

Introduction To Tensor Calculus For General Relativity

The second edition of this highly praised textbook provides an introduction to tensors, group theory, and their applications in classical and quantum physics. Both intuitive and rigorous, it aims to demystify tensors by giving the slightly more abstract but conceptually much clearer definition found in the math literature, and then connects this formulation to the component formalism of physics calculations. New pedagogical features, such as new illustrations, tables, and boxed sections, as well as additional “ invitation ” sections that provide accessible introductions to new material, offer increased visual engagement, clarity, and motivation for students. Part I begins with linear algebraic foundations, follows with the modern component-free definition of tensors, and concludes with applications to physics through the use of tensor products. Part II introduces group theory, including abstract groups and Lie groups and their associated Lie algebras, then intertwines this material with that of Part I by introducing representation theory. Examples and exercises are provided in each chapter for good practice in applying the presented material and techniques. Prerequisites for this text include the standard lower-division mathematics and physics courses, though extensive references are provided for the motivated student who has not yet had these. Advanced undergraduate and beginning graduate students in physics and applied mathematics will find this textbook to be a clear, concise, and engaging introduction to tensors and groups. Reviews of the First Edition “ [P]hysicist Nadir Jeevanjee has produced a masterly book that will help other physicists understand those subjects [tensors and groups] as mathematicians understand them... From the first pages, Jeevanjee shows amazing skill in finding fresh, compelling words to bring forward the insight that animates the modern mathematical view...[W]ith compelling force and clarity, he provides many carefully worked-out examples and well-chosen specific problems... Jeevanjee ’ s clear and forceful writing presents familiar cases with a freshness that will draw in and reassure even a fearful student. [This] is a masterpiece of exposition and explanation that would win credit for even a seasoned author. ” —Physics Today "Jeevanjee ’ s [text] is a valuable piece of work on several counts, including its express pedagogical service rendered to fledgling physicists and the fact that it does indeed give pure mathematicians a way to come to terms with what physicists are saying with the same words we use, but with an ostensibly different meaning. The book is very easy to read, very user-friendly, full of examples...and exercises, and will do the job the author wants it to do with style. ” —MAA Reviews In this text which gradually develops the tools for formulating and manipulating the field equations of Continuum Mechanics, the mathematics of tensor analysis is introduced in four, well-separated stages, and the physical interpretation and application of vectors and tensors are stressed throughout. This new edition contains more exercises. In addition, the author has appended a section on Differential Geometry.

Concise, readable text ranges from definition of vectors and discussion of algebraic operations on vectors to the concept of tensor and algebraic operations on tensors. Worked-out problems and solutions. 1968 edition.

An Introduction to Tensor Analysis and Its Geometrical Applications

Schaums Outline of Tensor Calculus

DUAL BASES, OR AN INTRODUCTION TO TENSOR ANALYSIS

Introduction to Differential Geometry

Tensor Calculus and Applications

Second edition of a widely-used textbook providing the first step into general relativity for undergraduate students with minimal mathematical background.

Special numerical techniques are already needed to deal with $n \times n$ matrices for large n . Tensor data are of size $n \times n \times \dots \times n = nd$, where nd exceeds the computer memory by far. They appear for problems of high spatial dimensions. Since standard methods fail, a particular tensor calculus is needed to treat such problems. This monograph describes the methods by which tensors can be practically treated and shows how numerical operations can be performed. Applications include problems from quantum chemistry, approximation of multivariate functions, solution of partial differential equations, for example with stochastic coefficients, and more. In addition to containing corrections of the unavoidable misprints, this revised second edition includes new parts ranging from single additional statements to new subchapters. The book is mainly addressed to numerical mathematicians and researchers working with high-dimensional data. It also touches problems related to Geometric Algebra.

