content, it is encyclopedic in character and will serve very well as a standard work of reference.

The style of treatment differs considerably from topic to topic, varying from the purely qualitative to detailed analysis. Numerous recommendations are made relating to correlations, codes, or calculational methods. While these in general will be found very useful, the reader should be circumspect in his acceptance of some of them. For example, there can be no universal correlation for pressure drop across pin bundle support grids. The organization of the topics is somewhat haphazard, but perhaps this is of little consequence in a work of reference. On the other hand, it would surely be better to deal with analysis of fuel elements under nominal conditions before embarking on a treatment of the uncertainties. Similarly, the discussion of flow orificing in Chap. 2 could well be omitted, given the more extensive treatment in Chap. 4, and the latter should be more closely linked to the description of radial power variation. As another example, subchannel analysis is referred to several times in the early chapters before it is fully explained on p. 206. These are minor irritations that emerge on reading the book from end to end, but are not likely to trouble the user dipping into it for information on particular topics. Overall, it will be a valuable addition to the library of people working in the field of thermal analysis of fast reactors, particularly those who already possess a good background in hydrodynamics and heat transfer.

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About the Reviewers: Gerald McAreavey holds an honors degree from London University and a postgraduate diploma from Birmingham University. He served for several years in the combustion side of the gas turbine industry in charge of a fluid flow laboratory; during this period, his main interests were flow visualization techniques and experimental studies of wall jets and turbulent jet mixing. Since 1958, he has been with the United Kingdom Atomic Energy Authority (UKAEA), involved in safety problems and the thermal-hydraulic analysis of fuel elements for both gas-cooled reactors and LMFBRs. John B. Love graduated with honors in mechanical engineering at Liverpool University in 1953. He then joined the gas turbine industry and worked for some six years on the development of centrifugal and axial flow compressors for both aircraft and industrial applications. In 1961, he joined the UKAEA. Since then, he has been involved in a wide range of work connected with rotating machinery, heat exchangers, and steam plant.

Energy Conversion Engineering. By Richard C. Bailie. Addison-Wesley Publishing Co., Inc., Reading, Massachusetts (1978). 537 pp. $19.50.

Within the current half-decade of energy anxiety in the U.S., many fine publications have made available large volumes of facts relating to the growth of energy demands and the potentiality of various supplementary energy sources. Those who have attempted to organize new college-level courses, however, have found that the recent "energy and environment" textbooks deal largely with (a) public information topics or (b) highly specific design calculations. In particular, suitable textbooks for basic instruction of upper division college students of engineering and science have not always been available. Some instructors have found it necessary to prepare their own textbooks for such upper division courses.

Energy Conversion Engineering is a thorough, carefully organized presentation of the principles, physical laws, and operational constraints that govern the performance and useful contributions of the many energy systems currently under study and application. Utilizing the fundamental *Laws of Thermodynamics*, as introduced in basic physics studies, it develops clear, connected, and quantitative methods of examination for all energy systems, with distinct conclusions that clarify some of the limitations of the many proposed "energy alternatives."

Energy Conversion Engineering has been designed to serve as a textbook for senior students in engineering and the physical sciences. It differs sharply from the "state-of-the-art reviews and data source books" on energy conversions. Following a concise, pleasantly readable review of the concurrent growth of the "Industrial Age" and the "energy age"—starting with Watt's perfection of the modern steam engine in 1765—the book then expands the relevant principles and methods from (a) Engineering Thermodynamics, (b) Chemical Thermodynamics and Equilibrium, (c) Fossil Fuel Combustion, (d) Coal Gasification and Liquefaction, (e) Nuclear Energy, (f) Solar Energy, and (g) Environmental Protection Systems. All discussions are generously and clearly illustrated with appropriate schematic diagrams, flow charts, sample calculations, significant graphs, extensive comparisons, and definite conclusions.

