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KARTER ALANNAH

The Algebraic Theory of Spinors and Clifford Algebras

Springer Science & Business Media

In the two volumes that comprise this work Roger Penrose and Wolfgang Rindler introduce the calculus of 2-spinors and the theory of twistors, and discuss in detail how these powerful and elegant methods may be used to elucidate the structure and properties of space-time. In volume 1, Two-spinor calculus and relativistic fields, the calculus of 2-spinors is introduced and developed. Volume 2, Spinor and twistor methods in space-time geometry, introduces the theory of twistors, and studies in detail how the theory of twistors and 2-spinors can be applied to the study of space-time. This work will be of great value to all those studying relativity, differential geometry, particle physics and quantum field theory from beginning graduate students to experts in these fields.

The Algebraic Theory of Spinors and Clifford

Algebras American Mathematical Soc. Reflection groups and invariant theory is a branch of mathematics that lies at the intersection between geometry and algebra. The book contains a deep and elegant theory, evolved from various graduate courses given by the author over the past 10 years.

Lie Algebras and Related Topics Springer Science & Business Media An in depth exploration of how Clifford algebras and spinors have been sparking collaboration and bridging the gap between Physics and Mathematics. This collaboration has been the consequence of a growing awareness of the importance of algebraic and geometric properties in many physical phenomena, and of the discovery of common ground through various touch points: relating Clifford algebras and the arising geometry to so-called spinors, and to their three definitions (both from the mathematical and physical viewpoint). The main points of contact are the representations of Clifford algebras and the periodicity theorems. Clifford algebras also constitute a highly intuitive formalism, having an intimate relationship to

quantum field theory. The text strives to seamlessly combine these various viewpoints and is devoted to a wider audience of both physicists and mathematicians. Among the existing approaches to Clifford algebras and spinors this book is unique in that it provides a didactical presentation of the topic and is accessible to both students and researchers. It emphasizes the formal character and the deep algebraic and geometric completeness, and merges them with the physical applications. **Algebraic and Dirac-Hestenes Spinors and Spinor Fields** Basic Books This book on the theory of three-dimensional spinors and their applications fills an important gap in the literature. It gives an introductory treatment of spinors. From the reviews: "Gathers much of what can be done with 3-D spinors in an easy-to-read, self-contained form designed for applications that will supplement many available spinor treatments. The book...should be appealing to graduate students and researchers in relativity and mathematical physics." -—MATHEMATICAL REVIEWS **Theory of Spinors and Its Application in Physics and**

Mechanics World Scientific This book is an exposition of the algebra and calculus of differential forms, of the Clifford and Spin-Clifford bundle formalisms, and of vistas to a formulation of important concepts of differential geometry indispensable for an in-depth understanding of space-time physics. The formalism discloses the hidden geometrical nature of spinor fields. Maxwell, Dirac and Einstein fields are shown to have representatives by objects of the same mathematical nature, namely sections of an appropriate Clifford bundle. This approach reveals unity in diversity and suggests relationships that are hidden in the standard formalisms and opens new paths for research. This thoroughly revised second edition also adds three new chapters: on the Clifford bundle approach to the Riemannian or semi-Riemannian differential geometry of branes; on Komar currents in the context of the General Relativity theory; and an analysis of the similarities and main differences between Dirac, Majorana and ELKO spinor fields. The exercises with solutions, the comprehensive list of mathematical symbols, and the list of acronyms and

abbreviations are provided for self-study for students as well as for classes. From the reviews of the first edition: “The text is written in a very readable manner and is complemented with plenty of worked-out exercises which are in the style of extended examples. ... their book could also serve as a textbook for graduate students in physics or mathematics." (Alberto Molgado, Mathematical Reviews, 2008 k)

The Algebraic Theory of Spinors

Cambridge University Press

Describes the algebraic and geometric applications to the theory of spinors and includes the principle of triality in eight dimensional space.

Real Spinorial Groups

Springer Nature

This book explores the Lipschitz spinorial groups (versor, pinor, spinor and rotor groups) of a real non-degenerate orthogonal geometry (or orthogonal geometry, for short) and how they relate to the group of isometries of that geometry. After a concise mathematical introduction, it offers an axiomatic presentation of the geometric algebra of an orthogonal geometry. Once it has established the language of geometric algebra (linear grading of the algebra;

geometric, exterior and interior products; involutions), it defines the spinorial groups, demonstrates their relation to the isometry groups, and illustrates their suppleness (geometric covariance) with a variety of examples. Lastly, the book provides pointers to major applications, an extensive bibliography and an alphabetic index. Combining the characteristics of a self-contained research monograph and a state-of-the-art survey, this book is a valuable foundation reference resource on applications for both undergraduate and graduate students.

Not Even Wrong

American Mathematical Soc.

