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.

Perturbation Methods in Heat Transfer

Authors	A. Aziz and T. Y. Na
Publisher	Hemisphere Publishing Corporation (1984)
Pages	199
Price	\$37.50
Reviewer	B. D. Ganapol

The title *Perturbation Methods in Heat Transfer* is somewhat misleading. Neither the subject of perturbation methods nor of heat transfer is treated in any great depth. Instead the authors present many case studies dealing with heat transfer problems that lend themselves to solution by perturbation techniques. The authors' treatment is not particularly mathematically oriented nor is it physically descriptive.

The fundamental concepts of regular and singular perturbation expansions are presented by example without mathematical justification or motivation. While this kind of presentation may be an appropriate learning technique, especially for engineers who are not interested in the mathematical rigor, it does not promote understanding. For example, it is not made clear why in some instances the small parameter raised to a nonintegral rather than an integral power is used. If one is to fully understand this technique and apply it to other physical problems, a more detailed recipe is required than is provided. Heat transfer only enters through the examples used to demonstrate the perturbation techniques. The physical processes are not at all described and no physical insight is given. The reader is expected to be knowledgable in the equations of heat transfer and fluid flow.

The final chapter is devoted to a mathematical investigation of the perturbation expansion and presents some powerful methods for improving series convergence such as the Euler and Shanks transformations. The important point that these series may on occasion be asymptotic is not discussed, however.

The book is, in my opinion, best suited to graduate students in applied mathematics who have studied both heat transfer and fluid flow in depth and have had an introduction to perturbation techniques. For the practicing nuclear technologist, this book is certainly not a must but would make interesting reading for those who wish to improve upon their numerical skills.

As a final note, I bring to the reader's attention that the authors overlooked an extremely powerful method of extending their results to higher order expressions. By the use of symbolic manipulating languages such as REDUCE and MACSYMA, the algebraic detail of generating higher order expansions is easily performed. In addition, FORTRAN code can be written directly to file, thus eliminating the need for programming assistance. Hopefully in the next edition, perturbation methods coupled with symbolic manipulation will be considered.

Dr. Ganapol received his PhD from the University of California at Berkeley in 1971 and was employed by the Swiss and French governments during the following three years. Upon returning to the United States, he went to work at Argonne National Laboratory in the fast reactor safety group. Dr. Ganapol's interests are numerical methods development in fast reactor safety and analytical and numerical particle transport theory. He has written 100 articles on these subjects and is currently writing a book on analytical benchmark solutions in transport theory.

Symmetries in Nuclear Structure

Editors	K. Abrahams, K. Allaart, and A. E. L. Dieperink
Publisher	Plenum Press (1983)
Pages	301
Price	\$47.50
Reviewer	N. V. V. J. Swamy

This work is essentially the proceedings of the Fifth International Summer School on Nuclear Physics organized by the Netherlands' Physical Society in the second half of August 1982. The theme of the summer school was symmetry in nuclear physics, and the book contains a collection of lectures given by invited speakers.

The lectures covered the important applications of symmetry in nuclear structure and ranged from the somewhat abstractly theoretical discussion of the statistical aspects of nuclear levels to a lucid review of nuclear probing by electron scattering experiments. There is an account of the basic topics in nuclear structure: infinite nuclear matter, independent particle model, optical model, Hartree-Fock potential, effective interactions, symmetry properties of the shell model, isolation of spurious center of mass excitations, and rotational levels. The isospin symmetry in nuclei is broken by electromagnetic forces and the neutron-proton mass difference arising out of the d quark being heavier than the u quark. Weak interactions violate parity or left-right symmetry. It is pointed out that among the experimental consequences of these symmetry-breaking interactions are the isospin-mixed doublets and parity-mixed doublets in light nuclei. The lectures on the microscopic basis of collective symmetries deal with the conservation of seniority as an SU(2) symmetry and its application to the study of the level structure of closed shell lead isotopes under the assumption of pairing interaction. Spectrum functions, ensembles of many dimensional random matrices, and the central limit theorem form the subject matter of another lecture that deals with the statistical analysis of the energy levels of complex nuclei, the foundations of which were laid by Bethe, Wigner, Dyson, and Mehta. The predominantly experimental presentation reviews the measurement of the ground state charge density of a lead nucleus by means of high-energy electron scattering, which is theoretically analyzed using direct Fourier transform techniques and density-dependent Hartree-Fock wave functions.

