Differential Geometry of Three Dimensions. By C. E. Weatherburn. Cambridge, University Press, 1927. xii+268 pp.

"The objects of the present volume are to provide an introductory treatise on (metric) differential geometry, and to show how vector methods may be employed to advantage."

The author shows excellent judgement in the way he goes about securing these two ends. He chooses his geometrical material well, and, in adopting Gibbs's notation for his vector treatment, he is undoubtedly in accord with the current preference.

The book begins with a treatment of space curves, and the curves and developable surfaces associated with a space curve. It passes on to the theory of surfaces, taking up the important classes of curves on an arbitrary surface and investigating certain special types of surfaces, and closes with treatments of congruences and triply orthogonal systems of surfaces.

This, at least, was the content of the book as originally planned by the author. After the manuscript went to press, he added two chapters dealing primarily with differential invariants and their applications. In the previous chapters he employs merely vector algebra. Here he introduces a vectorial differential operator ∇ for a surface analogous to the usual ∇ for the plane. By skillful use of it he succeeds in generalizing for a surface the classical differential and integral calculus of vectors and obtains from his generalizations a number of interesting and striking geometrical results.

When a specialist in vector analysis turns his attention to geometry, it is too often the result that the geometry becomes merely a foil for the aggrandizement of the vector analysis. The present writer treats geometry more kindly. He keeps it clearly in mind as the first of the two objects he set out to achieve and does exceedingly well by it.

The author's geometric insight is keen, clever, and instructive. But at times he is found offering, as rigorous proofs, intuitive geometric arguments which, though enlightening and to the point in their proper place, are lacking in substance. We quote, for example, his proof that a developable surface may be applied to a plane: "since *consecutive* generators are *coplanar*, the plane *containing* the *first* and *second* of the family of generators may be turned about the second till it *coincides* with the plane *containing* the *second* and *third*; then this common plane may be turned about the third till it *coincides* with the plane *containing* the *third* and the *fourth*; and so on. In this way the whole surface may be developed into a plane." The author is here led astray by the inaccurate use of the words which have been italicized. He is not again so completely betrayed by the language of little zeros. The reviewer is glad to say that this is an extreme case. Is it not, however, deserving of consideration by those of us who are tempted at times, either in the classroom or in writing for the printed page, to employ for the sake of brevity or convenience inaccurate or approximate terminology?

The author likes unusual terms and seems to enjoy devising new names and changing old ones. "Synclastic and anticlastic" surfaces for surfaces of positive and negative curvature respectively, and "specific curvature" instead of Gaussian curvature, are some examples. A little of this may be all very well, but when the author goes so far as to propose that the Gaussian curvature be subjected to the ignominy of the name "second curvature," surely it is time to call a halt.

An able presentation of the elements of the subject by vector methods, a clearly written text with an abundance of good exercises, this book should prove a welcome addition to the literature in differential geometry.

W. C. GRAUSTEIN

Figures d'Équilibre et Cosmogonie. Mémorial des Sciences Mathématiques, No. XIII. By Alex. Véronnet. Paris, Gauthier-Villars, 1926. 62 pp.

One of the greatest problems of celestial mechanics has been that of determining figures of equilibrium of rotating fluid bodies. Its application to the theory of evolution of planets, stars, and stellar systems, has given it perpetual interest. Its difficulties have long baffled mathematicians. The author gives in the present little book a brief yet fairly comprehensive account of the progress that has been made towards solving those difficulties, from the times of Maclaurin, Clairaut, Laplace and Jacobi, to the more recent successes of Darwin, Poincaré and a number of living mathematicians, amongst whom Véronnet holds a prominent place.

The first chapter gives a resümé of studies of figures of equilibrium for the case of a homogeneous fluid; included are the results concerning the stability of those figures. The second chapter is devoted to heterogeneous bodies and the figures of the planets. Chapter three is concerned with a body having an atmosphere, the Laplacian nebular hypothesis, the figures of comets, and Saturn's rings. The fourth chapter takes up the dynamical equilibrium of stellar systems, and theories of cosmogony. The final chapter considers the thermodynamical equilibrium of the universe and its evolution.

At the end of the monograph there is a six-page bibliography of books and memoirs appertaining to the field covered. While this bibliography is far from exhaustive, it is sufficient to indicate most of the principal sources for a study of the famous problem. One might wish that reference had been made to more of MacMillan's recent papers.

E. J. MOULTON

Geodäsie (Landesmessung und Erdmessung). By Gustav Förster. Sammlung Göschen. Berlin, de Gruyter, 1927. 122 pp.

This small volume gives a popular account of the purpose, scope, mathematical foundation, and technique of surveying and of higher geodesy. Although technical calculations for problems of moderate difficulty are included, the actual mathematical content of the book is small. In the reviewer's judgement the informal but clear definitions, the technical descriptions of procedure, and in particular the explanations of the brief periodic deformations of the earth will be attractive reading particularly for mathematicians whose professional interest in geodesy is slight.

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