

eclecticism in approach, in effect by the aim of the book. The success of this augmented edition of what is now a standard text appears nonetheless to be assured, and for very solid reasons. As one of my colleagues put it, if one were exiled to Corsica for a year in order to learn quantum mechanics, and could take but a single volume, a very good case could be made for the choice of this book.

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Special Functions: A Group Theoretic Approach

By James D. Talman

(Based on lectures by Eugene P. Wigner) 260 pp. Benjamin, New York 1968. Cloth \$10.00, paper \$5.95

This delightful volume does for most of one's favorite special functions what arithmetic does for the exponential: It displays them not as solutions to differential equations but as matrix elements of representations of elementary Lie groups.

If you feel deeply that there is nothing more to say after pointing out the e^x is the solution of $f' = f$ (with $f(0)=1$) and do not care that it is also 2.71828... multiplied by itself x times, then you also might feel inclined to ignore this book. This would be a pity, because almost half is devoted to the kind of general exposition of Lie groups, Lie algebras and their representations that few mathematicians are capable of treating us to. It is an exposition that prefers words to symbols, is intuitive and does not require us to scale a mountain when we only want to peek over the garden hedge. Knowing only a little linear algebra, one can read this much with joy and enlightenment without compromising one's devotion to differential equations.

If, however, you have always suspected that there was more to Bessel functions, Gegenbauer polynomials, associated Laguerre polynomials, and Hermite polynomials than Morse and Feshbach or Watson were letting on, then you can indulge in the feast as well as the cocktails. And there, in the algebraic paté, you will come upon those higher transcendental truffles you long ago snuffled in the garden of analysis. Only a hard man could fail to be moved by this trans-

formation, and you can see what it has done to a soft-hearted esthete like your reviewer.

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Statistical Mechanics Of Chain Molecules

By Paul J. Flory

432 pp. Interscience, New York 1969. \$17.50

In polymer science it is important to know the shape of an isolated polymer molecule and quantities that characterize this shape, such as the radius of gyration and distribution of end-to-end length. Almost always the chemical structure of the repeating unit (residue) is such that rotation is allowed about at least one chemical bond in each residue.

This means that a polymer molecule that is typically composed of thousands of residues has an enormous number of available shapes and that the calculations of measures of shape and size must rely on the methods of statistical mechanics. In this book, Paul J. Flory deals with this problem; he is eminently qualified to write such a book because he has worked extensively in this field.

By far the largest amount of effort is devoted to the formalism and calculations of the rotational isomeric-state model with short-range interaction. In this model, one allows rotation about certain chemical bonds to minimize the rotational-potential function. The energy of each molecular shape is calculated by accounting for interaction between atoms that are close to one another along the chain backbone. Interaction between atoms that are physically near to each other because they close a loop is ignored if the length of the loop is greater than a certain (small) size.

Flory's development is well done. The difficulty of the text is proportionate to the subject matter; there are no extraneous difficulties introduced by the author. By use of matrix methods, pertinent quantities are derived that describe the configuration of the macromolecule. Topics discussed in the theoretical part of the book include: a description of previous more approximate models, the

more accurate statistics of polymers with interdependent rotational potentials and a useful comparison of various solutions (both exact and approximate) of various polymer-chain models. The treatment of copolymers, which, however, takes up only four pages of the book, is in error. Use of the mole-fraction-weighted arithmetic mean on page 118 gives correct results only in certain limiting cases. A correct treatment of the copolymer problem has been obtained recently by G. W. Lehman and J. P. McTague (*J. Chem. Phys.* **49**, 3170, 1968).

Flory assumes, as a working hypothesis, that one can choose a solvent for a polymer that exactly cancels the effect of excluded volume (interaction of residues separated by relatively large distances along the chain backbone). This assumption, on which the validity of the application to real systems rests, is not discussed adequately. One is therefore not convinced that the parameters of the model have a meaning outside the model.

About a third of the book is devoted to application to real systems. Symmetric chains, asymmetric chains and biological macromolecules each comprise a chapter. It is shown that the parameters of the isomeric rotational-state model can be chosen so that its various predictions are in reasonable accord with available experiments for a sizable number of polymers. In addition (where comparisons are available), the required energy parameters are about what one would expect from independent estimates based on molecular structure.

Application is made to light scattering and to strain and electric birefringence in the last chapter. This book is a worthwhile addition to the library of anyone interested in the conformational statistics of polymer molecules.

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Theoretical Elasticity

By A. E. Green, W. Zerna

(2nd edition) 457 pp. Oxford U. P., London, 1968. \$16.80

Although not intended to be a treatise on the theory of elasticity, the first edition of this book in 1954 was a comprehensive presentation of the general theory of finite elastic deformations,

GLASS-CERAMICS AND PHOTO-SITALLS

By **Anatolii I. Berezhnoi**, Laboratory of Glass and Glass-Ceramics, Moscow, USSR

Translated from Russian by **Stanley A. Mersol**, Translation edited by **Alexis G. Pincus**, ITT Research Institute, Chicago, Illinois

Consolidates and systematizes all of the available knowledge on glass-ceramics and the various glasses employed in its manufacture. The volume stresses the importance of glass-ceramics as a potential electrical insulating material in the intermediate temperature range and discusses its value as a sealing material at high temperature. Research scientists will find valuable the material on the lightsensitive and photosensitive processes and properties of glass-ceramics, while industry will be interested in the chapters on practical applications.

