An Introduction to Computational Physics, Second Edition. *Tao Pang*; Cambridge University Press, 2006, pp: xvi + 368, ISBN 0521825695 (hc); Price: US$70.00

This is a book of mathematical techniques, often presented briefly, with references to more thorough discussions. It uses computer programs in the Java language to solve numerical problems. Each chapter ends in exercises. Electronic versions of the programs, some solutions to exercises, and lists of errors in the book are available at the Web site http://www.physics.unlv.edu/~pang/cp2.html. The site has programs intended for the C and FORTRAN 90 languages as well as Java routines. There is also a Web site, http://www.physics.unlv.edu/~pang/cp.html, for the first edition of the book. It offers programs for C, FORTRAN 77, and FORTRAN 90, many of which are relevant to the second edition of the book.

I noted two minor problems with supplied electronic files. First, program source codes were named with '.txt' extensions, which I had to remove to make the programs usable. Second, files ended each line of text with only a line feed character, instead of the MS-DOS or Windows standard of a carriage return-line feed sequence. Most MS-DOS or Windows systems I used accepted line feeds as new lines, but in Windows 98's Notepad, each source code looked like one continuous line. Anyone bothered by this problem can contact me for a utility that adds carriage returns.

I tried several development systems to handle the supplied program source codes. I mention only those systems that seemed most versatile and that are likely to be available to many users. I used Java development kit 1.3 for the Java routines. It is available free of charge at http://java.sun.com/j2se/1.3/download.html. The FORTRAN programs I tried suited g95 MinGW, a free, open-source FORTRAN 95 system I found at http://ftp.g95.org/. Many supposedly C programs were actually C++ programs. The command-line version of Borland C++ 5.5 could handle most of them. That Borland system was distributed free of charge a few years ago. Interested parties who cannot locate a copy can try http://www.thefreecountry.com/compilers/cpp.shtml for links to free C++ systems.

The book is introductory in its concise presentations of topics, but effectively assumes much familiarity with physics and mathematics. It outlines the features of Java source codes and tells how to compile them at the command line, but otherwise gives no directions for computer programming. Thus, it seems to me more suitable as an aid for advanced students and experienced workers than as an introduction for those completely new to the subjects.

Understanding the mathematical derivations in detail requires the reader to fill in missing steps, or to look up other works mentioned by Pang. While some supplied programs include enough comments to help an experienced programmer, I found many programs difficult to follow, largely because I could not readily see the relations between the variables used and the mathematical problems being solved.

There is a big range of topics: Approximation, numerical calculus, ordinary and partial differential equations, matrices, molecular dynamics simulations, modeling continuous systems, Monte Carlo simulations, genetic algorithm and programming, and numerical renormalization. Each has several subtopics. There are frequent references to physical theory or experiment.

The main text, especially in the later parts of the book, emphasizes analytic techniques. Some exercises are analytic. This is not just a book about computing or strictly numerical work.

The only errors I noted in the main text (for example, misspellings or incorrect mathematical operations) seemed easy to correct. Overall, the book is clearly written.

I had a little more trouble with the supplied programs. Some, like Maxwell.java, are not complete, but are routines that might be parts of complete programs or need refinement. Faddeev.java is supposed to invert a matrix, but gave incorrect results, while Inverse.java did that operation properly. Furthermore, the outputs of some programs took imagination to understand. For example, the elements of a 3 by 3 matrix might be listed in a single column. I revised Motion.c drastically to suit various C and C++ systems I have. However, the great majority of the supplied programs I tried worked as intended.

I appreciated receiving a prompt and helpful reply to a message I sent to Tao Pang.

I think this book might be quite helpful to anyone working on the topics it covers. It provides insight into a great range of topics in mathematics, physics, and computing. The many exercises should benefit students. The many techniques discussed should suit workers in a variety of fields.

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