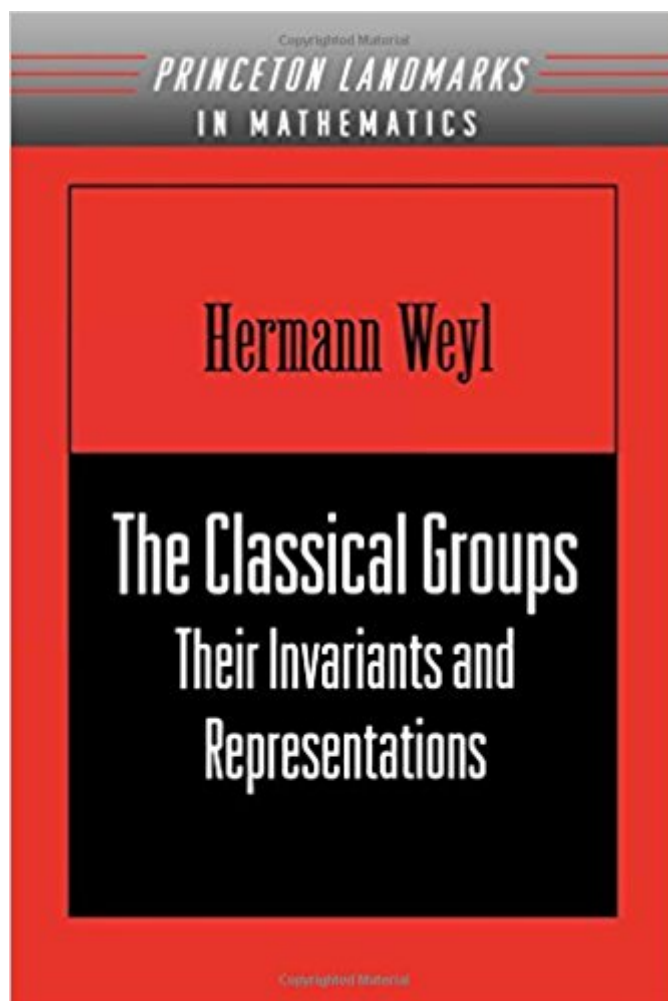


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# The Classical Groups: Their Invariants And Representations



## Synopsis

In this renowned volume, Hermann Weyl discusses the symmetric, full linear, orthogonal, and symplectic groups and determines their different invariants and representations. Using basic concepts from algebra, he examines the various properties of the groups. Analysis and topology are used wherever appropriate. The book also covers topics such as matrix algebras, semigroups, commutators, and spinors, which are of great importance in understanding the group-theoretic structure of quantum mechanics. Hermann Weyl was among the greatest mathematicians of the twentieth century. He made fundamental contributions to most branches of mathematics, but he is best remembered as one of the major developers of group theory, a powerful formal method for analyzing abstract and physical systems in which symmetry is present. In *The Classical Groups*, his most important book, Weyl provided a detailed introduction to the development of group theory, and he did it in a way that motivated and entertained his readers. Departing from most theoretical mathematics books of the time, he introduced historical events and people as well as theorems and proofs. One learned not only about the theory of invariants but also when and where they were originated, and by whom. He once said of his writing, "My work always tried to unite the truth with the beautiful, but when I had to choose one or the other, I usually chose the beautiful." Weyl believed in the overall unity of mathematics and that it should be integrated into other fields. He had serious interest in modern physics, especially quantum mechanics, a field to which *The Classical Groups* has proved important, as it has to quantum chemistry and other fields. Among the five books Weyl published with Princeton, *Algebraic Theory of Numbers* inaugurated the *Annals of Mathematics Studies* book series, a crucial and enduring foundation of Princeton's mathematics list and the most distinguished book series in mathematics.

## Book Information

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## Customer Reviews

Forget about that pansy abstract axiom approach. This is the WWF of group theory. Weyl will take anyone to the mat with this book. It is packed with detail and demonstrations. He follows the vector space/matrix representation approach common to digital systems, physics and chemistry rather than axiomatic, generators/permutations approach more common in Abstract Algebra courses. This is the lineage that develops matrix transforms as groups starting from "the full group of all non-singular linear transformations and .. the orthogonal groups" (p. vii). The latter chapters cover characters and invariants. Galois and field theory have been vanquished. Chapter 2, "Remembrance of things past" is very entertaining. My favorite quote, "Here there is only one man to mention - Hilbert. His papers (1890/92) mark a turning point in the history of invariants theory. He solves the main problems and thus almost kills the whole subject." It's funny because it's true. This is almost a botanical treatise in which the matrix groups are studied as specimens in the jungle -- "...after all each group stands in its own right and does not deserve to be looked upon merely as a subgroup of...Her All-embracing Majesty  $GL(n)$ ." (p 136). Historic references throughout provide motivation and entertainment. You couldn't possibly be disappointed with this book.

Although this is a dated work, lacking some of the more modern language, it is still worth owning and reading. It is, after all, a designated "classic." And the material presented has been incorporated within so many aspects of physics that one simply cannot avoid needing a book such as this. There are better books on the subject, for both mathematicians and physicists, but this book still proves its worth.

His presentation of symplectic groups ( although short) was helpful. That said having had Weyl's "Space, Time, Matter" for many years I'm used to his notation, but here he is very intense in his presentation and somewhat less than clear. As he is the founder of gauge group theory one expects some mathematics, just not where it seems more difficult than necessary? Also the, now, standard classifications of Cartan groups aren't mentioned ( although might be because of the original publishing date of 1939?). I got this book looking for the Weyl root groups used in making Cartan invariant matrices which I couldn't find. So on these points the book is a disappointment while

still being a classic text.

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