Obituary: FÉLIX POLLACZEK

Félix Pollaczek was born on 1 December 1892 in Vienna, Austria; he was the descendant of a well-known mid-European Jewish family which for several centuries had counted many learned men amongst its members. He became a Frenchman by naturalization in 1947. He obtained his scientific education and training at the Latin grammar school of Vienna, and at the Technical Universities of Vienna and Brno (Czechoslovakia); he later studied mathematics at the University of Berlin. A master's degree in electrical engineering in 1920 from Brno was followed by a doctoral degree in mathematics in 1922 from Berlin with a thesis on number theory. This was concerned with the fields generated by the lth and l^2th roots of one, l being an irregular prime number. His first paper, on number theory, dates from 1917.

He was employed in 1921 as an engineer by A.E.G. in Berlin. Then, in 1923, he became scientific adviser to the German Postal, Telephone and Telegraph Services at Reichspost-Zentralamt Berlin-Tempelhof. As a result of the political situation in Germany in 1933, he was dismissed from his post and then left the country. In Paris he made his living as a consulting engineer for the Société d'Études pour Liaisons Téléphoniques et Télégraphiques. In 1939–1940 and again from 1944 on, he held the position of Maître de Recherches at the Centre National de la Recherche Scientifique in Paris.

Félix Pollaczek's fruitful life came to an end on 29 April 1981 at Boulogne-Billancourt.

In 1977 Pollaczek was awarded the John von Neumann Theory Prize by the ORSA-TIMS prize committee. Although he had always enjoyed good health, his age then prevented him from travelling to the United States to receive this prize in person. At the country house of the hospitable Le Gall family in Bous-le-Roi, France, the prize was presented to him during a short ceremony in the presence of Pierre Le Gall, Ryszard Syski and myself. Pollaczek felt very honoured by this award from the American Operations Research community.

Pollaczek's scientific interests included number theory, analysis, mathematical physics and probability theory; his early research was in number theory. Erdélyi, for example, named a set of orthogonal polynomials after Pollaczek (cf. Erdélyi, *Higher Transcendental Functions*, McGraw-Hill, New York, 1953–55). Wave propagation and Newtonian potential theory related to phenomena in electrical transmission were also subjects on which he published many papers. But he is best known for his researches on what is currently understood as queueing theory: the Pollaczek–Khinchine formula has become a well-known elementary expression in operations research. Actually, Pollaczek may be regarded as the

research worker who laid the foundations for the analytic treatment of the basic queueing models by means of methods and techniques stemming from complex function theory and singular integral equations. His researches in this field started in the late twenties and retained his active interest for the rest of his life. The ultimate results culminated in two monographs published in the Mémorial des Sciences Mathématiques series in 1957 and 1961; these are fine examples of classical analysis.

In the period between the two world wars, active queueing theorists, like Vaulot, Khinchine, Pollaczek, and Palm, could not rely on a well-established probability theory, let alone a theory of stochastic processes (see J.L. Doob's article, William Feller and Twentieth Century Probability, *Proc. 6th Berkeley Symposium*, Vol. 2, xv–xx). Nearly every new queueing problem required its own translation into a mathematical formulation before the machinery of classical analysis could be used, provided this analysis already had the appropriate tools available. Pollaczek's translation of the many-server queueing model with general service and interarrival distributions is already itself a remarkable achievement for that period. For the resulting system of singular integral equations hardly any results were available in classical analysis at that time; the theory of the Wiener–Hopf integral equation was then in its early childhood. Here, Pollaczek showed his mastery of classical analysis; the analysis is difficult, but has still not been replaced by a simpler and more lucid approach.

Only recently have indications and some results been obtained which point to an analytic approach to the problems simpler than that formulated by Pollaczek. The theory of certain types of singular integral equations such as those occurring in continuum mechanics and developed by the Russian school around 1959 (Muskhelishvili, Gakhov, Vekua) seems to provide new tools for a deeper and much-needed analysis for two reasons. In the first place the single-server model is closely related to the general one-dimensional random walk, while the many-server model is related to a higher-dimensional random walk. Further, the modern needs of applicable queueing theory for processes encountered in present-day design and operation of computer and data-handling systems urgently need more analytic and numerically evaluable results. Handling such problems by simulation techniques, if this proves possible, is often an excessively costly and rough approach. Pollaczek made basic contributions in pointing to the direction in which the analytic approach must develop. In him queueing theory had a fine and sharp scientist. His modest and kind personality will be missed by his friends.

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