The problems involved in selecting hardware for real-time systems are not discussed, nor are the substantial software requirements of real-time processing listed. No checklist of "do's" and "don't's" is offered the would-be systems designer.

Two problems described in the book require comment. One is that of reliability, which was resolved in the Mercury system by utilizing duplicate 7094 systems. This must certainly draw a shudder from budget-pressed systems managers. Very few installations can afford this redundancy. Strong exception must also be taken to the implications that airline agents had to learn how to use the system for it to operate effectively. This is solving hardware or programming problems by manual procedures. There is too much of this sort of thing, and its extension should be discouraged.

Ronald W. Williams, Systems and Data Processing Manager for Brookhaven National Laboratory, has been involved in commercial and administrative data processing 1951. He programed for the first UNIVAC installation at the Bureau of Census and worked as Computer Applications Officer on one of the early commercial installations at the Chesapeake and Ohio Railway Company. After conducting the feasibility study for the General Tire and Rubber Company, he managed the design, programing, installation, and operation of an RCA 501 system there. He joined the Brookhaven staff in February of this year to establish the new Systems and Data Processing Division. His BA and MA degrees (both in economics) are from the University of Akron ('48) and the University of Chicago ('51), respectively.

LOW FREQUENCY SIGNALS

Title Whistlers and Related Ionospheric Phenomena

Author Robert A. Helliwell

Publisher Stanford University Press, 1965

Pages viii + 349

Price $12.50

Reviewer Erwin R. Schmerling

The author, whose group at Stanford University has long been associated with pioneering work in this area, gives an account of some of the rather remarkable phenomena observed in the kilocycle region of the radio spectrum. He discusses in some detail, from the viewpoint of geometrical optics, how low-frequency signals can enter the ionospheric duct and be propagated nearly along a line of force of the earth's magnetic field. Both ducted and nonducted propagation are treated. He shows how the dispersion of ducted whistlers generated by lightning flashes may be used to obtain both the latitude of origin and the electron density at the top of the path. This treatment is entirely from the ionospheric viewpoint, although the same theory is also applicable to plasma diagnostics in the laboratory.

A number of other types of very low-frequency emission, with entirely different dispersive characteristics, is also discussed, and the evidence is summarized for the triggering of periodic emissions by whistlers. This section is particularly well illustrated by numerous sonograms.

The viewpoint is mostly that of ground-based observations. It is unfortunate that is was not possible to include the phenomena recently discovered in satellites which appear to depend on the ionic composition of the medium, and it is hoped that a later edition will include a full discussion of proton whistlers, hybrid resonance effects, and subprotonosphere whistlers.

The style is readable and clear, and the historical introduction is excellent. This book can certainly be recommended to any reader who wishes to obtain a good start in this area.

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TWO GROUPS: PRAGMATIC APPROACH

Title Two-Group Reactor Theory

Author J. L. Meem

Publisher Gordon and Breach Science Publishers, 1965

Pages xiii + 417

Price $20.50
Text edition available

Reviewer Frederick J. Shon

A *whole book* about two-group theory? Well! Not really. This book, like many short-story anthologies, takes its title from what its author considers the most important of its facets. It is, in fact, a rather complete introduction to elementary reactor theory.

The first six chapters cover a broad range of subjects, including One Group and Fermi Age Theories, with a brief treatment of reactor kinetics and a nod at transport theory in the bargain. The reason for the title is that the two-group theory has been selected for detailed treatment. Indeed, the treatment is far more detailed than is available in any other text to my knowledge. The author's reason for selecting two-group theory as his calculational mainstay is that it represents an approach of sufficient sophistication to give useful resluts, but sufficient simplicity to permit hand calculations. Dr. Meem feels in fact that, since two groups are about as far as one can

go with a desk calculator, the treatment represents an invaluable pedagogical aid toward developing a feel for reactor calculations in a budding nuclear engineer.

