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BOOK REVIEW

A Student's Guide to Lagrangians and Hamiltonians, by Patrick Hamill, Cambridge University Press, Cambridge, 2014, x+173 pp, ISBN: 978-1-107-04288-9.

The author Patrick Hamill is Professor Emeritus of Physics at San Jose State University, California, USA. He has taught physics for over 30 years.

The purpose of the book under review is announced in the Introduction: "to give the student of physics a basic overview of Lagrangians and Hamiltonians". The book follows a standard exposition, but nevertheless, it is not a traditional graduate textbook in analytical mechanics. As stated in the title and confirmed on the way of presentation, the book is intended to be a guide to Lagrangian and Hamiltonian techniques. The expected reader is supposed to have been acquainted, at least basically, with the fundamental concepts of classical mechanics, such as Newton's laws, reference frames, work and energy, and as well as of calculus in more than one variables, including scalar and vector operations, coordinate transformations, differentiation and integration of vectors.

The book consists of seven chapters, structured into two relevant parts of equal lengths: "Lagrangian Mechanics" and "Hamiltonian Mechanics". The first two chapters lay the fundamental setup. They comprise all the introductory material that bridges the two approaches to mechanics: the Newtonian vectorial way of exposing the laws of nature and the Lagrangian analytical formulation of mechanics.

Chapter 1, entitled "Fundamental Concepts", begins with a sequence of short sections devoted to generalized coordinates, generalized velocity, constraints, virtual displacements, virtual work, generalized forces, configuration space and phase space. After some historical remarks on the physical and philosophical aspects of the force-versus-energy viewpoint, dating back to Newton and Leibnitz, the author underlines two important properties of the Lagrangian approach in mechanics: "all of the equations in analytical mechanics are scalar quantities" and "the Lagrangian method incorporates constraints into the framework of the analysis". Then the Lagrangian and the Lagrange's equations are introduced without proof – their derivation from the first principles is postponed for the next chapters. Henceforward, till the end of Chapter 1, the Lagrangian formalism is applied to certain