Papers in Mathematics

Numerical Solution of Partial Differential Equations. Proceedings of a symposium held at College Park, Maryland, May 1965. JAMES H. BRAMBLE, Ed. Academic Press, New York, 1966. 389 pp., illus. $16.50.

This is a collection of the invited papers given at a symposium held at the University of Maryland. Most of the papers are careful, detailed presentations of timely and interesting results, with excellent bibliographies. Some are little more than abstracts, and it is unfortunate that the complete versions are not provided.

For the purposes of this review I have grouped the papers into three categories: those that deal with elliptic equations, those that deal with hyperbolic equations, and miscellaneous. In the first category there is an elegant discussion by G. Fichera of the method of intermediate problems which seems to cover all variants as well as give a new approach which in certain instances eliminates the need to find a base problem. Variational methods are presented in different forms by R. S. Varga, by K. O. Friedrichs and H. B. Keller, and by L. E. Payne. A. Weinstein surveys numerical results obtained by the method of intermediate problems. B. Hubbard obtains refined error estimates for the Dirichlet problem by estimating the discrete Green's function. S. Bergman treats fluid flow problems by transforming them into a linear equation. The nonlinear two-point boundary value problem is treated by M. Lees with the use of fixed point theorems. S. V. Parter presents a monotone iteration for a discrete analogue of the Dirichlet problem for $\Delta u = f(P,u)$.

In the second category there is an interesting paper by H. J. Stetter on the stability of discretizations of nonlinear partial differential equations, in which it is clearly shown, both by the use of an implicit function theorem and by extensive computations, that explosive instability can occur if the approximate solution exceeds a threshold perturbation of the exact solution even though the linearized discretization is stable. The gap between theory and practice in the solution of nonlinear hyperbolic equations is clearly evident in E. Isaacson's survey of attempts to compute the motion of cold fronts and floods. P. D. Lax announces a local stability condition for difference operators with variable coefficients, and H.-O. Kreiss presents the beginnings of a theory of the stability of difference approximations for hyperbolic mixed initial boundary value problems. V. Thomée's contribution is a development of stability criteria in L_p, $p \neq 2$. G. Birkhoff and R. E. Lynch point out that lower-order terms in hyperbolic equations, although not affecting the speed of propagation of signals, can introduce difficulties into finite difference calculations.

In the last category there is a long paper by A. Douglis demonstrating the correctness of a certain initial boundary value problem for a class of integrodifferential equations which includes the transport equation. He also proves the convergence of a finite difference approximation for this problem. H. F. Weinberger obtains remarkable a posteriori error bounds for a particular matrix inversion process. Finally, there are papers by J. Douglas, Jr., on approximate analytic continuation and by D. A. Sprecher on representation of a function of several variables by functions of one variable, and a short note by I. Flügge-Lotz.

BURTON WENDROFF
University of Denver,
Denver, Colorado

Treatise on Molluscs

Physiology of Mollusca. Vol. 2. KARL M. WILBUR and C. M. YONGE, Eds. Academic Press, New York, 1966. 659 pp., illus. $22.

The question is often raised whether, in light of the rapid advance of current research, hardbound reviews are liable to be obsolete almost before the ink is dry. The answer is "no" if a research worker, a teacher, or a graduate student needs a readily available reference to the literature on a particular subject. The answer is again "no" when the authors of such works enlarge on their own views and extrapolate, thus adding a dimension beyond that of a compendium of results. The answer is "yes" when the authors do not do the latter, and of course "yes" if the authors' efforts, or lack of it, guarantee a built-in obsolescence at the time of printing.

The first volume of *Physiology of Mollusca*, which appeared in 1964, is a uniformly competent presentation. The excellent opening chapter on classification and structure of the Mollusca effectively introduces the group and is followed by two thoughtful, well-documented chapters on the physiological ecology of intertidal and nonmarine molluscs. The depth and breadth of coverage by each of the authors are commendable in the chapters on reproduction, development, growth and shell formation, osmotic and ionic regulation, muscle and neuromuscular physiology, special effectors, locomotion, and buoyancy. A chapter on bivalve culture, which is rather specialized for a volume of this scope, is included.

