



## BOOK REVIEW

*Geometric Mechanics, Part I: Dynamics and Symmetry, Part II: Rotating, Translating and Rolling*, by Darryl D. Holm, Imperial College Press, London, 2008. Part I: xx + 354 pages, ISBN-978-1-84816-195-5, Part II: xvi + 294 pages, ISBN-978-1-84816-155-9. Distributed by World Scientific Publishing Co., Singapore.

### 1. Presentation of the Book

Geometric Mechanics is currently an important subject of research, in pure and applied mathematics as well as in engineering science. Most existing textbooks on the subject [1–3, 6, 7] are suited for graduate students or professional researchers. In writing the present book, Professor Darryl D. Holm successfully undertook the difficult and important task of presenting the main ideas of Geometric Mechanics so that they can be understood by undergraduate students.

The first volume, *Dynamics and Symmetry*, is based on a course taught by the author for undergraduates in their third year of mathematics at the Imperial College London. In that volume, the ideas of reduction by symmetry and reconstruction are presented and used for several very different problems: geometric optics, the motion of a rigid body, ideal fluid dynamics, resonance of coupled oscillators, elastic spherical pendulum, laser light interaction with matter. The necessary mathematical tools (differential forms, Lie groups and Lie algebras, symplectic structures, Poisson brackets) are introduced when needed. The symmetry group most often used for reduction and reconstruction is the one-dimensional circle  $S^1$ .

The second volume, *Rotating, Translating and Rolling*, is based on a course of thirty three lectures taught by the author to fourth year undergraduate students in their last term in applied mathematics at the London Imperial College. The symmetry groups encountered in that volume are of higher dimensions: the rotation group  $SO(3)$  or more generally  $SO(n)$ , the group of Euclidean displacements  $SE(3)$ , the Galilean group, the unitary group  $U(n)$  are defined and used for several problems, including the motions of a heavy top and of round rolling bodies. The mathematical tools presented in the first volume are, for a large part, discussed again from scratch in the second. Results already obtained in the first volume are not used in