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Otakar Borůvka

Terms of use:

OTAKAR BORŮVKA

* 10 May, 1899   *† 22 July, 1995*

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Otakar Borůvka, member of the Academy of Sciences of the Czech Republic, full professor of mathematics, nestor and legend of Brno mathematics, was for long years one of the leading personalities of mathematical life all over our country, an eminent representative of our science abroad and a brilliant teacher and organizer of scientific life. For fifty years he worked at the Faculty of Science, University in Brno, to which he burned in the indelible seal of his exceptional personality.

Otakar Borůvka was born at Uherský Ostroh in Moravia, where his father was the principal of elementary schools. He studied at the grammar school at Uherské Hradiště. He was an excellent student of not only mathematics, but of all other subjects. After finishing the sixth year, in 1916, under the pressure of the war events of World War I he passed into the last year of the military secondary technical school at Hranice in Moravia and after a year to the Military Technical Academy at Mödling near Vienna. In 1918 he entered the Czech Technical University in Brno as a student of civil engineering. There he made the acquaintance of Prof. Matyáš Lerch who offered Otakar Borůvka, due to his excellent knowledge, the job of an assistant at the Mathematical Institute of the Faculty of Science of the newly established university in Brno. Otakar Borůvka then finished his university studies at that university, where he also habilitated at the age of 29. In 1922 Prof. M. Lerch died and Prof. E. Čech, who succeeded him, introduced O. Borůvka to the study of differential geometry and enabled him to stay for two years in Paris with Prof. É. Cartan (1926–1927 and 1929–1930) and a six-month stay in Hamburg with Prof. W. Blaschke (1930–1931).

After finishing his first stay of one year in Paris O. Borůvka obtained a binding offer to take a job of professor of mathematics at Zagreb University. After some hesitation he, however, did not accept it, because he believed in the possibility of his future activity in Brno.

In 1934 Otakar Borůvka was appointed professor extraordinary and later, with the validity from 1940, full professor at the university in Brno. Immediately after the end of World War II he helped with his lectures at several universities in Brno and in the years 1947–1958 also at the Faculty of Science of Comenius University in Bratislava, where he commuted regularly. In Bratislava he met many talented and diligent students who are today leading personalities of mathematics in Slovakia.

In 1953 Prof. Otakar Borůvka was elected a corresponding member and in 1965 full member of the Czechoslovak Academy of Sciences (CSAS). From 1969 he worked at the Mathematical Institute of the CSAS.

For his fifty years at University in Brno Otakar Borůvka held a number of important functions in scientific councils and committees, in the advisory board of the CSAS, in the bodies of the Union of Czechoslovak Mathematicians and Physicists and in the boards of editors of professional journals.

Professor Otakar Borůvka is the author of 86 scientific papers – out of which 8 monographs, other 44 popular-scientific and bibliographic publications and more than 200 reviews. In his scientific work the development of the world and the

Czechoslovak mathematics is reflected in several domains. He has a deep sense for a careful procession of details, which is a typical feature of his first teacher M. Lerch, and at the same time for the conceptual procession of a broad circle of problems, characteristic of his further teachers E. Čech, É. Cartan and W. Blaschke. O. Borůvka did not see his objective in solving only partial problems, but he creates complete theories elaborated to such a breadth and depth that they are often used by mathematicians for further long periods. His pioneering paper of 1926, *"O jistém problému minimálním"* (About a certain minimal problem), in which he algorithmically solved a problem arising from practice, the minimalization of costs in building an electrolead network can serve as one of the examples of this style. It is a fundamental paper from the sphere of transport problems which started developing some decades later and today represents one of the fundamental chapters of the theory of graphs which did not yet exist at that time.

In his first papers of 1923–1925, under the influence of M. Lerch, he applied himself to classical mathematical analysis. He returned to this topic in 1957-1959 in connection with a deep analysis of the work of his teacher.

In 1924–1935 he applied himself to differential geometry. For the first time he studied analytical correspondences between two projective planes, he elaborated a general theory of the normal curvature of a plane in the *n*-dimensional space with a constant curvature and he gave an extension of Frenet's formulae for curves of the parabolic Hermitan space. His extensive papers about spherical (twodimensional) surfaces in *2n*-dimensional spaces with a constant curvature find significant application in modern differential geometry and the geometrical school at Bologna links up, in many respects, with original Borůvka's papers on analytical correspondences. Also in the paper by S. Chern about minimal varieties immersed into superspheres the differential equations of those planes are called "Frenet-Borůvka formulae".

In the 1930s, with his extensive knowledge drawn from the preceding papers O. Borůvka joined the stormy development of algebra and topology. On the basis of sets he created the conceptual apparatus of general algebra, he built the theory of groupoids, as one of the first he studied the disintegration of sets and he laid the foundations of the theory of scientific classifications. He founded the modern algebraic school in Brno and published the monograph *"Základy teorie grupoidů a grup"* (Fundamentals of the theory of groupoids and groups) which appeared several times in Czech, in German (1960) and in English (1974). In 1971 his book *"Základy teorie matic"* (Fundamentals of the theory of matrices) appeared containing the first book procession of the results of E. Weyr. To the algebraic results of 1936-1952 and 1961 he adds his last paper in 1988.

In the 1950s O. Borůvka began studying purposefully differential equations, a discipline little pursued in Czechoslovakia at that time. At the same time, he did not leave his former spheres, algebra and geometry. He used his perfect knowledge in those spheres as well as in classical analysis, he founded a scientific seminar end submitted a program of global investigation into differential equations in the real field. He solved the problem of global equivalence of linear differential equations of the 2nd order, thus constituting a qualitative theory of global character of those equations characterized by a high degree of algebraization and geometrization. He

summarized those results in the monograph *"Lineare Differentialtransformationen 2. Ordnung"* which appeared in 1967 and in English in 1971. A number of Czechoslovak and foreign mathematicians utilise the results and methods of this theory for solving problems concerning not only equations of the 2nd order, but also higher.

The scientific work of O. Borůvka substantially enriched mathematical thinking by new methods and results. He holds the world priority in solving the fundamental type of the transport problem, he created the theory of correspondences between two projective planes which later gave rise to an extensive section of modern differential geometry. He elaborated the theory of disintegration of sets and the theory of groupoids and formed the theory of global transformations of linear differential equations of the 2nd order which penetrated deep into world literature.

The seriousness of the results O. Borůvka achieved is also witnessed by the response abroad and a number of distinctions and honours not only from this country, but also from abroad. Significant discoveries of course brought him numerous invitations for lecturing at foreign scientific institutions.

In connection with the evaluation of the work and the influence of Professor Borůvka it is necessary to point out his great credit of the establishment of the Mathematical Institute of the CSAS in Brno in 1969 (now the branch of the Mathematical Institute of the Academy of Sciences of the Czech Republic) and the new mathematical journal Archivum Mathematicum in 1965 which in a short time acquired a very good reputation abroad. The Slovak mathematicians highly appreciate the help he granted for more than 10 years to University in Bratislava outside the scope of his duties in Brno as an essential contribution to the development of mathematics in Slovakia.

During his scientific and pedagogic activity Prof. Borůvka educated a number of scientifically active mathematicians; most mathematicians working at universities in Moravia and Slovakia are his disciples or his disciples' disciples. He managed to give them encouragement in a broad circle of problems in abstract algebra, differential geometry, the theory of differential equations and other spheres of mathematics.

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