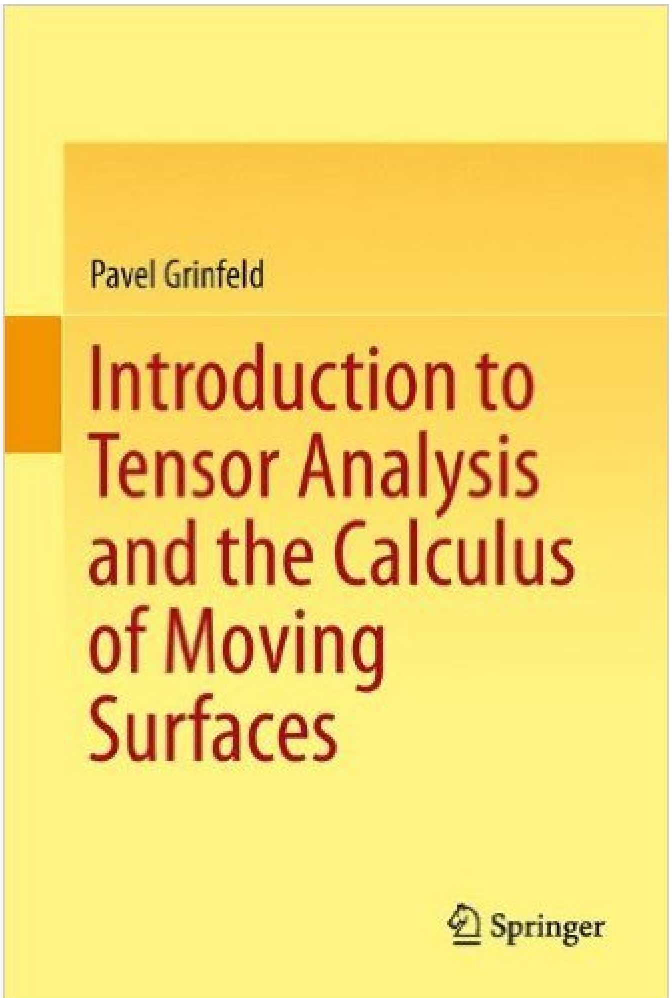
Introduction To Tensor Analysis And The Calculus Of Moving Surfaces



Synopsis

This textbook is distinguished from other texts on the subject by the depth of the presentation and the discussion of the calculus of moving surfaces, which is an extension of tensor calculus to deforming manifolds.Â Designed for advanced undergraduate and graduate students, this text invites its audience to take a fresh look at previously learned material through the prism of tensor calculus. Once the framework is mastered, the student is introduced to new material which includes differential geometry on manifolds, shape optimization, boundary perturbation and dynamic fluid film equations. Â The language of tensors, originally championed by Einstein, is as fundamental as the languages of calculus and linear algebra and is one that every technical scientist ought to speak. The tensor technique, invented at the turn of the 20th century, is now considered classical. Yet, as the author shows, it remains remarkably vital and relevant. The authorâ ™s skilled lecturing capabilities are evident by the inclusion of insightful examples and a plethora of exercises. A great deal of material is devoted to the geometric fundamentals, the mechanics of change of variables, the proper use of the tensor notation and the discussion of the interplay between algebra and geometry. The early chapters have many words and few equations. The definition of a tensor comes only in Chapter 6 â " when the reader is ready for it. While this text maintains a consistent level of rigor, it takes great care to avoid formalizing the subject.Â The last part of the textbook is devoted to the Calculus of Moving Surfaces. It is the first textbook exposition of this important technique and is one of the gems of this text. A number of exciting applications of the calculus are presented including shape optimization, boundary perturbation of boundary value problems and dynamic fluid film equations developed by the author in recent years. Furthermore, the moving surfaces framework is used to offer new derivations of classical results such as the geodesic equation and the celebrated Gauss-Bonnet theorem.

Book Information

Hardcover: 302 pages

Publisher: Springer; 2013 edition (September 24, 2013)

Language: English

ISBN-10: 1461478669

ISBN-13: 978-1461478669

Product Dimensions: 6.4 x 1 x 9.1 inches

Shipping Weight: 1.2 pounds (View shipping rates and policies)

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Customer Reviews

This review applies to the Hardcover edition.I definitely wish this book was available when I was doing my PhD in physics. Having used tensor notation in grad. school in various courses I was still hopelessly confused. There are number of Tensor Analysis books available (some of which, unfortunately, I have purchased) but they all, roughly, fall into one of these categories:1. Too mathy, i.e., even if you can follow the proof of some theorem you still have no idea what was just proven and why you should care. These books typically also have something related to Differential Geometry in the title.2. Very applied books, e.g., books on General Relativity will typically devote a good portion of the book to tensor analysis. Needless to say, they view Tensor Analysis as a tool and thus, don't painstakingly explain it.I tried learning tensor analysis from the above two categories but, for the most part, failed, i.e., learned the rules of moving indices around but had no real idea as to what I was actually doing. This brings me to Pavel Grinfeld's "Introduction to Tensor Analysis and the Calculus of Moving Surfaces" book, which is simply the best. Currently, I'm working through Chapter 11 and almost everything has been crystal clear to me thus far. I did have to work through the exercises, which are strategically placed throughout the text. The book is fairly rigorous and may be understood with minimal background (Calculus and some Linear Algebra).Here is what I like the best about the book:1. Clear explanation of the notation and why this or that notation works so well.2. NO awful phrases like "as one can clearly see" or "as it can be shown."3.

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