Readers concerned with elementary particle studies will find it interesting to go through the discussion of electroweak interactions, parity nonconservation in nuclei, neutrino oscillations, and delta dynamics. These talks, which cover theoretical as well as experimental research, include the development of semileptonic "charge-changing" weak interactions as well as neutral current interactions, electro-weak unification, neutrino mass oscillations conjectured by cosmological missing mass problems, solar neutrinos and double beta decay, and the GUT theory. The book ends on a rather facetious note with a proposed parity nonconservation experiment in muonic helium atoms, "a difficult experiment which may succeed if several unknown factors are favorable."

The lectures were presented by experts in the respective fields who very often updated their discussions by referring to recent work. As remarked in the Foreword, the talks aimed at reaching graduate students as well as advanced researchers, although there are some discussions that may be somewhat strange to the uninitiated. In spite of one of its proponents being a lecturing participant in the summer school, the interacting boson models are barely touched and supersymmetries based on U(6/4) etc., and quark degrees of freedom are left out. This notwithstanding, the book is not only useful but also enjoyable with occasional relaxing expressions like "Goldstone Cannibalism" and "idiot-model"! Finally, because of its being such a dynamic and rapidly changing field, a few may be tempted to view opinions like the top quark not yet discovered or the existence of neutrino oscillations as rather old-fashioned.

Dr. N. V. V. J. Swamy is a professor of physics at Oklahoma State University in Stillwater, Oklahoma. He is the author of a book and several publications relating to nuclear structure, nuclear fission, relativistic quantum mechanics, symmetry and group theory, astrophysics, and plasma wave dispersion relations. In 1975, he spent his sabbatical at the Plasma Physics Institute of Kernforschungsanlage in the Federal Republic of Germany, where the dominant theoretical activity was the study of radio-frequency heating of tokamak plasmas, and later at Cambridge University in England. Because of the levitation experiments that seem to establish the existence of fractionally charged particles (quarks) and the contention of particle physicists that the existence of quantized charges implies the existence of magnetic charges, his current research interests include the investigation of consequences in plasma physics of the existence of such charges, besides nuclear fusion.

Advances in Two-Phase Flow and Heat Transfer, Vols. 1 and 2

Editors S. Kakac and M. Ishii

Publisher Martinus Nijhoff Publishers, Boston, Massachusetts (1983)

Pages 920

Price $125.00

Reviewers R. K. Chohan and Belle R. Upadhyaya

The importance of two-phase flow to nuclear technology does not require emphasizing. Most of the early monographs on the subject, such as those by Tong,[1] Hewitt and Hall-Taylor,[2] and Collier,[3] were written by authors connected with the nuclear industry. The same remark seems to apply to the papers presented in this two-volume work. Certainly most of the papers deal with problems, either directly or indirectly, related to nuclear reactor systems.

A great deal of two-phase flow and heat transfer research has been motivated by safety analysis of nuclear reactors and, recently, severe accident analysis. Factors that have contributed to the increased complexity are (a) difficulties in describing two-phase flow (due to, for example, different flow patterns), (b) complex geometries, (c) heat transfer, and (d) the coupling of heat, mass, and momentum transfer. Two-phase modeling has seen considerable development in recent years and Ishii and Kocamustafaogullari discuss these and their limitations in the first chapter. As they point out, interfaces between the phases characterize such flows, and the quantification of transport phenomena across them present a great (and unsolved) problem.

The first article is followed by four papers on modeling: a system mean void fraction model, a two-fluid model, critical flow modeling, and shock wave analysis. The first accounts for evaporating and condensing flows under transient conditions. The second deals with linearized and coordinate frame invariant constitutive equations for two-phase mixtures. Critical flow, which finds relevance in pipe breakage, is dealt with in the third. It is pointed out that, unlike single-phase critical flows, the rate of vapor formation is an important parameter. The fourth paper involves two-component, two-phase flow. Though conditions considered