

Personal Report  
**Professor Ryozo Echigo**



Professor Echigo was born on January 5, 1937. He received his B. Eng. degree (1960) and M. Eng. degree (1962) in mechanical engineering, both from Tokyo Institute of Technology. After one year as a staff member at the Tokyo Institute of Technology, he enrolled in the University of Tokyo, and received his D. Eng. degree in the field of radiative heat transfer in 1966. He was subsequently appointed as an assistant professor at Kyushu University, advanced to an associate professor, and in 1977, became a full professor. In 1981, he renewed his long-standing relationship with the Department of Mechanical Engineering at the Tokyo Institute of Technology. He has also been an adjunct professor of Kyoto University since 1996. In 1997, he was made Professor Emeritus at the Tokyo Institute of Technology, and simultaneously joined the Shibaura Institute of Technology, located in the heart of Tokyo. He also served as Vice President of the Shibaura Institute of Technology from 2001 to 2003.

Internationally, Professor Echigo served as an associate editor of the International Journal of Heat and Mass Transfer between 1982 and 1992, and as an executive committee member of the International Centre for Heat and Mass Transfer in 1986. Domestically, he was

the chairman of the Thermal Engineering Division of the Japan Society of Mechanical Engineers in 1991, President of the Heat Transfer Society of Japan in 1996, and Vice President of the Japan Society of Energy and Resources from 1997 to 2001. Between 1978 and 1996, he played a key role in steering research on the effective use of energy under a Grant-in-Aid from the then Ministry of Education, Science, Sports, and Culture.

Professor Echigo has studied a wide range of topics relating to thermal engineering, with a special emphasis on thermal radiation and its application to the enhancement of heat transfer and combustion. A considerable amount of his effort has been devoted to the clarification of fundamental thermal phenomena as well as the development of novel energy-saving technologies.

Fortunately, at the start of his professional research career, Professor Echigo, like Professor Masaru Hirata, was supervised by Professor Niichi Nishiwaki at the University of Tokyo; although Professor Nishiwaki often appeared strict, the overall situation offered to the doctoral course students was ideal, even when compared with those in more advanced countries at that time. His three-year experience in the Nishiwaki Laboratory was formative for Professor Echigo's attitude toward

research and education. It is interesting to note that his first paper, coauthored with Professor Nishiwaki in 1964, concerned the measurement of force acting on oars in rowing eights. This is because Professor Nishiwaki, whose interests were far-reaching, supported the Japanese rowing team prior to the Tokyo Olympics in 1964. As is evident from these facts, Professor Echigo's research career started in the well-organized Nishiwaki Laboratory in the time of rapid growth of the Japanese economy.

After Professor Echigo moved to the Department of Nuclear Engineering at Kyushu University, his interest was directed at heat transfer by gas–solid suspension flow under high-temperature or high-heat-flux conditions. He collaborated with Professor Shu Hasegawa and conducted difficult measurements using a large-scale experimental facility specially designed for gaseous suspensions. A series of theoretical studies on radiative heat transfer by a flowing multiphase medium was published as three consecutive papers in *International Journal of Heat and Mass Transfer* from 1972 to 1973. These marked a major milestone in his research career because of the subsequent impact of the first and second oil crises and the environmental issues. Prior to the publication of these papers, the stay in Professor Wen-Jei Yang's Laboratory at the University of Michigan from September 1969 to October 1970 as a visiting scholar was a wonderful and memorable experience for Professor Echigo.

During the transition periods from the Department of Nuclear Engineering to the Department of the Mechanical Engineering, both in Kyushu University, and also from Kyushu University to the Tokyo Institute of Technology, Professor Echigo proposed an effective energy conversion method between gas enthalpy and thermal radiation using porous media. This concept originated in and was further simplified from his former studies on gaseous suspensions, because he had introduced porous media fixed in channels or ducts instead of flowing solid particles. The paper in which the concept was first proposed received an award from the Japan Society of Mechanical Engineers in 1984, and provided numerous seeds for later applications to energy saving.

As mentioned earlier, the Department of Mechanical Engineering at the Tokyo Institute of Technology invited Professor Echigo to join them in 1981; this was 18 years after he had left the Institute. His period of 16 years as a professor at the Tokyo Institute of Technology was, without doubt, the golden era for both Professor Echigo and the Institute. Professor Yasuo Mori and Professor Echigo served as Editor and Associate Editor of the *International Journal of Heat and Mass*

*Transfer*, respectively. In addition to them, Professor Naotsugu Isshiki, Professor Kozo Katayama, Professor Wataru Nakayama, Professor Yasuo Kurosaki, Professor Akio Saito, and Professor Kunio Hijikata, to name a few, raised the Department of Mechanical Engineering at the Tokyo Institute of Technology to a status as one of the world's centres of excellence in heat transfer research. In such a stimulating environment, Professor Echigo enthusiastically developed heat-transfer enhancement as well as combustion on the basis of his aforementioned energy conversion method. Simultaneously, he warmly nurtured many students, particularly those coming from abroad. Although in those days Professor Echigo was extremely busy with many administrative tasks, it cannot be forgotten that he often took time to demonstrate detailed derivations of governing equations to individual students.

One of the outstanding features of Professor Echigo is his continuing and deep interest in thermodynamics. About 10 years ago, he undertook to clarify the fundamental characteristics of the Joule–Thomson effect using a molecular dynamics simulation; although this study has not yet been completed, he still entertains the hope of controlling the inversion temperature by artificially manipulating the structure of molecules. More basically, he is currently involved in reexamining the principles originally given by Carnot, Kelvin, Clausius, Gibbs, Maxwell and Boltzmann. He is scrutinizing them without being obscured by conventional viewpoints. As a typical outcome, he proposed a new cycle that includes isothermal processes for gas turbines. His new concepts have frequently aroused creative controversy in the annual symposiums of various societies, and as a vigorous discussant he has stimulated many young scientists as well as senior professors.

Under the leadership of Professor Echigo, numerous professors and doctors have come into their own. In chronological order, they are Professor Koichi Ichimiya at Yamanashi University, Professor Kouichi Kamiuto at Oita University, Professor Kenji Fukuda at Kyushu University, Professor Kuniyasu Kanemaru at Nagasaki University, Professor Akihiko Shimizu at Kyushu University, Dr. Toshiro Ando at JAERI, Dr. Masato Akiba at JAERI, Dr. Izumi Kinoshita at CRIEPI, Professor Yasuyuki Takata at Kyushu University, Professor Yoshio Yoshizawa at the Tokyo Institute of Technology, Professor Xuezhong Tang in China, Professor Toshio Tomimura at Kyushu University, Professor Hideo Yoshida at Kyoto University, Professor Katsunori Hanamura at Tokyo Institute of Technology, Dr. Jae-Ho Yun in Korea, Professor Jugjai Sumrerng in Thailand, Professor Ken-ichi P. Kobayashi at Meiji University, Dr. Shigeru Tada at the

Tokyo Institute of Technology, Professor Masaaki Okuyama at Yamagata University, Dr. Tomoyuki Sugiyama at JAERI, Dr. Angel M. Bethancourt in Panama, Dr. Jürgen G. Hoffmann in Germany, Dr. Vladimir V. Martynenko in Belarus, and Dr. Cho-Young Han in Korea.

On behalf of his many students, colleagues and friends, I wish him many more productive years, continued good health, and happiness.

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