Shiro Tani

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1907-1990

By Yasuo Mori

ITIRO TANI, researcher in fluid dynamics and aeronautics, died on May 28, 1990, at the age of eighty-three.

Elected foreign associate of the National Academy of Engineering in February 1979, Dr. Tani was a world-famous scientist known for dedicating his time and effort to the study of fundamental phenomena in his field.

During his career, which extended over six decades, Dr. Tani published more than one hundred scientific papers and ten books. In particular, he made substantial, pioneering contributions to the theory of the boundary layer and its applications. He worked at the University of Tokyo, in teaching and research, for thirty-eight years. He was invited, as a distinguished scholar, to universities and research institutions throughout the world and presented invited lectures in international conferences.

Dr. Tani received his B.S. at the University of Tokyo in 1930 and was appointed lecturer in the Department of Aeronautics at the University of Tokyo. He immediately reported on two studies on ground effect and wall interference in wind-tunnel testing—this research was carried out at the university's Aeronautical Research Institute. In 1932 he was appointed assistant professor in the Department of Aeronautics and the institute. In 1943 he became professor and was awarded the doctor of engineering degree for his important thesis on the theory of laminar-boundary-layer airfoils.

The mathematical theory of the fluid boundary layer had been first reported by Professor L. Prandtl of Göttingen in the early 1900s, but at first it was not fully understood by most fluid-dynamic experts. Dr. Tani was introduced to this theory in the early 1930s; he grew extremely interested in the subject and began to concentrate his efforts on it. In 1939 and 1940 he published papers on laminar-boundary-layer separation and on the transition from laminar to turbulent flow in boundary layers.

In the late 1930s he focused his attention on the development of airfoils with small friction drag, known since that time as laminar-boundary-layer airfoils. These airfoils are shaped so as to maintain laminar flow in their boundary layer as extensively as possible. In the 1930s, when high-speed computers were not yet available, Dr. Tani reported pioneering methods for calculating the aerodynamic performance of airfoils and wings, and further, he wrote a famous paper on the design of shapes for which transition from laminar- to turbulent-boundary-layer flow is substantially delayed. These highly original papers were published in reports of the Aeronautical Research Institute, as were the results of his research on permissible surface roughness in the laminar boundary layers. These reports were published between 1939 and 1943, during the Second World War.

Following the war Dr. Tani's papers on laminar-flow airfoils represented a great, worldwide academic contribution in the progress of fundamental fluid mechanics. It may be emphasized that his work on laminar boundary layers and airfoil design, extended to compressible-fluid flow, has been instrumental in the development of modern airfoils for jet aircraft. Still in a day when high-speed computers were unavailable, he continued his efforts in the theoretical solution of laminar-boundary-layer problems and, in parallel, the problem of boundary-layer transition induced by two-dimensional and isolated roughness elements, streamwise vortices, steps, grooves, and unsteady conditions.

In the 1960s he became interested in the turbulent boundary layer, and wrote extensively on turbulent shear flow, the response of turbulent boundary layers to sudden perturbations, and the response of a turbulent shear flow to a stepwise change of wall roughness.

Examples of his contributions outside the realm of boundary layers are those concerning magnetohydrodynamics and, remarkably, the aerodynamics of ski jumps. In the former category he studied steady flow of electrically conductive fluids in channels under transverse magnetic fields with consideration of the Hall effect. In the latter category, he treated ski jump dynamics from the airfoil-theory standpoint and arrived at desirable ski jump configurations.

Throughout his career as a scientist and as a member of the Japanese Academy, Dr. Tani received many prestigious awards, both in Japan and internationally. He received the Toyo Rayon Science and Technology Award in 1966, and in 1968 the Japanese Academy honored him with the Japan Academy Prize, which is considered to be Japan's most honorable distinction. He was given the Second Class Order of the Rising Sun in 1977 by the Japanese government, was made a foreign member of the Indian Academy of Science in 1987, and was awarded the Premio Marco Polo Prize in Italy in 1979 and the Ludwig Prandtl Award in Germany in 1988.

Dr. Tani's dedication, insight, and expertise have not only set a standard to be emulated by research workers around the world, but have also furthered the science of fluid mechanics in general and our understanding of the phenomena of the boundary layer in particular.