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Mathematica Bohemica, Vol. 146 (2021), No. 2, 115–120

Persistent URL: <http://dml.cz/dmlcz/148925>

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NINETY-FIVE YEARS OF JAROSLAV KURZWEIL

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Professor Jaroslav Kurzweil (born 1926) belongs to the most important Czech mathematicians of the 20th century, whose work is widely recognized abroad. In an interview, he would probably argue against this statement, saying that in mathematics, every assertion needs to be proved, and that the most ingenious Czechoslovak mathematicians were Eduard Čech, Vojtěch Jarník, and Štefan Schwarz. Jaroslav Kurzweil was able to successfully combine his research with organizational activities at the Mathematical Institute of the Czechoslovak Academy of Sciences. He conducted the famous Thursday seminars on differential equations and organized the EQUADIFF conferences. As an editor of scientific journals, he paid attention to the generation of his teachers (E. Čech, V. Jarník, V. Knichal) and their work as well as to his collaborators. J. Kurzweil was formed by several Czech and Polish mathematicians during his studies and later, as a teacher and mentor, he in turn influenced several generations of scientists. Being aware that mathematical methods are rather distinct from those of other scientific disciplines, Jaroslav Kurzweil is always seeking ways of connecting people. Kurzweil's mathematical results are frequently recalled, and therefore we will focus on his life experiences, traits of his talent and personality, and attempt to place them in the context of historical events.

Jaroslav Kurzweil was born in Prague on May 7, 1926, to the family of a clerk of the Prague Credit Bank. He was influenced by his father Jaroslav, who had experienced World War I on the Eastern Front as a member of the Czechoslovak Legion. Jaroslav Kurzweil had acquainted himself with the writings of T. G. Masaryk and E. Beneš, and became sceptical of the promises of the Communist Party of Czechoslovakia after World War II. In the period 1945–1949, he studied mathematics at Charles University, Faculty of Science, which at that time encompassed exact sciences (mathematics, physics, astronomy) as well as natural sciences including pharmacy, anthropology, and demography. According to his own words, Kurzweil opted for mathematics out of a certain laziness—he was able to solve all problems in high school, admired the unambiguous truth of mathematical statements, as well as the fact that mathematics is remote from ideology.

Kurzweil gained his first teaching experience in the period 1949–1951 as an assistant of Prof. Václav Hruška in the Department of Mathematics and Descriptive Geometry at the Czech Technical University, Faculty of Mechanical Engineering.¹ In 1950, he defended his rigorous thesis on the metric theory of Diophantine approximations (see [7]) and obtained the title RNDr. from his alma mater.² He was among the last ones who received the title before its abolishment (1953) based on a new university act, which was adopted in 1950 and prevented many politically inconvenient students from finishing their studies.



The photo was taken by Milan Tvrđý on December 2015.

The scientific career of Kurzweil was influenced by his teacher, Prof. Vojtěch Jarník. Jaroslav Kurzweil is a representative of an extraordinarily strong generation of Czech mathematicians including also those who were unable to pursue their studies during World War II—let us mention e.g. Otto Vejvoda (1922–2009), Jan Mařík (1920–1994), Olga Pokorná (1926–2015), Vlastimil Pták (1925–1999), Jiří Kopřiva (born 1925), and especially Miroslav Fiedler (1926–2015), Kurzweil’s schoolmate

¹ Archives of the Czech Technical University, personal documents of Václav Hruška, decision of the Minister of Education, Science and Arts, November 11, 1949: The ministry accepts Prof. Hruška’s request, releases him from the duty to deliver lectures to first-year students, and makes him the supervisor of teaching substitutions.

