Computational Physics

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BOOK REVIEWS:

Computational Physics
Understanding Molecular Simulation

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Computational Physics

Nicholas J. Giordano

Prentice Hall, Upper Saddle River, NJ, 1997; ISBN 0-13-367723-0; 419 pp., cloth, $62.00.

Reviewed by Marvin L. De Jong

We now have another fine option in our choice of computational-physics texts at the undergraduate level. Nicholas Giordano's *Computational Physics* covers many of the same topics as Harvey Gould and Jan Tobochnik's now-classic *An Introduction to Computer Simulation Methods* (Addison-Wesley, Reading, MA, 1996). In addition, a few nonstandard interdisciplinary topics include protein folding, earthquakes, and neural networks and the brain. For specific details about the table of contents and other information, contact the World Wide Web site http://www.prenhall.com/divisions/esm/catalog.html.

Giordano begins where you would expect, by using either Euler's method or the Euler-Cromer method to solve some simple differential equations. These include equations from radioactive decay, projectile motion with air resistance, and oscillatory motion. The last topic allows chaos to be covered early in the course. The treatment of chaos is, in fact, excellent. The book then moves quickly through potentials and fields, waves, and Fourier analysis—all topics appropriate to the sophomore level, the author's principal target audience.

I like Giordano's personal writing style and enthusiasm, and I enjoyed reading his book. He provides many programs and subroutines written in True Basic. Gould and Tobochnik use this same language and provide Fortran and Pascal routines as well. Giordano seems to provide Fortran and Pascal programs only against his better judgment, but I feel they are absolutely essential. In fact, I would have liked to see many of the routines written in Mathematica as well as True Basic. Physics departments need to make some kind of choice about what language they will require of their students and then stick with it, and I believe either Mathematica or Maple would make a good choice. I tried doing some of Giordano's exercises in Mathematica, and they were not all that difficult.

Roughly halfway through the book, Giordano moves to random systems and statistical methods, then to quantum mechanics, and finally to the interdisciplinary topics mentioned above. Although not all these topics may be appropriate to the sophomore level, they make the book useful to a wider audience.

At the end of most sections there are exercises, which, in my opinion, seem to get more difficult and open-ended as you progress through the book. In fact, some of the exercises are more like projects than problems. Perhaps leading off every exercise set with a couple of easy problems with simple numerical answers would have been helpful to some students.

Computational Physics is a good book. My guess is it will be a toss-up whether to adopt Gould and Tobochnik or Giordano. In my view, either book will be useful for computational-physics classes, laboratories, and projects beginning at the sophomore level and continuing through the undergraduate physics curriculum. A paperback version would be nice.◆

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Understanding Molecular Simulation

Daan Frenkel and Berend Smit

Academic Press, San Diego, CA, 1996; ISBN 0-12-267370-0; 443 pp., cloth, $65.00.

Reviewed by Jan Tobochnik

Computer simulation has become an important part of physics research, particularly in the area of condensed matter. In the research context, simulation usually refers to the use of Monte Carlo and molecular-dynamics algo-