ganized into three parts. The first part establishes a working background by reviewing classical optics, the quantum theory and astrophysics. The second part is the vital portion with its eight chapters containing well over half the text. Its material is a rich collection that treats in considerable detail the developments in optical and electron microscopy, multiple-beam interferometry, luminescence, optical glasses and plastics and fiber optics.

Tolansky is particularly successful in showing how some of these developments have spawned various industrial and commercial applications, which touch on aspects of everyday life, and yet how others have played key roles in fundamental scientific research. In some instances he speaks from first-hand experience and conveys the lively sense of enthusiasm and excitement with which a research scientist attacks a problem. Moreover the debts to the past have not been overlooked and a nice historical perspective has been provided for certain subjects by mentioning the important beginning steps by individuals in earlier centuries. The relatively recent and publicly prominent topics of lasers and holography are taken up in the third part, where concise physical explanations are given and backed by both actual and speculative examples of applications.

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*A professor at Trinity College, Robert Lindsay has been teaching undergraduate physics for 13 years.*

## Singular perturbations

PERTURBATION METHODS IN APPLIED MATHEMATICS. By Julian D. Cole. 260 pp. Blaisdell, Waltham, Mass., 1968. $9.50

by GEORGE I. BELL

The term "perturbation method" may suggest to most physicists the Rayleigh–Schrödinger theory and related methods of obtaining energy eigenvalues. This book has nothing to do with such perturbation methods, but is rather about problems in singular-perturbation theory, boundary layers and the like.

These problems arise in differential equations containing a small parameter, $\epsilon$, where the solution of the differential equation for any finite value of $\epsilon$ is qualitatively different from the solution for $\epsilon = 0$. Consider, for example, an ordinary differential equation for $x(t)$

$$\epsilon \frac{d^2x}{dt^2} + \frac{dx}{dt} + x = 0$$

For $\epsilon = 0$, the differential equation is first order and $x(t)$ is uniquely determined by $x(0)$; for any finite $\epsilon$, the equation is second order, and both $x(0)$ and $(dx/dt)(0)$ are required to determine the solution that is, in general, qualitatively different from that for $\epsilon = 0$. This book is about solutions to similar and more complicated differential equations using asymptotic expansions in $\epsilon$.

The first half treats ordinary differential equations. Singular-perturbation theory is developed for equations in which $\epsilon$ multiplies the highest order derivative, and explanations are provided for matched asymptotic expansions and uniformly valid solutions. Julian Cole also describes methods for treating harmonic oscillators subject to perturbations affecting the period and amplitude, including the "two-time" method. The Van der Pol relaxation oscillator is studied at length. Differential equations with slowly varying coefficients are also examined and contacts are made with adiabatic invariants and the Wentzel–Kramers–Brillouin–Jeffreys method.

In the second half, partial-differential equations (of second order) are considered in which $\epsilon$ multiplies the highest-order derivatives. The solutions are examined for elliptic and hyperbolic equations and are applied to a number of hydrodynamic problems, including boundary-layer theory and magnetohydrodynamic pipe flow.

Cole, professor of applied mathematics at California Institute of Technology, is well qualified to write on these topics; he and his colleagues have contributed significantly to the development of these perturbation methods. His book could be read profitably by a graduate student familiar with ordinary and partial-differential equations, but a knowledge of hydrodynamics would help in appreciating some of the examples. Cole employs physical intuition and simple arguments throughout, rather than mathematical rigor, and methods are explained through examples. It could also profit theoretically inclined workers in many fields, for although these perturbation methods have been largely developed in hydrodynamics, they are applicable in many other fields.

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*George Bell, with the theoretical division at Los Alamos Scientific Laboratory, has had an interest in "singular-perturbation theory" since discovering that he had used it (inadvertently) in a transport-theory problem.*

## Concentration on the nucleus

NUCLEAR PHYSICS: AN INTRODUCTION. By Haro von Buttlar. 547 pp. Academic Press, New York, 1968. $14.50

by NORMAN A. BAILY

I examined this book from the point of view of using it as a text for the first quarter of an advanced radiation-dosimetry course. What was desired was a comprehensive review of nuclear-physics fundamentals to serve as a base in developing the specialized topics of the course.

The book provides excellent coverage of many topics and treats neutron interactions extensively, but gives very little coverage to charged-particle interactions or the interactions of photons with matter. Rather than the usual broad topical spread found in many texts with similar titles, the book concentrates, and probably rightly so, on the nucleus. It should, therefore, adequately prepare the physics undergraduate student for more advanced treatments of the same topics, in addition to providing the groundwork for advanced concepts not treated.

The approach is quite sound, starting with a review of collision theory and the central-force problem. Part A continues with such subjects as nuclear-binding energies, kinematics and decays. The liquid-drop model is described together with its limitations, and neutron physics concludes this section. Part B introduces the student to applicable quantum-mechanical concepts, and the third section then treats selected topics, which are nuclear spin, nuclear moments, the shell model, the two-nucleon problem, reaction cross sections, alpha- and beta-decay theory, and summaries of the various nuclear models.

Haro Von Buttlar is a professor at the Institut Für Experimentalphysik, Ruhr-Universitat Bochum, Germany. He wrote this text to bridge the gap

between German texts available for a qualitative introduction to the subject and high-level treatises on theoretical nuclear physics. Portions of the text are taken from his lectures at the Darmstadt Technical Institute.

