Kazimierz Kuratowski

Kazimierz Kuratowski (Polish pronunciation: [ka ˈʑimjɛʂ kuraˈtɔfskʲi]; 2 February 1896 – 18 June 1980) was a Polish mathematician and logician. He was one of the leading representatives of the Warsaw School of Mathematics.

Contents

Biography and studies
- Doctoral thesis
- Academic career until World War II
- During and after the war

Legacy
- Kazimierz Kuratowski Prize

Research

Publications

See also

Notes

References

External links

Biography and studies

Kazimierz Kuratowski was born in Warsaw, Vistula Land (the part of the former Kingdom of Poland controlled by the Russian Empire), on 2 February 1896, into an assimilated Jewish family. He was a son of Marek Kuratow, a barrister, and Róża Karzewska. He completed a Warsaw secondary school, which was named after general Paweł Chrzanowski. In 1913, he enrolled in an engineering course at the University of Glasgow in Scotland, in part because he did not wish to study in Russian; instruction in Polish was prohibited. He completed only one year of study when the outbreak of World War I precluded any further enrollment. In 1915, Russian forces withdrew from Warsaw and Warsaw University was reopened with Polish as the language of instruction. Kuratowski restarted his

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Born	2 February 1896 Warsaw, Vistula Land, Russian Empire
Died	18 June 1980 (aged 84) Warsaw, Polish People's Republic
Nationality	Polish
Alma mater	University of Warsaw
Known for	Kuratowski's theorem Kuratowski closure axioms Kuratowski–Zorn lemma Knaster–Kuratowski–Mazurkiewicz lemma
Scientific career	
Fields	Mathematics
Institutions	

university education there the same year, this time in mathematics. He obtained his Ph.D. in 1921, in newly independent Poland.

	University of Warsaw
Doctoral advisor	Stefan Mazurkiewicz Zygmunt Janiszewski
Doctoral students	Samuel Eilenberg Andrzej Mostowski Stanislaw Ulam

Doctoral thesis

In autumn 1921 Kuratowski was awarded the Ph.D. degree for his groundbreaking work. His thesis statement consisted of two parts. One was devoted to an axiomatic construction of topology via the closure axioms. This first part (republished in a slightly modified form in 1922) has been cited in hundreds of scientific articles.[1]

The second part of Kuratowski's thesis was devoted to continua irreducible between two points. This was the subject of a French doctoral thesis written by Zygmunt Janiszewski. Since Janiszewski was deceased, Kuratowski's supervisor was Stefan Mazurkiewicz. Kuratowski's thesis solved certain problems in set theory raised by a Belgian mathematician, Charles-Jean Étienne Gustave Nicolas, Baron de la Vallée Poussin.

Academic career until World War II

Two years later, in 1923, Kuratowski was appointed deputy professor of mathematics at Warsaw University. He was then appointed a full professor of mathematics at Lwów Polytechnic in Lwów, in 1927. He was the head of the Mathematics department there until 1933. Kuratowski was also dean of the department twice. In 1929, Kuratowski became a member of the Warsaw Scientific Society

While Kuratowski associated with many of the scholars of the Lwów School of Mathematics, such as Stefan Banach and Stanislaw Ulam, and the circle of mathematicians based around the Scottish Café he kept close connections with Warsaw. Kuratowski left Lwów for Warsaw in 1934, before the famous Scottish Book was begun (in 1935), hence did not contribute any problems to it. He did however, collaborate closely with Banach in solving important problems in measure theory.[2][3]

In 1934 he was appointed the professor at Warsaw University. A year later Kuratowski was nominated as the head of Mathematics Department there. From 1936 to 1939 he was secretary of the Mathematics Committee in The Council of Science and Applied Sciences.

During and after the war

During World War II, he gave lectures at the underground university in Warsaw, since higher education for Poles was forbidden under German occupation.

In February 1945, Kuratowski started to lecture at the reopened Warsaw University. In 1945, he became a member of the Polish Academy of Learning, in 1946 he was appointed vice-president of the Mathematics department at Warsaw University, and from 1949 he was chosen to be the vice-president of Warsaw Scientific Society. In 1952 he became a member of the Polish Academy of Sciences, of which he was the vice-president from 1957 to 1968.

