

of almost linear systems, and the book concludes with a discussion of discontinuous problems, such as relaxation oscillations, and again describes recent contributions (the topological theory of Vogel, the asymptotic methods of Cartwright and Littlewood, and the piecewise linear method) as well as the by now classical work of Van der Pol and Haag.

The format is clear and attractive and there do not appear to be any significant misprints except for the title page. The style and presentation are clear and complete, and make for interesting and informative reading, while the contents are so comprehensive (geographically and temporally) as to make it a very valuable survey (handicapped, however, by a rather skimpy index). This book will undoubtedly become the standard reference on nonlinear oscillations in the coming years.

Shock and Vibration Handbook. Cyril M. Harris and Charles E. Crede, eds. 2029 pp. McGraw-Hill Book Co., Inc. \$47.50. *Reviewed by H. M. Trent, US Naval Research Laboratory.*

THE subject of mechanical vibrations has been a significant part of physics ever since Lord Rayleigh devoted such a large fraction of his two-volume treatise on sound to the subject. However from the appearance of Rayleigh's books until the outbreak of World War II not too much attention was paid to the subject. On occasion some physicist might worry about creating a vibration-free environment for some critical experiment and infrequently an environment might be so obnoxious that even the man on the street might complain about it. These instances were rare, however, and as a result few papers appeared dealing with the subject, and few textbooks were published.

Early in World War II Great Britain suddenly awakened to the fact that she was in danger of losing the war through the loss of shipping. The trouble here arose from noncontact underwater explosions and, interestingly enough, these explosions did not necessarily sink the vessel under attack. Instead vital equipment inside the ship was rendered inoperative by the mechanical shock induced by the explosion and thus the vessel could no longer fulfill its mission. Since that time, the number and severity of problems that have arisen as a result of mechanical vibrations and shock has been on an increase, a situation which reflects our ever increasing speeds of travel and our ever more powerful propulsion devices. Indeed, no physicist today can consider conducting an experiment concerning, say, the Van Allen radiation belt without being prepared to deal with the vibration environment existing in a modern rocket.

Professors Harris and Crede have assembled an imposing list of seventy authors who have joined with them in writing the three volumes of the *Shock and Vibration Handbook*. As a handbook, it must be viewed as representing the state of the art at the time that the various articles were written.

The first volume devotes eleven chapters to a summary of those theoretical techniques which are available now. The remaining nine chapters describe those instruments which have been developed for observing and recording vibration and shock phenomena.

The second volume takes up several subjects. For example, the first three chapters discuss the question of data analysis, the next three cover test specifications together with machines for performing the tests, and the next three concern scaling techniques and methods of analysis, both analog and numerical. The remainder of the volume is devoted to pertinent aspects of the isolation problem with two chapters being devoted to theoretical concepts, one to the design and use of isolators and five to descriptions of various isolating devices and materials.

The final volume is devoted almost exclusively to a presentation of what is to be expected in a wide variety of environments. Two of the chapters are worthy of special comment for they provide the only known self-contained sources of information on machine-tool vibration and on the effects of shock and vibration on man. This volume will be of particular interest to any physicist who is anticipating running an experiment in a severe environment such as in a rocket.

The editors have done a good job in assembling a lot of pertinent information and in keeping errors to a minimum. It must be realized, however, that any compilation such as this, which concerns a rapidly expanding field of science and technology, will be out of date in some respects by the time it appears in print. On the other hand, it will be valuable for several years to come for it provides, in one place, access to most of what is known about the subject.

Experimentation: An Introduction to Measurement Theory and Experimental Design. By D. C. Baird. 198 pp. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1962. \$6.00. *Reviewed by J. Arol Simpson, National Bureau of Standards.*

HOPE springs eternal in the human breast. For years now I have been reading the new books on precise measurement and experimental design in hopes of finding the magical formula which would make all *my* measurements precise and my experiments successful.

My search is over. Professor Baird has not, unfortunately, given me the formula but has convinced me that further search is in vain. Of course, this result does not surprise me, really, but I do wish I had had the opportunity to study this book as an undergraduate so that my false dreams would have been strangled at birth.

What we have here is a text designed for first- and second-year laboratory courses for scientists and engineers which includes among its chapters a realistic study of the nature of measurement, the propagation of uncertainties, and the nature of experimenting, as well as experiment planning, experiment evaluation, and writing the scientific report.

Each of these chapters is well planned, lucidly written, and includes well-chosen problems illustrating the points made.

