Preface

We have written this book with the intention of providing the students (and the 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 novelty of our presentation consists of the extensive use of hyperbolic numbers for a complete formalization of the kinematics in the Minkowski space–time.

In other words, in this book the mathematical relation, stated by special relativity, between space and time is formalized.

We recall from Paul Davies book [1], the different significances attributed to "time" over the centuries:

For millennia the traditional cultures have given to time an intuitive meaning. Its cyclic nature and biological rhythms predominate over its measure and time and eternity are complementary concepts.

Before Galileo and Newton, the time was subjective, not a parameter we have to measure with geometrical precision.

Newton encapsulated it in the World description just as a parameter for the mathematical description of the motion: practically the time did nothing.

Einstein has given it again its place in the heart of the Nature, as a fundamental part of the physics.

Einstein did not complete this revolution that, unfortunately, remained unfinished.

To the last sentence Einstein would have most probably replied [2] that the physical laws will never be the definitive ones. All scientists can step forwards in the advancement of the scientific knowledge, but they are sure that the results obtained cannot be the definitive ones.

The achievement of special relativity, to which P. Davies refers, can be summarized as: *space and time must be considered as equivalent quantities for the description of physical laws.*

In this book we formalize this equivalence.

Actually, even if just after the formulation of special relativity, Hermann Minkowski proposed (1907–1908) that the relation between space and time can be considered as a new geometry, but a mathematics that would allow us to operate with this geometry as we do with Euclidean geometry was not formalized yet.

This formalization has been carried out by the authors in a series of papers [3, 4], later rearranged in a book [5] where, besides the well-established aforesaid formalization, some themes of research are proposed.

The aim of the present book is supplying the tools for solving problems in space–time in the same "automatic way" as problems of analytic geometry and trigonometry are solved in secondary schools. The previous knowledge of mathematics which is required is the same required in the first year of scientific University courses.

Further we show the basic ideas of our treatment and how these ideas derive from the "scientific revolutions" of 19th and 20th centuries: in particular, the necessary link between mathematics and physics and the synergic effects that allow their development.

The papers and the books listed in the bibliography are not indispensable for understanding the contents of the book, but they can help people who want to carry on further research. Actually, even if the mathematics used can be considered elementary, the topics dealt with are the subject of research in progress. What we are saying is that an appropriate reconsideration of some points of elementary mathematics and geometry can be the starting point for obtaining original and valuable results.

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