FEATURE

Accomplished Chinese Americans

Professor Yuan-Cheng Fung

Multi-disciplined Discoveries in Aeroelasticity and Biomechanics

As related by George Wan

Born: 15 September 1919 in China
Came to the U.S.: January 1946
U.S. Citizenship: March 15,1957

Bachelor of Science, (1941)
Master of Science, (1943)
National Central University, at a wartime site in China

Doctor of Philosophy, (1948) California Institute of Technology

Researcher, Chengdu Aeronautical Research Institute (1943-5)

Assistant, Researcher, Assistant, Associate and Full Professor, California Institute of Technology (1946-1966)

Professor to Professor Emeritus, University of California at San Diego (1966 - present)

Major Honors:

• Dr. Fung was the first and only engineer to receive the National Medal of Science (2000), and one of few to be elected a member of the National Academy of Science (1992), National Academy of Engineering (1979) and Institute of Medicine (1991).

• The Founder's Award from the National Academy of Engineering (1998);

• Bioengineering Award from Japan Society of Mechanical Engineering (1995);

• The Distinguished Alumnus Award from California Institute of Technology (1994);

• Timoshenko Medal (1991); the Melville Medal (1994);

• The Borelli Award from the American Society of Biomechanics (1992).

His research brought the fields of aerodynamics and structures together into a new field, aeroelasticity; and he published one of the first two textbooks on the subject.

1. Fung, Y.C., An Introduction to the Theory of Aeroelasticity. New York; John Wiley and Sons, 1955, Revised Dover Publication, New York, 1969 and 1993;

2. Fung, Y.C., Foundation of Solid Mechanics, Englewood Cliffs, NJ: Prentice Hall, 1965.

Prof Feng was born in Yuhong, Changzhou, Jiangsu Province. He went to elementary school in Yuhong, junior high first at the No 4 school in Beijing, then at the junior middle school in Changzhou. He attended the senior middle school in Suzhou. This year, the Suzhou Senior Middle School is celebrating its

85th anniversary of the modernized Institution. His childhood years were filled with wars. His college years were spent during the war against Japanese invasion in China. Despite of all this, he still had a pretty good education. He graduated from the National Central University with a Master degree in aeronautics {1943), Then worked for two years at the Chinese Bureau of Aeronautical Research in Chengdu. He worked under Director Wang Tsu. Mr. Wang led him to the U.S. Prof Fung said:

"When I graduated from the National Central University in China with a master's degree in 1943, I went to work at the Chinese Bureau of Aeronautical Research in Chengdu, China, where Tsu Wang was the Director. On the wall of his office there was a picture of him with Mr. Boeing [The Founder of the Boeing Co.]. I learned that he and Mr. Boeing were fellow students at MIT. He joined Boeing in Buffalo, New York" ... soon we moved to Seattle. "Wang was a real taskmaster. He insisted that we engineers work with our product in sight. So he designed our offices as cubicles on an open floor surrounding the workshop. ...Wang wrote the aircraft design manual for China. He assigned me the job to study the tail design. I read as much as possible about gusts, hurricanes, clear air turbulence, pilot maneuvers, combats, stunts, Laplace transforms, nonstationary aerodynamics, etc. .I did my best, and realized that there is much to learn. Tsu wang agreed with me, and encouraged me to go to Caltech. That period shaped my life..."

During World War II, (1944) a team of American professors led by Prof. Ernie Sechler visited Chungking, in Sichuan province, China, the provisional National Capital of China at the time and offered scholarship to help Chinese students come to study in the United States. A year later, the minister of education received the written promises for graduate scholarships from the U.S. colleges and universities and held nationwide examinations to choose the prospective recipients. Professor Fung was thrilled to earn the California Institute of Technology (Caltech or CIT) award and came to the United States. But when he showed up at the office of Professor Ernie Sechler at Caltech in January, 1946. He was told that he came two years too late. The scholarship had been given to someone else. Luckily, Professor Sechier was kind enough to take him in as a laboratory assistant. He earned a Ph.D. in both aeronautics and mathematics at Caltech in 1948. His early research was on the dynamics of the airplane in turbulent weather. He combined the study of aerodynamics and structures into one study, and called it the theory of aeroelasticity. Later, he focused on aircraft and spaceship safety, performance and design.

