

state-of-the-art computer calculations and provides fine examples of the graphical representation of subsequent numerical information. Moreover, each of the authors is a renowned contributor to ocean acoustics, bringing theoretical and experimental knowledge and experience to the subject.

The authors have successfully combined their considerable expertise to produce distinctive chapters on each of the major propagation models cur-

rently in use. Each approach is derived mathematically, its solution properties discussed and interpreted and the method placed in context relative to its usefulness. Moreover, each chapter carefully references early developmental work, key supporting material or informative review articles. Finally, the book is unique in its genre in that each of the four propagation-model chapters concludes with guidelines for the development of a working program or com-

puter code to generate solutions.

The book incorporates a wide variety of insightful examples to illustrate the techniques being discussed. Calculations for the examples show such results as the acoustic pressure field, coherent and incoherent transmission loss and the importance of source characterization (illustrated with point, line, beam and/or Gaussian sources). If you have ever wondered about "fuzzy" rays or the exact relationship between the ray solution and the Wenzel-Kramers-Brillouin solution or what method to use for your wave-number integration (trapezoidal rule? Filon method? adaptive nonuniform sampling?) or how best to apply root-finding techniques in your normal mode code or how to select your parabolic equation starting field, then this is the book to consult. It is a superb book that should be on the shelf of anyone with an interest in ocean acoustics.

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Analytical Fluid Dynamics

George Emanuel
CRC, Boca Raton, Fla., 1994.
424 pp. \$159.95 hc
ISBN 0-8493-8687-X

The maturation of fluid dynamics as a multifaceted discipline has taken place essentially during the last half-century. Apart from a few preliminary developments in Western Europe, it was in the 1940s that systematic attention began to be applied to compressible flow, a feature that provides the basic distinction between classical hydrodynamics and modern fluid dynamics. The physical bases for the former reside in the equations of continuity (mass conservation) and momentum (Newton's Second Law). When flow speeds are not negligible compared to sound velocity, variations of density and temperature take place with the result that the momentum and energy equations are now coupled. The fluid physics becomes more involved in view of the exchanges between kinetic and thermal energy, heat conduction and the dependence of viscosity coefficient on temperature, among other effects. The discipline of compressible flow is usually referred to as gas dynamics.

George Emanuel's book is partially motivated by the supposition that, within that discipline, a stronger bridge is needed between the mathematical formulation and the physical

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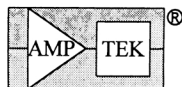
interpretation applied to specific problems in such major subfields as viscous boundary layers, shock waves, high Reynolds number flows and so on. His point of view is based on extensive experience teaching two graduate courses. The book has features of a graduate-level text and, as such, assumes some familiarity with elementary gas dynamics as well as vector and tensor analysis. For those who want to play catch up, there are several appendixes that provide reviews of basic mathematical aspects such as tensors, method of characteristics and the use of curvilinear coordinates. The book also includes illustrative examples and numerous problems with hints and answers. Another useful feature is the set of preliminary remarks at the start of each chapter. These provide a useful framework for the subsequent discussion.

According to the author, the book is also designed to prepare the student for more specialized studies, including a better understanding of the journal literature. At the same time, the book has some characteristics of a monograph in that a portion of the content, such as the so-called substitution principle, has not appeared previously in a comprehensive work devoted to gas dynamics.

The various features add up to a rather distinctive work that deserves to take its place in the archival fluid-dynamics literature. It is evident that the author is well-informed on the latest developments and has a clear view of the relative significance of different aspects of the subject. He is also quite clear on the assumptions introduced when seeking a solution for the problem at hand.

In retrospect, those writing on this subject surely know that they are, in a sense, competing with some first-class treatments of the subject, although the balance between mathematical methodology and phenomenological-physical description varies from author to author. For the reader who wishes to assess the basic physical underpinnings of the subject, there are treatments such as those by Hans Liepmann and Anatol Roshko (*Elements of Gas Dynamics*, Wiley, 1957), Lev Landau and E. M. Lifshitz (*Fluid Mechanics*, Addison Wesley, 1959), Philip A. Thompson (*Compressible-Fluid Dynamics*, McGraw-Hill, 1973) and Ascher Shapiro (*The Dynamics and Thermodynamics of Compressible Fluid Flow*, Ronald, 1953).