DIVTensor theory, applications to dynamics, electricity, elasticity, hydrodynamics, etc. Level is advanced undergraduate. Over 500 solved problems. /div

Tensor Algebra and Tensor Analysis for Engineers

Introduction to Vector and Tensor Analysis

An Introduction to Tensors and Group Theory for Physicists

Introduction to Tensor Analysis

Linear and Multilinear Algebra

Book 3 in the Princeton Mathematical Series. Originally published in 1950. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

This book is based on my previous book: Tensor Calculus Made Simple, where the development of tensor calculus concepts and techniques are continued at a higher level. Unlike the previous book which is largely based on a Cartesian approach, the formulation in the present book is based on a general coordinate system. The book is furnished with an index as well as detailed sets of exercises to provide useful revision and practice. To facilitate linking related concepts and sections, cross referencing is used extensively throughout the book. The book also contains a number of graphic illustrations to help the readers to visualize the ideas and understand the subtle concepts. The book can be used as a text for an introductory or an intermediate level course on tensor calculus.

DIVProceeds from general to special, including chapters on vector analysis on manifolds and integration theory. /div

A Brief on Tensor Analysis

Introduction to Tensor-Calculus

An introduction to tensor calculus

ENGLISH VERSION II, revised and expanded

An Introduction to Tensor Calculus and Relativity Tensor Calculus and Relativity

To Volume 1 This work represents our effort to present the basic concepts of vector and tensor analysis. Volume 1 begins with a brief discussion of algebraic structures followed by a rather detailed discussion of the algebra of vectors and tensors. Volume 2 begins with a discussion of Euclidean manifolds, which leads to a development of the analytical and geometrical aspects of vector and tensor fields. We have not included a discussion of general differentiable manifolds. However, we have included a chapter on vector and tensor fields defined on hypersurfaces in a Euclidean manifold. In preparing this two-volume work, our intention was to present to engineering and science students a modern introduction to vectors and tensors. Traditional courses on applied mathematics have emphasized problem-solving techniques rather than the systematic development of concepts. As a result, it is possible for such courses to become terminal mathematics courses rather than courses which equip the student to develop his or her understanding further.

Fundamental introduction of absolute differential calculus and for those interested in applications of tensor calculus to mathematical physics and engineering. Topics include spaces and tensors; basic operations in Riemannian space, curvature of space, more.

The aim of this book is to make the subject easier to understand. This book provides clear concepts, tools, and techniques to master the subject –tensor, and can be used in many fields of research. Special applications are discussed in the book, to remove any confusion, and for absolute understanding of the subject. In most books, they emphasize only the theoretical development, but not the methods of presentation, to develop concepts. Without knowing how to change the dummy indices, or the real indices, the concept cannot be understood. This book takes it down a notch and simplifies the topic for easy comprehension. Features Provides a clear indication and understanding of the subject on how to change indices Describes the original evolution of symbols necessary for tensors Offers a pictorial representation of referential systems required for different kinds of tensors for physical problems Presents the correlation between critical concepts Covers general operations and concepts

An Introduction to Tensor Calculus and Relativity

Tensor Spaces and Numerical Tensor Calculus

Tensor Calculus With Applications

Tensor Calculus and Analytical Dynamics

Ricci-Calculus

This textbook provides a rigorous approach to tensor manifolds in several aspects relevant for Engineers and Physicists working in industry or academia. With a thorough, comprehensive, and unified presentation, this book offers insights into several topics of tensor analysis, which covers all aspects of n-dimensional spaces. The main purpose of this book is to give a self-contained yet simple, correct and comprehensive mathematical explanation of tensor calculus for undergraduate and graduate students and for professionals. In addition to many worked problems, this book features a selection of examples, solved step by step. Although no emphasis is placed on special and particular problems of Engineering or Physics, the text covers the fundamentals of these fields of science. The book makes a brief introduction into the basic concept of the tensorial formalism so as to allow the reader to make a quick and easy review of the essential topics that enable having the grounds for the subsequent themes, without needing to resort to other bibliographical sources on tensors. Chapter 1 deals with Fundamental Concepts about tensors and chapter 2 is devoted to the study of covariant, absolute and contravariant derivatives. The chapters 3 and 4 are dedicated to the Integral Theorems and Differential Operators, respectively. Chapter 5 deals with Riemann Spaces, and finally the chapter 6 presents a concise study of the Parallelism of Vectors. It also shows how to solve various problems of several particular manifolds.

