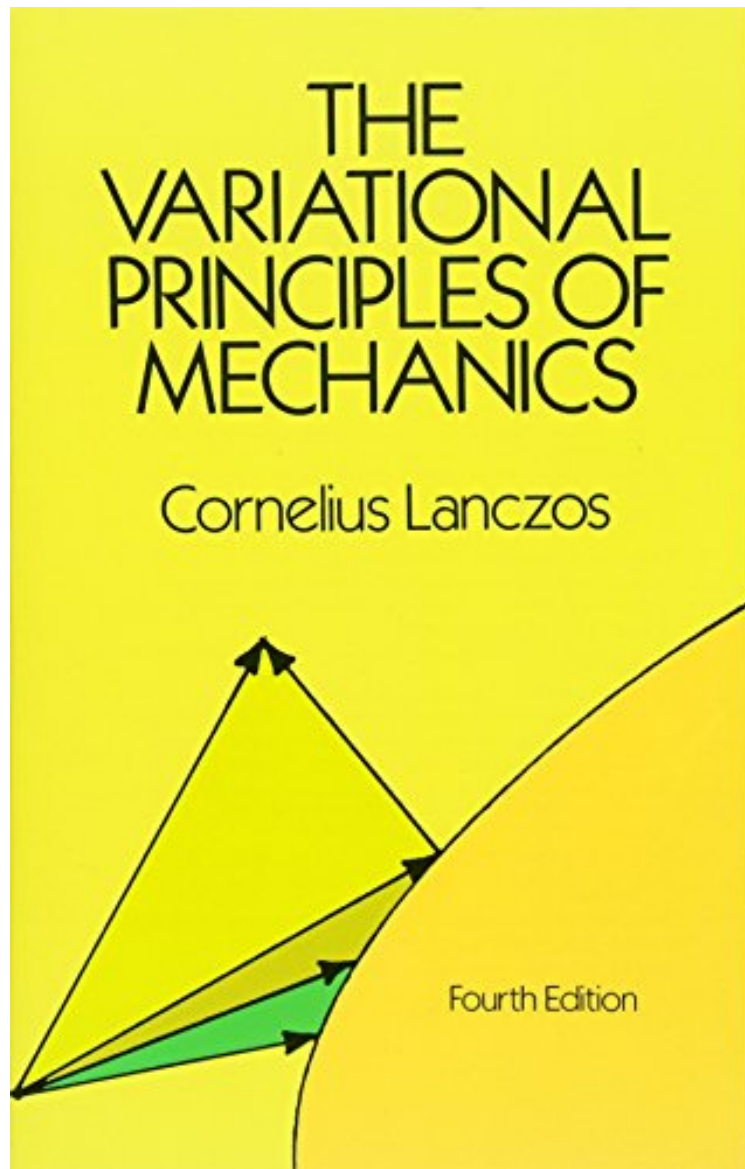


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## The Variational Principles of Mechanics (Dover Books on Physics)

*Cornelius Lanczos*

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**Cornelius Lanczos : The Variational Principles of Mechanics (Dover Books on Physics)** before purchasing it in order to gage whether or not it would be worth my time, and all praised The Variational Principles of Mechanics (Dover Books on Physics):

45 of 46 people found the following review helpful. A pedagogical introduction into analytical mechanicsBy Ruben Rodriguez AbrilBefore reading this book, I knew almost nothing about analytical mechanics. My first text books taught Physics from a Newtonian approach, using mostly vectors and potentials. So, the first time I encountered

