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(*b*. Buda, Hungary, 14 March 1864; *d*. Budapest, Hungary, 26 March 1933)

mathematics.

Kürschák's father, András Kürschák, an artisan, died when his osn was six; the boy was very carefully brought up by his mother, the former Jozefa Teller. Kürschák's mathematical talent appeared in secondary school after which he attended the Technical University in Budapest (1881–1886), which, although a technical school, also trained teachers of mathematics and physics. After graduating Küschák taught for two years at Rozsnyó, Slovakia. In 1888 he moved to Budapest, where he worked toward the Ph. D., which he received in 1890. The following year he was appointed to teach at the Technical University, where he served successively as lecturer, assistant professor, and professor (1900) until his death. In 1897 he was elected a corresponding, and in 1914 an ordinary, member of the Hungarian Academy of Sciences.

Kürschák's mathematical interests were wide, and he had the ability to deal with various kinds of problems. His first paper (1887) concerned the extremal properties of polygons inscribed in and circumscribed about a circle and proved the existence of the extremum. Another paper (1902) showed, in connection with Hilbert's *Grundlagen der Geometrie*, the sufficiency of the ruler and of a fixed distance for all discrete constructions. Meanwhile, in extending a result of Julius Vályi's, Kürschák had turned to the investigation of the differential equations of the calculus of variations (1889, 1894, 1896), proved their invariance under contact (Legendre) transformations (1903), and gave the necessary and sufficient conditions—thereby generalizing a result of A. Hirsch's—for second-order differential expressions to provide the equation belonging to the variation of a multiple integral (1905). These investigations also furthered his interest in linear algebra, aroused by Eugen von Hunyady, an early exponent of algrbraic geometry in Hungary, and led to a series of papers on determinants and matices.

Kürschák's main achievement, however, is the founding of the theory of valuations (1912). Inspired by the algebraic studies of Julius König and by the fundamental work of E. Steinitz on abstract fields, as well as by K. Hensel's theory of *p*-adic numbers, Kürschák succeeded in generalizing the concept of absolute value by employing a "valuation," which made possible the introduction of such notions as convergence, fundamental sequence, distance function, and limits into the theory of abstract fields. He proved that any field with a valuation on it can be extended by the adjunction of new elements to a "perfect"(i.e., closed and dense in itself) field which is at the time algebraically closed. Kürschák's valuation and his method were later developed, mainly by Alexander Ostrowski, into a consistent ang highly important arithmetical theory of fields.

Above all, Küschak was a versatile and thought provoking teacher. One of the main organizers of mathematical competitions, he contributed greatly to the selection and education of many brilliant students and certainly had a role in the fact that—to use the words of S. Ulam—"Budapest, in the period of the two decades around the First World War, proved to be an exceptionally fertile breeding ground for scientific talent" (*Bullentin of the American Mathematical Society*, **64** , no. 3, pt. 2 [1958], 1). Among Kürschék's pupils were mathematicians and physicists of the first rank, the most brillant being John von Neumann.

BIBLIOGRAPHY

I. Original Works. Kürschék's longer works include "Propriétés générales des corps et des variétés algébriques," in *Encyclopédie ds sciences mathématiques pures et appliquées*, I. pt. 2 (Paris-Leipzig, 1910), 233–385, french version of C. Landsberg's German article, written with J. Hadamard; *Analizis és analitikus geometria* (Budapest, 1920); and *Matematikai versenytételeck* (Szeged, 1929), trans. into English by Elvira Rapaport as *Hungarian Problem Book*, 2 vols. (New York, 1963).

Articles are "Über dem Kreise ein-und umgeschriebene Vielecke," in *Mathematische Annalen*, **30** (1887), 578–581; "Über die partiellen Differentialgleichungen zweiter Ordnung bei der Variation der doppelter Integrale," in *Mathematische und maturwissenschaftliche Berichte aus Ungarn*, **7** (1889), 263–275; "Ueber die partielle Differentialgleichung des Problems $\delta \iint v(p, q)d_x d_y = 0$," in *Mathematische Annalen*, **44** (1894), 9–16; "Über eine Classe der partiellen Differentialgleichungen zweiter Ordnung," in *Mathematische und naturwissenschaftliche Berichte aus Ungarn*, **14** (1896), 285–318; "as Streckenabragen," in *Mathematische Annalen*, **55** (1902), 597–598; "Über die Transformation der partiellen Differentialgleichungen der Variationsrechnung," *ibid*., **56** (1903), 155–164; "Über symmetrische Matrices," *ibid*., **58** (1904), 380–384; "Über eine characteristische," *ibid*., **60** (1905), 157–165; "Die Existenzbedingungen des verallgemeinerten kinetischen Potentials," *ibid*., **62** (1906), 148–155; "über Limesbildung und allgemeine Körpertheorie," in *Journal Für die reine und angewandte Mathematik*, **142** (1913), 211–253, presented at the International Congress of Mathematicians (1912); "Ein Irreduzibilitätssatz in der Theorie der symmetrischen Matrizen," in *Mathematische Zeitschift*, **9** (1921), 191–195; "On Matrices Connected With Sylvester's dialytic Eliminant," in *Transaction of the Royal Society of south Africa*, **11** (1924), 257–260; and "Die Irreduzibilität einer Dterminate der analytischen Geometrie," in *Acta mathematica Szeged*, **6** (1932–1933), 21–26.

II. Secondary Literature. See G. Rados, "Kürschák József emlékezete," in *Magyur tudományos akadémia Elhunyt tagjai fölött tartott emlékbeszédek*, **22** , no. 7 (1934), 1–18; L. Stachó, "Kürschák József," in *Müszaki Nagyjaink*, III (Badapest, 1967), 241–282, with complete bibliography; T. Stachó, "Kürschák József 1864–1933," in *Matematikai és physikai lapok*, 1903–1957," in *Bulletin of the American Mathematical Society*, **64** , no. 3, pt. 2 (1958), 1–49.

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