Annales Univ. Sci. Budapest., Sect. Comp. 58 (2025) 7–13

TO THE MEMORY OF PROFESSOR FERENC SCHIPP

(4 June 1939 – 7 December 2024)

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Abstract. Professor Ferenc Schipp's unparalleled and rich career ended on 7 December 2024. In honoring his memory, we recall the main milestones of his life and professional career.

Not so long ago, in October 2024, we celebrated the 40th anniversary of the Department of Numerical Analysis of Faculty of Informatics at Eötvös Loránd University along with the 85th birthday of its founder, Professor Ferenc Schipp. Unfortunately, Professor Schipp was unable to attend due to illness. Shortly afterwards, on 7 December 2024, his unparalleled and rich career came to an end. In honoring his memory, we recall the main milestones of his life and professional career.

Early biography

Ferenc Schipp was born in Somberek, in the south-central part of Hungary, on 4 June 1939. He completed his primary school education in his home village. He then attended the Kisfaludy Károly Gymnasium in the nearby town of Mohács from 1953 to 1957. His talent for mathematics was already evident at that time. Although no one in his family had ever studied mathematics, his father encouraged and helped him. He accepted that his son needed time and a relaxed environment to think about mathematical problems. Young Ferenc was a regular participant in the mathematical problem-solving competitions organized by KÖMAL (Mathematical and Physical Journal for High Schools) for talented secondary school students. His photo appeared among the most successful students of his time. An interesting and characteristic episode is that as a high school student he worked on the problem of Euclidean constructions. He proved, what his high school teacher at the time considered to be an open problem, that all Euclidean constructions can be carried out using only circles. The 40–50 page proof was carefully written up and sent to the editors

https://doi.org/10.71352/ac.58.310725
First published online: 8 August 2025

of KÖMAL. It is unfortunate that instead of encouragement and recognition of his talent, he received only the feedback that Masceroni had already solved the problem.

In 1957, after graduating from high school, he began his studies in mathematics and physics at the Eötvös Loránd University of Budapest (ELTE). One of his favorite subjects was geometry. He was particularly impressed by Professor Ferenc Kárteszi's lectures on descriptive geometry, so he took descriptive geometry as a separate subject and became Professor Kárteszi's assistant. As a graduate student he took a part-time job at the Institute for the Blind, where he taught mathematics and even geometry to blind children. One can imagine what a challenge this was for a beginner teacher. His love of geometry, the geometric vision, the models, the way of thinking there, accompanied him throughout his career.

Professional career

After graduation, in 1962, despite his experience in geometry, he began his teaching and research career, to which he devoted his whole life with great dedication, at the Department of Analysis II of Faculty of Sciences of ELTE. After obtaining his doctorate in 1966, he achieved the degree of Candidate of Science in Mathematics in 1970. At the young age of 37, he became Doctor of the Hungarian Academy of Sciences in 1976.

Throughout his life his professional career was closely linked to ELTE. His successes in both research and teaching were achieved as a member of his home institute. This is reflected in his academic career, which started in 1962 as an assistant professor and 14 years later in 1976 he was appointed professor. After his retirement in 2009, he was involved in the scientific programs and the educational and scientific life of ELTE as professor emeritus, researcher and advisor. During his career, Ferenc Schipp served the university and the mathematical community in many positions. He was Deputy Dean for Education at the Faculty of Natural Sciences of ELTE from 1977–1982. As vice dean he played a key role in preparing, organizing and establishing the training programs in computer science. Also, under his supervision was the postgraduate training of teachers of the preparatory high schools organized. He was the founder and for 20 years the head of the Department of Numerical Analysis at ELTE. He served as Head of the Institute of Computer Science from 1988 to 1993. As appreciation for his oeuvre the Eötvös Loránd University laureated him the title *Doctor et Professor Honoris Causa*, the greatest award of the university in 2012.

Professor Schipp played an important role also in other institutions besides ELTE. Between 1977–1990 he was secretary of the Mathematics Committee of the Hungarian Academy of Sciences under the leadership of Professor Béla Szőkefalvi Nagy. Between 1995 and 2014 he used his experience in mathematical applications as research professor at the institute for Computer Science

and Control (SZTAKI) of the Hungarian Academy of Sciences. From 1994 to 2004, he also held a major position at the University of Pécs as a professor and head of the Department of Mathematics. During his years in Pécs he made a significant contribution to the renewal of the Department of Mathematics. Under his leadership, many of the faculty members successfully obtained PhD and habilitation degrees. He maintained close contact with the institute until the end of his life. The University of Pécs also recognized his devoted work in university teaching and research with the award of *Honoris Causa* in 2017.

