

Shoshichi Kobayashi, Mathematician, 1932-2012



Shoshichi Kobayashi, 80, Emeritus Professor of Mathematics at the University of California at Berkeley, died peacefully in his sleep on August 29. He was on the faculty at Berkeley for 50 years, and has authored over 15 books in the area of differential geometry and the history of mathematics.

Professor Kobayashi studied at the University of Tokyo, receiving his B.S. degree in 1953. He spent one year of graduate study in Paris and Strasbourg (1953-54), and completed his PhD at the University of Washington, Seattle in 1956. He was appointed Member of the Institute for Advanced Study at Princeton (1956-58), Postdoctoral Research Associate at MIT (1958-60), and Assistant Professor at the University of British Columbia (1960-62). In 1962 he joined the faculty at Berkeley. He was a Visiting Professor at numerous departments of mathematics around the world, including the University of Tokyo, the University of Mainz, the University of Bonn, MIT, and the University of Maryland. Most recently he had been visiting Keio University in Tokyo. He was a Sloan Fellow (1964-66), a Guggenheim Fellow (1977-78) and Chairman of his Department (1978-81).

Shoshichi Kobayashi was one of the most important contributors to the field of differential geometry in the last half of the twentieth century.

His early work, beginning in 1954, concerned the theory of connections, a notion basic to all aspects of differential geometry and its applications. Professor Kobayashi's early work was essential in clarifying and extending many of Élie Cartan's ideas, particularly those involving projective and conformal geometry, and making them available to modern differential geometers. A second major interest of his was the relation of curvature to topology, in particular on Kähler manifolds.

Throughout his career, Professor Kobayashi continued to focus his attention on Kähler and more general complex manifolds. One of his most enduring contributions was the introduction in 1967 of what soon became known as the "Kobayashi pseudodistance," along with the related notion of "Kobayashi hyperbolicity." Since that time, these notions have become indispensable tools for the study of mappings of complex manifolds.

Other areas in which Professor Kobayashi made fundamental advances, into the twenty-first century, include the theory of complex vector bundles, intrinsic distances in affine and projective differential geometry, and the study of the symmetries of geometric structures using filtered Lie algebras.

Several of Shoshichi Kobayashi's books are standard references in differential and complex geometry, among them his two-volume treatise with Katsumi Nomizu entitled "Foundations of Differential Geometry". Generations of students and other scholars have learned the essentials of the subject from his books.

The following is a translation by Professor Toshiki Mabuchi (University of Osaka) of his 1992 description of Kobayashi's work:

His books "Foundations of Differential geometry, I, II" joint with K. Nomizu are very popular not only with mathematicians but also with physicists.

His books on hyperbolicity and transformation groups also influenced many mathematicians.

He wrote more than one hundred papers, which have received an exceptionally large number of citations.

His mathematical achievements range among differential geometry, Lie algebras, transformation groups and complex analysis. The most important ones are:

- (1) Kobayashi's intrinsic pseudo-distance and its distance-decreasing property for holomorphic mappings;
- (2) Kobayashi hyperbolicity;
- (3) Measure hyperbolicity and the generalized Schwarz lemma;
- (4) Projectively invariant distances for affine and projective structures;
- (5) The study of compact complex manifolds with positive Ricci curvature and Kobayashi-Ochiai's characterization of complex projective spaces and hyperquadrics;
- (6) Filtered Lie algebras and geometric structures;
- (7) The study of Hermitian-Einstein holomorphic vector bundles and the Kobayashi-Hitchin correspondence.

In (1), (2) and (3), we see his extremely high originality, and (5) has led succeeding mathematicians to Frankel's Conjecture, while (7) has had great impact on algebraic geometry as well as differential geometry ---- Tian-Donaldson-Yau's Conjecture on the K-stability and existence of Kaehler-Einstein metrics is still a central problem in complex geometry.

Professor Kobayashi's books include

- Foundations of Differential Geometry (with Katsumi Nomizu), Wiley & Sons, 1963/1996.
- Foundations of Differential Geometry, Vol. II (with Katsumi Nomizu), Wiley & Sons, 1969/1996.
- Hyperbolic Manifolds and Holomorphic Mappings, Marcel Dekker, 1970/2005.
- Transformation Groups in Differential Geometry, Springer-Verlag, 1972/1995.
- Differential Geometry of Curves and Surfaces, Shokabo 1972 (in Japanese).
- Complex Differential Geometry, Birkhäuser Verlag, 1983.
- Differential Geometry of Complex Vector Bundles, Princeton University Press, 1987.
- Differential Geometry of Connections and Gauge Theory, Shokabo, 1989 (in Japanese).
- Euclidean Geometry to Today's Geometry, Japan Hyoronsha, 1990 (in Japanese).
- Hyperbolic Complex Spaces, Springer, 1998.
- Mathematics of Circles, Shokabo, 1999 (in Japanese).
- Calculus – One Variable, Shokabo, 2000 (in Japanese).
- Calculus – Several Variables, Shokabo, 2000 (in Japanese).
- Understanding Euler and Fermat, Kodansha, 2003 (in Japanese).
- Complex Geometry, Iwanami, 2005 (in Japanese).