

with his introductory remarks on the hydrogen atom and hydroxyl radical, is a textbook model of clear writing.

How can molecules collect electromagnetic radiation energy and convey it into the synthesis of other molecules? Current answers are given in G. Tollin's paper on physical mechanisms in photosynthesis. The precise mechanisms by which ionizing radiations disrupt biological molecules are discussed in the paper on radiation inactivation of enzymes by Augenstein, Brustad and Mason.

In an entirely different direction is Forsberg's paper on effects of small doses of ionizing radiations, which discusses, among other remarkable biological items, the extreme sensitivity of certain molds. Measurable changes in growth rate are caused by 0.45 r given in 3 sec, and other responses are elicited by 10^{-3} r air dose.

The editors are to be commended for the thoroughness and compactness attained. The documentation is adequate. The table of contents, author index and subject index make the excellent material readily accessible to the reader.

Physics and engineering

PHOTOELECTRONIC MATERIALS AND DEVICES. Simon Larach, ed. 434 pp. Van Nostrand, Princeton, N.J., 1965. \$12.00.

by *Ladislav Marton*

The collection of papers presented in this book is based "in large part on a series of interdisciplinary papers in the general area of Photoelectronics, which appeared in the *R.C.A. Review* of December 1959." The foreword of the volume says, "Since this volume is an attempt to present a coherent picture of both materials and the devices in which these materials are utilized, the relevant device chapters have been extended and brought up to date."

The result is a rather inhomogeneous volume containing some pa-

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The reviewer, now Chief of International Relations for the NBS, has worked in electron physics for many years. He was one of the founders of the APS Division of Electron Physics.

pers that are very good physics and some that are pure engineering. A brief summary of the index of contents gives an idea about the general constitution of the volume. Chapter 1 is on the luminescence of solids, by A. G. Fischer, R. E. Shrader, and S. Larach, followed by Richard H. Bube's paper on photoconductors. The third is, "Infrared-Sensitive Extrinsic Germanium and Germanium-Silicon Alloy Photoconductors", by M. L. Schultz and G. A. Morton. A. Sommer and W. E. Spicer have written a chapter on photoelectric emission, A. Rose on noise currents, Paul Rappaport and J. J. Wysocki on the photovoltaic effect, E. E. Loebner on solid-state optoelectronics, and F. H. Nicoll on solid-state image intensifiers. The last chapter is by James A. Amick on Electrofax behavior.

I would like to single out the paper of Sommer and Spicer, together with that of Rose, as the highlights of the volume. They are excellent summaries of the subject, and can be used advantageously, whether for teaching purposes or for research work where an up-to-date review is required. Quite good are the chapters by Bube and by Schultz and Morton.

The first chapter has in its title in parentheses, "with emphasis on electroluminescence." I believe the title is misleading. There is very little on the luminescence of solids, and the emphasis on electroluminescence is so overwhelming that it would have been wiser to entitle the whole chapter "Electroluminescence" with some comments on the luminescence of solids. The chapter is written largely from an engineering viewpoint, although it does discuss the possible models for the action of electroluminescent materials. In the introductory "general comments" part of the paper, a very regrettable slip occurs. The authors write, "The search for a theoretical understanding of incandescence led Planck in 1900, to the first significant promulgation of a quantum theory and to the concept of a 'perfect radiator' or 'black body', which has the property of emitting at least the same, but usually more, radiant flux per unit area over any given wavelength range than that obtainable from any real source operat-

ing at the same temperature." The authors convey here the idea that Planck was the first to evolve the concept of the black body, which is utterly wrong. More than 40 years before 1900, the concept of the black body was clearly evolved in Kirchhoff's classical papers, as well as in the paper of Balfour Stuart, and the measurements which were made between 1860 and 1900, as well as successive theories of Stefan, Boltzmann, Wien, and Rayleigh, are proof that the idea was alive a long time before Planck's classical investigation. Of course Planck had the great merit of evolving the concept that unified all previous investigations and theories.

The chapter on optoelectronics by E. E. Loebner is the most deplorable of all of them. It is written in a kind of gobbledegook which requires a glossary for reading. This is highly regrettable because I gained the impression that the paper may contain a series of ideas, which are very bright but hard to extract.

I was very interested in reading the last paragraph on the Electrofax process. This seems to be a very interesting new application of solid-state physics that may serve as a complement to photography or may even supplant, in some instances, conventional photographic processes.

Acoustics and living cells

ULTRASONIC ENERGY. Biological Investigations and Medical Applications. Elizabeth Kelly, ed. 387 pp. University of Illinois Press, Urbana, 1965. \$12.50.

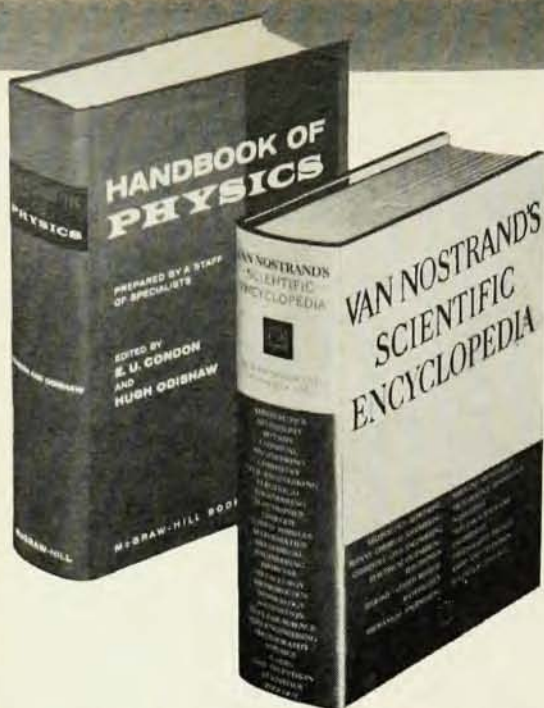
by *Walter G. Mayer*

The use of ultrasonics in biology and medicine was the topic of a symposium held during the Summer of 1962 at the University of Illinois. The twenty-five papers presented there have now been published together with the text of the frequently very illuminating discussions following the presentations.

