by no means a pat presentation of successive facts, and because it entirely avoids the calculus, this is a stimulating supplement to textbooks, rather than a textbook itself.

The author, professor of mathematics at Queens College of the City University of New York, uses an approach that is in sharp contrast to the common practice of stating a definition, followed by more or less discussion. Instead he "creeps up" on a definition by trying to get the student to figure out what a good definition would be. To illustrate the elementary level at which the book begins, its unconventional means of provoking thought, and its humor, chapter 1 mentions an Indian tribe who believed that arrows are vectors, and so to kill a deer due northeast they would simultaneously shoot arrows north and east, relying on their powerful resultant to bring down the game. The book continues in such vivid style through the usual topics of vector algebra into areas commonly ignored in introductory treatments, such as pseudovectors, which are lucidly considered in the last brief chapter on tensors. Vector fields are very briefly discussed, but most other topics involving calculus are ignored. A considerable treatment of areas as vectors skirts the concept of curl without mentioning it. The entire presentation is marked by warmth and clarity, with uncommonly acute attention given to the difference between free and bound vectors.

Exercises are interspersed, obviously intended to inspire thought rather than to provide practice in techniques. They range from numerical problems to the single query: "Why?" and may be accompanied by no answer, a hint, the final answer or a detailed solution.

The author suggests that his book has something for the beginner, for advanced students and also for instructors. It most certainly does. Some readers might decry its lack of rigor, but this is more than compensated by its stimulation and warmth, making the book one of the most enjoyable this reviewer has read.

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Reactor textbook

INTRODUCTION TO NUCLEAR REACTOR THEORY. By John R. Lamarsh. 585 pp. Addison-Wesley, Reading, Mass. 1966.

by George I. Bell

Nuclear reactor theory treats the diffusion or transport of neutrons in material media and has as its aim the prediction of the behavior of the neutron population in a fission reactor as a function of space, time and energy. As input for the theory one must take neutron-nucleus interaction cross sections, including fission, and these are then used in diffusion or transport theory in order to analyze neutron behavior in a variety of geometrical and material configurations of practical interest.

The present text serves as an excellent introduction to nuclear-reactor theory. It begins with three chapters outlining those aspects of nuclear physics that are of direct importance for fission reactors, in particular the interactions of neutrons with nuclei and nuclear fission. The diffusion of monoenergetic neutrons is next treated and this is followed by chapters on neutron moderation without and with absorption, and neutron thermalization. On the basis of these preliminaries there are then developed the Fermi treatment of bare homogeneous reactors, the group diffusion method for treating multiregion reactors, and special methods for treating heterogeneous reactors. Time-dependent problems of reactor kinetics are analyzed and the book concludes with sections on control rods and perturbation theory.

This book is designed for use as a textbook. The material is well organized and clearly presented and there are a large number of problems at the end of each chapter. The level is suitable for a student who has mastered advanced calculus and has some knowledge of the elements of nuclear physics.

In many respects the coverage in this book parallels and updates that in the classic text of Glasstone and Edlund. Examples of the updating are the discussion of neutron thermalization and the use of equivalence relations for obtaining the resonance escape probability in heterogeneous reactors. The cell method of Amouyal, Benoist and Horowitz is also developed in some detail.

It should be noted that this text contains no development of neutron transport theory, as based on the Boltzmann equation. I would think that a chapter including such a development would have been worthwhile; it could show how diffusion theory is an approximation to transport theory and how this approximation may be improved upon in a systematic fashion. In fairness, however, Lamarsh does rather clearly describe the limitations of diffusion theory and he uses collision probability methods and not diffusion theory for treating heterogeneous systems. It may also be noted that the text does not discuss numerical methods in any detail; numerical multigroup methods are mentioned but not developed. It may be that individual instructors would wish to supplement this book by some additional material on transport theory or numerical method.

In summary, I recommend this work as a first-rate introduction to nuclear reactor theory. It gives the student an excellent physical understanding of the theory as well as an introduction to many of the most important methods for solving practical problems in reactor design.

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Structural variety in crystals

POLYMORPHISM AND POLYTYPISM IN CRYSTALS. By Ajit Ram Verma and P. Krishna. 341 pp. Wiley, New York, 1966. $12.75

by H. M. Otte

The discovery of polymorphism apparently dates back to 1798 when Kloproth reached the conclusion that the minerals calcite and aragonite have the same chemical composition, $CaCO_3$. This observation was contrary to all the accepted ideas of that time, and was not universally accepted till more wide-spread occurrence of polymorphism was recognized some 25 years later. We now realize that the phenomenon is exhibited by a large number of substances. Knowledge of polytypism, however, is of more recent origin and can be traced to its discovery in silicon carbide around 1912 by Baumhauer, who named the phenomenon "polytypie." Although it has since been observed in other substances such as zinc sulfide and cadmium iodide, silicon carbide remains the one in which it has been investigated most extensively. In spite of its title, the book is primarily about polytypism and in particular about silicon carbide. In fact, chapter 5 is entitled "Silicon Carbide and Other Polytypic Substances." Apart from being, for a long time, the only substance known to be polytypic, silicon carbide has also received considerable attention because of its increasing technical and industrial importance. Its usefulness as an abrasive has long been known, but its importance as a high-temperature semiconductor is only currently being explored.

Polytypism is actually to be considered as a special one-dimensional polymorphism, so that the different polytypic modifications can be regarded as built up of layers of structure stacked parallel to each other at constant intervals along the variable dimension. The unit cell dimensions parallel to these layers are thus the same for all the modifications, but the third dimension, always an integral multiple of the layer spacing, will depend on the stacking sequence. Consequently, different manners of stacking these layers may result in structures having not only different morphologies but even different lattice types and space groups. As a result the possible number of polytypes is almost unlimited, and some 50, with repeat distances ranging from two to an incredibly large 1200 interlayer spacings, are listed by Verma and Krishna for silicon carbide.

The theory of polytypism is discussed in detail (chapter 8) and the book concludes with recent observations on polytypism and the present position (chapter 9). Other chapters in the book deal with the thermodynamic (or phase) aspect and with the structural aspect of polymorphism (chapters 2 and 3); with a description of polytypic structures (chapter 4) and with the structure determination