value.The pure math student can easily ignore the physics in Greiners book and pick up some new things in representation theory,such as Cartans criterion for irreducibility, derivations of dimension formulas for representations, etc.Meanwhile, the pure physics student should probably avoid trying to learn Group Theory from physics books (including Greiners).There is a lot of confusion in the physics books as to what is what.

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