Lagrangians and Hamiltonians I could not understand what these concepts meant. Because of that many areas of Theoretical Physics were forbidden for me: Phase and configuration space, Noether's theorem, Hilbert relativistic equations, Feynman quantum-mechanical interpretation of the principle of least action, and so on. So, two years ago, I decided to buy this book. And what I encountered? A systematical and pedagogical approach to analytical mechanics, which enabled me to acquire the fundamentals of the subject. For me, the most interesting features of this book are the following: 1) It explains the differences between VARIATION and DIFFERENTIATION, something that most books in the subject, leave behind. 2) It explains clearly D'Alembert Principle and the Principle of Virtual Work. 3) From those principles he derives the Principle of Least Action, using just elemental calculus. 4) He introduces the reader in Legendre's transformation and the relations between the two fundamental quantities of Analytical mechanics: Lagrangian and Hamiltonian. 5) You get the equations of movement corresponding to those quantities: Euler-Lagrange (Lagrangian) and canonical (Hamiltonian) equations. 6) A powerful insight in Configuration and Phase Spaces is given, including the wonderful Liouville's theorem. 7) Lanczos shows the analogies between Optics and Mechanics when he explains the Hamilton-Jacobi equations. So, why to learn Analytical Mechanics and why to buy this book?? These are my reasons: 1) From a historical point of view, Analytical Mechanics was developed by Continental Mathematicians like Maupertuis, Euler, D'Alembert and Lagrange as a rival system to the Newtonian one exposed in the Principia Mathematica. Newton used vectors and potentials. Euler and Lagrange employed the Principle of Least Action. 2) It was Analytical Mechanics the first to develop the principle of energy conservation. Even when this principle in its general form was developed by Wilhelm von Helmholtz in 1847, the conservation of the sum of kinetic and potential energy was well known to Euler a century earlier. 3) The concept of phase space is very important in Thermodynamics. In fact, the definition of entropy given by Ludwig Boltzmann refers to the logarithm of a volume in phase space. Liouville theorem, which states the conservation of such phase space volumes, is very useful today in black hole thermodynamics. 4) The quantum-mechanical interpretation of the Principle of Least Action given by Richard Feynmann was a fundamental contribution in the development of Quantum Field Theory, so any student who desires to progress in this field, must have substantial knowledge of Analytical Mechanics. So, to all of you that eventually decide to buy this book, I wish you a good reading. 6 of 6 people found the following review helpful. The soul of variational mechanics By Ismail Hameduddin This is one of the best books I have ever laid my hands on. Lanczos does a tremendous job of blending mathematics, physics, intuition and philosophy. It leaves the reader with a distinct satisfaction of having gained some insight into the beautiful connections between these realms. To top it off, he builds bridges across to relativity as well (albeit contrived at some points)! Analytical mechanics, by their very nature, are a philosophical lot. Maybe its because they assume everything will fit perfectly in their models or maybe its an outgrowth of their expectation of a rational natural order, regardless, this is a book tailored to that sort of mind. Recent texts in analytical mechanics, although tremendously useful for their pedagogical value, are usually quite cut and dry. There have been, in the last few years, exceptions to this but many of these spend more time attacking fellow researchers/scientists and dissecting competing views in the theory (quite reminiscent of traditional philosophers!) rather than attempt to give meaning through discussion. Lanczos is a great antidote for this. This is really an exquisite work that anyone in analytical mechanics will readily appreciate. If you want to know how to do analytical mechanics, look elsewhere. If you want to know the soul of analytical mechanics, look nowhere else. It must be noted that since many aspects of analytical mechanics are "point of view" rather than fact, some preferences of Lanczos may not be the only view or even orthodox. An example of this would be contemporaneous variations (Lanczos does not accept). Even though they are controversial in some sense, they do provide elegant alternatives of the proofs of several basic results in Hamiltonian mechanics. 8 of 8 people found the following review helpful. Delightful ... simply brilliant By Dukhat From organization, to prose, to content, to price, this is the best book on the Hamiltonian and Lagrangian formulation of Classical Mechanics. I just wish this book treated more subjects! The numbered list organization with pithy summaries really works for me. The thought provoking and mathematically fluent prose style is a joy to experience. The author is clearly a master of Einsteinian Relativity, Classical Physics, Differential Geometry, and functional analysis. In fact I seem to recall him writing some other books along those lines. Lanczos is a real treat to read. I have read parts of over a dozen different books on Intermediate/Advanced Classical Mechanics and Lanczos is just superb. As a standalone text, it may not be the best choice, but when accompanied by Arya or Hand and Finch it is very enriching. Fluent and cohesive are the words that come to mind when describing this work. This book is especially good for someone who knows a good deal of math and would like to be introduced to classical mathematical physics. I heartily recommend Lanczos's masterpiece!

Analytical mechanics is, of course, a topic of perennial interest and usefulness in physics and engineering, a discipline that boasts not only many practical applications, but much inherent mathematical beauty. Unlike many standard textbooks on advanced mechanics, however, this present text eschews a primarily technical and formalistic treatment in favor of a fundamental, historical, philosophical approach. As the author remarks, there is a tremendous treasure of philosophical meaning" behind the great theories of Euler and Lagrange, Hamilton, Jacobi, and other mathematical thinkers. Well-written, authoritative, and scholarly, this classic treatise begins with an introduction to the variational

principles of mechanics including the procedures of Euler, Lagrange, and Hamilton. Ideal for a two-semester graduate course, the book includes a variety of problems, carefully chosen to familiarize the student with new concepts and to illuminate the general principles involved. Moreover, it offers excellent grounding for the student of mathematics, engineering, or physics who does not intend to specialize in mechanics, but wants a thorough grasp of the underlying principles. The late Professor Lanczos (Dublin Institute of Advanced Studies) was a well-known physicist and educator who brought a superb pedagogical sense and profound grasp of the principles of mechanics to this work, now available for the first time in an inexpensive Dover paperback edition. His book will be welcomed by students, physicists, engineers, mathematicians, and anyone interested in a clear masterly exposition of this all-important discipline.