The space devoted above to criticism of individual excerpts is relatively much greater than they deserve, and is apt to give an erroneous effect. The main impression made upon the reviewer is that the book is very readable and even interesting (rarely true of textbooks on statistics), except possibly for the algebraic passages referred to above. Teachers of courses which cannot, or do not, require any knowledge of the calculus, will probably find in this book the text they have long sought.

C. H. FORSYTH

HUDSON ON CREMONA TRANSFORMATIONS

Cremona Transformations in Plane and Space. By Hilda P. Hudson. Cambridge University Press, 1927. xx+454 pp.

The appearance of a first exhaustive treatise in any field of mathematics is a matter of concern to those who pursue the particular subject. Books of that type frequently determine the trend of mathematical thought and progress for a considerable period. Perhaps no topic in algebraic geometry has been in greater need of such exposition than Cremona transformations. The earlier presentations are either elementary or incidental to some immediate geometric need. Existing encyclopedic accounts are rather cursory. Thus a large body of researches on the subject, widely distributed in the journals, has been either inaccessible or unknown to those who might wish to become acquainted with the field.

To digest and to unify this mass of material was a task which demanded not merely a mastery of the subject but also an uncommon capacity for detail. This task Miss Hudson has accomplished in a most admirable manner in the book under review.

The book itself gives an impression of unity which is rather remarkable in view of the diversity of the transformations of which it treats. This doubtless is due to the wisdom of the author in selecting from the field a naturally related group of topics. Only transformations in the plane and in space are considered. For each case these are discussed first with reference to the properties common to all and secondly with reference to their division into various types. The single application considered is to the resolution of singularities of curves and surfaces and a treatment of this is practically inevitable since such singularities are present in the transformations. This is the division of the subject to which most of the author's own contributions have been made. No geometric applications are given except as they may be involved in the construction of a type, or as they may be inherent in the general class such as the isologues of a transformation in superposed planes or the complex associated with a transformation in space. Applications to other fields of mathematics are omitted. No account of Cremona groups, finite or infinite, appears.

The nomenclature of the author is on the whole well chosen even though individual contributors to the subject must generally expect to find that their own notations have not, in all cases, been adopted. Miss Hudson adopts the term *F-system* (*fundamental system*) for the aggregate of points in S whose correspondents in S' are indeterminate; and *P-system* (*principal system*) for the aggregate of points in S whose correspondents in S' are adjacent to (that is, directions about) the points of the F-system in S'. It is to be hoped that this usage may become general. No confusion can arise in the plane, by calling a P-curve an F-curve and this is frequently done but in space a distinction must be made.

About one-third of the text is devoted to the planar transformations, one-half to the spatial transformations, and the remainder to a historical sketch, a bibliography of 425 titles, a series of tables of types, and an index. In the plane, Chapters I and II are devoted to the general theory; Chapter IV to the determination of the types of transformation; Chapter III to the quadratic transformation, and Chapter VI to other special types; and Chapter VII to the resolution of the singularities of plane curves. In Chapter V we find the geometry which arises when the planes S, S' are brought into coincidence; and in Chapter VIII proofs of Noether's theorem that every transformation is a product of quadratic transformations. For space we find in Chapters IX and XIII the general theory; and in Chapters X and XIV the quadratic and other particular transformations. The intervening Chapters XI and XII are devoted respectively to postulation and equivalence, and to contact conditions. In Chapter XV the cubo-quartic transformation, which presents examples of most of the phenomena previously discussed, is minutely examined. Chapter XVI contains an account of the work up to the present time on the resolution of the singularities of surfaces. The final Chapter XVII contains the historical sketch and the bibliography.

In general the exposition is clear, brief, and effective. One may differ at times from the author with respect to methods of proof and emphasis on aspects of the theory. Thus there is associated with a given Cremona transformation T a linear transformation L, with integer coefficients, first freely used by S. Kantor, which expresses the effect of T upon the curves of order n in the plane. L and its invariant linear and quadratic forms are introduced rather incidentally (p. 26). But from the obvious invariance under T of the genus of one curve, and of the free intersections of two curves, there follows the invariance of the two forms under L; and therefore as an immediate consequence the incidence relations of p. 18. Also the nature of the product T_1T_2 (p. 56) is immediately read off from the coefficients of the product L_1L_2. In the determination of types carried out in Chapter IV the emphasis is placed on a division of types with respect to the degree n of T. It is the reviewer's opinion that a division with respect to the number σ of F-points of T is more fundamental. Nevertheless on these two matters, and indeed throughout, the presentation follows the historical order of development.

It is in connection with the space theory that the book will be of greatest service to the advanced reader. The original articles, in widely different notations, with many obscurities and not a few errors, are here combined into an organic whole whose lapses from perfection are as a rule clearly indicated. The content is brought up to present date with, for example, a proof of the recently announced theorem of Tummarello on the equality of the sums of the genera of F-curves in S, S'; and with certain novelties such as the construction of a T with an arbitrarily given curve as an F-curve of the first kind.

In the chapter on the resolution of singularities of surfaces the author does not give complete proofs but refers on essential points to the sources. There is indeed difference of opinion as to whether such resolution has actually been accomplished. Thus the present exposition of progress to date is opportune.

References to the bibliography are made in the text by number. This convenient method would have been much improved if the authors cited were also given.

A forthcoming report on topics in algebraic geometry contains chapters on Cremona transformations which will cover as well the matters not discussed by Miss Hudson. Fortunately the prior appearance of this volume has enabled the authors concerned both to make their general list of references more complete, and to refer for a broader account to the book itself.

A. B. Coble

JORDAN ON STATISTICS

Statistique Mathématique. By Charles Jordan. Paris, Gauthier-Villars, 1927. xvii+344 pp.

This book is a scholarly treatment of the subject of mathematical statistics. It is in many respects the book which mathematicians have been waiting for. It performs for statistics much the same service as a standard *Cours d'Analyse* performs for analysis, and with the same typical French clearness; it would seem to be also of about the same degree of difficulty. Moreover, in point of difficulty, it is, considering the variety of subjects treated, of remarkably uniform grade throughout. The development is carefully planned in advance, and is carried out logically, and with uniform notation and nomenclature, producing maximum clearness of exposition in minimum space. There are no topics of dominant importance which the author has not considered, although there are some minor matters—this is true of almost every book—which he has omitted and the reviewer would like to have had included. Apparently the author has also drawn on all the important sources, but though many times it is possible to recognize in his exposition the essential arguments of others, never are these arguments copied bodily; they always bear the impress of his own method of thinking. The only possible criticism in this connection is that, in acknowledging his indebtedness to others, Jordan rather frequently mentions names only, without giving references to the publications—a flaw which could easily be remedied in a second edition.

Although the various chapters are almost uniformly good, the reviewer was particularly impressed with the first three introductory chapters and with those on frequency curves (9 and 10) and less well pleased with the final chapter, on sampling. The first three chapters contain an excellent account of the preliminary notions; the material is well chosen and the sequence carefully planned. Much is left unproved here; the account is