



### **Professor William Prager (1903 – 1980)**

From:

<http://www.learn-math.info/historyDetail.htm?id=Prager>

William Prager's parents were Helen Kimmel and Willy Prager. He studied at the Technical University of Darmstadt and was awarded his Dipl. Ing. degree in 1925. In the same year he married Ann Heyer, and he remained at Darmstadt where he undertook research, being awarded his doctorate in engineering in 1926. During the next three years he remained in Darmstadt where he had been appointed as an instructor. Then in 1929, when he was only 26 years old, Prager was appointed to act as Director of the Institute of Applied Mathematics at Göttingen.

In 1932 Prager was appointed as Professor of Technical Mechanics at Karlsruhe. As indication of just how rapid his success had been, we note that his appointment in Karlsruhe made him the youngest professor in Germany. It was certainly due to the leading international reputation he had already achieved, with over thirty papers and a book already showing the depth of his contributions to applied mathematics. However, life in Germany was about to change for on 30 January 1933 Hitler came to power. The Nazi regime forced Prager out of the professorship and in 1934 he left Germany to go to Turkey where he was appointed as Professor of Theoretical Mechanics at the University of Istanbul. But Prager did not accept his treatment by the Nazis without protest. He fought his dismissal through the German courts and, perhaps surprisingly, won his case. He accepted the back pay which the court awarded him to cover what his salary would have been if he had remained in post. He was also given permission to return to his professorship in Germany but he declined.

In Turkey Prager continued to output research at the highest level, publishing articles in German, Turkish, French and English. He also wrote textbooks in Turkish for his students, one on descriptive geometry and another on elementary mechanics. The outbreak of war in 1939 was distressing to Prager and the German advances by 1940 made him decide that he would be best placed if he could emigrate to the United States. This, however, was not easy at this difficult time, even for a scientist with the high international reputation enjoyed by Prager. Brown University, in Providence Rhode Island, took the opportunity to expand its graduate

programme by offering Prager the position of Director of Advanced Instruction and Research in Mechanics. Prager had to remain in Turkey until October 1941, and then the journey from Istanbul to Providence, Rhode Island, took him and his family about six weeks. Travelling at this time was extremely difficult and they had to go by a very indirect route.

Prager established the Division of Applied Mathematics at Brown in 1946, served as its first Chairmen, and guided its research and teaching by gathering round him younger people in a wide variety of fields of applied mechanics, applied mathematics, physics and engineering. His own research during this period covered an enormous diversity of topics in the mechanics of continua of all types, problems of traffic flow, and applications of computers to problems in economics and engineering.

J L Synge was visiting professor at Brown University in 1941 when Prager arrived there. They soon began collaborating and publishing papers in the Quarterly of Applied Mathematics which Prager founded in April 1943 and edited for over 20 years. For example their method of the hypercircle appears in a joint paper in that journal in 1947. In the Walker-Ames Lectures, Prager developed the hypercircle method applying it to statically indeterminate structures and to the equilibrium of elastic solids. The Lectures were published as The extremum principles of the mathematical theory of elasticity and their use in stress analysis in 1950. An important monograph, which Prager wrote jointly with P G Hodge, was Theory of perfectly plastic solids (1951). The main topics covered in the text are: basic concepts of stress, strain, and stress-strain relations; trusses and beams; torsion of cylindrical or prismatic bars; plane strain including problems with axial symmetry, general theory, specific problems, contained plastic deformations, limit analysis; and finally, general extremum principles.

In November and December 1954 Prager gave a series of lectures at the Polytechnic Institute in Zurich. These were published in the following year as Probleme der Plastizitätstheorie. E T Onat reviewing the book writes:

The book constitutes a clear and penetrating exposition of the concepts and applications of the theory of plasticity. The author is one of the principal contributors in the field and his book provides the reader with indications of the impending developments of the theory.

Prager further developed the material given in these lectures and presented it in an English version in An introduction to plasticity published in 1959. A review of this book, this time by J Heyman, again gives Prager high praise:

There are no spare lines and there is no padding; the author has considered every word, and thought deeply on every aspect of plastic theory. ... the author is completely master of this, his main field of study, and he communicates this sense of mastery to the reader.

In 1961 Prager published a German and an English version of the same work. The German version is titled Einführung in die Kontinuumsmechanik while the English one is Introduction to mechanics of continua. In this work Prager aimed to provide students with the common fundamentals of the various areas of hydrodynamics, elasticity, plasticity, etc., that constitute continuum mechanics. A great expert in the use of computers, Prager published Introduction to basic FORTRAN programming and numerical methods in 1965. Hamming describes the work as follows:

The basic aspects of FORTRAN are very well described, and many useful remarks are given to aid the student and point out common pitfalls of the beginner. The numerical methods aspect also shows the hand of a master and covers all the material that is usually given in a one term course, including ordinary differential equations, in a reasonably rigorous and at the same time practical manner. ... All in all it is a remarkable book and one wonders how the author managed to cover so much, so smoothly and unhurriedly as he has.

Prager retired from Brown University in 1973 and moved to Savignon, Switzerland, where he continued to undertake research, write books, give lecture tours, and edit journals. In particular he gave six lectures at the International Centre for Mechanical Sciences in Udine in 1974 which he wrote up and published as Introduction to structural optimization (1974). His first three lectures considered the derivation of necessary and sufficient conditions for global optimality from extremum principles, while the final three lectures looked at the optimisation of the structural layout.

His outstanding contributions to applied mathematics led to Prager receiving many honours and awards. He was elected to the National Academy of Engineering, the National Academy of Sciences, the American Academy of Arts and Sciences, the Polish Academy of Sciences, the French Académie des Sciences. He received the Worcester Reed Warner medal and the Timoshenko medal from the American Society of Mechanical Engineers and the von Kármán medal from the American Society of Civil Engineers. Many universities awarded him honorary degrees including Liege, Poitiers, Milan, Waterloo, Stuttgart, Hannover, Brown, Manchester and Brussels.

As to his interests outside mathematics, Drucker writes :

Among his broad range of interests outside of his work was classical music, to which he listened early in the morning before each busy day of research, teaching, and service to society.

(from Wikipedia, the free encyclopedia,  
[http://en.wikipedia.org/wiki/William\\_Prager](http://en.wikipedia.org/wiki/William_Prager) )

William Prager (May 23, 1903, Karlsruhe - 1980) was a German-born US applied mathematician.

He was a lecturer at Darmstadt, a deputy director at University of Göttingen, professor at Karlsruhe, University of Istanbul, the University of California, San Diego and Brown University, where he advised Bernard Budiansky.

The Society of Engineering Science has awarded the William Prager Medal in Solid Mechanics since 1983 in his honor.[1]

#### **Works:**

Beitrag zur Kinematik des Raumfachwerks, 1926, dissertation

"Dynamik der Stabwerke" (with K. Hohenemser), 1933

"Mechanique des solides isotropes", 1937

"Theory of perfectly plastic solids" (with P. G. Hodge), 1951