neer who would like to better understand these unique and fascinating materials, this book is for you.

Reviewer: Hans H. Stadelmaier is Professor Emeritus of Materials Science and Engineering at North Carolina State University, Raleigh. He has Diplom Physiker and Dr. rer. nat. degrees from the University of Stuttgart, Germany.

Cellular Solids: Structure and Properties, 2d ed.

Lorna J. Gibson and Michael F. Ashby
(Cambridge University Press, New York, 1997)
x+510 pages, $ 120.00
ISBN 0-521-49560-1

Cellular structures, defined as structures having density less than about 0.3 of the theoretical density of the solid, can be found in nature (wood, cork, coral, bones, and of course, the honeycomb of the bee) or can be synthetic (polymeric packaging material or sandwich panels). They afford unusual physical (e.g., thermal and acoustic) and mechanical (e.g., stiffness and energy absorption) properties that make them ideal for selected applications. A quantitative understanding of the mechanisms responsible for these properties is central to not only predicting but also enhancing the performance envelopes in various environments. The scientific publications on this subject spans the fields of materials science, mechanics, botany, physiology, and biomedical science. In the first edition of this book (published about 10 years ago), Gibson and Ashby surveyed the understanding of cellular solids.

In this second edition, the first three chapters quickly run through basic classifications of cellular solids (honeycombs versus foams, both open-celled and close-celled), techniques to produce them (a fairly superficial coverage) and characterize them, and characteristic physical and mechanical properties of the classes of materials that make up these cellular solids. A basic engineering undergraduate background is adequate to understand the information in these three chapters. The clarity in logic and presentation is commended and the approach of periodically reminding the reader of the direction that the authors intended to take in the rest of the book particularly appealed to me.

The next five chapters constitute the heart of the book: The first three of these deal with the mechanical behavior of cellular solids where the mechanics of honeycomb structures and foams are logically developed. The response of such cellular structures to tensile and compression loading is broken down into stages and consideration is given to various classes of materials constituting the cell walls (elastomers, metals, and ceramics). Issues related to anisotropy and multi-axial loading are addressed and yield surfaces are presented. The influence of the presence of fluids on mechanical response of open- and close-celled foams is analyzed. The mechanics throughout is kept to an easily understandable level and the clarity of arguments and presentation style are excellent. The last two chapters in this set of five deal with physical properties of foams (thermal, electrical, and acoustic) and the mechanisms of energy absorption in cellular solids; benefits of presenting these mechanisms using energy absorption diagrams are discussed. The strength of these chapters derives from the constant comparisons of the mechanics prediction to experimental data in the literature. The utility of the mechanics ideas developed in these chapters are clearly demonstrated in Chapter 9 where the authors describe the process of design optimization of sandwich panels using a foam core; two specific examples, the first of a downhill ski and the second of the iris leaf, are used. Chapters 10, 11, and 12 provide three case studies of naturally occurring cellular materials: wood, cancellous bone, and cork. The complexity in structure in each case is illustrated but perhaps intriguing is the ability to cope with such structures reasonably well by extending the basic mechanics developed in the earlier chapters in the book. The authors have been careful in identifying limitations of the analyses developed whenever pertinent, and emphasize the importance of understanding the microstructure carefully to develop meaningful mechanics as evidenced in the analysis on cork.

In summary, this book is very well written, makes for interesting reading, is a valuable addition to any engineer's library and a must for researchers and engineers working in the field of cellular materials.

Reviewer: K. Sharvan Kumar is a professor in the Division of Engineering at Brown University in Providence, Rhode Island. His field of interest is microstructure and deformation behavior of structural materials.

The Art of Molecular Dynamics Simulation

D.C. Rapaport
(Cambridge University Press, New York, 1997)
xiv+400 pages
$69.95 Cloth, ISBN 0-521-44561-2
$39.95 Paper, ISBN 0-521-59942-3

This how-to book is a welcomed addition to the small library of texts on modern methods in atomic-level simulations. The first two chapters present the basics of molecular dynamics with enough information and code to perform simple simulations without any prior knowledge. Building on this foundation are discussions of equilibrium and dynamical properties of fluids, nonlinear phenomena, rigid and flexible molecules, long-ranged and three-body forces, hard-sphere systems, and algorithms for vector and parallel computers. Throughout the book, the theory behind each topic is presented succinctly with references to the literature. This theory is followed by fully functional code implementing the technique. The code can be obtained from the website (www.cup.cam.ac.uk/onlinepubs/artmolecular/ArtMoleculartop.html), as can a detailed Table of Contents.

One important decision made at the outset is the choice of C for the program examples. In deference to FORTRAN programmers, however, C-specific constructions were avoided, allowing the C to be relatively directly translated into FORTRAN. Although not comfortable with C, I did not find this too difficult. Nevertheless, a couple of side-by-side examples of C and FORTRAN code would have been useful. Also, in some places it might have been clearer if more schematic code had been given, thereby allowing the central idea to be highlighted and explained without being obscured by the detail.

By way of comparison, M.P. Allen and D.J. Tildesley's classic book *Computer Simulation of Liquids* (Oxford University Press, Oxford 1987) provides a somewhat less textbook-like introduction to much of the same material. Rapaport's book is both more structured and goes considerably beyond Allen and Tildesley's in content. At times, however, Allen and Tildesley's somewhat more intuitive approach, illustrated by schematic FORTRAN fragments, is easier to follow. To a great extent, therefore, the two books are complementary, and reading the same subject matter in both is particularly illuminating.

The structured approach and fully functional code make this book ideal for a graduate course in molecular-dynamics simulation, taking the student with no prior knowledge to a position to be able to perform research-level simulations. For the practitioner, it provides a mine of useful techniques. My copy will stand next to Allen and Tildesley's book and will, I expect, receive frequent use.

Reviewer: Simon Phillpot is in the Materials Science Division of Argonne National Laboratory.