Book Reviews

Molecular Vibrations. The theory of infrared and Raman vibrational spectra. E. Bright Wilson, Jr., J. C. Decius, and Paul C. Cross. McGraw-Hill, New York–London, 1955. xi + 371 pp. Illus. $8.50.

The book on molecular vibrations by Wilson, Decius, and Cross has been awaited with keen interest by molecular spectroscopists throughout the world. The fundamental contributions that the authors have made to this subject led us to expect a presentation of unique qualities, and we are not disappointed in this expectation.

Up to the present time, there has been no detailed and comprehensive presentation available of the theory of molecular vibrations, of the methods of solution of the secular equations and the applications of this theory to an understanding of infrared and Raman vibration spectra. Such a presentation is provided by the authors in the present book.

The central problem discussed in this book is the derivation of the normal vibrations of a polyatomic molecule. The theory is developed with mathematical rigor and elegance. Starting from the simplest cases step by step, more and more complicated and general cases are dealt with. The powerful tools of group theory and matrix algebra are introduced, explained, and used in the derivations. This is a difficult subject to explain to the student. The authors have been notably successful in arriving at a satisfying presentation that is as readable as one can expect for such a complex subject. However, by the very nature of the subject, the book, particularly in the later parts, is not easy to read.

In addition to the solution of the vibration problem (both in classical mechanics and wave mechanics), the book gives derivations of selection rules, discussions of the anharmonic terms in the potential energy, the isotope effect, Fermi resonance, and the problem of several equilibrium positions. With regard to some of these items, particularly the anharmonic terms, one might have wished for more detail. The theorems derived in the book are illustrated in Chapter 10 by a detailed discussion of their application to the benzene molecule.

The main part of the text is supplemented by 16 appendixes, which present such things as character and correlation tables of the point groups, proofs of certain theorems, and, in the last appendix, a brief treatment of rotation and rotational selection rules.

All those interested in the fundamentals of molecular spectroscopy and all those who want to carry out calculations of force constants and potential functions from observed vibrational frequencies should turn to this book for guidance. They will find in it an authoritative and complete presentation written on a very high level.

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Numerical Methods. Andrew D. Booth. Academic Press, New York; Butterworths, London, 1955. vii + 195 pp. Illus. $6.

This new book on numerical analysis is based on a series of lectures given by the author at Birbeck College, London. Although it approaches its subject from the point of view of a person interested in learning the art and science of programming for an automatic digital computer, classical material is presented on virtually all the subjects treated. The book is peppered with "cautions and precautions," desirable warnings to students who have not experienced the hazards implicit in letting the machine obey orders that have not been thoroughly and carefully and explicitly formulated or follow computational designs that ignore some of the more elusive hypotheses necessary for the validity of the theorem.

The book is rather more ambitious in its coverage than most recent books on the subject, including treatments of the nature and purpose of numerical analysis, tabulations and differences, interpolation, numerical differentiation and integration, summation of series, ordinary and partial differential equations as well as integral equations, linear and nonlinear algebraic equations, approximating functions, and Fourier synthesis and analysis. Although the initial chapter devotes less than two pages to a discussion of precision, accuracy, and errors, there is a treatment of error estimates for most of the methods presented; and there is constant concern for methods of checking solutions.

The topics listed here cannot convey the wealth of detail covered. For example, the chapter on partial differential equations devotes only 31 pages to a set of topics including the classification of partial differential equations, methods for the numerical solution of parabolic and hyperbolic equations in two and in more than two variables, the method of characteristics, multipoint boundary conditions and elliptic partial differential equations, practical aspects of the relaxation method, Monte Carlo methods, and "more complicated" partial differential equations. This extraordinarily compact coverage is achieved partly by simplification and generalization from the classical treatment but largely by handling only the salient features of the problem and expecting the reader to seek fuller information from the bibliography (which is given for each chapter as well as for the book as a whole).

The detailed chapter bibliographies should prove very helpful. The author's objective is to present only the mathematical basis of his subject. He presents essentially a guide to numerical analysis, including detailed computation only in the chapter on simultaneous linear equations where the purpose is to illustrate the sort of behavior that may be expected in a calculation "rather than any detailed form of layout."

If there are some subjects (such as the rather specially oriented chapter on Fourier synthesis and analysis) that seem to be included more because the author is expert in the subject than because of their general importance, and if there are lapses from the most complete scholarly precision, such as the reference to Monte Carlo methods as methods that make use of the theory of games, the reader can forgive the author; for the book provides a useful and stimulating guide to a subject that has changed so rapidly during the past decade that the potential user of high-speed machines is sorely in need of informed and understanding help in finding his way through the maze of new literature on the subject.

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Electrons, Atoms, Metals and Alloys. William Hume-Rothery. Philosophical Library, New York; Iliffe & Sons, London, ed. 2, 1955. 387 pp. Illus. $10.

This is an excellent book, which aims at giving a qualitative understanding of the cohesion and the electronic properties of solids, particularly of metals and alloys. The book consists of a dialog be-

tween an older metallurgist (that is, before quantum theory) and a young scientist. In general such a treatment would be difficult to sustain for more than, say, 50 pages, but the author has done a wonderful job, giving the older metallurgist just the right amount of curiosity and intelligence.