Ultrasonic waves can be transmitted through biological specimens, and the

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Walter G. Mayer, a member of the Physics Department at Georgetown University, has done research in ultrasonics for the past 11 years.



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propagation characteristics can be used to obtain information about the samples. Acoustical reflections from tissue interfaces, transit-time measurements of acoustic pulses and ultrasonic absorption properties are indications of various characteristics of the specimens. Some of the authors report on the evaluation of these phenomena in the development of diagnostic techniques for studying heart diseases, tumors, skeletal muscle and various aspects of neurology.

High-intensity ultrasonic waves can change tissue structure at a molecular level. Since these selective changes may introduce modifications or damage in biological systems, possible applications of ultrasound in therapy and surgery are discussed, and well illustrated reports are included on the treatment of tumors and cancer and on the effect of ultrasonic irradiation on the pituitary, mouse livers and other tissue.

In addition to these specific reports the book also contains papers on the physical aspects of sound related to acoustic streaming and cavitation, focusing of acoustic waves, electronic design and transducer construction.

This Symposium report, authored by physicians, physicists, engineers and biologists from seven countries and edited by the Associate Director of Research at the Interscience Research Institute, should be of great value to the biophysicist and those interested in medical physics.

Linear differential equations

HANDBOOK OF LAPLACE TRANSFORMATION. Fundamentals, Applications, Tables and Examples. (2nd ed.) By Floyd E. Nixon. 260 pp. Prentice-Hall, Englewood Cliffs, N.J., 1965. \$10.00.

by Jacques E. Romain

The most frequent use of Laplace transformations is related to systems that may be represented by a linear differential equation, the problem being to find the system's response to a simple form of (single or periodically repeated) input. The usual "simple" inputs are those whose Laplace transforms are rational fractions in the

new variable (essentially polynomials, step functions, exponentials, trigonometric functions). The purpose of this book is to cover the field thus defined. It is meant as an introduction to the topic; no previous knowledge of Laplace transforms is required. Introductory chapters on determinants, mathematical identities and methods for finding the roots of algebraic equations are included. The Laplace transform and the essential relevant theorems (including the treatment of recurring waveforms) are very clearly introduced, and immediately followed by a good many examples of fully worked out applications to electrical, mechanical and electromechanical systems, so that the method's practical possibilities are vividly displayed. The emphasis on detailed examples and the treatment of recurring waveforms are the essential features of this second edition. Other features of the book are the inclusion of useful extra tables [e.g., table of the modulus and argument of $1 - \exp(-j\theta)$; representation of basic dynamical and electrical quantities], the exposition of Holzer's iterated approximation method for a quick computation of the mode frequencies and the associated relative amplitudes, and an ingenious indexing of the (careful and detailed) table of Laplace transform pairs, which appears quite efficient in retrieving the required pair for the inverse transformation.

These qualities make the book perfectly fit as a textbook for an introductory course or for self-study. It is also appropriate for the reader who is not planning any specific application but who would like to know, at a moderate expense in pains and time, what the method is up to. (Such a reader should skip the first, second and fourth chapters). However, the title may be somewhat misleading, as it might suggest that the book is a full-fledged treatise covering the whole field of Laplace transformation. Indeed, it does not deal with such advanced questions as contour integration for the inverse transformation in cases where the transform pair is not available from tables, or the transform of less usual functions whose transform is of a more complex form

than a rational fraction. (It is true that the latter limitation is easily overcome by using a separate table of Laplace transforms.)

In brief, this book may be unhesitatingly recommended to the great majority of readers, who have essentially to solve (sometimes quite complicated) well-behaved problems, be they new in the field or already familiar with it. But they must be aware that, were they ever to stumble on some unusual difficulty, more can be found elsewhere on the method.

F. E. Nixon, co-editor of the Prentice-Hall Space Technology Series, is manager of the Engineering Staff, Atlantic Missile Range for Aerospace Corporation, Cocoa Beach, Florida.

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The reviewer, a scientific advisor for the Centre de Recherches Routières in Sterrebeek, Belgium, is currently engaged in research work on visco-elasticity, which involves frequent recourse to Laplace transform techniques.

Generalized functions

DISTRIBUTION THEORY AND TRANSFORM ANALYSIS. An Introduction to Generalized Functions, with Applications. By Armen H. Zemanian. 371 pp. McGraw-Hill, New York, 1965. \$13.75.

by J. Gillis

Distributions have had a place in analysis since the days of Heaviside, but it is only during the past twenty years that they have had a name of their own. A great deal has been written about them during the latter period, but this book is the first attempt to present a fairly complete but elementary theory together with some idea of how it is to be applied.

The development is lucid, if unexciting, and contains all that one needs to know of basic theorems. The applications are disappointing in that all of those included could have been handled by classical Laplace or Fourier transform methods. This is not so

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The reviewer is a member of the department of Applied Mathematics at the Weizmann Institute of Science in Rehovoth, Israel.