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BOOK REVIEW

Géométrie différentielle et Mécanique, by Pierre Aimé, Ellipses, Paris, 2005, viii + 544pp. ISBN 9-782729-822613.

It is well known that differential geometry plays an important role in modern theoretical physics. In general relativity we are confronted with manifolds equipped with a metric and we have to manipulate the Riemann tensor and forms derived from it (e.g., the Ricci curvature). In classical mechanics in its symplectic incarnation we have to deal with the symplectic form. And in gauge theories we have to deal with principal fibre bundles with connections and the derived objects (such as holonomy and curvature). The newcomer to one of these fields is often confronted with the (sad) reality that modern differential geometry seems to be an unsurmountable amount of formalism. I would argue that it is like a new language that one has to learn to speak. Once one knows the language, it becomes natural and the initial obstacles seem trivial.

Given this situation, it is not surprising that several authors have written books with titles like “differential geometry for physicists”, in order to explain to the (accomplished or beginning) physicist the intricacies of differential geometry. The level of these books varies from very elementary to tough. It is often the case that these books are written with a particular kind of application in physics in mind, in particular classical mechanics or relativity. The subjects treated thus differ, even though the basics remain the same.

The title of the book under review is “Differential Geometry and Mechanics”, but it should not be interpreted as restrictive to standard classical mechanics. It also includes the formalism of fluid mechanics and mechanics of deformable bodies. The book is meant to be self contained, even though it is part of a five volume series on “geometry and applications”. Moreover, the reader is not supposed to have any prior knowledge of mechanics as he/she should have only a minimal knowledge of real analysis and some knowledge of curves and surfaces in $\mathbb{R}^3$. Each of the five chapters starts or finishes with one or two sections on mechanics to illustrate the notions described in it. The treatment of the subjects is rather