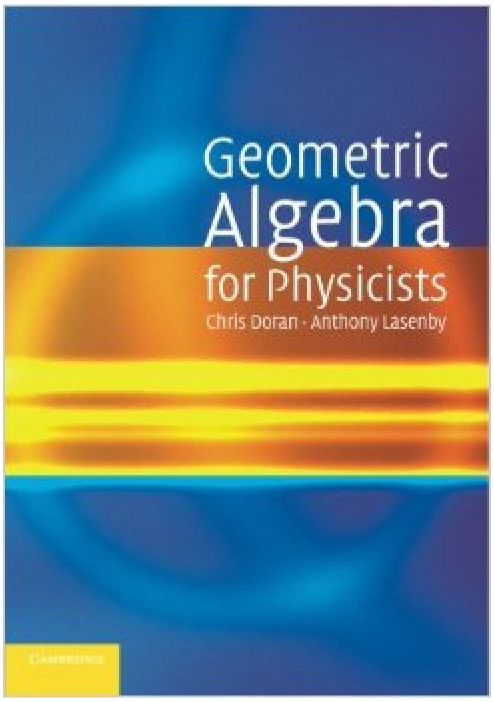
Geometric Algebra For Physicists



Synopsis

This book is a complete guide to the current state of geometric algebra with early chapters providing a self-contained introduction. Topics range from new techniques for handling rotations in arbitrary dimensions, the links between rotations, bivectors, the structure of the Lie groups, non-Euclidean geometry, quantum entanglement, and gauge theories. Applications such as black holes and cosmic strings are also explored.

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Customer Reviews

This is truly a great book for any one who is interested in not just physics, but physical reality. Although the ideas expressed therein have a long history and are by no means as uniquely those of its authors as were Albert Einstein’s in his day, I believe that they will have comparable lasting value. Moreover the synthesis presented in this book, which builds pre-eminently on the work of Hestenes, is absolutely superb. Interested readers need not take my word for these claims, but are invited to prove it to themselves.Although the above should be a sufficient review, my experience nevertheless indicates that it is a good idea to warn potentially enthusiastic readers against several common semantic misconceptions, lest they jump to conclusions which prevent them from ever taking that vital first step. Thus let it be clearly understood that Geometric Algebra is NOT:(1) A replacement for linear/matrix/tensor algebra (on the contrary, it is a very nice complement to these formalisms).(2) Identical, or even very close, to Emil Artin’s earlier excellent book on bilinear forms with the title "Geometric Algebra".(3) Another name for the enormous field "algebraic geometry" (it is indeed appropriate that the word stemming from "geometry" comes first in "geometric algebra").(4) Just another reformulation of complex / quaternion / octonian analysis; for it connects all these purely algebraic objects, and many generalizations thereof, to Felix Klein's Erlangen Programme and Sophus Lie's theory of continuous groups.(5) The ultimate theory of everything (although it probably will eventually be found to have something to do with it).

I'm reading this book somewhat in parallel with Hestenes' New Foundations for Classical Mechanics. Both are fantastic books (Hestenes' predates this one), and in some parts they are complementary, while of course they overlap in the foundations and many special topics. What is so fascinating about Geometric Algebra and Calculus? I think it's mainly the recognition that many seemingly complicated theorems of mathematical physics really become much clearer - in a sense of getting a guts feeling about the geometry. The method opens a way to look at the same thing from totally different angles: If one can't imagine something based on geometric arguments, one can take the presented formalism and translate it back into geometry, and suddenly things become clear.Is the book (or that by Hestenes) basic and easy to understand or are they difficult? Certainly they require some work by the reader. To follow the entire book, one really can't do without learning to master the formalism of geometric algebra, which is simple, yet sometimes bizarre. I suspect though that it is only bizarre to the one who "knows it all" already: The student or scientist who has grown familiar with vector spaces, matrix notation and wiggling around with tensor notation, needs to go through the same exercises as the bloody beginner to whom even the idea of a vector may not be clear. In fact, the beginner could be at a real advantage to not being poisoned by vector calculus. For example, take the very basic notation for a geometric product of two multi-vectors: ab = a.b + a^b (the sum of inner and outer product). What's so confusing about it? Nothing, really, after one really understands what "+" here means.

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