Examines general Cartesian coordinates, the cross product, Einstein's special theory of relativity, bases in general coordinate systems, maxima and minima of functions of two variables, line integrals, integral theorems, and more. 1963 edition.

Tensor Calculus and Analytical Dynamics provides a concise, comprehensive, and readable introduction to classical tensor calculus - in both holonomic and nonholonomic coordinates - as well as to its principal applications to the Lagrangean dynamics of discrete systems under positional or velocity constraints. The thrust of the book focuses on formal structure and basic geometrical/physical ideas underlying most general equations of motion of mechanical systems under linear velocity constraints.

Written for the theoretically minded engineer, Tensor Calculus and Analytical Dynamics contains uniquely accessbile treatments of such intricate topics as: tensor calculus in nonholonomic variables Pfaffian nonholonomic constraints related integrability theory of Frobenius The book enables readers to move quickly and confidently in any particular geometry-based area of theoretical or applied mechanics in either classical or modern form.

Tensor Calculus for Physics

An Introduction to Tensor Calculus

Relativity and Cosmology

Tensor Calculus

Introduction to Tensor Analysis and the Calculus of Moving Surfaces

This elementary introduction pays special attention to aspects of tensor calculus and relativity that students tend to find most difficult. Its use of relatively unsophisticated mathematics in the early chapters allows readers to develop their confidence within the framework of Cartesian coordinates before undertaking the theory of tensors in curved spaces and its application to general relativity theory. Topics include the special principle of relativity and Lorentz transformations; orthogonal transformations and Cartesian tensors; special relativity mechanics and electrodynamics; general tensor calculus and Riemannian space; and the general theory of relativity, including a focus on black holes and gravitational waves. The text concludes with a chapter offering a sound background in applying the principles of general relativity to cosmology. Numerous exercises advance the theoretical developments of the main text, thus enhancing this volume’s appeal to students of applied mathematics and physics at both undergraduate and postgraduate levels. Preface. List of Constants. References. Bibliography.

Tensor Analysis and Nonlinear Tensor Functions embraces the basic fields of tensor calculus: tensor algebra, tensor analysis, tensor description of curves and surfaces, tensor integral calculus, the basis of tensor calculus in Riemannian spaces and affinely connected spaces, - which are used in mechanics and electrodynamics of continua, crystallophysics, quantum chemistry etc. The book suggests a new approach to definition of a tensor in space R3, which allows us to show a geometric representation of a tensor and operations on tensors. Based on this approach, the author gives a mathematically rigorous definition of a tensor as an individual object in arbitrary linear, Riemannian and other spaces for the first time. It is the first book to present a systematized theory of tensor invariants, a theory of nonlinear anisotropic tensor functions and a theory of indifferent tensors describing the physical properties of continua. The book will be useful for students and postgraduates of mathematical, mechanical engineering and physical departments of universities and also for investigators and academic scientists working in continuum mechanics, solid physics, general relativity, crystallophysics, quantum chemistry of solids and material science.

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. 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. 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 author’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 - 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. 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.

An Introduction to Linear Algebra and Tensors

Principles of

Tensor Calculus for Engineers and Physicists

The Very Basics of Tensors

Tensor Calculus and Riemannian Geometry

This book is an introduction to tensor calculus and continuum mechanics. i.e. applied mathematics developing basic equations in engineering, physics and science.

Eminently readable, completely elementary treatment begins with linear spaces and ends with analytic geometry, covering multilinear forms, tensors, linear transformation, and more. 250 problems, most with hints and answers. 1972 edition.

Tensor calculus is a generalization of vector calculus, and comes near of being a universal language in physics. Physical laws must be independent of any particular coordinate system used in describing them. This requirement leads to tensor calculus. The only prerequisites for reading this book are a familiarity with calculus (including vector calculus) and linear algebra, and some knowledge of differential equations.

