Prof. Wen-Tsun Wu turned 90 in May 2009. He has made fundamental contributions to numerous areas of mathematics, including topology, invariant theory, automated theorem proving, symbolic computation, and history of ancient Chinese mathematics.

Wu was born in Shanghai, China on May 12, 1919. He received his B.S. degree in mathematics from the Shanghai Jiao Tong University in 1940 and taught mathematics in high schools from 1940 to 1946. In 1946, Shiing-Shen Chern accepted Wu as one of his research assistants in the newly established Institute of Mathematics belonging to the Academia Sinica. Wu began studying modern mathematics and learned algebraic topology including the nascent theory of fiber bundles and characteristic classes at that time. A year later, Wu published his first paper in the Annals of Mathematics, about a simple proof of the product formula of sphere bundles discovered by Whitney for which Whitney's complicated original proof had never published.

In 1947, Wu went to France to study mathematics under a Sino-France exchange program. Wu went to Strasbourg to study under Charles Ehresmann, who was one of the founders of fiber bundle theory and also a specialist of Grassmannian varieties. Wu completed his National Doctor Thesis in 1949 which was a detailed study of characteristic classes via Grassmannian varieties. It seems that the terminology of Pontrjargin classes and Chern classes appeared for the first time in Wu's thesis.

In 1949, Wu moved to Paris to study under Henri Cartan at the CNRS. With Cartan's help, Wu discovered the classes and formulas about the characteristic classes of fiber bundles and manifolds, now bearing Wu's name.

Characteristic classes are basic invariants depicting fiber bundles and manifolds. This concept had been developed since the end of 1940s by many celebrated scholars, but their work was mostly descriptive. Wu simplified their work and systematized the theory. Wu completed a deep-going analysis of the relations among the Stiefel–Whitney characteristic class, Pontrjargin's characteristic class, and Chern's characteristic class, and proved that other characteristic classes can be derived from Chern's classes. He also introduced new techniques, e.g., in the field of differential manifold, he introduced Wu's characteristic class, not only being an abstract concept but also computable. He established formulas to express the Stiefel–Whitney class by Wu's classes. Wu's work led to a series of important applications, thus enriching the theory on characteristic classes.

In 1951, Wu returned to China. He was first appointed as a professor in the Peking University, and later in the Chinese Academy of Sciences from 1953 onwards. Wu continued his work on Pontrjargin's classes. In 1953, Wu discovered a method of constructing topological invariants of polyhedra which are non-homotopic in character. With these new tools, Wu made a systematic investigation of classical topological but non-homotopic problems. They did not get much prominence partly owing to the rapid development of homotopy theory during that time period. Later, Wu found successful applications to embedding problems which are typically of topological but non-homotopic character. Wu introduced the notion of embedding classes, and established a theory of embedding, immersion, and isotopy of polyhedra in Euclidean spaces which was published as a book in 1965.
Wu was awarded one of the three national first prizes for natural sciences in 1956 and became a member of the Chinese Academy of Sciences because of his fundamental contributions to characteristic classes and embedding classes. He was invited to give an invited lecture at the 1958 International Congress of Mathematicians, which he was unable to attend.

In 1965, Wu discovered a simple computational method of defining generalized Chern classes and Chern numbers of an algebraic variety with arbitrary singularities via composite Grassmannians. Wu’s papers on these topics were published in Chinese and were little known outside China. His research was unfortunately interrupted by the cultural revolution in China. In 1986, Wu was able to take up this subject again and proved by simple computations, the extension of the so-called Miyaoka–Yau inequalities between Chern numbers of algebraic manifolds of dimension 2 to algebraic surfaces with arbitrary singularities. A large number of inequalities as well as equalities among the generalized Chern numbers of algebraic varieties with arbitrary singularities have been discovered since by means of this computational method.

In 1967, Wu extended and applied his embedding theory to the practical layout problem of integrated circuits, giving a criterion for the planarity of linear graphs in the form of solvability of some system of linear equations on mod 2 coefficients. This work also resulted in methods of actually embedding embeddable graphs in the plane, a problem which seems to have not been studied by any one else at that time.

During the cultural revolution, Wu was sent to a factory manufacturing analog computers and hybrid computers. Wu was awed by the power of a computer. Wu also used this time to learn about ancient Chinese mathematics. Wu was greatly impressed by the deepness and power of the approach and methods of Chinese mathematics from ancient times. Wu observed that ancient Chinese mathematics mostly developed algorithmic methods for solving various problems and in particular, solving algebraic equations. The constructive approach of ancient Chinese mathematics, which was in sharp contrast to Euclid’s axiomatic approach, had deep influence on the developments of mathematics in China. Wu was invited for the second time to give an invited lecture on the development and history of ancient Chinese mathematics in the 1986 International Congress of Mathematicians in the US.

It was under these influences that Wu tried at the end of 1976 to seek the possibility of proving geometry theorems in a mechanical way. After several months of trials, Wu ultimately succeeded in developing a method of mechanical geometry theorem proving. Wu implemented this method using an outdated machine (the Great Wall 203 with 4K memory); subsequently, during a visit to the US in 1979, Wu was able to get a better computer. Wu's method has been applied to prove and discover hundreds of non-trivial difficult theorems in elementary and differential geometries on a computer. Based on the classic work of Shi-Jie Zhu in the fourteenth century and Ritt’s techniques in differential algebra, Wu developed a method for solving systems of algebraic equations by transforming an equation system in the general form to a family of equation systems in a triangular form, much like the Gaussian elimination method for linear equations. For his work on automated geometry theorem proving, Wu was awarded the Herbrand Award for Distinguished Contributions to Automated Reasoning in 1997, which is considered the highest award in the field of automated reasoning.

Wu's work on automated geometry theorem proving marked the second turning point in Wu’s scientific life, the first one being his meeting with Chern. Wu completely changed his directions of research and concentrated his efforts in extending his method in various directions, both theoretical and practical, aiming at what he has called the Mechanization of Mathematics. Wu was offered in 1990, special funds by the Chinese Academy of Sciences to establish the Mathematics Mechanization Research Center, which later became the Key Laboratory of Mathematics Mechanization.

Wu served as the president of the Chinese Society of Mathematicians from 1984 to 1987, the director of the Mathematics and Physics Division of the Chinese Academy of Science from 1992 to 1994. Wu served as the conference chair of the International Congress of Mathematicians in 2002 when it was held in Beijing.

In 2000, the Chinese government bestowed on Wu, the Highest Award of Science and Technology. In 2006, Wu together with David Mumford received the Shaw Prize in Mathematical Sciences, considered to be the Nobel prizes of the East. In a communiqué, the Shaw Prize Committee stated:
Mumford and Wu, “beginning with the traditional mathematical field of geometry, contributing to its modern development and then moving into the new areas and opportunities which the advent of the computer has opened up, they demonstrate the breadth of mathematics. Together they represent a new role model for mathematicians of the future”. In his speech, Sir Michael Atiyah, the famous British mathematician said, “Mathematicians were prominent in the development of computer from the early 19th century ideas of Charles Babbage to the modern fundamental work of Alan Turing and John von Neumann in the middle of the 20th century. But computer science has now developed into a vast enterprise and the close connection with mathematics is in danger of being lost, to the detriment of both. David Mumford and Wu Wentsun are two leading mathematicians who have, in the second part of their careers, reestablished that link in two different ways”.

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