This monograph provides an introduction to the theory of Clifford algebras, with an emphasis on its connections with the theory of Lie groups and Lie algebras. The book starts with a detailed presentation of the main results on symmetric bilinear forms and Clifford algebras. It develops the spin groups and the spin representation, culminating in Cartan's famous triality automorphism for the group Spin(8). The discussion of enveloping algebras includes a presentation of Petracci's proof of the Poincaré–Birkhoff–Witt

theorem. This is followed by discussions of Weil algebras, Chern--Weil theory, the quantum Weil algebra, and the cubic Dirac operator. The applications to Lie theory include Duflo's theorem for the case of quadratic Lie algebras, multiplets of representations, and Dirac induction. The last part of the book is an account of Kostant's structure theory of the Clifford algebra over a semisimple Lie algebra. It describes his "Clifford algebra analogue" of the Hopf–Koszul–Samelson theorem, and explains his fascinating conjecture relating the Harish-Chandra projection for Clifford algebras to the principal sl(2) subalgebra. Aside from these beautiful applications, the book will serve as a convenient and up-to-date reference for background material from Clifford theory, relevant for students and researchers in mathematics and physics.

Clifford Algebras and Spinor Structures

Cambridge University Press

Clifford Algebras continues to be a fast-growing discipline, with ever-increasing applications in many scientific fields. This volume contains the lectures given at the Fourth Conference on Clifford

Algebras and their Applications in Mathematical Physics, held at RWTH Aachen in May 1996. The papers represent an excellent survey of the newest developments around Clifford Analysis and its applications to theoretical physics. Audience: This book should appeal to physicists and mathematicians working in areas involving functions of complex variables, associative rings and algebras, integral transforms, operational calculus, partial differential equations, and the mathematics of physics.

Conformal Groups in Geometry and Spin Structures

Springer Science & Business Media

This International Conference on Clifford AlgebrfU and Their Application, in Math ematical Phy,ic, is the third in a series of conferences on this theme, which started at the Univer,ity of Kent in Canterbury in 1985 and was continued at the Univer,iU de, Science, et Technique, du Languedoc in Montpellier in 1989. Since the start of this series of Conferences the research fields under consideration have evolved quite a lot. The number of scientific papers on Clifford Algebra, Clifford Analysis and their impact

on the modelling of physics phenomena have increased tremendously and several new books on these topics were published. We were very pleased to see old friends back and to wellcome new guests who by their inspiring talks contributed fundamentally to tracing new paths for the future development of this research area. The Conference was organized in Deinze, a small rural town in the vicinity of the University town Gent. It was hosted by De Ceder, a vacation and seminar center in a green area, a typical landscape of Flanders's "plat pays" . The Conference was attended by 61 participants coming from 18 countries; there were 10 main talks on invitation, 37 contributions accepted by the Organizing Com mittee and a poster session. There was also a book display of Kluwer Academic Publishers. As in the Proceedings of the Canterbury and Montpellier conferences we have grouped the papers accordingly to the themes they are related to: Clifford Algebra, Clifford Analysis, Classical Mechanics, Mathematical Physics and Physics Models. **Clifford Algebras and their Applications**

in Mathematical Physics Springer Science & Business Media William Kingdon Clifford published the paper defining his "geometric algebras" in 1878, the year before his death. Clifford algebra is a generalisation to n-dimensional space of quaternions, which Hamilton used to represent scalars and vectors in real three-space: it is also a development of Grassmann's algebra, incorporating in the fundamental relations inner products defined in terms of the metric of the space. It is a strange fact that the Gibbs Heaviside vector techniques came to dominate in scientific and technical literature, while quaternions and Clifford algebras, the true associative algebras of inner-product spaces, were regarded for nearly a century simply as interesting mathematical curiosities. During this period, Pauli, Dirac and Majorana used the algebras which bear their names to describe properties of elementary particles, their spin in particular. It seems likely that none of these eminent mathematical physicists realised that they were using Clifford algebras. A few research workers such as Fueter realised the power of this algebraic

scheme, but the subject only began to be appreciated more widely after the publication of Chevalley's book, 'The Algebraic Theory of Spinors' in 1954, and of Marcel Riesz' Maryland Lectures in 1959. Some of the contributors to this volume, Georges Deschamps, Erik Folke Bolinder, Albert Crumeyrolle and David Hestenes were working in this field around that time, and in their turn have persuaded others of the importance of the subject.

Clifford Algebras and Spinors The Algebraic Theory of Spinors and Clifford Algebras
A definitive self-contained account of the subject. Of appeal to a wide audience in mathematics and physics.