² Archives of Charles University, Faculty of Science. Meeting of the Faculty Board on April 27, 1950, report of the Scientific Mathematical Section: “There are no objections against the dissertation theses of the candidates Otto Vejvoda, Georgi Petrov, Miroslav Fiedler, Jiří Kopřiva, and Jaroslav Kurzweil.”

since high school. Their potential was noticed by Eduard Čech, who gave impetus to hiring a higher number of postgraduates at the Central Mathematical Institute, which was incorporated as the Mathematical Institute into the Czechoslovak Academy of Sciences in 1953.³ Kurzweil entered the institute as a postgraduate (“aspirant”) on July 1, 1951. After its establishment, the institute comprised 12 researchers, 11 other employees, as well as 20 postgraduates, and it was not an easy task to provide scientific supervision for all of them. Jaroslav Kurzweil still appreciates the ingenuity of Eduard Čech, i.e., his ability to suggest solutions of mathematical problems outside the scope of his specialization. Inspiring were also Čech’s skills as an organizer of seminars and winter holidays in the mountains, where skiing was followed by evening mathematical discussions (Čech himself did not ski).⁴

We did not find out who in the Czechoslovak Academy of Sciences had decided that the first Czech postgraduate sent to Poland in 1953 was Jaroslav Kurzweil. His advisor Vojtěch Jarník as well as Eduard Čech had numerous contacts among Polish mathematicians. Čech’s efforts led to the reestablishment of contacts after World War II. A joint congress of Czechoslovak and Polish mathematicians (third one and seventh one, respectively) took place in Prague in 1949. Moreover, there were short visits of Tadeusz Ważewski, Bronisław Knaster, Edward Marczewski, Jan Mikusiński, Marcell Stark, and Kazimierz Kuratowski, who came to lecture in Prague. Kuratowski, the director of the Institute of Mathematics of the Polish Academy of Sciences, influenced Kurzweil by his attitude toward young postgraduates, whom he treated as his peers. A similar attitude can be noticed in the pedagogical and mentoring activities of J. Kurzweil. Another famous member of the Lwów School of Mathematics, Marcell Stark, suggested to Kurzweil after his arrival to Warsaw to spend his stay with Professor Władysław Orlicz in Poznań. Under Orlicz’s leadership, Kurzweil focused on analytic operations in Banach spaces. Thanks to Orlicz, Kurzweil was able to present his results at other Polish universities and they were subsequently published in *Studia Mathematica*, see [8], [9].

While in Poznań, Kurzweil also established contacts with Orlicz’s students Jerzy Albrzycht and Andrzej Alexiewicz. Prof. Orlicz’s influence on Kurzweil’s further career is evident from their mutual correspondence.⁵ Kurzweil’s new contacts turned out to be beneficial not only for himself, but also for his peers from the Mathematical Institute of the Czechoslovak Academy of Sciences. He obtained a position in the institute after his return from Poland, the formal beginning of the contract being January 1, 1954. The internship in Poland was a turning point in his career, but also

³ More on E. Čech can be found e.g. in [6].

⁴ Kurzweil himself published earlier on this topic. See [10], [11].

⁵ Archiwum PAN w Poznaniu, spuścizna W. Orlicza, korespondencja, letters of J. Kurzweil from the years 1953–1990.

in his personal life. He met his future wife Stefania, who came from Świątchłowice near Katowice, and they created a harmonious family.

After his return to the Mathematical Institute, Kurzweil was busy elaborating the results obtained in Poland. In 1955, he completed his postgraduate period and defended the title CSc. (Candidate of Sciences). He was soon appointed the chair of the Department of Ordinary Differential Equations. He fostered research in this area by organizing regular Thursday seminars, which became a meeting place for mathematicians coming from various institutions.⁶ The inspiration came from regular Wednesday seminars organized by Prof. Orlicz in Poznań. J. Kurzweil's seminars were attended by several generations of Czech mathematicians, including those from Brno, most of them students of Otakar Borůvka. Thus, Kurzweil managed to establish in Czechoslovakia a type of seminar with which he became familiar during his stay in Moscow, 1957: an environment where experts from different places meet regularly to solve and discuss mathematical problems.

