Yih-Hsing Pao

January 19, 1930 – June 18, 2013

Early Childhood Education

Yih-Hsing Pao was born in Nanking, China in 1930. He studied first at National Chiao Tung University in Shanghai for two years and in the wake of the Chinese Civil War finished his studies at National Taiwan University in Taipei in 1952 with a B.S. in civil engineering. He came to the United States and obtained a M.S. degree in engineering mechanics from Rensselaer Polytechnic Institute and went on to Columbia University where he received his Ph.D. in wave propagation in solids in 1959. At Columbia he was exposed to an environment of fundamental applied physics, rather than just elements of structural engineering, and with his advisor, Professor Raymond Mindlin, he wrote his first paper, titled 'Dispersion of flexural waves in an elastic, circular cylinder', a classical subject of applied dynamics.

In coming to Cornell in 1958 as an assistant professor in the Department of Theoretical and Applied Mechanics (T&AM, is now merged with Mechanical and Aerospace Engineering) he invited colleagues to call him "Pao." Friendly and outgoing, he soon attracted research students who went on to teach at many of the top universities in the US and abroad.

Professor and Chair T&AM

In 1974 Pao became Chair of T&AM and strove with great vigor to move applied mechanics at Cornell into the top ranks. In 1982, Pao succeeded in bringing the 9th US Congress of Applied Mechanics with over 600 participants to Cornell. Pao's national leadership potential was recognized in 1985 when he was elected to the National Academy of Engineering. However, in 1980 his rising career was dealt a blow with the diagnosis of *retina pigmentosa*, an eye disease that eventually left him without sight. Nonetheless, in the 1980's he spearheaded a major research project with the late Professor Larry Payne of Mathematics and several others on the subject of inverse problems in wave propagation with applications to nondestructive testing.

Research Accomplishments

Pao's multi-disciplinary research might be called 'Waves in complex continuous systems.' Although Pao was primarily a theoretician, he believed in the importance of defining experiments coupled with thorough mathematical analysis. As chair of a service department in the College of Engineering, he strongly supported the teaching of engineering mathematics by engineering faculty. He also upgraded the experimental teaching laboratories in applied mechanics. He hired and supported faculty who established nationally recognized laboratories in ultrasonic wave propagation, magneto-mechanics, nonlinear dynamics, constitutive behavior of materials, and fracture mechanics.

Pao's main research interest was in dynamics of solid materials, especially wave propagation, ultrasonics, nondestructive testing as well as the mechanics of structures in electromagnetic fields. He was a consultant to the Rand Corporation and collaborated with his former student, Dr C C Mow. In 1973 they jointly published their monograph *Elastic Waves and Dynamic Stress Concentrations*.

This pioneering work extended the ideas of static stress concentrations in solid elastic materials into the dynamic regime. In anticipation of applications to the then new technologies of magnetic transportation and magnetic fusion, beginning in 1964, Pao with several graduate students, expanded his research into the mechanics of elastic structures in magnetic fields. Their discoveries in tuning natural frequencies of structures with static magnetic fields eventually were re-discovered decades later in the application of static electric fields to tune micro-sensors, called MEMS, which are used today in many consumer products.

The descriptor 'waves in complex systems' is appropriate for describing Pao's research on waves in trusses and frames, begun in the late 1990's. He and his student took the classical problem of steady vibration of trusses and frames and addressed the more difficult analysis of wave propagation in the transient regime.

Yih-Hsing Pao was the author or co-author of more than 100 papers in different fields, published in internationally renowned journals. In addition he was invited to publish more than six comprehensive review articles. His 1977 paper "Generalized Ray Theory and Transient Responses of Layered Elastic Solids" was selected by the International Union of Theoretical and Applied Mechanics (IUTAM) as one of the landmark papers in Mechanics of the 20th century (see *Mechanics at the Turn of the Century*, W. Schielen and L. van Wijngarden, eds., 2000).

That Pao kept his spirit and intellectual level in the face of his eye disease is absolutely amazing and deserves our highest respect and admiration. He was not only able to follow research at the cutting edge but also to inspire and take part in the research activity. He would often lecture at a conference with complete blindness, with a well-organized lecture, guiding the audience through his densely filled transparencies, made by one of his aides.

Return to Taiwan, National Taiwan University, Institute of Mechanics

In 1984, Yih-Hsing Pao was invited to Taiwan to plan the building of a new Institute of Applied Mechanics at the National Taiwan University in Taipei. From 1989 -1994, he was Director of this new research institute that has since become a leader in educating engineers in engineering mechanics in Asia. In 1998 he retired from NTU and in 2000 became Professor Emeritus at Cornell. He finished his career in China with a position as professor at Zhejiang University. In his later years he was a senior statesman of applied mechanics, attempting to build bridges between researchers in Taiwan and mainland Chinese universities.

Honors and Awards

In addition to his election to the National Academy of Engineering, Professor Pao was awarded a Humboldt Prize by Germany where he visited the Technische Hochschule Darmstadt. He was also awarded an honorary doctorate from National Chiao-Tung University (Shin- Chu). In 1986 he was elected Academician by Academia Sinica (Taipei). From 1992 to 1995, he was elected President of the Chinese Society of Theoretical and Applied Mechanics, Taipei.

Personal Anecdotes

During his years at Cornell, Pao was known as a strong personality, who often expressed his views forcefully and always with a view towards the future. Pao moved his department into the realm of nonlinear dynamics in the late 1970's by aggressively moving to hire a new professor who eventually led a nationally recognized team in chaos theory at Cornell. T&AM held weekly lunches at Johnny's `Big Red' restaurant in Collegetown. There, Pao would often lead a discussion as to where mechanics research was going or what role T&AM should play in teaching in the College of Engineering.

Pao was a hands-on advisor to his graduate students, always making suggestions and 'red-lining' their research writing and dissertations with extensive notes. While he often proffered advice to his students, he was patient and open to their own ideas, especially when they wished to move into new directions.

Family

Yih-Hsing Pao was married to Amelia Pao, now living in Taipei, Taiwan. They have three children, Winston Pao, May Pao and Sophie Pao. Yih-Hsing Pao is also survived by his brother Yih-Ho Pao, Ph.D., of Zhejiang , China. The Pao brothers are one of the few brother pairs to be elected to the National Academy of Engineering.

Francis C. Moon, Chairperson; Kolumbar Hutter, Wolfgang Sachse