BOOK REVIEWS

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Studies in Heat Transfer, A Festschrift for E.R.G. Eckert

Editors	J. P. Harnett, T. F. Irvine, Jr., E. Pfender, and E. M. Sparrow
Publisher	Hemisphere Publishing Corporation, Washington D.C. (1979)
Pages	516
Price	$42.50
Reviewer	Samuel H. Levine

Studies in Heat Transfer is a compilation of 30 papers written and published as a festschrift for E.R.G. Eckert. A festschrift is a tribute to the person being honored—in this case, E.R.G. Eckert, an outstanding investigator in problems of heat transfer. The papers in this volume reflect Professor Eckert's wide range of interest in heat transfer problems presenting a collage of loosely connected subjects covering boundary layers, external flows and jets, natural convection, internal flows, solar energy, conduction and fins, and boiling and condensation. Only a few papers relate to the mainstream of heat transfer problems in nuclear reactor technology. However, those interested in evaluation of solar collectors and other topics in solar energy will find a few excellent articles in the latter half of the book.

The first three papers cover problems encountered with turbine and jet engines. The cooling effect of different types of holes in jet blades, gas flow characteristics near a wall with strong injection, and film cooling using lateral injection of the gas jet to the surface are studied. These articles will be of interest to those who are specialists in this field.

The remaining 27 papers cannot be reviewed in a short summary; hence, only a few papers are reviewed here, these having been chosen to be of greatest interest to American Nuclear Society members.

The first paper selected for review describes a flow visualization system to obtain the heat transfer distribution and the region of melting around a circular cylinder that is placed in a solid close to its melting point; naphthalene is used for the melting material. This method of observation should permit optimizing the geometry of heating tubes in a thermal energy storage system by observing the pattern of the molten region.

In another paper, the effect of surface roughness on heat transfer characteristics for single-phase forced convection is presented for the designer. Specific recommendations for correlation of heat transfer and friction data are presented, together with a design procedure for particular design applications.

Among the last nine papers in the book are a few excellent papers on solar energy. The first of these introduces the basic methods for computing the exergetic efficiency, i.e., the ratio of the exergy (work potential) of the useful heat obtained to the exergy of the useful heat available from solar radiation. The optimal mode of a solar system is studied wherein the efficiency of the collector and the supplemental equipment are both discussed with numerical examples. Emphasis is made on the collectors. A gray absorber coating has a maximum efficiency of 8%, a highly selective absorber may have an efficiency as high as 30%, and the maximum efficiency is 70% using a focusing collector. The other papers present studies on absorption heat pumps for solar space heating systems and layout of solar towers.

A paper related to nuclear energy problems is one that presents results of an experimental study of liquid-liquid boiling heat transfer. The effect of simulating conditions when water contacts molten metal after a loss-of-coolant accident is achieved by floating a layer of film boiling water on an aluminum plate and the boiling water is covered with another layer of hydrocarbons. With Pentane on top, the heat flux from the solid to the liquid was double that of water alone, whereas other hydrocarbons reduced the heat flux from the plate.

Another paper describes methods for augmenting heat transfer in single-phase media with boiling and condensation of fluids in channels. The study has application to decreasing the weight and dimensions of heat exchangers. Heat transfer intensification is gained by increasing the hydraulic resistance of the channel per unit length. One interesting aspect of this paper relates to film boiling wherein it is shown that application of a thin, low thermal conductivity film will stop film boiling and cause more intensive heat transfer processes at higher temperatures.

The final paper introduces the concept of a thermal triode; a heat pipe with a controlling zone. The temperature of the controlling zone regulates the heat flow through the

triode in the same way the potential bias of the grid alters the current in an electric triode.

This book is intended for the aeronautical and mechanical engineer working in areas of heat transfer in systems of advanced design or related fundamental heat transfer processes. This book is worth reading by persons interested in performing research in the relevant areas of heat transfer.

Samuel H. Levine is professor of nuclear engineering and director of the Breazeale Nuclear Reactor of The Pennsylvania State University. For the past 12 years, Professor Levine has been teaching courses on heat transfer and in-core fuel management at Penn State. His principal areas of research include fuel management and experiments performed using research reactors and critical facilities.

