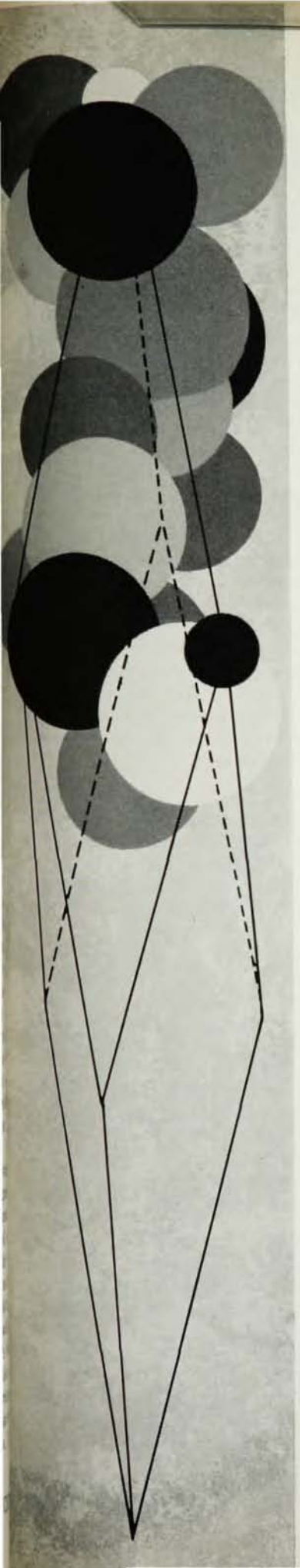
for predicting some of the properties of pure gases and liquids and then using empirical data to complete the presentation of the data. Many empirical and semiempirical methods are available and after critically discussing these the recommended procedure is presented with worked-out examples.

Not all properties are included but the ones that are are certainly the most useful ones—critical properties, P-V-T relationships, vapor pressure, latent heat of vaporization, heat of formation, free energy of formation, heat capacity, viscosity, thermal conductivity, diffusion coefficient, and vapor-liquid equilibria. Polar and nonpolar, organic and inorganic liquids and gases of a great variety are included. The great care which the authors have taken to obtain data and critically evaluate both data and methods of correlation with theory makes this book a valuable tool for all engineers and scientists who need this information in their work. The student of thermodynamics and/or kinetic theory will also find this book a stimulating introduction to a most useful application of his subject, prediction of the gross properties of fluids.

Applied Mathematics for Engineers and Physicists (2nd Revised Edition). By Louis A. Pipes. 723 pp. McGraw-Hill Book Co., Inc., New York, 1958. $8.75. *Reviewed by Harold Mendlowitz, National Bureau of Standards.*

There are now quite a few books available in English on mathematical physics, theoretical physics, and applied mathematics. To a certain extent, we associate the terms mathematical physics with classical theoretical physics, theoretical physics with modern theoretical physics, and applied mathematics with "theoretical engineering". These associations have some justification in the present division of our technological and scientific efforts, even though those working in the different "disciplines" utilize similar tools. In general, it is not the tools that are different, but, rather, the emphasis on the types of problems and the goals. Of course, in many investigations the tools utilized in "theoretical physics" may differ considerably from those employed in applied mathematics. Therefore, one should not expect that a book written to satisfy a need in applied mathematics would satisfy those with requirements in theoretical physics and vice versa.

I feel that this book would surely satisfy those whose requirements lie in the field of "theoretical engineering" and, to a lesser degree, the worker in mathematical physics. The present edition is an improved and more up-to-date version of the first edition under the same title. The additional material on matrices, oscillations, calculus of variations, tensor analysis, solutions of wave equations, Laplace transform, and nonlinear systems certainly improves the usefulness of the book. I would like to point out that although physicists are included in the title, the emphasis is on the requirements of the engineer. One of the new sections includes a discussion on the diagonalization of matrices. To a



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graduate student in physics this topic would bring to mind the eigenvalue problems in both classical and quantum physics, especially the latter. This connection is not pointed out. Also, there is a very nice treatment of the Laplace transform and operational methods but the treatment of Fourier transforms is extremely short. The additional sections on tensors and tensor analysis are welcome. However, if the author was also aiming towards an audience of physicists a discussion of spinors would not have been out of place. There is a whole chapter on wave equations. Here again, the physicist feels somewhat cheated. He looks in vain for the Schrödinger equation. The closest to the Schrödinger equation that he can get is the diffusion equation. However, the latter is not in the chapter on wave equations but rather in the chapter on vector analysis, where it is only mentioned but not treated. There are no treatments of Hilbert space, group theory, or combinatorial analysis, subjects interesting to present-day students in theoretical physics. Although the Dirac delta function is discussed, it is not called by that name. One also looks in vain in the index for the Green Function. In fact, I got the feeling that if a topic was not of primary importance to the engineer it was left out. I would like to emphasize that my major objection is to the inclusion of physicists in the title. However, those whose interests are in "theoretical engineering" will find this book a desirable contribution to the pedagogic literature on applied mathematics.

Comparison of the Large-Scale Structure of the Galactic System With That of Other Stellar Systems: IAU Symp. No. 5 (Dublin, Sept. 1955). Edited by N. G. Roman. 72 pp. (Unesco) Cambridge U. Press, New York, 1958. $3.00. *Reviewed by Cecilia Payne-Gaposchkin, Harvard College Observatory.*

It is scarcely a decade since our knowledge of the *structure* (as distinguished from the dimensions) of the galactic system emerged from speculation into certainty. Three avenues converged to produce this result: the precision of the photoelectric photometer allowed us to recognize and locate the luminous stars that follow the spiral structure; the new techniques of radio astronomy provided means for surveying the spiral structure of the interstellar gas; and the new and powerful optical telescopes revealed many distant spiral systems that clearly resemble our own.

All three approaches are included in the symposium, and all are discussed by those who were pioneers in opening them up. Especially notable are the papers of W. W. Morgan on the distribution of blue giant stars (which he first located in the spiral arms); of H. C. van de Hulst on the distribution of the hydrogen gas (whose hyperfine structure line in the radio region he first successfully predicted); and of W. Baade on the structure of spiral galaxies. The section, by N. U. Mayall, on the distribution of gas in extragalactic systems, is one of the most stimulating in the volume, and gives a tantalizing glimpse into the surveying of galaxies