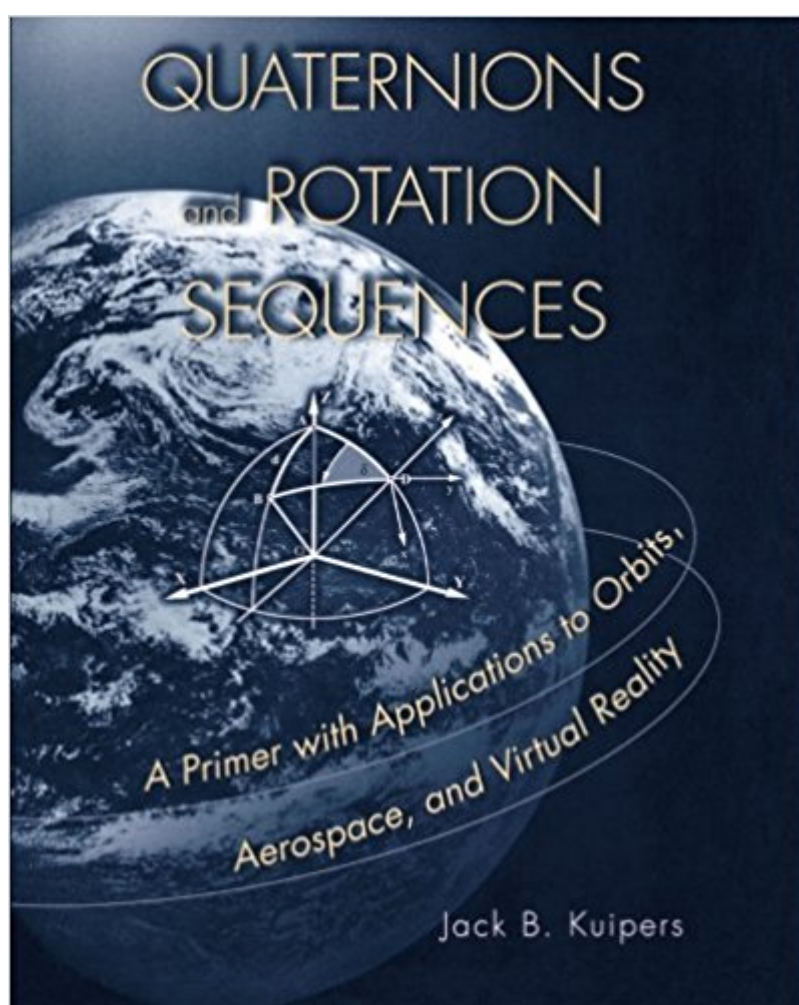The book was found

Quaternions And Rotation Sequences: A Primer With Applications To Orbits, Aerospace And Virtual Reality

Synopsis

Ever since the Irish mathematician William Rowan Hamilton introduced quaternions in the nineteenth century--a feat he celebrated by carving the founding equations into a stone bridge--mathematicians and engineers have been fascinated by these mathematical objects. Today, they are used in applications as various as describing the geometry of spacetime, guiding the Space Shuttle, and developing computer applications in virtual reality. In this book, J. B. Kuipers introduces quaternions for scientists and engineers who have not encountered them before and shows how they can be used in a variety of practical situations. The book is primarily an exposition of the quaternion, a 4-tuple, and its primary application in a rotation operator. But Kuipers also presents the more conventional and familiar 3 x 3 (9-element) matrix rotation operator. These parallel presentations allow the reader to judge which approaches are preferable for specific applications. The volume is divided into three main parts. The opening chapters present introductory material and establish the book's terminology and notation. The next part presents the mathematical properties of quaternions, including quaternion algebra and geometry. It includes more advanced special topics in spherical trigonometry, along with an introduction to quaternion calculus and perturbation theory, required in many situations involving dynamics and kinematics. In the final section, Kuipers discusses state-of-the-art applications. He presents a six degree-of-freedom electromagnetic position and orientation transducer and concludes by discussing the computer graphics necessary for the development of applications in virtual reality.

