Atmospheric Research

Problems of Atmospheric and Space Electricity. Proceedings of the Third International Conference (Montreux, Switzerland), May 1963. Samuel C. Coroniti, Ed. Elsevier, New York, 1965. xiv + 616 pp. Illus. $35.

Conference proceedings seem to have a way of taking about 2 years to emerge between hard covers; perhaps a significant fraction of that time is spent by the publishers in summoning up courage to set the high asking price. In the present instance, delay and high price are considerably offset by the generally high quality of the finished product. Coroniti's editorial work on this volume, and his efforts in planning the conference, deserve strong commendation.

The book follows the actual conference in that it is organized into seven topical subdivisions: Survey of the present status of atmospheric and space electricity; fair weather phenomena; stormy weather phenomena; thunderstorm charge-separation theory; physics of lightning; miscellaneous lightning phenomena; and "space electricity." There is an almost pleasant lack of uniformity in the editorial management of the large number of papers that are fitted into these subdivisions. One finds lengthy review papers and lively floor discussions interspersed with occasional quarter-page abstracts where some speaker wished to make only a single brief but emphatic point. It was initially planned that conferees should address themselves primarily to summarizing the state of the art and to stressing optimal modes of attack on unsolved problems. These objectives were well met in many review papers; the latter, by themselves, make the volume valuable. In addition, however, a substantial number of reports are concerned with original work. But the outstanding virtue of the published proceeding is the very full transcription of the floor discussions, which have been edited enough to make the speakers sound grammatical, but not so much that the vigor of controversy is lost. I recall no other conference proceedings characterized by so satisfactory a job in reporting floor discussions.

Of the many topics covered in the proceedings, two might be singled out for special comment. First, one finds that the long-standing mystery of how such prodigious charge-separation is accomplished in thunderstorms seems to be almost as confusing as ever. The increasing amount of research being devoted to that fundamental question of atmospheric electricity seems to continue to lead to new questions and new answers in roughly equal proportion. Second, the conference made an initial effort to bring into the ambit of atmospheric electricity a broad array of near-space and planetary-atmospheric electrical phenomena, which are treated in the proceedings under the somewhat uninformative heading "space electricity." Several contributors urge that terrestrial atmospheric electricians should begin to turn some of their attention to the novel atmospheric electrical problems likely to be found once space probes begin taking a really close look at the physics of other planetary atmospheres; their case is convincingly made.

In all, these proceedings are editorially well handled and handsomely published. They can be strongly recommended for institutional libraries. Conferees and reviewers who get complimentary copies can sympathize with individual scientists who must sacrifice a day's wages in order to add this valuable volume to their personal reference collections.

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Applications of Ultrasonics

Ultrasonic Engineering. Julian R. Frederick. Wiley, New York, 1965. xiv + 379 pp. Illus. $15.

This book is described by the publisher as a complete introduction to the industrial, laboratory, and medical uses of ultrasonics. I believe that this is an accurate description. Written by one of the scientists who has been instrumental in the application of ultrasound to the inspection of materials for flaws, the book emphasizes the applicability of ultrasonics to a wide range of processes.

Frederick begins with a chapter that discusses the basic principles of acoustics in very simple terms; the remaining chapters apply this knowledge to various ultrasonic processing applications. The general outline of an industrial process is divided into (i) a source of energy, (ii) a device for converting this energy into ultrasonic vibrations in solids, liquids, or gases—that is, a transducer, (iii) a coupling element to get the ultrasonic vibrations into the work as efficiently as possible, and (iv) the material which is modified in some way as a part of the process.

Various types of transducers are considered in chapter 4. These consist of air and liquid sirens and whistles, piezoelectric and electrostrictive transducers, and magnetostrictive transducers. In chapter 5, cavitation as a source of high pressure and various solid horns, which produce a large motion at the small end when driven by a small displacement transducer, are discussed.

The remaining chapters discuss the use of ultrasonic energy in cleaning processes, the production of aerosols, the combustion of fuels, the casting of metals, friction reduction, extrusion and wire drawing, grinding, welding, measuring liquid velocity, counting and sorting, density and viscosity measurement, and determining the elastic properties of liquids and solids. A complete chapter is devoted to flaw detection. This technique, which was invented in 1940 by Floyd Firestone (the book is dedicated to Firestone), is widely applied in industry. Two final chapters describe the application of ultrasonics to biology and medicine. This is a rapidly growing field from which much may be expected.

Altogether this book represents the most up-to-date description of the processing applications of ultrasonics that has yet appeared in book form. It merits a hearty recommendation to engineers who deal with ultrasonic processing and to those who wish to investigate the possibility of this rapidly growing branch of engineering.

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Science and Society

The New Priesthood: The Scientific Elite and the Uses of Power. Ralph E. Lapp. Harper and Row, New York, 1965. x + 244 pp. $4.95.