The Particle Play

Author J. C. Polkinghorne

Publisher W. H. Freeman and Company

Pages 138

Price $12.75

Reviewer Mark A. Samuel

What is the ultimate structure of matter? Is there a small number of elementary particles, out of which the tremendous variety of material objects in nature is constructed? These are questions that have been asked, in one form or another, since the days of the ancient Greeks. There is reason to believe, however, that today the answer may be very close at hand.

Polkinghorne has done a beautiful job in providing a remarkably complete and up-to-date description of our current understanding of the fundamental constituents of matter and their interactions. His style is extremely readable and this book should provide interesting reading for both the layman and the scientist.

This account also gives the reader a taste of the excitement of the discovery process itself, as well as its dead ends. The latter purpose is presumably fulfilled by inclusion of such topics as *S*-Matrix Theory and Bootstrap Theory, although the inclusion of so many subjects may be somewhat confusing for the nonexpert.

There are just a few minor corrections and criticisms I would like to mention. On p. 77, the anomalous magnetic moment of the muon (not μ-meson) should be $(g - 2)/2$. There are remarkably few typographical errors; however, there is one on the first line of p. 118 that may be very confusing. The phrase "a lepton column like (A) of p. 112" should be omitted. Finally, the author in the Epilogue permits himself the indulgence of presenting his view of the connection between science and religion, although he expresses his irritation at the previous attempts of others. The book would have been better had this brief Epilogue been omitted.

Mark A. Samuel received his BS and MS degrees in physics from McGill University and his PhD degree in physics from the University of Rochester. He is presently associate professor of physics at Oklahoma State University. Dr. Samuel was a visiting scientist at the Stanford Linear Accelerator Center during the summers of 1973 and 1975 (Theoretical Physics Group). He was also a visiting scientist at the Niels Bohr Institute, Copenhagen, in 1977. He is the co-author or author of some 25 professional papers in theoretical particle physics as well as a co-author of a book on group theory.

Fast Pulsed and Burst Reactors

Author E. P. Shabalin

Publisher Pergamon Press, Maxwell House

Pages 263

Price $59.00

Reviewer Noel R. Corngold

Early in 1945, before Alamogordo, separated ^{235}U began to arrive at Los Alamos. By April 13, O. R. Frisch's group had achieved the first critical assembly of metallic ^{235}U. However, the experimental kinetics of fast systems and bombs remained unknown territory. Frisch, later Jacksonian Professor of Natural Philosophy at Cambridge, "... thought it would be nice to go one step nearer to a real atomic explosion." He and his colleagues designed a simple experiment. They stacked tiny blocks of uranium hydride inside a box on a steel table, leaving space for a uranium slug that was hoisted above the assembly. With the slug in place, the system was "slightly" super-prompt-critical. But, the drop, in the derrick-like arrangement, would cause the slug to be in place for only a few milliseconds. As Richard Feynman phrased it, one was tickling the tail of a sleeping dragon. Thus, the DRAGON experiment was born and christened. The experiment was carried out, in fact, after Alamogordo. For a few weeks, drops were made, and the burst data were recorded and analyzed—to everyone's satisfaction.

The DRAGON's seed—IBR and SPR, VIPER and FRAN, and others—forms the subject of E. P. Shabalin's book, *Fast Pulsed and Burst Reactors*. Its subtitle, "A comprehensive account of the physics of both single burst and repetitively pulsed reactors," expresses the matter nicely.

The author, a Russian physicist, is a staff member at the Joint Institute for Nuclear Research in Moscow, and Pergamon's clumsy translation from the Russian, with its occasional howlers, cannot hide his enthusiasm for his subject. Shabalin knows well Dubna's pulsed period reactor, the IBR, and its progeny. The original IBR, which began operation in 1960, had its reactivity modulated through the rotation of a steel disk, which carried, in turn, a disk of enriched uranium, and passed between two fixed parts of a reactor core. In the next two decades, designs became much more complicated, with elaborate arrangements of moving parts. At the close of the book, Shabalin discusses an exotic "modern" version, pulsing a 10-mg pellet of fissile material that has been compressed strongly by laser light!