

A listing of the contents of the chapter on two-dimensional motions, which covers over 200 pages, must suffice as an example of the coverage of this book: Lamé potentials; reflection and refraction, including critical incidence; Rayleigh and Love waves; waves in plates; moving line loads; punches and impulses, and dynamic contact problems. Inserted in the chapter where needed are discussions of more general concepts and techniques, such as dispersion and group velocity and similarity solutions.

It is a pity that in a work of this length the authors do not treat linear dynamic thermoelasticity at least as far as the isotropic approximation. In fact the authors imply on page 344 that the mechanical theory of linear elastodynamics is isothermal; it is not, it is approximately isotropic with limitations that come out of the full mechanical-thermal treatment. Fortunately the rest of the book is unaffected by this omission.

The books will prove of value to research workers in continuum mechanics who wish to know in some detail what has been done in the different branches of elastodynamics, as well as to teachers of the subject and to students, provided their reading is directed. Both authors have contributed to the development of solid mechanics. In particular, A. C. Eringen has written and edited many books, for example on the foundations of continuum mechanics and on solid propellants.

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Applied Solar Energy: An Introduction

A. B. Meinel, M. P. Meinel

651 pp. Addison-Wesley, New York, 1976.
\$17.95

Solar energy is being recognized as a most promising renewable energy source with the potential to meet a significant portion of future world energy demands. If this promise is to be fulfilled, solar-energy systems will have to be developed that are technically feasible, economically competitive, environmentally compatible and socially acceptable. This volume, by Aden B. Meinel and Marjorie P. Meinel of the Optical Sciences Center at the University of Arizona, addresses the technical aspects of solar-energy systems. The book is presented by the authors as an introduction to the theory that must be mastered to successfully engineer and evaluate the performance of these systems. The book is intended primarily for college seniors and graduate students in energy conversion, although it should be useful to researchers too.

The authors have succeeded admirably

in covering their own area of specialization, thermal conversion, with a thorough discussion of the optics of solar collection and the properties of selective surfaces. Both authors are widely known for their pioneering efforts to develop "solar farms" and their significant contributions to selective-surface research. The treatment of mirror optics covers refractive-collector optics, mirror-collector optics, fixed-mirror collectors and optical surfaces and provides an excellent foundation for the understanding of solar-energy systems. The material presented constitutes valuable supplementary reading for anyone interested in optics and optical design generally.

Selective surfaces are treated, deservedly, in depth, with easy-to-understand expositions and valuable data on this important subject. The historical survey of solar-energy applications may provide the reader with an appreciation of the world-wide efforts that have been made to harness the energy of the Sun. The treatment of solar flux and weather data and of solar availability is among the best available.

The Meinel's discussion of heat transfer in solar collectors and their description of flat-plate collectors will give a good understanding of the basic principles involved. The discussion would have been more useful had it included energy systems that use flat-plate collectors and descriptions of computer programs for heating- and cooling-system design.

The emphasis generally is on the fundamental science of designing systems for solar-energy utilization, rather than a specific application. Although it is of crucial importance to the performance of solar-energy systems, energy storage receives only superficial coverage. The utility interface in solar-energy systems is barely touched upon, and passive solar-energy systems are not mentioned. The discussion of thermodynamic cycles alternates between elementary exposition and detailed model calculations. The treatment of the direct conversion of solar energy to electricity is too abridged to do justice to this topic. The examples cited in the survey of solar-energy applications are presented in a simplified manner that leaves the reader unsure of the assumptions being made. However, the reader who masters the fundamentals in the text will have little difficulty in reading the current technical literature. Finally, the use of assorted units rather than just SI units is disconcerting.

The book is well produced and illustrated. Among the book's valuable aspects are the excellent problems at the end of each chapter. A student capable of providing the solutions should be well on his way to making contributions to the solar-energy field.

