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Obituaries

Anatole Katok, mathematician who explored chaos theory, dies at 73

By Martin Weil May 9

Anatole Katok, an American mathematician who was a leader in the theoretical exploration of dynamical systems, a subject that treats the way complex aspects of the real world — including weather, disease and the economy — change and develop over time, died April 30 at a medical center in Danville, Pa. He was 73.

The causes were pneumonia and complications from an infection, said his wife, Svetlana Katok.

At his death, Dr. Katok was director of the Center for Dynamics and Geometry at Pennsylvania State University. Before going to Penn State in 1990, he had taught for six years at the California Institute of Technology. From 1978 to 1984, he was on the University of Maryland faculty.

Among colleagues, he was hailed for revolutionizing the study of dynamical systems through sophisticated mathematics. Gregory Margulis, a member of the mathematics faculty at Yale University, called him “one of the giants.”

In his scholarly work, Dr. Katok ventured into areas that embraced some of the most intriguing aspects of modern mathematics, including what has been called chaos theory, symbolized by the “butterfly effect.”

At one time, it seemed to scientists that exact prediction was possible for many important natural systems in the world around us, particularly those composed of inanimate particles such as the ones that make up the atmosphere and govern the weather. The belief was that perfect knowledge of the state of the system, and of the rules of interaction that prevailed among its components, would allow for perfect forecasts.

However, the desired degree of precision often proved impossible to obtain. And sometimes, the evolution of a system could depend with great sensitivity on just the sort of information that could not be precisely obtained — its state at any given moment.

That introduced the idea of chaos, the suggestion that some systems (such as the atmosphere) depend so sensitively on their initial characteristics that a disturbance as slight as the flapping wing of a butterfly in one region of the system may induce a major event such as a hurricane in another.

Seeking to understand such systems and the mechanisms that cause their complexities has been a major mathematical enterprise of recent years and one in which Dr. Katok achieved eminence.

Among his particular contributions to dynamical-systems theory was the creation of an all-encompassing mathematical framework that shaped and organized results and ways of thinking. Depending on behavior, the systems were placed in elliptic, hyperbolic or parabolic categories.

Regarded as a particularly eager participant in the search by peers and colleagues for deeper insight, he provided new paradigms and aided in the solution of specific problems. In addition, he was known for work in ergodic theory, and for mastering and influencing all aspects of dynamical-systems problems and approaches.

Making use at times of advanced geometrical concepts, sophisticated spaces or borrowings from physics such as the idea of entropy, Dr. Katok built overarching frameworks of abstraction, classification and generality, offering insight and a deeper understanding of dynamical systems.

Regarded as one of the more influential figures in modern mathematics, he was known for his collegiality, his ability to inspire the efforts of others and his ability to open the curtain to important new areas of inquiry. His many published papers were widely cited by others, offering a measure of their importance to the edifice of mathematics.

University of Chicago President Robert J. Zimmer, a mathematician and onetime co-worker of Dr. Katok, called him “a whirlwind of mathematical activity” who expanded the boundaries of his field, “brought new connections and engaged all around him with an infectious and buoyant enthusiasm for mathematics and its mysteries.”

Anatole Borisovich Katok was born in Washington on Aug. 9, 1944. His parents — his father a metallurgical engineer and his mother a chemist — were part of a Soviet delegation working with the American lend-lease program to aid allies during World War II.

After the war, his family returned to the Soviet Union. At Moscow State University in the 1960s, he received a master’s degree and a doctorate in mathematics.

But in time, Communist control in the academic world as well as anti-Semitism prompted by his Jewish background compelled him to leave. Some daring was required in the decision, which at the time was regarded as almost treasonous. But, by reason of the place of his birth, Dr. Katok was confirmed to be an American citizen. He and his family left in 1978 and joined the U-Md. faculty.

The next year marked the departure from the Soviet Union of one of his former students, Michael Brin, now an emeritus mathematics professor at U-Md. Brin’s son Sergey co-founded Google.

Dr. Katok’s collaboration with his former student Boris Hasselblatt resulted in the book “Introduction to the Modern Theory of Dynamical Systems,” published by Cambridge University Press in 1995. It is considered an encyclopedia of modern dynamical systems and is among the most cited publications in the area.

Dr. Katok, a resident of State College, Pa., was a fellow of the American Mathematical Society and a member of the American Academy of Arts and Sciences. A chair was recently endowed in his name in Penn State's mathematics department. In addition, the Center for Dynamics and Geometry was endowed and renamed in his honor.

Survivors include his wife of 52 years, Svetlana Rosenfeld Katok, also a Penn State mathematics professor, of State College; three children, Elena Katok of Dallas, Boris Katok of Reno, Nev., and Danya Katok Ahlbin of the Bronx; and three grandchildren.

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