Applied Solar Energy: An Introduction

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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 isentropic approximation. In fact the authors imply on page 344 that the mechanical theory of linear elastodynamics is isothermal; it is not, it is approximately isentropic 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 Meinels' 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