A few shortcomings of the book include the use of a font size that is 15% to 20% smaller than is common for a technical book and will tend to tire the reader. Also, apart from the



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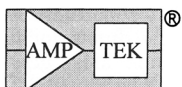
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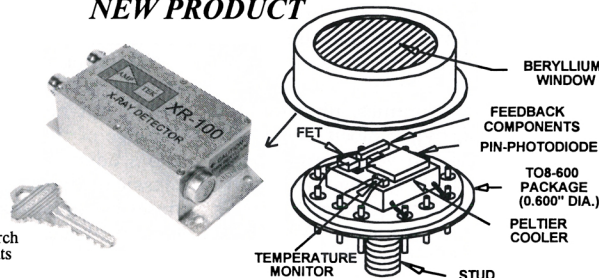
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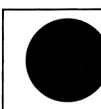
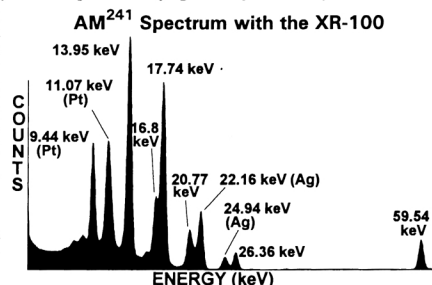
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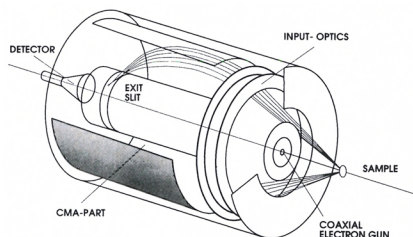


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diagrams that illustrate mathematical relations, there is a shortage of charts and numerical data to supplement physical aspects of the discussion. In addition, as the author points out, several major topics are not included in the present work. These include turbulent flow, computational fluid dynamics, physical gas dynamics and hypervelocity flow. Finally, some of the vector and tensor notation is a little strange, especially the symbol for the orthonormal basis of Cartesian coordinates. All in all, however, what is covered is done with good insight. The book deserves to be in the library of those actively working in both inviscid and viscous gas dynamics.

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Introduction to Quantum Field Theory

George Sterman
Cambridge U. P., New York,
1993. 572 pp. \$39.95 pb
ISBN 0-521-31132-2

I was hoping to find in *Introduction to Quantum Field Theory* a text that would cover both the "how to" (which the book under review does reasonably well) and the "why" of quantum field theory (where this book, as many of the recent texts I have seen, is woefully inadequate). I realize how difficult it is to write a pedagogical introduction to quantum field theory, explaining the motivation as well as the current techniques. Nonetheless, I find the current tendency—the presentation of techniques with little or no attention to motivation—detrimental to the education of future generations of physicists. It also harms the "public relations" of particle physicists, since it makes it harder for physicists outside the field to find out what we are doing and why.

Most of the chapters of George Sterman's book that are devoted to applications, such as those on the standard model, perturbation theory and renormalization theory based on dimensional regularization, are quite good (though too often the reader is referred to other texts or articles, and various chapters show their vintage). I would not hesitate to use this book as a supplement in a graduate course on particle physics or quantum field theory. I would warn the students, however, not to try to imitate the author's extremely cavalier handling

of mathematical terminology (such as calling the Legendre transform a Laplace transform, or giving an incomplete definition of a functional derivative or defining a functional as a "function of functions").

The book starts out with a chapter on the action principle for classical fields, but no motivation is given for the use of the action principle, nor is the student told why one should use classical fields when attempting to describe particles. The chapter on canonical quantization is also highly condensed, and I am not sure the average graduate student could do the problems accompanying this chapter without appealing to other textbooks.

Part II of the book is devoted to fields with spin and contains a readable account of the representation theory of the Poincaré algebra, Dirac and Weyl spinors, gauge fields (in a very nongeometric presentation) and the standard model. The notations are sometimes impenetrable, and the letter δ is overused, so that sometimes it is hard to know whether it is a delta function, a variation or part of a functional derivative.

Part III is devoted to renormalization, based mainly on the dimensional regularization technique. More general developments (such as the BHPZ theorem) are described, and references are given. The discussion of ghosts never mentions the geometric aspects, and the introduction to the renormalization group is poor. This part ends with a brief chapter on bound states and limitations of perturbation theory.

The book is nicely typeset, but the editorial work is sloppy: Too many proper names are misspelled both in the text and the bibliography: Haag is spelled correctly and misspelled on the same page; Feynman is variously written as Feynman and Feynmann, Itzykson as Itzkson, Weinberg as Weiberg and Becchi as Becci. In addition, a spell checker should have caught such errors as "introductory" and "catastrophy." We can only hope that a second edition will be more carefully prepared.

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