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Theory and Application of the Boltzmann Equation

C. Cercignani

415 pp. Elsevier, New York, 1976. \$35.00

The past 20 years have seen the rapid domestication of kinetic theory. Much of this has involved using modern techniques to investigate variants of classical problems that have practical engineering applications; two outstanding examples are neutron transport and rarefied-gas dynamics. In both areas of study the basic quantity of interest is the single-particle distribution function as determined by the Boltzmann equation or one of its offspring. No one is more qualified than Carlo Cercignani to give an account of these developments.

Cercignani has titled his book aptly, for he has dealt richly with both theory and application. The book's virtues as either "a textbook for an advanced course on kinetic theory" or as "a reference for applied mathematicians, physicists and aerodynamicists interested in the theory and application of the Boltzmann equation," in the words of the author, outweigh considerably its rather minor defects.

Starting from a discussion of the Liouville equation and the justification for statistical averaging, Cercignani derives the hierarchy equations and then the Boltzmann, Fokker-Planck and hydrodynamic equations. Throughout the book, he is liberal in his discussion of models from the fields of gas-surface interaction, neutron transport and thermalization, and gas dynamics in a variety of regimes. He makes clear through his many examples the applicability of mathematical techniques suitable for a variety of problems, such as expansion in singular eigenfunctions. At the same time, he stresses the unity of physical concepts, such as that of the boundary or transition layer. Both analytic and approximate methods are developed and applied to the solution of a number of model problems. In the realm of theory, Cercignani devotes considerable space to existence and uniqueness properties of solutions and to the spectrum of the linear transport operator. Throughout, he keeps in mind the interplay between theory and application. There are extensive references at the end of every chapter.

On the negative side, there are some surprising omissions and inconsistencies in tone which may be confusing for the putative student. The author does not make clear that only a classical theory is presented, since he nowhere hints at the existence of quantum theory. He introduces the delta function as if the reader had never heard of it—unlikely for his readers—but in terms of generalized functions, with which many potential readers are certainly not familiar. He discusses generalizations of the

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Vol. 1. 392 pp. (0 471 35325-6)
1975 \$23.25

Vol. 2. 402 pp. (0 471 35326-4)
1975 \$23.25

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Edited by Timothy C.L. Robinson

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Boltzmann equation without mentioning the divergence difficulties inherent in the multiple-collision contributions, except perhaps for a single cryptic statement on page 67.

The experienced toiler in the vineyard is likely to be more disturbed by frequent difficulty in dipping into a discussion in the middle of a chapter without having to look back through the book to determine the meaning of symbols. Someone familiar with a subject would like to be able to grasp the meaning from the context.

Notwithstanding these reservations, the book is a significant piece of work. One final remark: it is good to have a book in which some of Cercignani's own considerable contributions to the field are discussed at length.

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Scales and Weights: A Historical Outline

B. Kisch

297 pp. Yale U. P., New Haven,
Conn., 1965 (3rd printing, 1975).
\$20.00

This book deals with scales and standard weights used for weighing from antiquity through the 19th century, in terms of the artifacts in museum collections around the world, with about 100 photographic illustrations. In these times when all the world is coming to the use of a single standard of units for all measurement—the SI units (*Système International d'Unités*)—it is interesting to read a good historical review of the tremendous variety of weights that have been used in the past.

Most of us know that the pound, the ounce and the dram are units that have different sizes depending on whether they are avoirdupois or troy (apothecary) units, but I had never realized that different standards of weight were formerly used for ordinary commodities in the marketplace. Bruno Kisch has made a special study of the history of weighing in the city of Cologne; he tells us that, in the 14th century, the weight of a centner (100-pound weight) was 100 pounds if silk was being weighed but 106 pounds for yarn and 120 pounds for iron. The author quotes Paetus (c. 1573) to the effect that "Whereas different people, particularly the Greeks, had different weights for different goods, the Romans had for all things only one weight unit: the libra . . ." and its subdivisions.

In different countries, and indeed in various cities and towns within European countries, up to the 19th century there were differing standards of weight. The author says, "The Magna Charta (1215) stressed the point that uniformity of

weights and measures should exist in England. However, even in 1794 Martin was deploring the difficulties arising to men of trade and commerce from the variety of weights and measures used in different parts of England."