We have been repeatedly indebted to Ralph Lapp for pointing out a number of embarrassing but important facts that public officials preferred not to face. He here raises the important subject of the scientific "elite." There

is one, or there is widely thought to be one—in human affairs it is often difficult to distinguish a hard fact from a fancy widely or persuasively expounded. It is a pity that this volume adds little to our knowledge of the matter. The presentation is better than Donald Cox's recent pot-boiler, *America's New Policy Makers: The Scientists Rise to Power*, because Lapp gets more of his facts right, but few are new and the lack of references does not help anyone to check on them.

Five of the 11 chapters tell again the story of the atom bomb, the Franck report, the fights over atomic legislation and the hydrogen bomb, the Oppenheimer hearings, and the disputes about nuclear fallout and test bans. The remaining chapters contain a potpourri of reportage and comment on the research and development (R&D) boom in universities and industry, the space race, the political activities of scientists during the last two presidential campaigns, and the organization and disorganization of science policy making in the Executive and the Congress.

Lapp forecasts national (meaning, apparently, federal) R&D expenditures of $35 billion a year by 1980, of which he would assign $10 billion to arms and arms control, $7 billion to basic research, and $18 billion to vast programs in the domain of civilian welfare and technology. He advocates the formation of a nonprofit institute staffed by scientists to advise Congress on R&D matters, and favors the concentration of federal basic research programs in a Department of Science.

The book is unfortunately marred by *ex cathedra* pronouncements that bridge gaps in the author's knowledge or sympathies. Thus, it is grossly unfair to say that the National Science Foundation "has not been a howling success by any means" and offer in evidence only its "inability to deal with large-scale projects such as Project Mohole," projects which have never been central to NSF's purpose and which receive only a fraction of its budget. And there is the astoundingly mistaken observation that university presidents prefer federal research grants to broader institutional awards. The remark that "PSAC members are extremely stuffy about discussing their committee deliberations" does not really help us to understand the reasons for such recalcitrance and what may be right and wrong about it.

It requires painstaking attention to identify all the hits and the misses in the buckshot Lapp has fired at much-used targets.

HAROLD ORLANS

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University Mathematical Monographs

Integration, Measure, and Probability. H. R. Pitt. Hafner, New York, 1963. viii + 110 pp. Illus. $4.

This very pleasant book gives a concise (106 pp.), rigorous, and readable presentation of everything that a student of probability theory should know. One could call the book a miniature version of the standard Loéve treatise had it not differed radically in outlook and emphasis.

Anyone who writes a textbook on probability theory is confronted at the beginning with a dilemma: how much of measure theory should be included. If not enough is considered, then most of the theorems cannot be given in full generality; if too much is treated, then the theorems of principally analytical character become overburdened by seemingly superfluous material. These difficulties have been admirably described by J. L. Doob in the introduction to his *Stochastic Processes*.

Furthermore, it has long been recognized that the classical Kolmogorov structure is too general, and one would prefer to deal with a rather restricted but more "individual" framework. In fact, in elementary texts, once everything is mapped on the real line, the underlying abstract probability space is forgotten (occasionally, acknowledgment of its presence is made with a friendly nod); in advanced texts one usually does the same thing without admitting it.

The author of this book made his choice by introducing measure theory as applicable to probability theory, and then presenting probability theory as seen by measure theory. However, he departed from the original Kolmogorov scheme in favor of recent approaches towards topological probability spaces. The result is an unorthodox, highly individual, and very valuable text.

Accordingly, the book is divided into two parts: part 1 (44 pp.) deals with measure theory and integration and part 2 (62 pp.) is devoted to probability theory and elements of stochastic processes. Since the presentation and approach are not those commonly seen in textbooks, more detailed description of the contents may be useful.

The author chooses rings as his basic concepts and calls Borel sets the elements of a minimal σ-ring. The Lebesgue integral is introduced (via simple functions), and a measurable function is defined as the limit a.e. of simple functions (measurable sets are then defined by their indicators, so measurable sets differ from Borel sets by null sets). The Radon-Nikodym theorem and the Fubini theorem are proved, and the last chapter of part 1 gives a full account of the Lebesgue-Stieltjes integral and discusses in detail distribution functions, convolution integrals, characteristic functions, and corresponding basic convergence theorems.

Part 2 contains two chapters, "Random variables and probability" and "Limit processes in probability." The author takes as his basic space a space X (with probability measure defined on it) in which random variables take their values. However, random variables are identified (through identity mapping on X) with their probability distributions (measures of sets of their values), and the concept of a measurable function usually employed in this connection is not needed here. (The author even refers to random integers or random real numbers when X is a set of integers or a real line). The author then explains in detail (with worked out examples) how difficulties of this point of view can be overcome in the case of several random variables, and functions of random variables. The rest of the chapter treats moments, conditional expectations, and multivariate distributions and lists properties of typical distributions. The last chapter gives detailed treatment of weak laws of large numbers, central limit theorem, and convergence of series of random variables and includes a short outline of stochastic processes (Brownian motion, Poisson process, and the like). The point of view adopted in this book is particularly convenient for the Daniel-Kolmogorov extension theorem (theorem 25, page 94) on construction of probability measure in function spaces. However, the author did not refer to his interesting version of this theorem, quoted by J. E. Moyal in the *Journal of the Royal Statistical Society* **B:11**, 162 (1949).