In this period, Jaroslav Kurzweil wrote his perhaps best known paper containing a new definition of integral, now known worldwide as the Henstock-Kurzweil integral. It is known that J. Kurzweil introduced this notion earlier (1957) and independently of Ralph Henstock (1963)⁷ and that the integral has recently found applications in theoretical economics.⁸

In 1962, J. Kurzweil together with his peer Ivo Babuška (born 1926) organized the first international conference on differential equations in Czechoslovakia, EQUADIFF. Subsequent conferences took place in Bratislava, Brno, and Praha (1966 Bratislava, 1972 Brno, 1977 Praha, 1981 Bratislava, 1985 Brno, 1989 Praha, 1993 Bratislava, 1997 Brno, 2001 Praha, 2005 Bratislava, 2009 Brno, 2013 Praha, and 2017 Bratislava). Jaroslav Kurzweil had close associates in the area of differential equations, his younger colleagues from the institute, e.g., Zdeněk Vorel, Ivo Vrkoč, Jiří Jarník, Štefan Schwabik, Jan Kučera. He also collaborated with the Slovak mathematician Pavol Brunovský (who defended his candidate dissertation under Kurzweil's supervision) and the Polish mathematician Tadeusz Ważewski, the creator of the Kraków School of Differential Equations, see [1].

Mathematicians are able to establish worldwide contacts, but in the second half of the 20th century, the possibilities for the exchange of scientific ideas were often limited for reasons lacking (mathematical) logic. Although Czech mathematicians

⁶ Earlier papers give the year 1952 as the beginning of the seminar, but the 80th birthday tribute states more precisely that since 1954 the seminar was held regularly and directed by J. Kurzweil, which makes sense in view of his Polish stay in the previous year. See [5].

⁷ See [4].

⁸ It appears in models describing rapid changes of growth, e.g., in economics, population dynamics, epidemiology, etc. See [12].

justified their contacts throughout whole Europe, it happened that the proposal to invite Kurzweil's Polish mentor W. Orlicz for a stay in Praha was dismissed on June 22, 1956. Shortly after the Poznań protests of 1956, the Presidium of the Czechoslovak Academy of Sciences was hesitant to invite a professor from Poznań; other proposed stays were approved. In the academic year 1968/69, J. Kurzweil had no trouble visiting the University of Warwick in Coventry and staying in England with the whole family. Nevertheless, he decided to return to Czechoslovakia, having in mind his broader family as well as colleagues from the seminar.

The reader can find many interesting facts from the fruitful life of Jaroslav Kurzweil in the interview he gave to the Czech journal *Pokroky matematiky, fyziky a astronomie* (Advances of Mathematics, Physics, and Astronomy) in 2020, see [13]. Kurzweil was gaining the ability to connect researchers and organize scientific meetings in the difficult time of “normalization”, when numerous scientists were dismissed from leading positions. Until 1970, J. Kurzweil was (since 1956) the editor-in-chief of the journal *Časopis pro pěstování matematiky* (Journal for the Cultivation of Mathematics) and a member of the Scientific Board for Mathematics of the Czechoslovak Academy of Sciences (being a vice-chair in the period 1966–1970). In 1968, he was appointed a corresponding member of the Czechoslovak Academy of Sciences, with ordinary membership being postponed until the end of 1989. Taking into account the requests and wishes of his colleagues, he was nominated for the director's position to the Presidium of the Czechoslovak Academy of Sciences and became the director of the Mathematical Institute in February 1990 (until 1996). He was among the founding members of the Learned Society of the Czech Republic, chaired the Accreditation Commission in the period 1990–2000, and was active in the Union of Czech Mathematicians and Physicists (chairman in the period 1996–2002).

He received numerous domestic and international awards for his excellent results. In 1997, president Václav Havel awarded him the Medal of Merit of the First Grade, see [3], [5]. It is also necessary to mention an important recognition of Kurzweil's lifelong scientific work in the field of integral and differential equations, the National Prize of the Government of the Czech Republic “Czech Brain”, also known as “the Czech Nobel Prize”, which he received on November 18, 2006. He still feels honoured by the award and likes to recall how he spontaneously thanked for it. His sentence “What was true yesterday is true today” was perceived by the guests, mainly politicians, as an apt comment on the tie situation in the Chamber of Deputies of the Parliament of the Czech Republic (an equal number of chairs for the left-wing and right-wing parties resulted in an unprecedented period of government crisis), see [2]. Kurzweil's second sentence reads: “Mathematics is beautiful.”

For the years to come, we wish Professor Kurzweil to keep inspiring his family and friends in a similar vein, and not to lose his critical humor and good health.

Acknowledgement. I would like to express my gratitude to Antonín Slavík, who translated this paper to English.

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