Those topics presented appear to be thoroughly treated and clearly presented. A comprehensive set of problems is also furnished.

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*Norman Baily is professor of radiology and head of the physics division of the radiology department in the School of Medicine, University of California, San Diego. He teaches graduate students in medical physics.*

## Computing without tears

OMNITAB: A COMPUTER PROGRAM FOR STATISTICAL AND NUMERCIAL ANALYSIS. (NBS-101). Joseph Hilsenrath, Guy G. Ziegler, Carla G. Messina, Philip J. Walsh, Robert Herbold, eds. 275 pp. National Bureau of Standards, Washington, D.C., 1968. $3.00

by DAVID JOWETT

The title of this book is deceptive, for it offers more than conventional computer programs and provides in fact a language in which to write programs. The operative phrase in the title "for statistical and numerical analysis" covers a useful and varied range of computer applications. Within this range, OMNITAB grants easy access to the computer for unsophisticated users, enabling them to carry out complex calculations of their own devising, assisted by standard routines for more conventional tasks.

The program does not replace symbolic languages such as FORTRAN, which explains the authors' reluctance to present it as "just another computer language." Rather it provides an easily mastered substitute for them in a limited range of circumstances. The limits are such that many users will rarely go further.

Joseph Hilsenrath and his colleagues at the National Bureau of Standards have taken an elementary piece of scientific equipment, a worksheet, and stored it in the computer. The scientist's worksheet characteristically consists of a sheet of paper, ruled by rows and columns, in which he enters data and operates on them in a variety of ways. OMNITAB makes it as easy to explain to the computer what is to be done, as it would be to write instructions for a computational assistant. Thus the command MULTIPLY COLUMN 1 BY COLUMN 2 AND STORE IN COLUMN 3 suffices to carry out the operation described. More complex operations with many steps, such as matrix inversion and least-squares fitting, are often initiated with a single command.

The book is well documented and contains many examples related to physics and engineering. It also contains many illustrations produced by the data-plotting routines in the program. The capacity to produce plots easily and cheaply on the line printer is perhaps the most significant feature distinguishing OMNITAB from programmable desk-top machines. Using such plots intelligently provides a powerful means whereby large sets of data can be examined without tedious labor.

The descriptions of OMNITAB commands are generally clear and concise. They are classified as input, output, manipulative and matrix and scattered throughout the book interspersed with textural material and examples. This makes it a little difficult to use for self-instruction or teaching. However, the commands are listed at the beginning, and many of them are self-explanatory.

In the section on self-teaching the authors emphasize that the program may provide the easiest resolution of questions or ambiguities. To learn how to use OMNITAB one starts with real problems, using this book as a reference to the meaning and utility of the commands. If doubt arises, the command should be used on a trial basis and the output examined. The natural progression to increasingly complex problems leads to greater competence.

David Hogben has contributed a useful essay on statistical applications of the program in an appendix. However, as Hogben readily admits, this can do no more than indicate the generality of the program, to which no manual can possibly do full justice. Any scientist or teacher should examine this book if he is not confident that both he and his students are already using the computer to the fullest possible extent. But the book should be used in conjunction with the program, which is now available for several computer systems.

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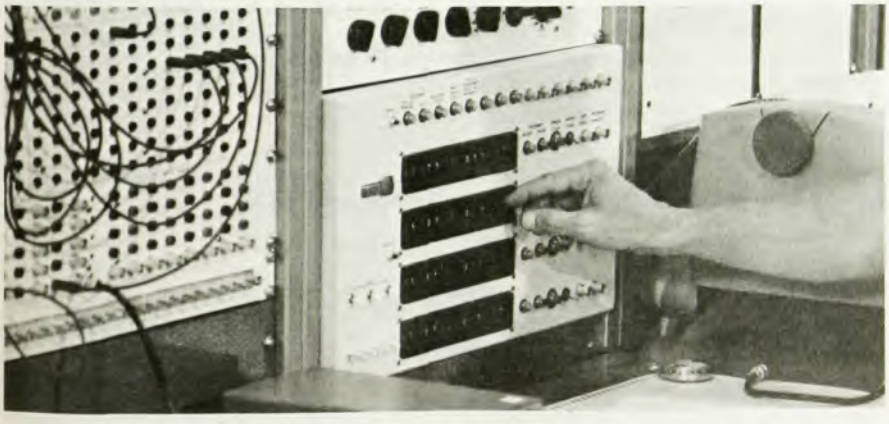
*After obtaining a PhD in botany and spending six years in Uganda with the British Colonial Service, David Jowett joined the statistics laboratory, Iowa State University in 1965. He now teaches and consults in statistics, making extensive use of* OMNITAB *in both these activities.*



## In a past context

PRACTICAL PHYSICS. By G. L. Squires. 244 pp. McGraw-Hill, New York, 1968. $6.50

by ERNEST C. POLLARD

I read this book with the wisdom (or burden) of teaching laboratory physics for three full generations. I can well remember in the first generation the predecessor to this same course at Cambridge, where G. F. C. Searle sharply, nervously and shrewdly ran the laboratory. I can hear him now telling students *never* to call him "sir," watch him getting out his "lady elevators" to help the girl students reach over the bench to read instruments and producing from his knapsack a thermos flask of tea that was shared with various embarrassed students each time. The next generation is represented by John Strong with *Pro-*