Research

Research areas

Ferenc Schipp is one of the leading, internationally recognized representatives of the Hungarian Fourier Series and Real Function Theory school, which has a long tradition and whose foundations date back to the early twentieth century. A major part of his professional work is related to current and difficult questions in harmonic analysis, including the theory of Walsh–Fourier series, martingale theory, and the interface between orthogonal series and martingale theory, and Hardy spaces. His outstanding results include Carleson's theorem for the almost everywhere convergence of Fourier series, Banach's basis problem, fast Fourier transform algorithms, multiplication systems, dyadic analysis, wavelets, among others.

One of his inseminating ideas was the application of the methods of martingale theory to solve problems of harmonic analysis. This approach led to the famous proof of Carleson's theorem for the Walsh system. The question of almost everywhere convergence of the trigonometric Fourier series of square integrable functions was an open problem for a long time. Carleson finally answered affirmatively to the question, the proof of which was long and difficult. For the proof of the Walsh system, Ferenc Schipp used martingales whose index set is not linearly ordered, but has a tree structure. He then generalized to tree martingales a number of results that were previously known only for conventional regular martingales.

He also observed that in all known examples of fast Fourier transform algorithms for orthogonal systems such as the discrete trigonometric and the Walsh system can be derived in the same way, namely as a product system of certain martingale differences. Taking advantage of this, he constructed an efficient general algorithm to unify examples of fast Fourier transforms for different discrete orthogonal systems. His method can be applied to many systems for which no fast transform was known at the time.

Another famous problem is the so-called basis problem: Does every separable Banach space have a Schauder basis. Enflo answered this long-standing question by giving a counterexample. Soon afterwards, using non-linearly ordered martingales, Professor Schipp constructed a VMO space with no Schauder basis.

His research results in the field of dyadic analysis have generated a great international response and have placed him and the research team he led at the forefront of the field. Many of the fundamental results of dyadic analysis are due to him and to the research group he led. Under his leadership, a monograph on the results of dyadic analysis was written in international cooperation, which was awarded the Academic Merit Prize: *Walsh series: An introduction to dyadic harmonic analysis*, Akadémiai Kiadó–Adam Hilger, Bristol, New York, 1990, 560 pages, co-authors: W.R. Wade, P. Simon and J. Pál. This monograph is now one of the most cited source works on dyadic analysis, and became a seminal work in the field.

His research on wavelets has also led to many valuable results. He summarized them in a monograph with Professor Wade: *Transforms on normed fields*, Leaflets in Mathematics, Pécs, 1995.

His excellence as scientist could be measured by the number of his papers, monographs or his fame by the many citations to his works. However, a better indicator is the originality of his ideas that inseminated several areas in harmonic analysis. By combining seemingly distant topics, he carried out and initiated groundbreaking research that has since proved to be extremely successful and useful. Examples of his original ideas include the application of martingale theory methods to harmonic analysis problems, the development of the theory of hyperbolic wavelets, and the application of rational systems to signal processing.

Applied mathematics

He was very interested in the applications of mathematics in fields such as engineering and medicine. His open-mindedness, interest and cooperativeness made it possible to contribute to such research. In this context, he always praised the engineering mindset.

Particularly successful was his decades of research collaboration with the Systems and Control Theory Laboratory at SZTAKI. Using the tools of harmonic analysis, many joint results have been achieved in systems and control theory. In cooperation with the colleagues of SZTAKI and the Department of Ophthalmology of Semmelweis University, a method for the high-precision topographic examination of the cornea was developed, which can be applied in clinical ophthalmology practice, involving colleagues from the Budapest and Pécs departments. All this required the development of efficient computer algorithms in addition to mathematical models. Another new idea of him was the use of rational function systems in processing biological signals, in particular in ECG signals. He worked with rational function systems in connection with problems in system and control theories. Then he noticed many of their advantageous properties which can be utilized in signal processing as well. As a result now there is a team of colleagues and students at the Numerical Analysis Department working on different issues signal and image processing. His open interest in new research areas and problems is exemplary even for young researchers.

Publications: highlights, references

His scientific work is marked by more than 150 publications. The more than 2700 references to these publications clearly show the impact of his achievements. His human and professional openness is reflected in the fact that he collaborated with more than 40 co-authors on his articles. He was active even in the last period of his life. In the last 5 years he authored 10 scientific publications with 13 co-authors. The list of these publications is very informative, as it clearly shows the wide range of interests and research areas in which he was actively and successfully working in recent years.

