The Mathematics Of Minkowski Space Time With An Introduction To Commutative Hypercomplex Numbers Frontiers In Mathematics

The Special Theory of Relativity
Gauge Field Theory in Natural Geometric Language
Geometry of Minkowski Space-Time
A revisitation of mathematical notions of quantum physics
Energy and Geometry
Geometric Methods in Physics XXXVI
The Geometry of Minkowski Spacetime
Space-Time Algebra
An Introduction to Special and General Relativity
Introduction to Lorentz Geometry

The Einstein-Klein-Gordon Coupled System
Spacetime and Geometry
Special Relativity, Tensors, And Energy Tensor: With Worked Problems
Global Stability of the Minkowski Solution: (AMS-213)
The Evolution Problem in General Relativity
Minkowski Geometry
A Critical Analysis
An Introduction to the Mathematics of the Special Theory of Relativity
Space and Time
Extensions of the Stability Theorem of the Minkowski Space in General Relativity
The Spacetime of Special Relativity
General Relativity
The Global Nonlinear Stability of the Minkowski Space (PMS-41)
The Mathematics of Black-Hole Mechanics
Geometry: from Isometries to Special Relativity
The Geometry of Numbers
Philosophy of Physics
An Introduction to Deformed Special Relativity
The Special Theory of Relativity for Mathematics Students
Introduction to Algebraic and Constructive Quantum Field Theory

Deformed Spacetime
Independent Axioms for Minkowski Space-Time
The Geometry of Special Relativity
General Relativity for Mathematicians
GeLoMa 2016, Málaga, Spain, September 20–23
The Mathematics of Minkowski Space-Time
The Geometry of Spacetime
The Einstein Theory of Space-time Without Mathematics
Geometrical Physics in Minkowski Spacetime

TIANA FORD

The Special Theory of Relativity Springer Science & Business Media
Writing a new book on the classic subject of Special Relativity, on which numerous important physicists have contributed and many books have already been written, can be like adding another epicycle to the Ptolemaic cosmology. Furthermore, it is our belief that if a book has no new elements, but simply repeats what is written in the existing literature, perhaps with a different style, then this is not enough to

justify its publication. However, after having spent a number of years, both in class and research with relativity, I have come to the conclusion that there exists a place for a new book. Since it appears that somewhere along the way, mathem-ics may have obscured and prevailed to the degree that we tend to teach relativity (and I believe, theoretical physics) simply using “heavier” mathematics without the inspiration and the mastery of the classic physicists of the last century. Moreover current trends encourage the application of techniques in producing quick results and not tedious conceptual approaches resulting in long-lasting reasoning. On the other hand, physics cannot be done a´ la carte stripped from philosophy, or, to put it in a simple but dramatic context A building is not an accumulation of stones! As a result of the above, a major aim in the writing of this book has been the distinction between the mathematics of Minkowski space and the physics of r-ativity.

Gauge Field Theory in Natural Geometric Language Springer Science & Business Media

This concise book introduces nonphysicists to the core philosophical issues surrounding the nature and structure of space and time, and is also an ideal resource for physicists interested in the conceptual foundations of space-time theory. Tim Maudlin's broad historical overview examines Aristotelian and Newtonian accounts of space and time, and traces how Galileo's conceptions of relativity and space-time led to Einstein's special and general theories of relativity. Maudlin explains special relativity with enough detail to solve concrete physical problems while presenting general relativity in more qualitative terms. Additional topics include the Twins Paradox, the physical aspects of the Lorentz-FitzGerald contraction, the constancy of the speed of light, time travel, the direction of time, and more. Introduces nonphysicists to the philosophical foundations of space-time theory Provides a broad historical overview, from Aristotle to Einstein Explains special relativity geometrically, emphasizing the intrinsic structure of space-time Covers the Twins Paradox, Galilean relativity, time travel, and more Requires only basic algebra and no formal knowledge of physics

Geometry of Minkowski Space-Time
Springer
The primary aim of this monograph is to clarify the undefined primitive concepts and the axioms which form the basis of Einstein's theory of special relativity. Minkowski space-time is developed from a set of independent axioms, stated in terms of a single relation of betweenness. It is shown that all models are isomorphic to the usual coordinate model, and the axioms are consistent relative to the reals.