In 1958, he took a sabbatical leave from Caltech with the Guggenheim Fellowship and went to Germany. He became interested in the mechanics of the eye because his mother was suffering from glaucoma. He translated medical articles, and sent them to her doctor. He noticed that these articles avoided mechanics. Gradually, he became convinced that the understanding of the function of human bodies could be improved if the roles played by forces and motions, stress and strain were analyzed as thoroughly as we have done for airplanes. Upon returning to Caltech, he began to work on blood cells, blood vessels and microcirculation. The Fung's tunnel theory of smallest blood vessels was formulated. Thus, Prof Fung opened up a brand new field, Biomechanics, in which principles of engineering mechanics was, for the first time, rigorously applied to human organs and tissue of the medical science.

In 1965, he published a paper to theorize that if we know the structure and mechanical properties of the materials for a living organ, then by the principles of the physics, we should be able to predict the functions of that organ. The relationship between Professor Fung and biomechanics became very intense. He had to leave Caltech and moved in 1966 to the University of California at San Diego to initiate a program in Bioengineering. He started this program with his colleagues Ben Zweifach and

Marcos Intaglietta. The program offered B.S., M.S., and Ph. D. degrees. For his pioneering work. Prof Fung have been recognized as the Father of Bioengineering.

He also decided to clarify the mystery of blood circulation in the lung and formulated the sheet-flow theory. His team (Fung, Zweifach and Intaglietta) finished the first round of the lung work in 12 years. They worked on experimental details, design and construction of new instruments, testing, theorizing and calculating. They found new things frequently and published about 100 papers on the subject of lung. For example, (1) Y.C. Fung, B.W. Zweifach, and M. Intaglietta, Elastic Environment of the Capillary Bed. Circ. Res. 19:441-461, 1966 and (2) Y.C. Fung, A Theory of Elasticity of the Lung, J. Appl. Mech,41E:8-14, March 1974)).

Following the lung work, the Fung team looked into the heart, the intestines, the ureter, tissue remodeling under stress, the problem of high blood pressures etc. (Fung, Y.C. Stress-Strain History relations of Soft Tissues in Simple Elongation. Publications include: In Biomechanics: Its Foundations and Objectives, Edited by Y.C. Fung, Englewood Cliffs, NJ: Prentice-Hall, 1971, Chapter, 7. 181-208). Fung, Y.C, Shu Qian Liu, Wei Huang and others. Change of Residual Strains in arteries due to Hypertrophy caused by Aortic Constriction, Cir Res. 65; 1340-1349,1989. Fung, YC, Stress, Strain, Growth, and Remodeling of Living Organisms, Z. Angew, Math. Phys. (Special issue) 46, S469-S482 (1995).

Professor Fung is a man full of curiosity. With his discipline in engineering, he tries to understand everything he studies and enthusiastically helps other people study with him. After studying, exploring and enjoying over a half century. Professor Fung still encourages us to be a pioneer in the field of bioengineering and to make new, exciting discoveries. He is convinced that the sum total of the team effort will definitely improve individual health personally and benefit mankind as a whole.

[George Chee-Chun Wan] is EDA/IT support manager of Wireless Analog Technology Center of Texas Instruments, a leader in DSP and Analog semiconductors. He is currently a member of TI EDA Execution Team and also focuses on mixed signal SOC methodology development and deployment. Since 1993, he has been actively involved in the community activities and efforts to promote Chinese/Asian in the American society. He is a member of the OCA (Organization of Chinese Americans) BAC (Business Advisory Council) representing Texas Instruments, and is actively involved in the CIE (Chinese Institute of Engineers). He pioneers the effort to organize CIE Asian American Engineer of the Year Award banquet in conjunction with the National Engineers Week Program to recognize distinguished Asian American scientists and engineers. He has worked with Dallas Fort Worth volunteers to organize DFW-Asian American Citizen Council to promote and assist Asian involvement in social political and civic endeavors.

In 1973 He graduated from Electronics Department of the [Chung-Yuan] Christian University in Taiwan, and earned his Master degree from the joint program of the University of Texas at Arlington and Southwest Medical Center in 1980. He also received a Master of Engineering degree from the University of Texas at Arlington in 1982.