Introduction to Tensor Calculus and Continuum Mechanics

A First Course in General Relativity

Tensor Analysis on Manifolds

An Introduction to Riemannian Geometry and the Tensor Calculus

Introduction to Vectors and Tensors

This is an entirely new book. The first edition appeared in 1923 and at that time it was up to date. But in 193 5 and 1938 the author and Prof. D. J. STRUIK published a new book, their Einführung I and li, and this book not only gave the first systematic introduction to the kernel index method but also contained many notions that had come into prominence since 1923. For instance densities, quantities of the second kind, pseudo-quantities, normal Coordinates, the symbolism of exterior forms, the LIÉ derivative, the theory of variation and deformation and the theory of subprojective connexions were included. Now since 1938 there have been many new developments and so a book on RICCI calculus and its applications has to cover quite different ground from the book of 1923. Though the purpose remains to make the reader acquainted with RICCI's famous instrument in its modern form, the book must have quite a different methodical structure and quite different applica tions have to be chosen. The first chapter contains algebraical preliminaries but the whole text is modernized and there is a section on hybrid quantities (quantities with indices of the first and of the second kind) and one on the many abridged notations that have been developed by several authors. In the second chapter the most important analytical notions that come before the introduction of a connexion are dealt with in full.

This work covers all the basic topics of tensor analysis in a lucid and clear language and is aimed at both the undergraduate and postgraduate in Civil, Mechanical and Aerospace Engineering and in Engineering Physics.

It is an ideal companion for courses such as mathematical methods of physics, classical mechanics, electricity and magnetism, and relativity.

Tensor Analysis and Nonlinear Tensor Functions

A Concise Guide

With Applications to Continuum Mechanics

Simplified Tools and Techniques

Vector and Tensor Analysis with Applications

The ideal review for your tensor calculus course More than 40 million students have trusted Schaum’s Outlines for their expert knowledge and helpful solved problems. Written by renowned experts in their respective fields, Schaum’s Outlines cover everything from math to science, nursing to language. The main feature for all these books is the solved problems. Step-by-step, authors walk readers through coming up with solutions to exercises in their topic of choice. 300 solved problems Coverage of all course fundamentals Effective problem-solving techniques

Complements or supplements the major logic textbooks Supports all the major textbooks for tensor calculus courses

There is a large gap between engineering courses in tensor algebra on one hand, and the treatment of linear transformations within classical linear algebra on the other. This book addresses primarily engineering students with some initial knowledge of matrix algebra. Thereby, mathematical formalism is applied as far as it is absolutely necessary. Numerous exercises provided in the book are accompanied by solutions enabling autonomous study. The last chapters deal with modern developments in the theory of isotropic and anisotropic tensor functions and their applications to continuum mechanics and might therefore be of high interest for PhD-students and scientists working in this area.

This textbook presents the foundations of tensor calculus and the elements of tensor analysis. In addition, the authors consider numerous applications of tensors to geometry, mechanics and physics. While developing tensor calculus, the authors emphasize its relationship with linear algebra. Necessary notions and theorems of linear algebra are introduced and proved in connection with the construction of the apparatus of tensor calculus; prior knowledge is not assumed. For simplicity and to enable the reader to visualize concepts more clearly, all exposition is conducted in three-dimensional space. The principal feature of the book is that the authors use mainly orthogonal tensors, since such tensors are important in applications to physics and engineering. With regard to applications, the authors construct the general theory of second-degree surfaces, study the inertia tensor as well as the stress and strain tensors, and consider some problems of crystallophysics. The last chapter introduces the elements of tensor analysis. All notions introduced in the book, and also the obtained results, are illustrated with numerous examples discussed in the text. Each section of the book presents problems (a total over 300 problems are given). Examples and problems are intended to illustrate, reinforce and deepen the presented material. There are answers to most of the problems, as well as hints and solutions to selected problems at the end of the book.

Applications of Tensor Analysis