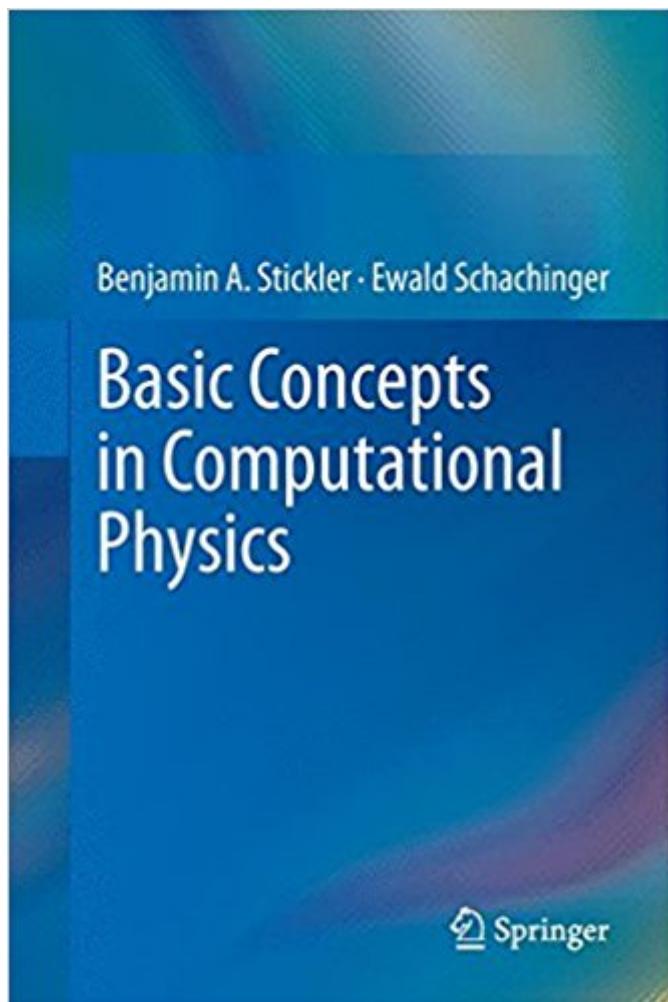


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Basic Concepts In Computational Physics



Synopsis

With the development of ever more powerful computers a new branch of physics and engineering evolved over the last few decades: Computer Simulation or Computational Physics. It serves two main purposes:- Solution of complex mathematical problems such as, differential equations, minimization/optimization, or high-dimensional sums/integrals.- Direct simulation of physical processes, as for instance, molecular dynamics or Monte-Carlo simulation of physical/chemical/technical processes. Consequently, the book is divided into two main parts: Deterministic methods and stochastic methods. Based on concrete problems, the first part discusses numerical differentiation and integration, and the treatment of ordinary differential equations. This is augmented by notes on the numerics of partial differential equations. The second part discusses the generation of random numbers, summarizes the basics of stochastics which is then followed by the introduction of various Monte-Carlo (MC) methods. Specific emphasis is on MARKOV chain MC algorithms. All this is again augmented by numerous applications from physics. The final two chapters on Data Analysis and Stochastic Optimization share the two main topics as a common denominator. The book offers a number of appendices to provide the reader with more detailed information on various topics discussed in the main part. Nevertheless, the reader should be familiar with the most important concepts of statistics and probability theory albeit two appendices have been dedicated to provide a rudimentary discussion.

Book Information

Hardcover: 377 pages

Publisher: Springer; 2014 edition (December 11, 2013)

Language: English

ISBN-10: 3319024345

ISBN-13: 978-3319024349

Product Dimensions: 6.1 x 0.9 x 9.2 inches

Shipping Weight: 2 pounds (View shipping rates and policies)

Average Customer Review: 5.0 out of 5 stars 1 customer review

Best Sellers Rank: #2,123,925 in Books (See Top 100 in Books) #96 in Books > Science & Math > Chemistry > Physical & Theoretical > Quantum Chemistry #341 in Books > Science & Math > Mathematics > Popular & Elementary > Counting & Numeration #1517 in Books > Science & Math > Physics > Mathematical Physics

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From the reviews: "The authors characterize the aim of their book to 'address the scenarios of direct simulation of physical processes and the solution of complex mathematical problems on a very basic level'™. It is directed to lecturers teaching basic courses in Computational Physics and to students as a companion when starting studying in this field." • (Rolf Dieter Grigorieff, zbMATH, Vol. 1287, 2014)

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Excellent book! It's full of very useful and practical information.

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