Protection, chairman of its Scientific Committee 46 on Operational Radiation Safety, and a member of its Scientific Committee 1 on Basic Radiation Protection Criteria.

Radiation Heat Transfer Notes

Author D. K. Edwards

Publisher Hemisphere Publishing Corporation (1981)

Pages 370

Price $19.95

Reviewer J. N. Anno

What is new in radiation heat transfer since the work in the 1920s by H. C. Hottel (to which the author refers in a 1954 reference)? Well, apparently plenty is new. The author approaches the age-old topic of radiation heat transfer from a modern physics standpoint. Indeed, these notes will probably be more appreciated by physicists than by engineers. The author goes to great lengths to dispel the old approximation that the radiation heat flux is proportional to the difference in the fourth power of the temperatures between the hot and cold surfaces. In fact, he may have gone too far so as to lose the usefulness of this work to the field engineer. Extensive commentary on the relationship of his notes to the more familiar engineering usage would have been appreciated. With this as the only major criticism, let me now extol the virtues of this book to selected members of the American Nuclear Society (ANS).

Radiation Heat Transfer Notes abounds with useful detailed data for radiation heat transfer calculations. This collection of such information in a single volume may, of itself, make this text a worthwhile addition to the members' bookshelves. In addition, the last four chapters, and especially Chap. 6, should be particularly useful to fission reactor safety people interested in the details of radiation heat transfer through gas (steam).

To those members of ANS in the academic world, I highly recommend this text for a graduate or dual-level nuclear engineering course in heat transfer. It comes complete with exercises (problems) and illustrations. It also sets a firm groundwork for computer calculations of complex heat transfer problems, especially in Chap. 8, the last chapter. In summary, I believe that this 370-page book will be useful to a significant fraction of the ANS membership, and so recommend it.

J. N. Anno is a professor of nuclear engineering at the University of Cincinnati and president of Research Dynamics Incorporated, a small business research and development (R&D) corporation. During the almost 30 years he has spent in R&D activities, he has been involved in a number of experimental and theoretical investigations in the area of heat transfer. In addition, he has taught several courses in heat transfer in the nuclear engineering program at the University of Cincinnati. He has authored several journal articles on heat-transfer-related topics and considers the subject to be basic to the engineering sciences.

Atomic Energy

Author R. M. E. Diamant

Publisher Butterworths, Woburn, Massachusetts (1982)

Pages 553

Price $49.95

Reviewer K. Almenas

The first difficulty in reviewing *Atomic Energy* by R. M. Diamant concerns classification. Where does the book fit? What audience does it try to address?

The plain cover, the number of pages (553), the profusion of tables, graphs, and diagrams leave the initial impression that this is a technical work addressed to the professional. However, a somewhat closer inspection shows that this cannot be the case. The scope of the book is enormous. It starts with a basic definition of the fission process, covers reactor theory and reactor development history, describes all possible reactor types, polemicizes about reactor safety, and closes with a chapter on the hydrogen economy. Understandably, such a scope does not allow depth of treatment, and even if it were written in an exemplary fashion, it would be of little interest to the professional.

Presumably then, the author has the general public in mind. This is suggested also by a statement in the brief preface that expresses the hope that " . . . this book will help a little in clarifying what atomic energy is all about." Let us assume then that the intended framework has been found. Then the proper question in evaluating this work can be stated as follows: Should this book be recommended to the interested layman who wants to learn about nuclear energy?

The answer falls easier than the question. It is an emphatic–no! The clearly negative evaluation follows not from one, but from a whole range of reasons. They include the lack of a consistent plan for presentation of the subject matter, an apparent inability to exercise selectivity, numerous misstatements, outright errors, and general carelessness. The writing style is annoyingly glib in some paragraphs and barely understandable in others.

Such a strongly negative evaluation should be justified to the reader of this review. It seems only fair to allow the author himself to do this. The number of quotations that could be used for illustrative purposes is extensive; thus, selectivity is required. For an easier overview, the chosen excerpts are grouped into several categories.

