



Yih-Hsin Pad

YIH-HSING PAO

1930–2013

Elected in 1985

“For contributions of basic significance and for stimulating innovative applications in the field of wave propagation in elastic solids.”

BY FRANCIS C. MOON, KOLUMBAN HUTTER,
AND WOLFGANG SACHSE

YIH-HSING PAO, a mechanical engineer whose research interest was in the dynamics of solid materials, especially wave propagation and ultrasonics, died June 18, 2013, at age 83.

He was born January 19, 1930, in Nanking, China. He studied first at National Chiao Tung University in Shanghai for two years and, after the Chinese Civil War, finished his studies at National Taiwan University in Taipei in 1952 with a BS in civil engineering. He came to the United States and obtained an MS degree in engineering mechanics from Rensselaer Polytechnic Institute, and went on to Columbia University where he received his PhD in wave propagation in solids in 1959. At Columbia he was exposed to fundamental applied physics, rather than just elements of structural engineering, and with his advisor, Raymond Mindlin, wrote his first paper, “Dispersion of Flexural Waves in an Elastic, Circular Cylinder,” a classical subject of applied dynamics.

When he came to Cornell in 1958 as an assistant professor in the Department of Theoretical and Applied Mechanics (T&AM, now merged with the Sibley School of 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 United States and abroad.

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 were rediscovered decades later in the application of static electric fields to tune microsensors, called MEMS, which are used today in many consumer products.

In 1974 he became chair of T&AM and strove with great vigor to move applied mechanics at Cornell into the top ranks. 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. He upgraded the experimental teaching laboratories in applied mechanics. He believed in the importance of defining experiments coupled with thorough mathematical analysis and strongly supported the teaching of engineering mathematics by engineering faculty. And he moved his department into the realm of nonlinear dynamics in the late 1970s by aggressively moving to hire a new professor who eventually led a nationally recognized team in chaos theory at the university. In 1982 he succeeded in bringing the 9th US Congress of Applied Mechanics, with over 600 participants, to Cornell.

In 1980, however, his rising career was dealt a blow with the diagnosis of retinitis pigmentosa, an eye disease that eventually left him without sight. Nonetheless in the 1980s he spearheaded a major research project with Larry Payne and several others on the subject of inverse problems in wave propagation with applications to nondestructive testing.

In 1984 he was invited to Taiwan to plan the building of a new Institute of Applied Mechanics at the National Taiwan University (NTU). In 1989–1994 he was director of this new research institute that is now a leader in engineering mechanics education in Asia.

In 1998 he retired from NTU and in 2000 became professor emeritus at Cornell. He finished his career in China as a

professor at Zhejiang University. In his later years he was a senior statesman of applied mechanics, working to build bridges between researchers in Taiwan and mainland Chinese universities.

Pao's main research interest was the dynamics of solid materials, especially wave propagation, ultrasonics, non-destructive testing, and the mechanics of structures in electromagnetic fields. His multidisciplinary research on waves in trusses and frames, begun in the late 1990s, might be called "waves in complex continuous systems." He and his students took the classical problem of steady vibration of trusses and frames and addressed the difficult analysis of wave propagation in the transient regime.

During his career he was a consultant to the Rand Corporation and collaborated with C-C Mow. He was also a visiting professor at Princeton and Stanford, the Technische Hochschule Darmstadt, and Hong Kong University of Science and Technology. He served on the US National Committee on Theoretical and Applied Mechanics (1980–1984) and the NRC Panel for Manufacturing Engineering (1980–1983). And from 1992 to 1995 he was president of the Chinese Society of Theoretical and Applied Mechanics, Taipei.

Yih-Hsing Pao was the author or coauthor of more than 100 papers in different fields, published in internationally renowned journals, and he was invited to publish a number of comprehensive review articles. His pioneering 1973 monograph *Diffraction of Elastic Waves and Dynamic Stress Concentrations* (coauthored with Mow; Crane, Russak & Co.) extended the ideas of static stress concentrations in solid elastic materials into the dynamic regime. His 1977 article "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.; Shaker Verlag GmbH, 2000).

In 2010 his former students and colleagues organized a tribute to him in Taipei. A list of his research papers as well as

the invited papers at the conference were published under the title *From Waves in Complex Systems to Dynamics of Generalized Continua* (ed. K. Hutter, T-T Wu, and Y-C Shu; World Scientific, 2011).

Pao's leadership was recognized with his elections to the National Academy of Engineering in 1985 and the Academia Sinica (Taipei) in 1986. He also received the Humboldt Foundation's Senior Scientist Award, and an honorary doctorate from National Chiao Tung University (Hsinchu City).

That Pao kept up his spirit and very active intellectual engagement in the face of his eye disease is absolutely amazing and deserves our highest respect and admiration. He not only followed research at the cutting edge but also inspired and took part in research. Even when he was completely blind he presented at conferences with a well-organized lecture, guiding the audience through densely filled transparencies prepared by one of his aides.

At Cornell Pao was known as a strong personality who often expressed his views forcefully and always with a view toward the future. But during T&AM's weekly lunches at Johnny's Big Red Grill in Collegetown, he would often lead a discussion about where mechanics research was going or what role mechanics should play in teaching in the College of Engineering.

He 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 in new directions.

Yih-Hsing Pao is survived by his wife, Amelia Pao, now living in Taipei; their children Winston, May, and Sophie; and his brother, Yih-Ho Pao (NAE 2000). The Pao brothers are one of very few brother pairs elected to the National Academy of Engineering.