The book is well organized and starts by examining the physical principles upon which quantum mechanics is based; quantum theory is then described, and the periodic table is examined. The behavior of electrons in a solid is then considered, with free electrons, Brillouin zones, and electron density versus energy curves being examined. Various types of cohesion are then considered: molecular crystals, valence crystals, and metals. Next the electronic differences among metals, insulators, and semiconductors are described. Atomic and ionic radii are then discussed. Then a thorough study of the cohesion of univalent and, finally, of the transition metals is given. In the case of the transition metals the treatment includes an accurate and up-to-date discussion of ferromagnetism. The last major section of the book deals with alloys. Since this is a field in which the author has made notable contributions, one hopes for something rather special. The expectations are fully realized, for all of the various results produced by electron to atom ratio, size, and the electrochemical factor are described with illustrations.

It can be seen that the book covers a tremendous amount of material, but the writing is skillful and careful so that the net result is to instruct rather than to confuse. A very useful feature of the book is a good set of references for further reading.

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Political Systems of Highland Burma. A study of Kachin social structure. E. R. Leach. Harvard Univ. Press, Cambridge, Mass., 1954. xii + 324 pp. $7.

A brief review can hardly do justice to a major contribution to theory in any field. The judgment "major contribution" should not be lightly bestowed, and certainly in the case of *Political Systems of Highland Burma* many anthropologists would dissent. I shall therefore restrict my comments to assertions of the book's importance—criticisms, of which I have many, will be reluctantly foregone.

Several of the most crucial aspects of anthropological theory are treated and skillfully interrelated by Leach. His work is not an ethnography but a remarkably keen analysis of varieties of social structure in the still remote mountainous reaches of northeastern Burma. But social structure for Leach is not a topic exclusively devoted to kinship or political algebra. Starting firmly with the contrasting ecological bases of three subregions within the general area, he seeks to isolate and construct conceptual models of the political organization of the "simple" Kachin and the "sophisticated" Shan. This in itself would represent a contribution only in the degree of its elaboration of detail, for the gross dichotomy involving the generally lowland dwelling, irrigated rice cultivating, territorially organized Shan (T'ai) and the generally highland dwelling, shifting cultivators with kinship-oriented societies, in Leach's case the Kachin, has long been utilized either implicitly or explicitly by Chinese and British rulers and many of the literate travelers who left commentaries on the area of which this present volume treats a small part.

But the genuine contribution of Leach is twofold: he has constructed his models with unusual vigor, and he has substituted a trichotomy for the earlier dual categorization. He still retains Shan with no apparent amendment of his predecessors' work and he similarly utilizes the concept of the simple political organization, although he describes it in terms of a model of *gumlao,* the idealized Kachin structure based on egalitarian kinship. The innovation is the insertion of a transitional sociopolitical type, *gumsa.* This, stripped to essence, I would call "stratified kin society," although Leach does not use this terminology.

While Leach, trained in British social anthropology, nowhere explicitly commits himself to a general evolutionary view of culture (he would say "society") and although he explicitly seeks the dynamic of change outside the system with which he is concerned (p. 212), other anthropologists may wish he had gone much farther with the implications of his work. Briefly, this would have meant adding to the *general* theory of the evolution of class-stratified society and the state.

Here, then, is the locus of my enthusiasm. As Leach himself points out, none of the great 19th-century evolutionists in social science, Morgan, Engels, Spencer, and so forth, "discussed in detail—still less observed—what happened when a society in Stage A changed into a society at Stage B; it was merely argued that all Stage B societies must somehow have evolved out of Stage B societies" (p. 283). The work that might fill this lacuna is still quite scanty, but I find it incredible that, although Leach cites the pioneer work of Fortes and Evans-Pritchard, *African Political Systems* (1940), he makes no conspicuous use of his own excellent report on various peoples of Sarawak, *Social Science Research in Sarawak* (1950).

Leach, himself, ends on an equivocal note. He finds the transitions from kin to stratified kin to state organization a difficult one and wonders in print how other peoples have dealt with similar situations. I apparently am more confident of the richness of comparative data presently in hand. But, regardless of the ultimate determination of the issue, it must be admitted that a scientific approach to basic questions of the evolution of social classes and state organization is an exciting reality demonstrated by this book.

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An Introduction to Stochastic Processes with Special Reference to Methods and Applications. M. S. Bartlett. Cambridge University Press, New York, 1955. xiv + 312 pp. Illus. $6.50.

This book, based on the author's lecture notes at the University of North Carolina, is the first of a proposed three-volume work on the theory and application of stochastic processes. It is an introductory work addressed to the applied mathematician and statistician and presents the elementary methods and statistical techniques involved in stochastic processes. A detailed treatment of the basic mathematical theory and applications in physics are the topics for the forthcoming two volumes, both by J. E. Moyal.

A stochastic process, aside from its precise mathematical formulation, is initially defined by Bartlett as some possible actual process in the real world that has a random or stochastic element in its structure. After a brief introduction into some of the basic concepts of statistics and probability, the author introduces discrete and continuous Markov processes. He then deals with the random walk, the theory of queues, the application of stochastic processes to population growth and epidemic models. Two chapters are devoted to limiting stochastic operations and stationary processes. Prediction, communication theory, and the statistical analysis of stochastic processes make up the latter portion.

Although Bartlett does not always conform to the commonly accepted notation of the theory, his volume is a model of clarity and organization. On the whole this book is to be highly recommended for the applied mathematician and statistician who like a sound but not too abstract treatment of the theory of stochastic processes. For research workers in the natural, physical, and social sciences, who