Volume 2 made its appearance approximately two and a half years after volume 1. It contains 12 chapters covering feeding, digestion, heart, circulation and blood cells, respiration, hemoglobin and myoglobin, hemocyanins, pigmentation, carbohydrate metabolism, nitrogen metabolism, excretion, and physiology of the nervous system and sense organs. Three additional chapters are concerned with the feeding and digestion, the sense organs, and the brain and behavior of the most highly evolved group of the molluscs, the cephalopods. There is a decided unevenness in the contributions to volume 2.

The chapter on respiration is superficial in coverage, and both it and the chapter on pigmentation lack current coverage. In contrast, the chapter on hemoglobin and myoglobin has both an addendum and a note added in proof which brings the coverage right up to the time of publication. The remainder of the chapters are first-rate by any standards one wishes to use.

This volume does not have the balance of the first. Continuity would have been better served if the chapters on the physiology of the nervous system, the two chapters on sense organs, and the chapter on brain and behavior had been included in volume 1 and the chapter on ionic and osmotic regulation had been saved for volume 2. In this way all the chapters concerned with the reception of stimuli, central activities, effectors, and those whole-animal activities that are intimately dependent upon the coordination of the nervous and muscular systems, such as locomotion, would have been grouped in one volume.

Lastly, the paper stock the publishers used in volume 2 is not uniform. Both copies in my possession have, at irregular intervals, non-glare easy-to-read pages interspersed with shiny, light-reflecting pages, which subject at least this reviewer's eyes to unneces-

sary indignity. Publishers should show a little more consideration for the optically infirm.

Criticisms over, the question remains whether these volumes meet the criteria posed at the beginning of this review. Emphatically, yes. The research worker, teacher, or graduate student has readily available over 4600 references on various aspects of the physiology of molluscs. Most of the authors have enlarged on their own views, and their speculations are not only stimulating but have heuristic value. Both volumes contain extensive indexes (subject, author, and systematic) which allow the reader to get around in the text easily. *Physiology of Mollusca* is an indispensable addition to the growing list of group-oriented treatises.

EARL SEGAL
Department of Biology,
San Fernando Valley State College,
Northridge, California

Plasmas and Magnetic Fields

Reviews of Plasma Physics. Vol. 2. M. A. LEONTOVICH, Ed. Translated from the Russian edition (Moscow, 1963) by Herbert Lashinsky. Consultants Bureau, New York, 1966. 305 pp., illus. $12.50.

This book is the second in a series of volumes setting forth the status, as seen by our Soviet colleagues, of theoretical plasma physics. The four articles it includes are concerned with the problem of utilizing a magnetic field to contain a plasma, and are guided by the objective of achieving a controlled thermonuclear reaction.

The first, and longest, article was written by A. I. Morozov and L. S. Solov'ev and is devoted to the structure of magnetic fields. Since plasma tends to stream rapidly along magnetic lines of force, it is desirable to know where the lines go. Can they be confined within a given volume or within a thin shell? This is a problem of considerable subtlety and complexity which has not been answered completely. The current status is rather well presented in this article, along with more mundane material on the theoretical construction of particular magnetic field configurations.

The next two articles, by V. D. Shafranov and B. B. Kadomtsev respectively, discuss equilibrium and stability and are based on the model in which the plasma is approximated by its macroscopic pressure and velocity. The article on equilibrium is quite complete. The other gives an excellent description of the theory but does not exploit that power to treat complex geometries which is its chief reason for existence. Also, this article seems more dated than the others.

The last article was written by the same authors as the first. It deals with the behavior of individual charged particles in complex magnetic and electric fields. Corrections to simple streaming along field lines are treated adequately but in less detail than is available elsewhere. Perhaps this article was included here because the problem of finding confined trajectories is analogous to that of finding contained magnetic field lines.

The overall quality of the volumes in this series is quite high. Any specialist in the field will find he needs access to a copy of this one. Others will be mainly interested in the section (6) of the first article that deals with the confinement of magnetic lines of force.

JOHN M. GREENE
Plasma Physics Laboratory,
Princeton University,
Princeton, New Jersey

Books Received

The Scientific Conscience. Reflections on the modern biologist and humanism. Catherine Roberts. Braziller, New York, 1967. 144 pp. $4.50.

The Solid-Gas Interface. vol. 1. E. Alison Flood, Ed. Dekker, New York, 1967. 532 pp. Illus. $21.75.

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