doi: 10.14232/actasm-020-287-3

Acta Sci. Math. (*Szeged*)
86 (2020), 343–346

László Leindler

1935 – 2020

One of the leading members of the Szeged school of mathematics, an outstanding researcher in classical and Fourier analysis, a former editor-in-chief of this journal, László Leindler passed away at the age 85 on September 18, 2020.

He was born in Kecskemét, Hungary, on October 1, 1935. He attended the elementary and high schools in his native town. In high school he barely had any mathematics education, and although his school marks were always the best, he did not want to pursue university studies. Eventually the principal of the school convinced him to get admission to the University of Szeged, where he caught up with the rest of the class by the end of the first semester and soon became a top-notch student. He got his teacher's degree in 1958 after which he spent one year as a mathematics teacher in a technical school in Veszprém. In 1959 he received a three-year scholarship ("candidature") to work under the guidance of György Alexits and Károly Tandori on some questions related to orthogonal series. He received his doctorate with distinction *"sub auspiciis Rei Publicae"*, which means that all his school marks from elementary school until the doctoral defence were 5 (top marks in Hungary) — in such rare cases the doctorate diploma is granted by the president of Hungary along with a gold ring. In the same year he got his second scientific degree "candidate of the mathematical sciences", and just 4 years later he received his highest degree "doctor of the Hungarian Academy of Sciences" for a dissertation with title "Investigations on convergence and summability of orthogonal series". He became a corresponding member of the Hungarian Academy of Sciences in 1973, and was elected to ordinary membership in 1982. He was the vice-head of the Mathematics and Physics Section of the Academy in the period 1976-1990, and of the Szeged Branch of the Academy in the period 1996-2002. From 1982 till 1992 he was the editor-in-chief of *Acta Scientiarum Mathematicarum.* He also served on the editorial board of *Acta Mathematica Hungarica*, *Analysis Mathematica* and *Periodica Mathematica* for extended periods. He retired in 2005 at age 70, but continued to do mathematics until the very end of his life.

He was a master of series and inequalities. Most of his 254 papers fall into the following sub-fields of mathematical analysis.

1. *Strong summation and approximation.* By a classical theorem of Fejér and Lebesgue, if s_k is the k-th partial sum of the Fourier-series of a 2π-periodic function f, then the averages of the first n signed errors $(s_k(x) - f(x))$, $0 \le k < n$, tend to 0 as $n \to \infty$ (uniformly in the continuous case and almost everywhere in the L^1-case). Hardy and Littlewood asked if this is so because there are a lot of cancellations in the sum, or because the moduli $|s_k(x) - f(x)|$ of the errors themselves obey the same rule: their averages tend to zero. Strong summation started with this question, and if the rate of convergence to 0 is also considered, then we arrive at strong approximation. A complete theory emerged by the mid 1980's mainly through the work of László Leindler and his collaborators. He wrote in 1985 the monograph *"Strong approximation by Fourier series"* in the subject which summarizes the most important aspects of the theory.

2. His first research area was *the theory of orthogonal series.* His very first result was a remarkable extension of divergence phenomena from standard orthogonal systems to orthogonal systems consisting of polynomials (not orthogonal polynomi-

als though, for the degree of the n-th member of the system is, in general, much larger than n). This result allowed him to show that most results, in particular 12 theorems of K. Tandori, on divergence phenomena for orthonormal systems remain true word-for-word for (smooth) systems consisting of polynomials. Later in his research he periodically returned to convergence and summation questions of orthogonal series — this topic followed him throughout his scientific carrier.

3. *Imbedding theorems.* This is a classical area of mathematical analysis which makes quantitative the observation that if a function belongs to and is sufficiently smooth in a function space (say in $L^p[0,1]$), then it automatically belongs to a much narrower space (say to $L^q[0,1]$ with $q > p$). László Leindler obtained several sharp results in this subject.

4. He proved various results in connection with *inequalities*, of which we mention the generalizations of the classical Hardy-Littlewood inequalities. These give bounds on weighted infinite sums of partial sums $\sum_1^k a_i$ (or of remainders $\sum_k^\infty a_i$ of such partial sums) of nonnegative series $\sum_1^\infty a_i$ in terms of related sums involving the terms a_i themselves. In the original Hardy-Littlewood inequalities, as well as in many of their later variants, the weights were of power type k^{-c}. László Leindler gave the ultimate generalization where the weights were arbitrary positive numbers λ_k. His formulation not only showed the true nature and natural form of such inequalities, but also gave the best constants in them.

5. *Coefficient conditions.* This is the subject area where he had most of his papers later in his life. It deals with various conditions and relations among such conditions on numerical series (or coefficient sequences of trigonometric and Fourier series) that provide a certain order on certain partial sums. In this subject he introduced a number of extremely general conditions/properties that could be still used in applications (say guaranteeing certain properties like continuity or integrability of the associated trigonometric sums).

6. Finally, we mention a pretty subject: the so-called inverse *Hölder inequalities.* While the classical Cauchy-Schwarz or Hölder inequalities do not have a direct converse, A. Prékopa, in connection with log-concave probability distributions, found the following converse $\int \max_{x+y=t} |f(x)g(y)|dt \geq 2\|f\|_2\|g\|_2$ to the Cauchy-Schwarz inequality $\int |fg| \leq \|f\|_2\|g\|_2$. László Leindler extended that to the L^p, i.e., to the Hölder case, gave the best constant (instead of 2 then stands $p^{1/p}(p/(p-1))^{p/(p-1)}$) and gave the proper form for more than 2 terms. Later A. Prékopa showed that those extensions were true in any dimension. By now these so-called Prékopa-Leindler inequalities are considered as functional forms of the Brunn-Minkowski inequality on the volume of the Minkowski sums of sets in convex geometry.

For his fundamental works László Leindler received various awards: Grünwald

Prize (1961), Szele Medal (1984), Széchenyi Prize — the highest scientific governmental award in Hungary — (1992), Klebelsberg Award (2002), Szőkefalvi-Nagy Medal (2002), Honorary Doctor of the University of Szeged (2003), Middle Cross of the Hungarian Order of Merit (2004). He was a visiting scholar in Giessen (1977, 1980), Edmonton (1974, 1983, 1989, 1990), Toronto (1993, 1966), and Moscow (1968).

László Leindler was a modest person. He referred to most of his results as "trifles", "minor improvements". Sports played always an important role in his life; in his youth he almost gave up the academic career for football. Later he regularly played tennis — according to his modesty, always on the far-out courts of the university complex.

His death ended a bright scientific career and we lost an outstanding researcher, a fine colleague, an esteemed teacher and a good friend.

The Editors