clerical details which can be of considerable aid to the reader,—the careful numbering of paragraphs and formulas, adequate cross-references, and the explicit statement of theorems,—have been scrupulously attended to. There are numerous diagrams and an excellent bibliography.

Analysis situs is a comparatively young science; yet its importance can not be doubted. It deals with the most primitive questions of geometry and is fascinating to those who enjoy moulding in precise mathematical rigor the visions of a sharpened physical intuition. Its most important problems deal with the very structure of space, and many of them are still to be solved. It is pleasant to reflect that much of what has been accomplished has been the work of American mathematicians, and to that work the present volume is a distinguished contribution.

P. A. SMITH

FUBINI AND ČECH

Introduction à la Géométrie Projective Différentielle des Surfaces. By Fubini et Čech. Paris, Gauthier-Villars, 1931. vi+291 pp.

This volume is in some sense a sequel to the treatise entitled *Geometria Proiettiva Differenziale* published in two volumes in 1926 and 1927 by the same authors. It should receive a generous welcome from the geometrical public for several reasons. First of all, it is in French, a language admittedly more widely read than Italian. The authors, profiting no doubt by their previous experience, have produced a quite readable book. Some detailed developments of their treatise have been omitted; the treatment here is more elementary, and the style of exposition is clearer than before. The discussion is confined to surfaces in ordinary space. Altogether, this book should serve well its purpose of being an introduction to projective differential geometry.

It must not be understood that the present volume is merely an abstract from the treatise. In fact, certain subjects are included which do not appear in the larger work at all. An analysis of the contents of the volume under review will amplify these remarks.

There are in all fourteen chapters, of which the first three may be regarded as introductory. The first is properly an introduction, containing some preliminary analytical results concerning collineations and correlations, matrices, and algebraic forms. The second treats of plane curves, and the third of curves in ordinary space.

Chapters IV–VIII contain an exposition of the projective differential theory of curved surfaces in ordinary space. The point of view is primarily that of the method of differential forms, but the differential equations which define a

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(Footnote contined from page 647.) "The proof as outlined holds for simplicial and convex cells, the only types for which it is used later in the book. The proof for the general case has been obtained recently by A. W. Tucker." Chapter III, No. 45, replace everywhere "M" by "$\overline{M}$."
page 206, end of No. 49, add, "For $n=1$, $Lc\,(\Gamma_0\cdot\Gamma_0')$ can also be defined provided that either Γ_0 or $\Gamma_0'\sim 0$.
page 403, end of reference to W. Mayer, add "219–258."

surface except for a projective transformation are also employed. The asymptotic curves are taken as parametric throughout.

The next three chapters are comprised in a separate group. Chapter IX is devoted to ruled surfaces. In Chapter X we find an account of the theory of plane nets. The well known theorem of Koenigs, that the perspective of the asymptotic curves on a surface in ordinary space from a point onto a plane is a plane net with equal Laplace-Darboux invariants, and conversely, suggests that plane nets with equal invariants should be called *asymptotic plane nets.* These nets are studied in some detail, particularly with reference to the perspectives of the various configurations associated with a point of the surface. The research in this chapter is, for the most part, guided by the idea of associating with a point of a plane net configurations analogous to those associated with a point of a surface, and more generally by the idea of the analog between a curved surface and a flat surface. Chapter XI is designed to present some results on point-correspondences between two surfaces.

The last three chapters are given over to the methods of Cartan. Chapter XII contains a résumé of the analytic theory of equations of Pfaff, and is preliminary to the final two chapters, which are taken up with an extended exposition of the methods of Cartan and their applications to the projective differential geometry of surfaces.

The reader who is familiar with the treatise previously referred to will see from the foregoing analysis that the last five chapters of the volume before us contain material not found in the two-volume treatise. These five chapters extend over 110 pages, or approximately two-fifths of the total number of pages.

There are two features of the new book which deserve to be especially commended in conclusion. The first of these is the excellent set of historical and critical notes at the ends of the chapters. These notes contain various comments and references to the literature. The second praiseworthy feature is the bibliography at the end of the text, containing about 600 references to books, memoires, and notes. This is probably the most ambitious bibliography of projective differential geometry yet published, and is an impartial scientific effort to construct a scholarly bibliography of the subject. However, it is not perfect. For example, the authors do not recognize that the brothers A. L. Nelson and C. A. Nelson are two different men, and credit C. A. Nelson with papers of A. L. Nelson. The reviewer would like to suggest that there still seems to be room for some one to write a comprehensive history of projective differential geometry, and to compile a bibliography complete to date to accompany it.

E. P. LANE