These alone would make this book a worthwhile addition to the literature, but its true value lies beyond this in the depth of the discussion of what, for lack of a better term, must be called the philosophy of experimentation. This subject which goes to the roots of physics involving, as it does, the reciprocal relations between theory, measurement, and experiment is a field too often passed off by a brief preface in a laboratory manual. Yet, it is this philosophy that gives point to our laboratory efforts and raises them above the level of tinkering.

Again, the book has value beyond its use as an adjunct to a laboratory course for it makes an excellent book to hand to each newcomer to a research laboratory and also for the older people who need reference to least squares, normal distribution and the like. The utility of the book is enhanced by its sturdy looking semi-limp binding.

I believe congratulations are due to all involved in the book's preparation.

Progress in Biophysics and Biophysical Chemistry, Volume 2. J. A. V. Butler, B. Katz, R. E. Zirkle, eds. 277 pp. Pergamon Press, New York, 1961. \$12.50. Reviewed by Joseph G. Hoffman, University of Buffalo.

THE six review articles presented are timely and highly commendable, but the atomic age with its emphasis on radioactivity is seen again: three of the papers involve ionizing radiations and living systems. The first of these, "Natural Radioactivity of the Human Body", by W. V. Mayneord, might well have been entitled The Alpha Activity of the Human Body and of Human Foods. In these days of endless inquiry about radiations and human-tissue tolerances, Mayneord's paper gives a timely report on a fundamental aspect of radioactivity in living systems. Alpha activities are exceedingly small, yet most of us are curious to see what they are in mundane things such as sardines, walnuts, tapioca, chocolate, peanuts, and so on. Of the nearly two hundred foods listed it is noteworthy that the extreme case is in Brazil nuts. In arbitrary units, Brazil nuts count at 1750, while the next highest food in magnitude is a cereal (United Kingdom) at 58. Peanut butter is 12, bread is 3, and ice cream is 0.7. The lowest of alpha activities is less than 0.1 for baked beans. As for human tissue, Mayneord's figures for an Egyptian who died about 4000 years ago are about equal to those for bones from humans in this century. Animals such as cattle and other domesticated animals have wide ranges of alpha activity at much higher levels than humans. A typical human sustains in a 70-year lifetime about 3.3×10^{10} alpha disintegrations in his tissues. This is about one curie second and is extremely low from the dosage standpoint even though each disintegration in a live cell would be lethal for that cell.

Mayneord's 23-page report is concise and is recommendable to the general reader as well as the technical specialist.

The other two radiation papers are by R. Goutier on the mode of action of x rays on the biosynthesis of nucleic acids, and by L. G. Lajtha on the effect of ionizing radiations and chemotherapeutic agents on bone marrow. One of the most intriguing and also the most difficult paper is by A. N. Uttley on the engineering approach to the problem of neuro-organization. Four different kinds of technical language are used: psychology, neuro-psychology, physics, and computer mathematics. The reader soon is aware that the mind that studies is quite different from the mind that is studied, and that, moreover, the language for describing the physical construction of mind needs to be developed. Uttley's paper gives an excellent indication of the unique nature of the problems arising when one tries to say what a perceptive response is.

The two remaining papers are on vastly different areas of biology. The fifth paper by P. I. Corner deals with some factors influencing the dispersion of indicator substances in the mammalian circulation. The sixth paper by E. J. Denton is a review of the problem of the buoyancy of fish and cephalopods. Control of buoyancy is one of those typical biologic phenomena, which seem to violate physical law. Like the sodium ion pump, it evokes teleologic ideas. This is an extended review of about 54 pages on the description of fish and a review of the research which had led to the findings of various types of gas-filled buoyancy chambers as well as examples of fish which do not have a gas-filled swim bladder.

There is a seventh chapter in this book on cytoplasmic particles and their role in protein synthesis. It reviews an informal discussion held in March 1960 at the University of Reading in a series of abstracts and it contains a bibliography on subjects related to cytoplasmic particles.

Instruments and Measurements. Conf. Proc. (Stockholm, Sept. 1960). Helge von Koch, Gregory Ljungberg, Vera Reio, eds. Vol. 1, Automatic Process Control, Physical Methods of Chemical Analysis, 506 pp., \$16.00; Vol. 2, Nuclear Instrumentation, Measurement of Electric and Magnetic Quantities, Reactor Control, 721 pp., \$22.00. Academic Press Inc., New York, 1961. Reviewed by Peter L. Balise, University of Washington.

AS is typical of proceedings, the 120 papers in these books vary widely in subject matter and quality, ranging from descriptions of commercial instruments and reviews of basic techniques to interesting theoretical suggestions. The classification into five divisions seems arbitrary, since there is considerable overlapping of subjects and no segregation of papers within each category. About a quarter of the work is in German, the rest in English.

The greatest emphasis in the automatic process-control section is on computer control, with several appli-