After World War II, Kuratowski was actively involved in the rebuilding of scientific life in Poland. He helped to establish the State Mathematical Institute, which was incorporated into the Polish Academy of Sciences in 1952. From 1948 until 1967 Kuratowski was director of the Institute of Mathematics of the Polish Academy of Sciences, and was also a long-time chairman of the Polish and International Mathematics Societies. He served as vice-president of the International Mathematics Union (1963–1966) as well as president of the Scientific Council of the State Institute of Mathematics (1968–1980). From 1948 to 1980 he was the head of the topology section. One of his students was Andrzej Mostowski.

Legacy

Kazimierz Kuratowski was one of a celebrated group of Polish mathematicians who would meet at Lwów's Scottish Café. He was a president of the Polish Mathematical Society (PTM) and a member of the Warsaw Scientific Society (TNW). What is more, he was chief editor in "Fundamenta Mathematicae", a series of publications in "Polish Mathematical Society Annals". Furthermore, Kuratowski worked as an editor in the Polish Academy of Sciences Bulletin. He was also one of the writers of the Mathematical monographs, which were created in cooperation with the Institute of Mathematics of the Polish Academy of Sciences (IMPAN). High quality research monographs of the representatives of Warsaw's and Lwów's School of Mathematics, which concerned all areas of pure and applied mathematics, were published in these volumes.

Kazimierz Kuratowski was an active member of many scientific societies and foreign scientific academies, including the Royal Society of Edinburgh, Austria, Germany, Hungary, Italy and the Union of Soviet Socialist Republics (USSR).

Kazimierz Kuratowski Prize

In 1981, IMPAN, the Polish Mathematical Society, and Kuratowski's daughter Zofia Kuratowska established a prize in his name for achievements in mathematics to people under the age of 30 years.[4] The prize is considered the most prestigious of awards for young Polish mathematicians; past recipients have included Józef H. Przytycki, Mariusz Lemańczyk, Tomasz Łuczak, Mikołaj Bojańczyk, and Wojciech Samotij.[4]

Research

Kuratowski's research mainly focused on abstract topological and metric structures. He implemented the closure axioms (known in mathematical circles as the Kuratowski closure axioms). This was fundamental for the development of topological space theory and irreducible continuum theory between two points. The most valuable results, which were obtained by Kazimierz Kuratowski after the war are those that concern the relationship between topology and analytic functions (theory), and also research in the field of cutting Euclidean spaces. Together with Ulam, who was Kuratowski's most talented student during the Lwów Period, he introduced the concept of so-called quasi homeomorphism that opened up a new field in topological studies. Kuratowski's research in the field of measure theory, including research with Banach, Tarski, was continued by many students. Moreover, with Alfred Tarski and Wacław Sierpiński he provided most of the theory concerning Polish spaces (that are indeed named after these mathematicians and their legacy). Knaster and

Kuratowski brought a comprehensive and precise study to connected components theory. It was applied to issues such as cutting-plane, with the paradoxical examples of connected components.

Kuratowski proved the Kuratowski-Zorn lemma (often called just Zorn's lemma) in 1922.[5] This result has important connections to many basic theorems. Zorn gave its application in 1935.[6] Kuratowski implemented many concepts in set theory and topology. In many cases, Kuratowski established new terminology and symbolism. His contributions to mathematics include:

- a characterization of topological spaces which are now called Kuratowski closure axioms;
- proof of the Kuratowski–Zorn lemma;
- in graph theory, the characterization of planar graphs now known as Kuratowski's theorem;
- identification of the ordered pair (x, y) with the set $\{\{x\}, \{x, y\}\}$;[7]
- the Kuratowski finite set definition, see Kuratowski-finite;[8]
- introduction of the Tarski–Kuratowski algorithm;
- Kuratowski's closure-complement problem;
- Kuratowski's free set theorem;
- Knaster-Kuratowski fan;
- Kuratowski-Ulam theorem;
- Kuratowski convergence of subsets of metric spaces;
- the Kuratowski and Ryll-Nardzewski measurable selection theorem;

Kuratowski's post-war works were mainly focused on three strands:

- The development of homotopy in continuous functions.
- The construction of connected space theory in higher dimensions.
- The uniform depiction of cutting Euclidean spaces by any of its subsets, based on the properties of continuous transformations of these sets.