Clifford Algebras and Their Applications in Mathematical Physics Springer
In this book, Professor Lounesto offers a unique introduction to Clifford algebras and spinors. The initial chapters could be read by undergraduates; vectors, complex numbers and quaternions are introduced with an eye on Clifford algebras. The next chapters will also interest physicists, and include treatments of the quantum mechanics of the electron, electromagnetism and special

relativity with a flavour of Clifford algebras. This book also gives the first comprehensive survey of recent research on Clifford algebras. A new classification of spinors is introduced, based on bilinear covariants of physical observables. This reveals a new class of spinors, residing between the Weyl, Majorana and Dirac spinors. Scalar products of spinors are classified by involutory anti-automorphisms of Clifford algebras. This leads to the chessboard of automorphism groups of scalar products of spinors. On the analytic side, Brauer-Wall groups and Witt rings are discussed, and Caucy's integral formula is generalized to higher dimensions. Springer Science & Business Media
The purpose of this paper is to establish the spinor genus theory of quadratic forms over global function fields in characteristic 2. The first part of the paper computes the integral spinor norms and relative spinor norms. The second part of the paper gives a complete answer to the integral representations of one quadratic form by another with more than four variables over a global function field in characteristic

2. The Algebraic Theory of Spinors
Cambridge University Press
This volume describes the substantial developments in Clifford analysis which have taken place during the last decade and, in particular, the role of the spin group in the study of null solutions of real and complexified Dirac and Laplace operators. The book has six main chapters. The first two (Chapters 0 and I) present classical results on real and complex Clifford algebras and show how lower-dimensional real Clifford algebras are well-suited for describing basic geometric notions in Euclidean space. Chapters II and III illustrate how Clifford analysis extends and refines the computational tools available in complex analysis in the plane or harmonic analysis in space. In Chapter IV the concept of monogenic differential forms is generalized to the case of spin-manifolds. Chapter V deals with analysis on homogeneous spaces, and shows how Clifford analysis may be connected with the Penrose transform. The volume concludes with some Appendices which present basic results relating to the algebraic and analytic structures

discussed. These are made accessible for computational purposes by means of computer algebra programmes written in REDUCE and are contained on an accompanying floppy disk.

Spinors and Space-Time: Volume 1, Two-Spinor Calculus and Relativistic Fields

Cambridge University Press

This book contains a systematic exposition of the theory of spinors in finite-dimensional Euclidean and Riemannian spaces. The applications of spinors in field theory and relativistic mechanics of continuous media are considered. The main mathematical part is connected with the study of invariant algebraic and geometric relations between spinors and tensors. The theory of spinors and the methods of the tensor representation of spinors and spinor equations are thoroughly expounded in four-dimensional and three-dimensional spaces. Very useful and important relations are derived that express the derivatives of the spinor fields in terms of the derivatives of various tensor fields. The problems associated with an invariant description of spinors as objects that do not depend on the choice of a coordinate system are

addressed in detail. As an application, the author considers an invariant tensor formulation of certain classes of differential spinor equations containing, in particular, the most important spinor equations of field theory and quantum mechanics. Exact solutions of the Einstein–Dirac equations, nonlinear Heisenberg's spinor equations, and equations for relativistic spin fluids are given. The book presents a large body of factual material and is suited for use as a handbook. It is intended for specialists in theoretical physics, as well as for students and post-graduate students of physical and mathematical specialties.

An Introduction to Clifford Algebras and Spinors

American Mathematical Soc.

This book contains a systematic exposition of the theory of spinors in finite-dimensional Euclidean and Riemannian spaces. The applications of spinors in field theory and relativistic mechanics of continuous media are considered. The main mathematical part is connected with the study of invariant algebraic and geometric relations between spinors and tensors. The theory of spinors and the methods of the tensor representation

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Spinors, Twistors, Clifford Algebras and Quantum Deformations

Springer Nature

This book presents a

broad overview of the theory and applications of structure topology and symplectic geometry. Over six chapters, the authors cover topics such as linear operators, Omega and Clifford algebra, and quasiconforma l reflection across polygonal lines. The book also includes four interesting case studies on time series analysis in practice. Finally, it provides a snapshot of some current trends and future challenges in the research of symplectic geometry theory. Structure Topology and Symplectic Geometry is a resource for scholars, researchers, and teachers in the field of mathematics, as well as researchers and students in engineering. *Spinor Construction of Vertex Operator Algebras, Triality, and E8(1)* Springer Science & Business Media - Combines material from many areas of mathematics, including algebra, geometry, and analysis, so students see connections between these areas - Applies material to physics so students appreciate the applications of abstract mathematics - Assumes only linear algebra and calculus, making an advanced subject accessible to undergraduat es - Includes 142 exercises, many with hints or

complete solutions, so text may be used in the classroom or for self study

The Many Faces of Maxwell, Dirac and Einstein Equations

Springer Science & Business Media

Describes orthgonal and related Lie groups, using real or complex parameters and indefinite metrics. Develops theory of spinors by giving a purely geometric definition of these mathematical entities.