Although weighing dates back to around 3000 BC, as indicated by Egyptian, Assyrian and Hittite reliefs showing the use of balances, weight is still not used universally as a basis for commerce. Cortes reported back to Spain in 1521 that the Mexicans sold everything by number or volume but never by weight. The fishmongers of Cologne were ordered in 1482 to sell salted fish by weight, and Chambers is cited as saying that butchers were not required to sell meat by weight in some parts of England in the early 18th century. And we still buy eggs in the US by the dozen, with different prices for extra-large, large, medium and small eggs.

Kisch is curator of the Streeter Collection of Weights and Measures at Yale University; he mentions in this book a number of interesting weights in his own personal collection. He lists some 64 collections in Europe and Israel that he has visited personally, and there are twelve pages of bibliography from which he has culled material for this scholarly book.

His interest is in the artifacts rather than in metrology. In his very brief discussion of exactness of weighing, he tells us that three "exact" copies of the standard Cologne mark, made in Vienna in 1703, were found to differ by more than half a gram (ranging from 467.548 to 468.125 grams) when weighed more accurately in 1870. Kisch goes on to say that the sensitivity of balances was not to be blamed because the small scales used by money changers and pharmacists had a much higher sensitivity than half a gram. This statement is a slip on the author's part, for he probably knows that a sensitivity of 0.1% would correspond to 0.005 gram in 5 grams but to only 0.5 gram in 500 grams.

The scales presented include those with weights hung from opposite ends of a beam balanced on the finger; beams with equal arms and a fixed fulcrum; steelyards with fixed, unequal arms; steelyards with a single weight adjustable to various distances from the fulcrum; folding scales packed with their sets of weights in small wooden cases and used particularly for weighing money, ducat scales with equal arms but with one pan heavier than the other by just the weight of a coin and others. The weights presented are described in terms of actual weight in grams, material of construction (stone, brass, iron, glass and so on), shape (trussed duck, animals, busts of men, truncated cones and spheres, cylinders, rectangular shapes, nested weights or whatever) and maker.

Kisch pays a good deal of attention to

the mastersigns of the makers, who were regulated by their medieval guilds. The names, metric equivalents and special symbols of the various weights of many countries and cities are given in detail. Much attention is given also to the role of governments in regulating the standards and providing official sealers to check weights and scales periodically and to mark them with special signs of approval. The author tells a good deal about the development of the platinum-iridium "kilogramme des Archives," which is now the standard unit of weight, in terms of which even such non-SI units as the pound are defined.

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Computer Power and Human Reason: From Judgment to Calculation

Joseph Weizenbaum

300 pp. W. H. Freeman, San Francisco,
1976. \$9.95

The idea of a stored-program computer leads immediately to studying mental processes as abstract computer programs. Artificial intelligence treats problem-solving mechanisms non-biologically, and modern cognitive psychology makes information-processing models of the human mind. Both studies have proved fruitful though difficult and have been pursued with ever increasing vigor.

Progress in either study, like Darwinism and like most progress in medicine and biology, moves the scientific picture of man's nature directly away from the subjectivity preferred in modern literary culture. Full success, like successful genetic engineering, will present individuals and society with a bewildering collection of options. Joseph Weizenbaum fears both the options he can imagine and the rationalist world-view that computer modeling reinforces.

The author criticizes all present work in artificial intelligence, information-processing-based psychology and computer linguistics as mere technique. In particular, he regards the computer linguists as "hackers" whose work there is no point in studying, but he explicitly puts no limit on the potential problem-solving capability of computers except when understanding humans is required. His point is moral, and his arguments use the 1960's technology of moralistic invective.

Weizenbaum finds it immoral for a scientist to adopt certain hypotheses even tentatively, to perform certain experiments or propose certain applications—not because they are dangerous or won't work, but because they are "obscene." He distinguishes between not closing