Publications

Among over 170 published works are valuable monographs and books including Topologie (Vol. I, 1933, translated into English and Russian, and Vol. II, 1950) and Introduction to Set Theory and Topology (Vol. I, 1952, translated into English, French, Spanish, and Bulgarian). He authored "A Half Century of Polish Mathematics 1920-1970: Remembrances and Reflections" (1973)[9] and "Notes to his autobiography" (1981). The latter was published posthumously thanks to Kuratowski's daughter Zofia Kuratowska, who prepared his notes for printing. Kazimierz Kuratowski represented Polish mathematics in the International Mathematics Union where he was vice president from 1963 to 1966. What is more, he participated in numerous international congresses and lectured at dozens of universities around the world. He was an honorary causa doctor at the Universities in

Glasgow, Prague, Wroclaw, and Paris. He received the highest national awards, as well as a gold medal of the Czechoslovak Academy of Sciences, and the Polish Academy of Science. Kuratowski died on 18 June 1980 in Warsaw.

- Kuratowski, Kazimierz; Mostowski, Andrzej (1976) [1968], *Set theory. With an introduction to descriptive set theory*, Studies in Logic and the Foundations of Mathematics, **86** (Second ed.), Amsterdam-New York-Oxford: North-Holland Publishing Co., MR 0485384 (https://www.ams.org/mathscinet-getitem?mr=0485384)

See also

- List of Polish mathematicians
- Scottish Café

Notes

1. Kuratowski 1922.
2. MacTutor article: Kazimierz Kuratowski (http://www-history.mcs.st-and.ac.uk/Biographies/Kuratowski.html).
3. www.day.kiev.ua article: "Scottish Book: Lviv's mathematical relic" (http://www.day.kiev.ua/en/article/society/scottish-book-lvivs-mathematical-relic).
4. "Nagroda im. Kazimierza Kuratowskiego" (https://www.impan.pl/pl/wydarzenia/nagrody/nagroda-kazimierza-kuratowskiego). *Instytut Matematyczny Polskiej Akademii Nauk* (in Polish). Retrieved 19 July 2017.
5. Fundamenta Mathematicae 3: p.
6. Bulletin of the American Mathematical Society, 41: p.
7. Kuratowski 1921, p. 171.
8. Kuratowski 1920.
9. Kuratowski 1980.

References

- Borsuk, Karol (1960). "On the Achievements of Prof. Dr. Kazimierz Kuratowski in Topology". *Wiadomości Matematyczne*. **2** (3): 231–237. (in Polish)
- Kuratowski, Kazimierz (1920). "Sur la notion d'ensemble fini" (http://matwbn.icm.edu.pl/ksiazki/fm/fm1/fm1117.pdf) (PDF). *Fundamenta Mathematicae*. **1**: 129–131.
- Kuratowski, Kazimierz (1921). "Sur la notion de l'ordre dans la Théorie des Ensembles" (https://web.archive.org/web/20131021233518/http://matwbn.icm.edu.pl/ksiazki/fm/fm2/fm2122.pdf) (PDF). *Fundamenta Mathematicae*. **2** (1): 161–171. Archived from the original (http://matwbn.icm.edu.pl/ksiazki/fm/fm2/fm2122.pdf) (PDF) on 21 October 2013. Retrieved 8 August 2014.
- Kuratowski, Kazimierz (1922). "Sur l'opération Ā de l'Analysis Situs" (http://matwbn.icm.edu.pl/ksiazki/fm/fm3/fm3121.pdf) (PDF). *Fundamenta Mathematicae*. **3**: 182–199. ISSN 0016-2736 (https://www.worldcat.org/issn/0016-2736).
- Kuratowski, Kazimierz (1980). *A Half Century of Polish Mathematics: Remembrances and Reflections*. Oxford: Pergamon Press. ISBN 978-0-08-023046-7..

External links

- TOPOLOGIE I, *Espaces Métrisables, Espaces Complets* (http://matwbn.icm.edu.pl/kstresc.php?tom=20&wyd=10&jez=) *Monografie Matematyczne* series, vol. 20, Polish Mathematical Society, Warszawa-Lwów, 1948.
- TOPOLOGIE II, *Espaces Compacts, Espaces Connexes, Plan Euclidien* (http://matwbn.icm.edu.pl/kstresc.php?tom=21&wyd=10&jez=) *Monografie Matematyczne* series, vol. 21, Polish Mathematical Society, Warszawa-Lwów, 1950.
- O'Connor, John J.; Robertson, Edmund F., "Kazimierz Kuratowski" (http://www-history.mcs.st-andrews.ac.uk/Biographies/Kuratowski.html), *MacTutor History of Mathematics archive*, University of St Andrews.
- Kazimierz Kuratowski (https://www.genealogy.math.ndsu.nodak.edu/id.php?id=24546) at the Mathematics Genealogy Project

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