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Customer Reviews

"This book will appeal to anyone with an interest in three-dimensional geometry. It is a competent and comprehensive survey. . . . This book is unique in that it is probably the only modern book to treat quaternions seriously. . . . A valuable asset."--Aeronautical Journal"[A] splendid book . . . everything one could wish for in a primer. It is also beautifully set out with an attractive layout, clear diagrams, and wide margins with explanatory notes where appropriate. It must be strongly recommended to all students of physics, engineering or computer science."--Peter Rowlands, Contemporary Physics

"The text is written in a clear and readable style well suited for students wishing to master fundamental quaternion concepts."--Mark C. Allman, Senior Engineer, The Boeing Company"This is the most complete discussion of quaternions and their applications that I have seen."--Alan C. Tribble, author of A Tribble's Guide to Space

Latitude and longitude look simple enough, at first - just put your finger in the globe, and see which horizontal line crosses which vertical. When you start doing arithmetic, though, things get weird. Measuring longitude in degrees, 179+2=-179. In degrees latitude, 89+2=89, but the longitude changes! And, when you try to figure longitude precisely at the north pole, you run into a singularity. Believe me, you don't want to be in a plane when its navigation programs run into singularities.Those bits of strangeness all vanish when quaternions represent angles. Quaternions are a bit like complex numbers, but with three different complex parts instead of one. They have very nice mathematical properties, even better than rotation matrices, and a compact form.Kuipers gives a clear, thorough introduction to quaternions and their uses in geometric computations. Everything is explained one step at a time, giving the reader plenty of chance to back off and try again when the discussion gets thick. The buildup is very methodical, just about every derivation is carried out in steps that are easy to follow, using legible, standard notation. Kuipers uses side bars to remind the reader about the basics under more complex discussions, keeping an awareness of where a beginner might go off the rails. Since this discusses geometric computations, illustrations are profuse.The book is not for the reader in a hurry. There are lots of gems here, but you really do have to dig through a lot to find them. The illustrations contain all needed information, but it may take some effort to pick them apart. And, like any technical book, this assumes a reader with a certain background. In this case, intuition about 3D objects, trig, and linear algebra are compulsory, but I guess a sufficiently dedicated reader could substitute blind obedience to formulas for linear

algebra. Ch.11-13 assumes calculus through partial differentials and ODEs, but many readers can skip these chapters without loss.This is all the how and why of quaterion representations of 3D rotations. It's gently paced, and makes only moderate assumptions about the reader's background. I've never seen this material presently so clearly, from so many angles, anywhere else. Highly recommended.//wiredweird

The great thing about this book is the author goes through detailed expositions of every topic. So if you "get it" the first time, you can skim ahead to the next topic; if not, you can work through the proofs, step-by-step, to make sure you understand it. There's no "the proof is left as an exercise for the interested reader."Another thing I really like about this book is that you don't need to be a mathematician to understand it (i.e. it's perfect for engineers). If there is reference to a mathematical topic, the author defines the terminology and gives you a concise explanation. He will give you enough to make it relevant to the current subject.For example, you don't need to have a grad-school course in groups and fields to be able to understand how they relate to the specific applications of quaternions covered in the book. That cannot be said about some other books on quaternions I have been reading. About all you need here is some knowledge of vectors, matrices and complex numbers.This book is not only tractable but downright accessible. And it is so well organized that, after reading the first few chapters, you may find the specific application of interest to you and jump straight to it.

I have not read it completely to give a good review, but so far it seems like it's been worth the money. I wish there was a pdf copy. I'm running out of bookshelf space.

am already excited. Someone was actually THINKING when they presented the contents AND when they set this book up at the press. It is almost unheard of to have both things happen for a math book. Lots of diagrams, large print, ample room for notes, doesn't start off at a sophisticated level, and doesn't ramp up too quickly.Thought I already knew how to calculate astronomical trajectories from physics and Calculus classes...until I actually tried to do it. Put the plans on hold, ordered this book to help, and went on to other things. There were a half dozen books in line for my reading over the next few months. A minute rummaging through this book after it arrived and it has gone to the head of the reading list.If the logic is as well thought out as the layout, this should be fun!

This book does an excellent job of presenting to the general reader what can be a rather difficult topic. I used this book extensively while working on my dissertation and found it to be an excellent resource. The book gives straight forward explanations and a method of visualization for what a quaternion actually does. The mathematics behind the rotations that quaternions perform is clearly explained. Real world applications for using quaternions as rotations are presented in a clear and concise manner. If you are trying to find an alternative to Euler angles, this book makes the transition from Euler angles to quaternions as seamless as possible.

If you need to learn about quaternions, do not hesitate in buying this book; you will not find a more intuitive reference on quaternions. At no point does the author jump ahead and leave the reader lost. The author builds up a nice foundation upon which the development of quaternions is presented. I read through the first 150 pages like a novel and only had to stop once or twice to draw out what the author was describing.

After not have been convincing the explanation of many references on rotations formula in terms of quaternion, I finally have found a very convincing explanation of it in this book.It is very comprehensible and convincing. Read this monograph,if you feel with dissatisfaction of derivation on rotation formula. Other parts of this book can also be read readily and you will feel satisfaction at the description.If you want to know the secret of invention of quaternion, you have to read Hamilton's original paper. It is not hard to understand the secret.

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