A revisitation of mathematical notions of quantum physics Princeton University Press
Volume 2 introduces the theory of twistors and two-spinors and shows how it can be applied. Includes a comprehensive treatment of the

conformal approach to space-time infinity with results on general relativistic mass and angular momentum.

Energy and Geometry Princeton University Press

In Minkowski-Space the space-time of special relativity is discussed on the basis of fundamental results of space-time theory. This idea has the consequence that the Minkowski-space can be characterized by 5 axioms, which determine its geometrical and kinematical structure completely. In this sense Minkowski-Space is a prolegomenon for the formulation of other branches of special relativity, like mechanics, electrodynamics, thermodynamics etc. But these applications are not subjects of this book. Contents Basic properties of special relativity Further properties of Lorentz matrices Further properties of Lorentz transformations Decomposition of Lorentz matrices and Lorentz transformations Further structures on Ms Tangent vectors in Ms Orientation Kinematics on Ms Some basic notions of relativistic theories

Geometric Methods in Physics XXXVI CRC Press

One of the problems facing mathematics and physics is that mathematicians and physicists speak languages that the others find hard to understand. These notes take a fundamental part of physics, the special theory of relativity and describe it in terms that can be understood by mathematics students who have studied the two basic undergraduate topics, linear algebra and multivariable calculus. It gives a full description of the geometry of space-time and the foundations of the theory of electromagnetism in terms they are familiar with. Contents:Space and TimeMinkowski SpacesThe Principle of RelativitySpecial Relativity in the Real WorldNotationsThe Tensor Product of Vector SpacesElectromagnetism 1Dual Spaces and Covariant TensorsThe Theory of Minkowski SpacesElectromagnetism 2 Readership: Mathematicians and undergraduate mathematics students. Keywords:Special Theory;Relativity;Space;Time;Speed of Light;Minkowski Space;Electromagnetism;Maxwell&s EquationsReview: “The exhibition of the theory is very detailed. No deeper background in physics is necessary to understand the contents of this book. From this point of view the book can be recommended to students of mathematics who want to get insight into some basic theories of physics.” Bernd Wegner Mathematics Abstracts, 1992

The Geometry of Minkowski Spacetime

Springer Science & Business Media

This volume contains a collection of research papers and useful surveys by experts in the field which provide a representative picture of the current status of this fascinating area. Based on contributions from the VIII International Meeting on Lorentzian Geometry, held at the University of Málaga, Spain, this volume covers topics such as distinguished (maximal, trapped, null, spacelike, constant mean curvature, umbilical...) submanifolds, causal completion of spacetimes, stationary regions and horizons in spacetimes, solitons in semi-Riemannian manifolds, relation between Lorentzian and Finslerian geometries and the oscillator spacetime. In the last decades Lorentzian geometry has experienced a significant impulse, which has transformed it from just a mathematical tool for general relativity to a consolidated branch of differential geometry, interesting in and of itself. Nowadays, this field provides a framework where many different mathematical techniques arise with applications to multiple parts of mathematics and physics. This book is addressed to differential geometers, mathematical physicists and relativists, and graduate students interested in the field.

Space-Time Algebra Springer
This book provides an original introduction to the geometry of Minkowski space-time. A hundred years after the space-time formulation of special relativity by Hermann Minkowski, it is shown that the kinematical consequences of special relativity are merely a manifestation of space-time geometry. The book is written with the intention of providing students (and teachers) of the first years of University courses with a tool which is easy to be applied and allows the solution of any problem of relativistic kinematics at the same time. The book treats in a rigorous way, but using a non-sophisticated mathematics, the Kinematics of Special

Relativity. As an example, the famous "Twin Paradox" is completely solved for all kinds of motions. The novelty of the presentation in this book consists in the extensive use of hyperbolic numbers, the simplest extension of complex numbers, for a complete formalization of the kinematics in the Minkowski space-time. Moreover, from this formalization the understanding of gravity comes as a manifestation of curvature of space-time, suggesting new research fields.