Emphasis throughout the entire work is on methods of computation rather than on mathematical nicety, and if Dr. Meem pursues his subject with more vigor than rigor, that is at once the chief strength and weakness of the work. As an example of the strength this approach contributes, we might note that his treatment of the diffusion of thermal neutrons through a parallelepiped simply ignores the problem of fitting the boundary condition with a point source of thermal neutrons. Since no one has ever seen a point source of thermal neutrons, I consider this a step forward from the traditional approach of Glasstone and Edlund, wherein the fit is made with great eclat in a shower of scintillating orthogonal functions. Dr. Meem, by contrast, tells the student far more of what he needs to know of practical fact and less of mathematical fancy.

On the other hand, the present book displays an occasional rough spot because of this disinclination toward mathematical profundity. For example, in the development of a hitherto unpublished expression for the effective resonance integral of a homogeneously dispersed absorber, Dr. Meem's rather casual regard for the significance of mathematic averages yields an approximation, the limits of whose usefulness are not clearly defined in the text. In general, the emphasis throughout the book is on the practical means available for making approximations and for getting, or indeed even forcing, answers. Pure mathematicians might look with some trepidation upon the methods employed and the proofs developed. However, there is a strong case for the practice of following in the footsteps of a man who has been there, and in the matter of reactor calculation, Dr. Meem is certainly that.

His first six chapters present a general introduction to reactor theory, and the next four apply two-group theory to various reactor configurations and to control-rod estimation. The last quarter of the book consists of three appendices in which detailed calculations are made on a pool-type reactor, a natural-uranium graphite reactor, and a fast critical assembly. Not only are methods given for obtaining critical dimensions and loadings, but approximations are given to fit fluxes with separable solutions for the wave equations (even for the cases where, strictly speaking, no such solutions exist).

The book is a thorough, detailed guide aimed at teaching graduate nuclear engineering students to do many of the practical calculations of the trade. It is generally complete, and the inclusion of subjects which it does not cover (e.g. calculation of adjoint fluxes) would probably only have made it cumbersome. To sum up, unlike many other books in the field, it is less a mathematical *tour de force* than a reactor builders' guide.

Frederick J. Shon is Chief of the Reactor Safety Branch of USAEC's Division of Operational Safety. Prior to this position he helped establish many of the standards for reactor operator qualifications used by the AEC's regulatory organization. He has taught graduate courses in Nuclear Engineering at the University of California and has been a consultant to General Electric and Atomics International on reactor-operator training. For some eight years he supervised reactor operations at Lawrence Radiation Laboratory. He received a BS degree from Columbia University in 1946, and had graduate training at Ohio State University and the University of California.

A GOOD INTRODUCTION

Title Statistics for Scientists and Engineers.

Author R. Lowell Wine

Publisher Prentice-Hall, Inc., 1964

Pages xvi + 671

Price $12.00

Reviewer Horace P. Flatt

Statistics is a mathematical field which is still rapidly developing, with somewhat uneven progress in different application areas. This book is a first introduction to this field, and attempts to make available statistical tools to students at an early point in their studies. It is intended to supply the necessary material for a course for junior, senior, or first-year graduate students. Elementary calculus is supposed to be the only mathematical prerequisite.

The book is quite lenghty for an introductory text and clearly has ample material for more than one course. The first few chapters cover in an extremely clear manner the basic definitions, concepts, and results of statistics. The format is generally the same, that is, basic definitions followed by plentiful illustrations and, where appropriate, worked examples. There are included many problems to be solved, including a few drawn from various fields of science and engineering. Proofs of some of the theorems stated in the text are given as problems to be solved, and the more difficult have some helpful hints. In this way, basic definitions such as mean, modes, and class marks are covered, and concepts such as measures of dispersions, distributions, etc., are introduced. Many theorems are developed, and the groundwork is laid for understanding the central-limit theorem, a restricted proof of which is given in an exercise for the reader.

Even in these early chapters, it becomes quite clear that more than a course in elementary calculus is required for following the text, and a still more sophisticated mathematical background is required for many of the problems. The manipulation of infinite integrals and multiple integrals is quite common, and the behavior of solutions of ordinary differential equations enters into at least one problem.

Subsequent chapters discuss sampling from normal populations, and include such topics as the chi-square distributions, the student t distribution, and the usefulness of the F distribution for problems involving two variances. An extensive discussion of the analysis of variance is included and leads into the problems of experimental design.