A Modern Textbook on Differential Geometry

Differential and Riemannian Geometry. Detlef Laugwitz. Translated from the German edition (Stuttgart, 1960) by Fritz Steinhardt. Academic Press, New York, 1965. xii + 238 pp. Illus. $8.50.

The student of modern differential geometry finds himself in a most awkward position. The contemporary advanced treatises are based on abstract, coordinate-free definitions of concepts such as curvature and connections, a variety of different notations are used, and the geometric content is far from readily apparent. Presumably, such a student should begin with the study of the elementary geometry of curves and surfaces, but this is frustrating because the textbooks are full of details with which he is not concerned and, moreover, are written in a variety of notations, few of which are similar to any of those used in advanced books.

This book is a successful attempt at a first text on the subject which is aimed at the modern developments. Clearly, compromises in content and method are necessary, and in general the decisions made are sound. The author discusses curves and surfaces in Euclidean space with admirable concentration on the essentials. Later, Riemannian geometry and tensor analysis appear, and finally there are selected topics in geometry "in the large."

A mastery of this material is an excellent first step for the fledgling differential geometer. It is far from sufficient, however, for in addition he must look elsewhere for material on differential forms, Lie groups, and algebraic topology. Nevertheless, this book is an excellent way for him to begin his studies; it is sound, brief, and interesting.

A reviewer can always find objections to any book, and I have some in this case. First, some of the theorems in chapter 1 are true only for a curve whose first and second vector derivatives are nowhere zero. This restriction may not be apparent to the reader. The impression is given that there is a unique, arc-length parameter s, whereas this depends on a base point and the direction of the curve. Thus, there is no proof that the curvature and torsion of the curve are independent of the possible choices for s. The author also falls into the trap that he warns us against at the bottom of page vi when, on page 5, he assumes that the zeros of a function either are isolated or fill out an interval. What about a convergent sequence of zeros? The reader needs to be alert for situations like these, but they do not detract from the general usefulness of the book.

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Summer School, Solid-State Physics, 1963

The Interaction of Radiation with Solids. Proceedings of the International Summer School on Solid State Physics (Mol, Belgium, August 1963). R. Strumane, J. Nihoul, R. Gevers, and S. Amelinckx, Eds. North-Holland, Amsterdam; Interscience (Wiley), New York, 1964. 824 pp. Illus. $25.

The 23 articles in this volume are based on lectures delivered in August 1963 at a 3-week international summer school concerned principally with radiation damage in solids. The articles, all in English, have been grouped by the editors into eight sections: the general theory of radiation damage; damage in pure metals, in alloys and fissionable materials, in ionic crystals, and in semiconductors; diffraction and scattering phenomena; experimental techniques; and a short section treating diffusion in the solid state. Biological systems are not discussed. The broad range of topics covered gives the reader a fair indication of the relevance of damage studies to solid-state physics and to metallurgy. It has unfortunately become standard practice to publish the proceedings of almost all international gatherings in expensive hard-cover volumes, even when many of the contributions are of short-term interest and abstract detailed reports have been published in the standard literature, but there is a bona fide need for longer-lived volumes such as this one in which the authors attempt to sift and to review the accomplishments and prospects of an important field.

Roughly one-fourth of the material presented concerns the dynamics of defect formation and motion, one-fourth the effects of defects on physical properties of materials, and one-third the theory and practice of defect investigation by electron and neutron spectroscopy. The remainder covers miscellaneous useful topics—for example, Motte and Debrue discuss aspects of nuclear-reactor theory relevant to in-pile damage experiments. Although the emphasis throughout most of the volume is on microscopic defects, Wechsler, in discussing the relevance of defects to metallurgy, has wryly included a maritime photograph to illustrate that sometimes large defects from little defects grow!

The specialist (and the prospective specialist) will find the articles readable and informative. The level of presentation is not elementary, but it is introductory. For example, the several authors who discuss the theory of defect formation by energetic primaries refer the reader to cited literature for details of specific calculations but endeavor to indicate in their articles general methods of attack, basic approximations and assumptions, and typical results and their relation to experiment.

A good deal of space has been allocated to electron and neutron diffraction. These articles constitute in themselves a useful compendium. They summarize the basic theoretical developments underlying diffraction experiments and illustrate with numerous figures, data, and photographs representative results.

Although this is not a textbook, graduate students and research workers will find that it is a useful reference source, even though its utility in this respect is seriously impaired by the lack of a subject index, an all-too-common characteristic of scientific anthologies. The short table of contents lists only the titles and authors of the separate articles. (The author index at the back of the volume has 26 entries.) The lack of a subject index might have been partially compensated if the editors had prepared a more detailed table of contents or if the authors had tabulated their paragraph subheadings at the beginning of each paper; however, this has not been done.

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