An Introduction to Special and General Relativity Springer Science & Business Media

This book takes the reader from the preliminary ideas of the Special Theory of Relativity (STR) to the doorsteps of the General Theory of Relativity (GTR).The first part explains the main concepts in a layman's language, including STR, the Lorentz transformation, relativistic mechanics. Thereafter the concept of tensors is built up in detail, especially Maxwell's stress tensor with illustrative examples, culminating in the energy-momentum conservation in electromagnetic fields. Mathematical structure of Minkowski's space-time is constructed and explained graphically. The equation of motion is formulated and then illustrated by the example of relativistic rocket. The principle of covariance is explained with the covariant equations of classical electrodynamics. Finally, the book constructs the energy tensor which constitutes the source term in Einstein's field equation, which clears the passage to the GTR.In the book, the concepts of tensors are developed carefully and a large number of numerical examples taken from atomic and nuclear physics. The graphs of important equations are included. This is suitable for studies in classical electrodynamics, modern physics, and relativity.

Introduction to Lorentz Geometry Cambridge University Press

From the reviews: "This attractive book provides an account of the theory of special relativity from a geometrical viewpoint, explaining the unification and insights that are given by such a treatment. [...] Can be read with profit by all who have taken a first course in relativity physics." ASLIB Book Guide

The Einstein-Klein-Gordon Coupled System Springer

Hermann Minkowski recast special relativity as essentially a new geometric structure for spacetime. This book looks at the ideas of both Einstein and Minkowski, and then introduces the theory of frames, surfaces and intrinsic geometry, developing the main implications of Einstein's general relativity theory.

Spacetime and Geometry Cambridge University Press

The main goal of this work is to revisit the proof of the global stability of Minkowski space by D. Christodoulou and S. Klainerman, [Ch-Kl]. We provide a new self-contained proof of the main part of that result, which concerns the full solution of the radiation problem in vacuum, for arbitrary asymptotically flat initial data sets. This can also be interpreted as a proof of the global stability of the external region of Schwarzschild spacetime. The proof, which is a significant modification of the arguments in [Ch-Kl], is based on a double null foliation of spacetime instead of the mixed null-maximal foliation used in [Ch-Kl]. This approach is more naturally adapted to the radiation features of the Einstein equations and leads to important technical simplifications. In the first chapter we review some basic notions of differential geometry that are sys tematically used in all the remaining chapters. We then introduce the Einstein equations and the initial data sets and discuss some of the basic features of the initial value problem in general relativity. We shall review, without proofs, well-established results concerning local and global existence and uniqueness and formulate our main result. The second chapter provides the technical motivation for the proof of our main theorem.

Special Relativity, Tensors, And Energy Tensor: With Worked Problems Springer Science & Business Media

This textbook offers a geometric perspective on special relativity, bridging Euclidean space, hyperbolic space, and Einstein’s spacetime in one accessible, self-contained volume. Using tools tailored to undergraduates, the author explores Euclidean and non-Euclidean geometries, gradually building from intuitive to abstract spaces. By the end, readers will have encountered a range of topics, from isometries to the Lorentz–Minkowski plane, building an understanding of how geometry can be used to model special relativity. Beginning with intuitive spaces, such as the Euclidean plane and the sphere, a structure theorem for isometries is introduced that serves as a foundation for increasingly sophisticated topics, such as the hyperbolic plane and the Lorentz–Minkowski plane. By gradually introducing tools throughout, the author offers readers an accessible pathway to visualizing increasingly abstract geometric concepts. Numerous exercises are also included with selected solutions provided. Geometry: from Isometries to Special Relativity offers a unique approach to non-Euclidean geometries, culminating in a mathematical model for special relativity. The focus on isometries offers undergraduates an accessible progression from the intuitive to abstract; instructors will appreciate the complete instructor solutions manual available online. A background in elementary calculus is assumed.

Global Stability of the Minkowski Solution: (AMS-213) Springer Nature
This volume provides a detailed discussion of the mathematical aspects and physical applications of a new geometrical structure of space-time, based on a generalization ("deformation") of the usual Minkowski space, as supposed to be endowed with a metric whose coefficients depend on the energy. This new five-dimensional scheme (Deformed Relativity in Five Dimensions, DR5) represents a true generalization of the usual Kaluza-Klein (KK) formalism.

