

Sturm, Friedrich Otto Rudolf | Encyclopedia.com

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(b. Breslau, Germany [now Wrocław, Poland], 6 January 1841; d. Breslau, 12 April 1919)

mathematics.

The son of a Breslau businessman, Sturm attended the St. Maria Magdalena Gymnasium. In the winter semester of 1859 he began to study mathematics and physics at the University of Breslau, where in the summer of 1863 he received his doctorate of philosophy. From then until 1872 he worked as a teaching assistant, part-time teacher, and (from 1866) science teacher in Bromberg (now Bydgoszcz, Poland). With the Easter semester of 1872 he became professor of descriptive geometry and graphic statics at the Technical College in Darmstadt. In 1878 he was appointed full professor at Münster, and in 1892 he accepted a similar post at Breslau, where he taught until his death.

Sturm's principal interest was in pure synthetic geometry. Following Poncelet, Steiner, and von Staudt, the practitioners of this field sought to work with very few or no formulas. At Breslau, Sturm had the good fortune to be taught by Heinrich Schroeter, who, as a student of Steiner, strongly encouraged Sturm to take up this type of geometry. Since at Darmstadt, Sturm was required to teach descriptive geometry and graphic statics, he directed his efforts to these subjects and as early as 1874 wrote *Elemente der darstellenden Geometrie* (Leipzig, 1874, 1900), a textbook on descriptive geometry for his students. Except for this book and another such textbook that he published later, *Maxima und Minima in der elementaren Geometrie* (Leipzig-Berlin, 1910), his work was devoted entirely to synthetic geometry. His first studies in this area concerned the theory of third-degree surfaces in their various projective representations. In his dissertation, "De superficiebus tertii ordinis disquisitiones geometricae," Sturm proved a number of properties of these representations that Steiner had stated without proof. In 1864 Sturm shared with Luigi Cremona the Steiner Prize of the Berlin Academy for further investigations of surfaces, all of which are collected in *Synthetische Untersuchungen über Flächen* his first textbook on the subject.

Sturm was a prolific writer, but there is no need to mention his many journal articles individually, since he later collected almost all of them in two multivolume textbooks (*Die Lehre von den geometrischen Verwandtschaften*, I, II [Leipzig 1908], III, IV [Leipzig, 1909]) on line geometry and geometric transformations. The three-volume work on line geometry is the most extensive ever written on this specialty. Like Plücker, the author of the first systematic treatment of line geometry in algebraic form, Sturm sought to develop subsets of straight lines of P_3 . Accordingly, in the first two volumes Sturm treated linear complexes, congruences, and the simplest ruled surfaces up to tetrahedral complexes, all of which can be particularly well handled in a purely geometric fashion. He did not systematically investigate the remaining quadratic complexes until volume three, where he did not systematically investigate the remaining quadratic complexes until volume three, where the difficulties of his approach—as compared with an algebraic treatment—place many demands on the reader. Sturm rejected as "unintuitive" the interpretation proposed in the nineteenth century by [Felix Klein](#) and C. Segre, who held that the line geometry of P_3 could be considered a point geometry of a quadric of P_5 .

Sturm's *Lehre von den geometrischen Verwandtschaften*, which appeared in four volumes with more than 1,800 pages, was even larger than *Liniengeometrie*. In Sturm's use of the expression, geometric relationships encompassed, first, all collineations and correlations of projective spaces (extended to both real and complex numbers) of three dimensions at the most. The work, however, is much more than a textbook of projective geometry; it also contains many chapters on [algebraic geometry](#), and among "geometric relationship," Sturm included correspondences, Cremona transformations, and plane projections of the simplest types of rational surfaces. Volume I deals with (1,1) relationships and also with (a,b) correspondences on straight lines, spheres, and the constructs generated from them. Volume II contains a description of collineations and correlations between two-step constructs; Volume III provides a similar treatment for three-step constructs; and Volume IV is devoted to Cremona transformations, several plane projections of rational surfaces, and a number of spatial correspondences. Frequently in the work Sturm touches upon questions related to Schubert's enumerative geometry, for example in the treatment of problems of plane and spatial projectivities.

In *Lehre von den geometrischen Verwandtschaften* synthetic geometry in the style of Sturm and his predecessors was developed virtually as far as it could be. During the final years of Sturm's life, mathematicians became markedly less interested in the large number of detailed geometric questions that are discussed in his writings. Consequently, although he trained many doctoral candidates in the course of his career, Sturm had no successor to continue his mathematical work.

BIBLIOGRAPHY

I. Original Works. A list of Sturm's works is in Poggendorff III, 1312–1313; IV, 1462; V, 1227–1228; VI, 2576.

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II. Secondary Literature. For works about Sturm, see W. Lorey, "Rudolf Sturm zum Gedenken," in *Zeitschrift für mathematischen und naturwissenschaftlichen Unterricht*, **50** (1919), 289–293; and W. Ludwig, "Rudolf Sturm," in *Jahresbericht der Deutschen Mathematikervereinigung*, **34** (1926), 41–51.

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