Let us start with the "misstatements." These are errors for which it is apparent that the author knows better. Some examples are:

p. 25. "As is well known the primary particles of elements are known as atoms . . . "

p. 73. "The shorter the gamma ray, or in other words, the higher their energy content, the greater their penetrating power."

p. 91. "Enriched uranium costs an average 50% more than unenriched uranium."

p. 147. "It is at all times essential that heat is not abstracted from fuel rods at a rate in excess of that capable of being born by the rod; otherwise, meltdown can occur."

A moderately competent technical editor could have eliminated the type of errors quoted above. More problematical are statements of the following nature. On p. 249, reasons are cited for the low breeding ratio of thermal reactors: "The reason for this is that moderated neutrons have good fissile powers but are very poor from the breeding point of view, i.e., they are not readily incorporated into the nucleus of the atom."

A review of nuclear bomb development history includes the following statements:

p. 54. "In actual fact, nuclear bombs can only be made from 100% U-235 or Pu-239 . . . "

"The German development came to an abrupt halt when their supply of heavy water, without which nuclear bombs cannot be made, was destroyed. . . . "

A description of a cooling power mismatch event in light water reactors appears on p. 310: "PCMA (power-cooling mismatch) could occur if a region in the core overheats due to excessive fissioning or undercooling at full power operation. Again, there could be a cascading core meltdown followed by steam explosion and rupture of the reactor vessel or coolant piping." Another quotation in the same chapter (p. 309) illustrates the author's conception of the chronology of core meltdown events: "As the fuel melts, it loses contact with the moderator and reflector and therefore the nuclear reaction comes to an abrupt end."

Two statements regarding nuclear power risks serve as further illustrations:

p. 318. "Emergency systems that can be operator overridden are useless."

p. 327. "In nuclear power stations, due to the very clean and methodical methods of working, risks of either workers or people outside the plant ingesting or inhaling even the merest trace of radioactive nuclides are zero."

As the phrasing of the quoted examples shows, a primary shortcoming is carelessness. This is clearly illustrated by the outright contradictions that occur in the book. Some examples follow.

Regarding the relative abundance of thorium and uranium, we read:

p. 108. "Also, there is far more thorium to be found in nature than there is uranium."

p. 193. "It (thorium) has advantages over plutonium (which is made from uranium) in being somewhat more plentiful in the earth's surface than uranium."

A backward glance into breeder reactor history leads to the following observations:

p. 259. "The original experimental fast reactor was built at Dounreay in 1955 . . . "

p. 279. " . . . the U.S. can claim the distinction of having constructed the world's first experimental convertor of nuclear energy into electricity . . . finished in 1951 and situated at Idaho. It was called the EBR-I and employed breeding . . . "

The current status of breeder construction is described:

p. 259. "There are plans afoot to construct much bigger stations: the Super Phenix in France and the 1320 MW commercial fast reactor (CFRI) in G.B. Both plants have already been fully designed on the basis of appropriate prototype fast reactors, but neither in France nor in the U.K. has the final go-ahead been given by the government."

p. 279. "A larger plant, the 1240 MWe Super Phenix is at present being built."

In some cases the contradictions occur fairly close together. Thus, on p. 68 we read that "It is true that there is no threshold at all to nuclear radiation. Even the slightest exposure is harmful." On p. 69, barely four sentences further we find "Furthermore, it is questionable whether radiation is really as dangerous as it is claimed to be."

As seen from the quoted examples, the writing style is at best awkward. At times it completely disregards the conventions of syntax and grammar. Let us quote just one example:

p. 25. "In such a case the neutron and the target nuclei behave like rigid, completely elastic bodies, and the normal law of conversation of momentum applies. However, this is of very little interest in practice, because hardly any collisions between neutrons and nuclei are head-on, but tend to be collisions at various angles, to strike glancing blows."

With this, the reviewer rests his case.

K. Almenas is an associate professor of nuclear engineering at the University of Maryland. He obtained his PhD degree in 1968 from the University of Warsaw and has worked at the Argonne National Laboratory. His research papers have been mainly concerned with the thermal-hydraulic aspects of the light water reactor safety field, particularly containment design.