The Evolution Problem in General

Relativity Cambridge University Press The aim of this work is to provide a proof of the nonlinear gravitational stability of the Minkowski space-time. More precisely, the book offers a constructive proof of global, smooth solutions to the Einstein Vacuum Equations, which look, in the large, like the Minkowski space-time. In particular, these solutions are free of black holes and singularities. The work contains a detailed description of the sense in which these solutions are close to the Minkowski space-time, in all directions. It thus provides the mathematical framework in which we can give a rigorous derivation of the laws of gravitation proposed by Bondi. Moreover, it establishes other important conclusions concerning the nonlinear character of gravitational radiation. The authors obtain their solutions as dynamic developments of all initial data sets, which are close, in a precise manner, to the flat initial data set corresponding to the Minkowski space-time. They thus establish the global dynamic stability of the latter. Originally published in 1994. 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.

Minkowski Geometry Springer Science & Business Media

Gauge Field theory in Natural Geometric Language addresses the need to clarify basic mathematical concepts at the crossroad between gravitation and quantum physics. Selected mathematical and theoretical topics are exposed within a brief, integrated approach that exploits standard and non-standard notions, as well as recent advances, in a natural geometric language in which the role of structure groups can be regarded as secondary even in the treatment of the gauge fields themselves. In proposing an original bridge between physics and mathematics, this text will appeal not only to mathematicians who wish to understand some of the basic ideas involved in quantum particle physics, but also to physicists who are not satisfied with the usual mathematical presentations of their field.

A Critical Analysis Courier Corporation

Special Relativity (SR) is essentially grounded on the properties of space-time, i.e. isotropy of space and homogeneity of space and time (as a consequence of the equivalence of inertial frames) and on the Galilei principle of relativity.

An Introduction to the Mathematics of the Special Theory of Relativity Lulu.com

This book arose out of original research on the extension of well-established applications of complex numbers related to Euclidean geometry and to the space-time symmetry of two-dimensional Special Relativity. The system of hyperbolic numbers is extensively studied, and a plain exposition of space-time geometry and trigonometry is given. Commutative hypercomplex systems with four unities are studied and attention is drawn to their interesting properties.

Space and Time Princeton University Press

This is a book about physics, written for mathematicians. The readers we have in mind can be roughly described as those who: I. are mathematics graduate students with some knowledge of global differential geometry 2. have had the equivalent of freshman physics, and find popular accounts of astrophysics and cosmology interesting 3. appreciate mathematical elarity, but are willing to accept physical motiva tions for the mathematics in place of mathematical ones 4. are willing to spend time and effort mastering certain technical details, such as those in Section 1. 1. Each book disappoints so me readers. This one will disappoint: 1. physicists who want to use this book as a first course on differential geometry 2. mathematicians who think Lorentzian manifolds are wholly similar to Riemannian ones, or that, given a sufficiently good mathematical back ground, the essentials of a subject !ike cosmology can be learned without so me hard work on boring detaiis 3. those who believe vague philosophical arguments have more than historical and heuristic significance, that general relativity should somehow be "proved," or that axiomatization of this subject is useful 4. those who want an encyclopedic treatment (the books by Hawking-Ellis [1], Penrose [1], Weinberg [1], and Misner-Thorne-Wheeler [I] go further into the subject than we do; see also the survey article, Sachs-Wu [1]). 5. mathematicians who want to learn quantum physics or unified field theory (unfortunately, quantum physics texts all seem either to be for physicists, or merely concerned with formal mathematics).

Cambridge University Press

This 2004 textbook fills a gap in the literature on general relativity by providing the advanced student with practical tools for the computation of many physically interesting quantities. The context is provided by the mathematical theory of black holes, one of the most elegant, successful, and relevant applications of general relativity. Among the topics discussed are congruencies of timelike and null geodesics, the embedding of spacelike, timelike and null hypersurfaces in spacetime, and the Lagrangian and Hamiltonian formulations of general relativity. Although the book is self-contained, it is not meant to serve as an introduction to general relativity. Instead, it is meant to help the reader acquire advanced skills and become a competent researcher in relativity and gravitational physics. The primary readership consists of graduate students in gravitational physics. It will also be a useful reference for more seasoned researchers working in this field.

Related with The Mathematics Of Minkowski Space Time With An Introduction To Commutative Hypercomplex Numbers Frontiers In Mathematics:

- Does Blood Flow Restriction Training Increase Vascularity : click here