

jectories are the geodesics of the manifold, and they are described with constant velocity. An important result is that the knowledge of an algebraic integral of the system (12) carries with it that of a homogeneous integral of the differential equations for geodesics in the manifold. The chapter closes with a discussion of homogeneous linear and quadratic integrals of the equations of geodesics; the determination in invariant form of the criteria that two dynamical systems have the same trajectories; and the geodesic representation of one manifold upon another.

The subject matter is presented in an inspiring way, so that it seems very probable that the reader will turn to the papers of Ricci and Levi-Civita, as the author hopes. The proof reading has been well done and in every way the printer's work is satisfactory.

It is impossible to close this review without remarking the loss to American mathematics by the death of Mr. Wright. His brilliant record at Cambridge and his subsequent career in this country had won for him a high place in his field.

LUTHER PFAHLER EISENHART.

---

### STURM'S GEOMETRISCHE VERWANDTSCHAFTEN.

*Die Lehre von den geometrischen Verwandtschaften. Vierter Band: die nichtlinearen und die mehrdeutigen Verwandtschaften zweiter und dritter Stufe.* By RUDOLF STURM. Leipzig and Berlin, Teubner, 1909. x + 486 pp.

As the subject matter of this fourth volume of Professor Sturm's extensive treatise on geometric relations is so different from that of the preceding ones,\* but little analogy can be drawn with the methods already discussed. With the exception of one elementary treatise, mathematical literature did not include a book on birational transformations before the appearance of the present volume, although over five hundred memoirs have been devoted to the subject during the last two decades. The newness of the subject, the possibility of approaching it from different standpoints, and its applicability to so many other

---

\* These volumes have been reviewed in the BULLETIN; volume 1 in vol. 15, p. 135; volume 2 in vol. 15, p. 252; volume 3 in vol. 16, p. 250.