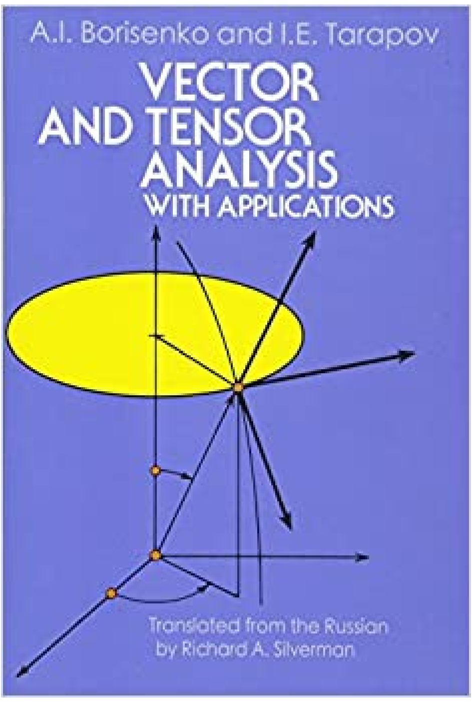
Vector And Tensor Analysis With Applications (Dover Books On Mathematics)



Synopsis

" â | the exposition is clear and the choice of topics is excellentÂ â |" Prof. R. E. Williamson, Univ. of Sussex, Brighton, EnglandThis concise introduction to a basic branch of applied mathematics is indispensable to mathematicians, physicists and engineers. Eminently readable, it covers the elements of vector and tensor analysis, with applications of the theory to specific physics and engineering problems. It lays particular stress on the applications of the theory to fluid dynamics.The authors begin with a definition of vectors and a discussion of algebraic operations on vectors.Â The vector concept is then generalized in a natural way, leading to the concept of a tensor. Chapter Three considers algebraic operations on tensors. Next,Â the authorsÂ turn to a systematic study of the differential and integral calculus of vector and tensor functions of spaceÂ and time. Finally, vector and tensor analysis is considered from both a rudimentary standpoint, and in its fuller ramifications, concluding theÂ volume.The strength of the bookÂ lies in the completely worked out problems and solutions at the end of each chapter. In addition, each chapter incorporates abundant exercise material. Intended primarily for advanced undergraduates and graduate students of math, physics and engineering, the work is self-contained and accessible to any student with a good background in calculus.Vector and Tensor Analysis With Applications is one of a series of SELECTED RUSSIAN PUBLICATIONS IN THE MATHEMATICAL SCIENCES,Â several of which have already been published by Dover. The authors are distinguished Russian mathematicians and specialists in gas dynamics and numerical analysis. Richard A. Silverman, editor of the series as well as editor and translator of thisÂ volume, has revised and improved the original edition and added a bibliography." â | a concise, clear and comprehensive treatmentÂ â |Â " Prof. Henry G. Booker, University of California, San Diego

Book Information

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Customer Reviews

It is a good book I like the first two chapters, its is very useful two understand the basics idea if tensors.Also applications help a lot to complement the reading.

