Book Review

Works intended for notice in this column should be sent direct to the Editor (A. Guinier, Faculté des Sciences d'Orsay, Université de Paris, Service de Physique des Solides, Bâtiment 210, 91 *Orsay, France). As far as practicable books will be reviewed in a country different from that of publication.*

Théorie Mathématique des Dislocations. By M. Zorawski. Pp. x + 147. Paris: Dunod, 1967. Price 44 F.

The basic idea of this book is simple. A crystal without defects can be described in terms of an undistorted lattice in Euclidean space. When a crystal contains defects, such as dislocations, vacancies, or additional atoms, such a description is no longer possible, and one tends to speak loosely of a distorted lattice. The author makes this idea precise by using a lattice with a non-Euclidean geometry. The dislocation density then appears, as Nye has pointed out, as a nine-component tensor relating the Burgers vector to the element of area enclosed by the circuit defining the Burgers vector. The density of vacancies or additional atoms can be represented as a fourth-order tensor with six independent components.

Although this basic idea is simple, the working out of it is not. The book consists of five chapters, of which the first is a review of differential geometry. In it the ideas that will be required in later chapters are developed, but it is hardly intelligible to someone without considerable previous knowledge of the subject. The second chapter develops the general field equations governing the motion of defects. Roughly speaking, motion of dislocations corresponds to a change of the system of coordinates, and motion of holes and additional atoms corresponds to a change in the metric of the Riemannian geometry. Chapter 3 considers displacements small enough for their squares and the squares of their derivatives to be neglected, and thus corresponds to systems that are geometrically linear, and chapter 4 applies variational methods based on the functions of Hamilton and Lagrange. The final chapter contains the ideas least familiar to the crystallographer, who tends to regard defects as stationary during the time required to observe them. It develops a relativistic and quantum-mechanical theory. The latter contains a constant h, which is analogous to Planck's constant in classical quantum-mechanics. It appears, however, that it would be a matter for experiment to determine it for the particular crystal. Similarly, the speed coming into the relativistic equations is related to the method of measurement, and not to the speed of light.

The publishers claim that research workers, engineers, and students of theoretical physics and metallurgy will read this book with profit. However, the treatment is entirely mathematical and abstract, with no attempt to relate it to actual observations of the behaviour of defects. This does not detract from its beauty as a closed theory, but it is very tough reading for those who are not well acquainted with differential geometry. A few detailed references are given in footnotes, but there is an annoying tendency to give other references simply by naming the author or, at the most, the author and year. The index, as in many French books, is very short and incomplete. For example, density of vacancies and density of additional atoms appear, but not density of dislocations.

A. J. C. Wilson

The University of Birmingham
Birmingham 15
England