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complex variable methods for two-dimensional problems of the linear theory and the theory of small displacements of thin shells.

In this second edition, the plan is unchanged. However, the constitutive relations are significantly modified and the theory of shells is considerably expanded and modified, including a new chapter on the derivation of the shell equations by asymptotic expansion of the three-dimensional equations of elasticity. The changes bring the work up to date without changing its original intent and scope.

Albert Green is a well known mathematician, now of Oxford University; Wolfgang Zerna is an eminent engineer and professor at the Ruhr-Universität of West Germany. Their high-level monograph is the most authoritative, complete and up-to-date treatment of elasticity available. There are extensive references to the original literature and original contributions.

The research worker in this field can not be without this volume. It is also a suitable source for the advanced graduate student. Tensor analysis, differential geometry of surfaces and functions of a complex variable are summarized in the first chapter so that the reader may proceed without reference to other works. One unusual aspect that distinguished the first edition is retained, that is, the use of imbedded or convected coordinates. Some readers find this system rather obtuse, but I have found it to be here a clear conceptual device.

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Hermann Weyl Gesammelte Abhandlungen, Band I, II, III, IV

K. Chandrasekharan, ed.

2830 pp. Springer-Verlag, New York, 1968. \$42.00

This edition of Hermann Weyl's collected papers ends with a biography of Weyl, written after his death by Claude Chevalley and André Weil. The following passage (my translation) appears in it. "To celebrate his seventieth birthday, the friends and pupils of Hermann Weyl published a volume entitled 'Selecta' of extracts from his works. Perhaps we ought not to feel proud of this method of

honoring with bits and pieces the retirement of eminent mathematicians. It is too much for some, and not enough for others." Hermann Weyl was one of the others, as this complete collection of his papers makes clear.

Among all the mathematicians who began their working lives in the 20th century, Weyl was the one who made major contributions in the greatest number of different fields. He alone could stand comparison with the last great universal mathematicians of the 19th century, Henri Poincaré and David Hilbert. So long as he was alive, he embodied a living contact between the main lines of advance in pure mathematics and in theoretical physics. Now he is dead, the contact is broken, and our hopes of comprehending the physical universe by a direct use of creative mathematical imagination are, for the time being, ended.

For any physicist with a taste for history and for style in scientific work, it will be a rewarding experience to browse through these four volumes. The majority of the papers are purely mathematical, but there are a substantial number concerned with physics. Weyl's major contributions to general relativity and to the group-theoretical formulation of quantum mechanics will be found in volumes 2 and 3. By bringing group theory into quantum mechanics, Weyl and Wigner led the way to our modern style of thinking in particle physics. Today the instinctive reaction of every physicist, confronted with an unexplained regularity in the behavior of particles, is to postulate an underlying symmetry group.

Scattered through the four volumes are biographical and historical papers that can be understood by everybody. Many of these are little masterpieces, full of human insight, revealing Weyl's own character as well as the characters of those he is writing about. There are obituary notices of Poincaré (volume 1), Emmy Noether (volume 3) and Hilbert (volume 4). The account of Emmy Noether is particularly fine, summing up in a few pages a whole historical epoch. Here is a thumbnail sketch of Gordan (of the Clebsch-Gordan coefficients): "When he had to listen to others, in classrooms or at meetings, he was always half asleep." And here is Weyl's description of the Bourbaki school of mathematical writing: "The books of the type I refer to are rather like slot

machines which fire at you for the price you pay a medley of axioms, definitions, lemmas and theorems, and then remain numb and dead however you shake them."

There is nothing numb and dead in any of Weyl's writing. He once complained that "The gods have imposed upon my writing the yoke of a foreign tongue that was not sung at my cradle." But nobody ever wrote in a foreign tongue with greater mastery.

The editing of these volumes by Chandrasekharan is unobtrusively excellent; the printing and binding by Springer are up to the high standard that the contents demand.

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Thermal Conductivity

C. Y. Ho, R. E. Taylor, eds.

(Conf. Proc., Purdue Univ., West Lafayette, Ind., 7-10 Oct. 1968) 1169 pp. Plenum, New York, 1969. \$40.00

The publication of conference proceedings, usually after a time delay of about a year, is not normally very useful. *Thermal Conductivity* does not escape from this generic objection. The papers by now have presumably been published in professional journals. The abstracts provide very little information. There is an author index, but no subject index. Use of the book as a reference is difficult.

Despite these reservations, the book has value. The conference covered a broad spectrum of experimental and theoretical techniques, as well as temperatures from cryogenic to several thousand degrees. The materials were divided into solids, liquids, gases, fibers, polymers, soils and biological materials.

I found the most striking feature to be the almost unbelievable discrepancies within the published data. I had assumed that, in an area of physics as mature as thermal conductivity, debates over numerical values would range over at most a fraction of a percent, and that qualitative features would not be ambiguous. But this is not so. Often the published data are so disparate that it is not clear whether thermal conductivity increases or decreases with increasing temperature.

An amusing appendix consists of letters written in response to a proposed new "f" unit—the fourier—for a heat conductivity of one watt per