DESCRIPTION

The use of computation and simulation has become an essential part of the scientific process. Being able to transform a theory into an algorithm requires significant theoretical insight, detailed physical and mathematical understanding, and a working level of competency in programming.

This upper-division text provides an unusually broad survey of the topics of modern computational physics from a multidisciplinary, computational science point of view. Its philosophy is rooted in learning by doing (assisted by many model programs), with new scientific materials as well as with the Python programming language. Python has become very popular, particularly for physics education and large scientific projects. It is probably the easiest programming language to learn for beginners, yet is also used for mainstream scientific computing, and has packages for excellent graphics and even symbolic manipulations.

The text is designed for an upper-level undergraduate or beginning graduate course and provides the reader with the essential knowledge to understand computational tools and mathematical methods well enough to be successful. As part of the teaching of using computers to solve scientific problems, the reader is encouraged to work through a sample problem stated at the beginning of each chapter or unit, which involves studying the text, writing, debugging and running programs, visualizing the results, and the expressing in words what has been done and what can be concluded. Then there are exercises and problems at the end of each chapter for the reader to work on their own (with model programs given for that purpose).
ABOUT THE AUTHOR

Rubin H. Landau is Professor Emeritus in the Department of Physics at Oregon State University in Corvallis. He has been teaching courses in computational physics for over 25 years, was a founder of the Computational Physics Degree Program and the Northwest Alliance for Computational Science and Engineering, and has been using computers in theoretical physics research ever since graduate school. He is author of more than 90 refereed publications and has also authored books on Quantum Mechanics, Workstations and Supercomputers, the first two editions of Computational Physics, and a First Course in Scientific Computing.

Manuel J. Paez is a professor in the Department of Physics at the University of Antioquia in Medellin, Colombia. He has been teaching courses in Modern Physics, Nuclear Physics, Computational Physics, Mathematical Physics as well as programming in Fortran, Pascal and C languages. He and Professor Landau have conducted pioneering computational investigations in the interactions of mesons and nucleons with nuclei.

Cristian C. Bordeianu teaches Physics and Computer Science at the Military College “?tefan cel Mare” in Campulung Moldovenesc, Romania. He has over twenty years of experience in developing educational software for high school and university curricula. He is winner of the 2008 Undergraduate Computational Engineering and Science Award by the US Department of Energy and the Krell Institute. His current research interests include chaotic dynamics in nuclear multifragmentation and plasma of quarks and gluons.

NEW TO EDITION

The important aspects of computational modelling should not be strongly focused on programming. Hence the authors have chosen Python (instead of Java), which is considered as one of the easiest and most accessible language for beginning programming, and commonly used for interactive and exploratory computations in scientific research.

a. A chapter on Visualizations tools

b. Advanced object-oriented programming examples

c. A section on classical scattering

d. New sections on noise reduction
e. New sections on the Fast Fourier Transform (FFT)

f. A new chapter on Wavelet Analysis and Data Compression

g. New sections on Predator-Prey models

h. New sections on Fractals and Perlin Noise

i. New sections on Parallel Computing

j. A new chapter on Molecular Dynamics

k. A new chapter on Finite Element Methods for PDEs

l. New sections on electromagnetic waves using the Finite Difference Time Domain method

m. New sections on fluid dynamics and shock waves as background for the Solitons chapter

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