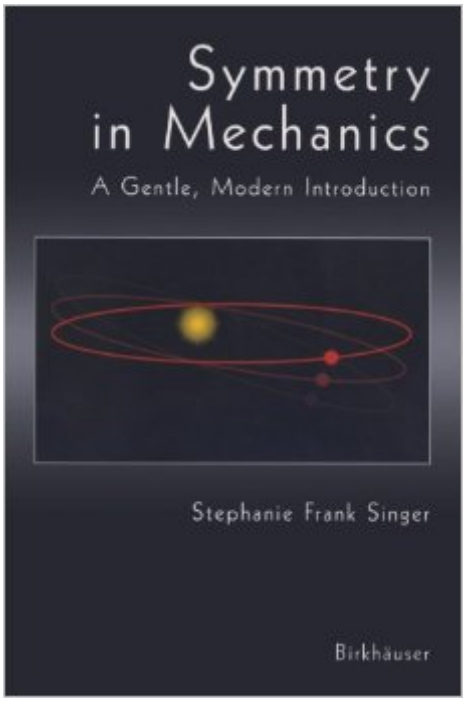
Symmetry In Mechanics: A Gentle, Modern Introduction



Synopsis

"And what is the use," thought Alice, "of a book without pictures or conversations in it?" -Lewis Carroll This book is written for modem undergraduate students - not the ideal stuÂ- dents that mathematics professors wish for (and who occasionally grace our campuses), but the students like many the author has taught: talented but apÂ- preciating review and reinforcement of past course work; willing to work hard, but demanding context and motivation for the mathematics they are learning. To suit this audience, the author eschews density of topics and efficiency of presentation in favor of a gentler tone, a coherent story, digressions on matheÂ- maticians, physicists and their notations, simple examples worked out in detail, and reinforcement of the basics. Dense and efficient texts play a crucial role in the education of budding (and budded) mathematicians and physicists. This book does not presume to improve on the classics in that genre. Rather, it aims to provide those classics with a large new generation of appreciative readers. This text introduces some basic constructs of modern symplectic geometry in the context of an old celestial mechanics problem, the two-body problem. We present the derivation of Kepler’s laws of planetary motion from Newton’s laws of gravitation, first in the style of an undergraduate physics course, and x Preface then again in the language of symplectic geometry. No previous exposure to symplectic geometry is required: we introduce and illustrate all necessary conÂ- structs.

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Customer Reviews

There are two classes of books in mechanics: the extremely physical, which are intended to teach

you how to solve problems but lack any mathematical rigour, and the mathematical ones, where the examples are generally one-line statements without any explanation. This book sits exactly in the middle of both: if you are a physicist (or mathematician for that matter) with a fair knowledge of classical mechanics and you understand the basics of Hamiltonian systems, but you want to expand your horizon with momentum maps and symplectic reduction, but you don't understand anything of the hardcore abstract books by mathematicians or you are afraid of them, this is where you should put your money.Physicists usually simplify their equations by using symmetry in a rather ad hoc way; intuition tells you that a rotation around a certain axis does not change anything or that the system is invariant under translations, or that angular momentum is conserved in a certain direction. Symplectic reduction is the systematic study of these symmetries and how to simplify you equations with them. Don't expect to be shocked because most of the analyses can be carried out without knowing anything about symplectic reduction, but it can aid your life if you are working on more complicated systems, where your intuition does not help you very much (or if you just want to impress someone with your knowledge of mathematical mechanics).The book does not go deeply into the material, but it explains the basics clearly (symplectic two-form, momentum maps, Lie derivative, reduction...) without being pedantically mathematical. Don't expect any proofs or general theorems; e.g.

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