Great book

I was first exposed to tensors in college, and the experience was so unpleasant and bewildering that I switched to quantum mechanics. QM made sense to me; tensors did not.Decades later, I had a real need for tensors in my job, so I had to learn them. I bought and read a half-dozen well-rated books from , but only this book worked. The exposition is mathematically rigorous, but the content is also well-motivated. Their explanation of "The Tensor Concept" is the subject of a dedicated chapter; it alone is worth the price of the book. Its presentation encapsulates the book’s style, so I’ll preview it here.A standard, one-dimensional vector is a ray in space, with direction and length independent of the coordinate system. As the coordinate system changes (e.g. rotate and/or stretch the axes), the coordinate values change, but the vector is the same. (Indeed, that’s how you figure out the new coordinate values!)The most simple example of mapping one vector into another is multiplication by a two dimensional matrix. Here is the golden insight: if the input and output vectors are coordinate independent, then there must be some kind of coordinate-independent function that defines the mapping, and it is called a tensor. In short, a mixed rank-2 tensor is the coordinate independent version of a matrix.They work through the transformation rules of a standard vector to establish notation, then work through the exact corresponding process to get the transformation rules for the matrix. Instead of just asserting that "A Tensor is something which transforms the following way", they start with the intuitive notion and present a simple derivation of the transformation rule. For example, they state up front that the reason why the tensor transforms is that there is a change in basis vectors. Some descriptions never mention what is causing the tensor to ’transform’ -- they just assume you already know. An excellent precept of math education is "Never memorize, always re-derive" (because memorizing what you don’t understand may get you through the next test, but it deprives one of the foundation necessary to get through the test after next). The presentation in this book follows that precept beautifully (e.g. starting at transformation of bases and deriving the transformation laws). The Soviets were famous for their mathematical education, and this book reflects the excellence of that educational approach.Similarly, the dot product of two vectors defines a scalar. If the scalar is coordinate independent, then there must be a coordinate independent function from vectors to numbers. It is a different kind of rank-1 tensor. When they do the same basic derivation, the distinction between covariant and contravariant indicies becomes crystal clear. If the components of the vector are a "contravariant" tensor, then this "different kind" is a "covariant" tensor. They also explain the relationship between reciprocal basis systems, and illustrate in clear pictures why whatever is "covariant" in one system is "contravariant" in the other, and vice versa. So they finally made clear what was so confusing about "covariant" and "contravariant": there is no fundamental distinction, and it just depends on which arbitrary choice of coordinate system one makes.That’s the first 100 pages. The next 150 present the "applications" portion. Once the basic concept is clear, the rest is fairly straightforward algebra. Again, it is quite well presented, but the main value to me was the conceptual foundation.

This book is a translation from the Russian of a regarded text written in the 1960’s. Taking this into account you cannot expect to find a state-of-the-art exposition of the subject. However, the book is written in a very concise and focused style, making it endurable. Its clear introduction to many delicate topics (covariant derivatives, metric tensors, geodesics, etc.) is still valuable even now when the differential form approach seems to have won the battle. Also, the sections it devotes to integral theorems look more in touch with current trends in mathematics than most of the classical texts at this level.

I have a solid foundation in vector analysis, but never felt comfortable with tensors and generalized coordinates, yet these are necessary for much of modern physics. This book was an ideal fit for my background. It presented a clear and steady development of both tensor and vector concepts with illustrations and examples. Covariant and contravariant components, metrics, and generalized coordinates were developed alongside of orthogonal basis concepts. Then, after the first half of the book developed the tools, the second half of the book presented analysis covering such topics as Stokes and Gauss’ theorem, finishing with the fundamental theorem of vector analysis. My only complaint is that the book ended where it did. A section on more advanced tensor concepts would have fit in nicely.

I must agree with the other reviewer, this is a excellent book if you want to have clear ideas about the most basic tensor concepts.In other books of tensors, you start to see transformations of coordinates with any sense, you can't understand anything and after closing the book you forget everything, that kind of books treat tensor analysis like if it would be an alphabet soup .This is not the case, if goes slowly and explaining not only the how (that is in all the books) but the WHY.I love this book, finally it helped me a lot to undertand so many things.Five stars.

All of the basic concepts of introductory Tensor Analysis were adequately dealt with in a relatively clear and concise way; however, the numerous errors, oversimplifications, and oversights was a constant source of annoyance and doubt.

While using this to study vector and tensor calculus, I worked through the concepts being presented and also found a number of errors. Wasn't sure if that was a good thing (that I was understanding the material and was able, therefore, to find the errors) or a bad thing (that they were there in the first place). I give it a ranking of 3 because it presents the concepts well (well enough for the student to find the mistakes). But, it should not be the only text a student uses.