Perhaps the outstanding feature of the textbook is its strict adherence to the rules of procedure outlined in an early chapter. The continuity of the treatment of many diverse subjects is impressive, the methods of analysis recommended for solar systems and coal conversion being adaptations of the procedures for the evaluation of steam turbines and internal combustion engines. The assumptions and rules of interpretation are carefully established in the chapter on Engineering Thermodynamics. It will be found that these are followed consistently throughout the book.

While the book is planned for upper division college classes, guided by an experienced instructor, it is entirely plausible that it could serve for "self-instruction" by an interested and diligent student. The textbook contains an abundance of fully detailed "illustrative solutions" to typical problems. The reviewer is certain that very few textbooks equal *Energy Conversion Engineering* in this respect. Solved examples are used throughout the entire text—to emphasize the applications and interpretations in the respective cases. In fact, one could claim, justifiably, that this is a "problem-solving" manual in engineering thermodynamics. However, that would not give proper credit to the many fine verbal discussions, historical resumes, and thoughtful conclusions found throughout the presentation.

The completeness and accuracy of the quantitative and technical illustrations have already been emphasized. It should also be noted that the treatment of historical, factual, and descriptive information is equally clear, concise, and complete. For the *nonmathematical reader*, the description of energy systems, the remarks on operating conditions, and the conclusions to be inferred from the calculations form a narrative that is largely independent of the mathematical details. One finds that omission of the carefully designed illustrative examples detracts very little from the instructional quality of many portions of the text. Thus, the "nonscience" or "nonmathematical" student will find valuable contributions to his understanding of energy systems and environmental protection programs.

The highlights of this treatment of the thermodynamics of energy conversion systems must certainly include the exceptionally complete array of *illustrative examples and solutions*, which are smoothly integrated into the mainstream of the general development. Throughout the entire book, one finds carefully detailed solutions to characteristic applications of the principles under discussion. These are included in the appropriate portions of the narrative, not collected into a supplementary manual or appendix. This is helpful to the student and is somewhat unique. The author of one of the most widely used textbooks on thermodynamics in recent decades once observed, "The mistake most authors of thermodynamics texts make—is the inclusion of one million formulas without any specific illustrative examples." In correcting this mistake, *Energy Conversion Engineering* is a shining model!

Careful attention and identification of units throughout the illustrative computations is certainly a commendable highlight. The inclusion of some of the methods of chemical thermodynamics and chemical equilibrium is noteworthy, as is the quantification of the diverse considerations in environmental protection systems. Special commendation is due the excellent schematic diagrams of apparatus and systems, as well as the flow charts that portray the total problem vividly. Finally, the limited selection of energy problem summarizations has been expertly made, such as the overleaf pictograph illustrating the tiny fraction of input solar energy to the biosphere that becomes available for the "eighty electrical servants" in the average modern home.

The excellent "bookkeeping system" for all of the energy components of the complex conversion systems permits honest and meaningful comparisons. The inclusion of the chart portraying the influence of economics on the availability of fossil fuel resources is indeed timely and instructive, as is the comparison of energy efficiency and energy storage capabilities of typical modern systems.

Perhaps the single criticism to be recorded pertains to the inevitable typographical and format errors of a first edition. The thriftiness of the "camera-ready" preparation of the manuscript by the author's office is to be commended. In a few instances, however, the format suffers somewhat from (a) lack of page separation for at least one chapter, (b) possibly stronger emphasis on major topical headings by increased line separation, (c) the inclusion of page references for tables used in example solutions, and (d) better differentiation between similar numerical notations for figures, tables, and examples. (Page references might assist in the use of the limited group of tables; the *two* Figs. 2.25 might have page references given.)

The only serious problems may be (a) the need for a review of the basic thermodynamic and gas expansion laws from chemistry and physics and (b) some identification of entropy and enthalpy before those concepts are applied in the calculations. It is recognized that a diligent instructor will supply these supplements in the classroom, under normal circumstances.

In summary, it must be concluded that the author has succeeded very effectively in preparing "a teaching text . . . providing some of the analytical tools that will allow many arguments surrounding energy policy to be reduced to numerical values" and emphasizing the "basic principles that are invariant with time." It will be an excellent contribution to the nebulous field of "energy conversion science and engineering."

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