In his publications, he did not hide the new ideas that led to his results, but tried to explain them as clearly as possible, so that they could be used by his fellow researchers. In his work, he was never shy about asking and consulting others. He recognized and valued professional achievements regardless of any other consideration or person. He had an exceptional talent for presenting the development of a major research field in an interpretative, historically authentic and inspiring way. As a result, he received numerous requests to write summary reports and articles. He always took special care to ensure that in these works the great Hungarian mathematical predecessors received the recognition they deserved.

Professor Schipp was an active supporter of the international mathematical community. Belonging to the editorial boards his expertise was exploited by several mathematical journals, among them are *Analysis Mathematica*, *Annales Universitatis Scientiarum Budapestinensis de Rolando Eötvös Nominatae, Sectio Computatorica* and *Mathematica Pannonica*. As a member or chairman of the organizing committee of international conferences, he helped to build up contacts and collaborations.

The most productive collaboration, active for several decades, was with Professor William Wade (University of Tennessee, Knoxville, Tennessee, USA). This was supported for three consecutive terms by the National Science Foundation (USA). Without questioning the importance of international relations, he always gave priority to cooperation with domestic research groups. In particular, he maintained regular professional contacts with the mathematical community of the partner universities of Pécs, Szeged, Debrecen, Nyíregyháza and Győr. In addition, he was in regular contact with leading experts in his field of research around the world. It would make a long list of prestigious research institutions around the world where he was as a guest lecturer or visiting researcher.

Professor

For more than 50 years, Professor Schipp was a successful university teacher of high professional and pedagogical quality. As a teacher and university lecturer, his mission was to provide high quality mathematics education and

teacher training. His carefully written notes and lectures set an example to be followed. He placed great emphasis not only on mathematically precise formulation, but also on clear and illustrative presentation of the underlying ideas and applications. In his teaching, he always took great care to encourage talented students and promote their professional development. He provided professional guidance and management to young colleagues, doctoral students and talented students in the form of personal consultations and seminars. Several doctoral and PhD theses were written under his inspiration and professional guidance. He mentored generations of young researchers and followed and supported the careers of his students throughout their professional lives. Several of his former students are now university professors or hold a doctorate from the Hungarian Academy of Sciences.

As head of the department, he took great care to secure its future by hiring young talented colleagues. He built up an internationally recognized school of harmonic analysis. He was always unselfish in sharing his ideas with his colleagues and so encouraging them to exercise these ideas on open problems. In particular, he helped the PhD students by making valuable suggestions for the completion of doctoral theses in the course of their thesis examinations. As a result, there are many of us, not only at our department or in other institutes within Hungary but also in many countries around the world, who are proud to call ourselves his students. This is what one calls a genuine indicator of greatness. In addition to his own publications, the number of scientific papers in which he is not listed as an author, but in which the research results presented were inspired, initiated and supported by him, is several times higher.

He could always be approached for advice on various matters, especially on issues related to the content and development of teaching, where he always considered quality as a guiding principle.

Awards

His research accomplishments in mathematics and activity in mathematical pedagogy at the two universities was recognized by *Doctor et Professor Honoris Causa, ELTE* in 2012 and *Honoris Causa, University of Pécs* in 2017.

The Hungarian Academy of Sciences has awarded him several prestigious professional prizes for his scientific achievements in the field of mathematics and for his outstanding teaching and school-educational activities in higher education: the *Erdős Prize* (1978), the *Academy Prize* (1990), the *Albert Szent-Györgyi Prize* (1995), the *Tibor Szele Memorial Prize* (2000), the *József Eötvös Wreath* (2016).

In 2004, the Hungarian State awarded him the *Order of Merit of the Republic of Hungary, Officer's Cross*, and in 2008, in recognition of his life's work, he was awarded the *Széchenyi Prize*, the highest state scientific award.

Legacy

Anyone who met Professor Schipp in his research or teaching work experienced his consistently values-based approach, as well as his benevolent, selfless personality. His values of research, teaching and public service were always in harmony. His contacts, whether at home or abroad, initially professional, never remained within the formal framework. In all cases, without exception, they developed into human, friendly relationships. His basic nature can be characterized by patience, serenity and even self-irony.

Those of us who worked with him were lucky to know the scientist, the teacher and the man intimately. To the end of his life, he took the fate of the department he founded to heart, and the preservation and improvement of the quality of research and teaching. We could always count on his advice, based on his wealth of experience, when problems arose. He was the founder and builder of a new research school. Through his example we experienced the true meaning of this concept. His students and colleagues respected him as a role model.

Professor Schipp was an outstanding mathematician and exceptional teacher, but above all an excellent friend.

His memory will be preserved. We will cherish his rich scientific legacy.

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