

## NON-EUCLIDEAN GEOMETRY.

*Bibliography of Non-Euclidean Geometry including the Theory of Parallels, the Foundations of Geometry, and Space of  $n$  Dimensions.* By DUNCAN M. Y. SOMMERVILLE. London, Harrison and Sons, 1911. xii+404 pages.

ALMOST simultaneously with its quincentenary celebration, the University of St. Andrews has published this valuable compilation, the result of nine years of research on the part of one of its lecturers in mathematics. The title inevitably suggests similar lists by Halsted, Stäckel and Engel, Schlegel, and the lamented Bonola. To the work of all these bibliographic forebears Dr. Sommerville gives scrupulously exact reference. The bibliography of Halsted, "a model of its kind," includes nearly 200 titles of works relating to non-euclidean geometry and space of  $n$  dimensions, from about 1830 to 1879. Short notes appended to the chief works "form a valuable feature." Stäckel and Engel's bibliography on the theory of parallels is a chronological list of nearly 300 titles from 1482 to 1837 and, as Dr. Sommerville remarks, is almost complete. Schlegel's list of works on  $n$  dimensions accompanies a report on the subject, which supplies the place of Halsted's notes. It contains about 400 titles arranged alphabetically under the authors. The bibliography of Bonola is the most extensive which has recently appeared. It contains over 900 titles chronologically arranged from 1839 to 1902 with an index of authors. There is a classification under the headings Elementary geometry, Metrical and differential geometry, Group theory, Projective geometry, Finite distances, Vectorial methods, Mechanics and physics, General expositions, Philosophy and history, but there is no subject index.

Dr. Sommerville's idea at first was to prepare a continuation of Halsted's work but the growth of the subject rendered such diffuse treatment impossible and he was led to "produce as far as possible a complete repository of the titles of all works, from the earliest times up to the present, which deal with the extended conception of space, and to form a guide to the literature in an easily accessible form. It includes the theory of parallels, non-euclidean geometry, the foundations of geom-