BIOGRAPHY OF TSUYOSHI ANDO

Tsuyoshi Ando was born on February 1, 1932 and he grew up in Saporo, the provincial capital of the northern island Hokkaido in Japan. His father was a middle-ranking city official. Tsuyoshi has two elder brothers.

The second world war broke out when he was in elementary school. In the spring of 1945, after finishing the first year of a junior high school, he entered a military cadet school in Sendai with the hope of becoming a military officer in the Imperial Japanese Army. After half a year, however, Japan surrendered to the allied nations, and he returned to the junior high school. At that time Japan was in great confusion.

He entered Hokkaido University, which was transformed from an old imperial university into an American style university. His primary interest was in physical science. But just when he was about to decide his major, *Hideki Yukawa* won the Nobel prize for physics as the first Japanese Nobel Laureate, and that created a boom in physicics among university students. Many wanted to choose physics as their major. Ando did not wish to be swept away by a populaer trend so he chose mathematics. Among the few who chose mathematics was Dr. Tetsuya Shimogaki, who was destined to make important contributions to the interpolation theory and passed away at the young age of 39, in the year 1970. The Department of Mathematics in 1950 had four chairs: algebra, real analysis, complex analysis and geometry. But when Ando chose mathematics as his major, the department was in chaos because professors were at odds with each other. Many faculty members left the department and Dr. Akitsugu Kawaguchi was the only remaining full professor. Kawaguchi was a famous geometer, but was sick and could deliver only 3 or 4 lectures a year. Other mathematics courses were taught by visiting professors.

When Ando was a junior, Hidegoro Nakano was invited from the University of Tokyo to be a full professor for the chair of real and functional analysis. Ando was attracted to the lectures of Nakano, and after receiving a B.S. degree, he together with Shimogaki entered the newly opened graduate school and began to study functional analysis under Nakano.

Professor Nakano had at that time already made significant contributions in the abstract treatment of measure theory in regard to vector lattices. During the most difficult years of wartime he had successfully completed three volumes of measure theory (in Japanese) and was devoting himself to an axiomatic treatment of spaces of Orlicz type, which he named "modulared semi-ordered linear spaces".

Ando's lifelong interest in order structure is a reflection of the influence of Nakano. But, he said, yet he could have little personal contact with the professor because of Nakano's aristocratism. Ando seemed to be significantly influenced, however, by Dr. Amemiya, at that time a young lecturer. He frecalls that Dr. Amemiya appeared to have a vacant look to his eyes, but his ability to grasp the essence of mathematical problems and to discover astounding solutions was truly amazing.

In his year of graduate school Ando together with Shimogaki read the famous book of S. Banach "Thorie des oprations linaires" and later the newly published volume of Nakano "Semi-ordered linear spaces". He was very impressed by the original ideas of Nakano. He says, however, that it is quite regrettable that Professor Nakano used his original notations in all of books, which prevented the writings as widely accepted in mathematics world as they should have been.

As his own field of research Ando took up the problem of investigating aspects of Perron-Frobenius and Krein-Rutman theory in regard to order complete Banach lattices. In 1958 he was awarded Ph.D. in Science for his thesis entitled "Positive linear operators in semi-ordered linear spaces". Because he was the first doctorate in the new system of graduate study, many news papers acknowledged his accomplishment.

Subsequently Ando was awarded a junior academic position at the Division of Applied Mathematics in the Research Institute of Applied Electricity of Hokkaido University. At that times this institute consisted of several divisions; electronics, physics, chemistry, physiology and mathematics, and have been developing researches of interdisciplinary character.

In this setting Ando sought to do research into a direction deviated from the ever far established theory of Nakano. His first important contribution concerned with finitely additive measures. This was an extension of the theorem of Nikodym on equicontinuity of countably additive measures. He showed that the Yosida-Hewitt decomposition is continuous with respect to sequential convergence. Then he turned his attention to the study of predual characterization in the theory of ordered Banach spaces. One of his most significant contributions, known sometimes as a Krein-Ando theorem, gives predual characterization for lattice property of the dual space in terms of "Riesz interpolation property".

During this same period he started investigation of Hilbert space operators. His interest was in the theory of unitary dilation, discovered by the famous Hungarian mathematician, B. Sz.-Nagy. In this theory there remained open a problem as to whether a pair of commuting contractions admits a pair of commuting unitary dilations. Ando solved this problem affirmatively. This result was refined by several mathematicians in a form of the "commutant lifting theorem", which is now a key tool in the mathematical theory of linear system theory.

Ando made another important discovery with I. Amemiya. They settled that when T_i $(i = 1, 2, \ldots, N)$ are positive contractions, any products $T_{i_1} T_{i_2} \ldots T_{i_n}$ converges weakly as $n \to \infty$, where i_n are chosen randomly from $\{1, 2, \ldots, N\}$. This result is now recognized as one of the mathematical basis of computer tomography.

To distinguish metric difference between Hilbert space L^2 and other classical Banach lattices L^p $(p \neq 2)$, Ando proved that any contractive linear projection in L^p $(p \neq 2)$ is essentially a conditional expectation operator. This work was connected with his later metric characterization of L^p spaces.

He acknowledges that this mathematical ability is not so muchin developing a large theory but rather in solving special problems by original ideas. But in the later years of his career he together with F. Kubo, a research associate, developed a theory of operator means, which is based on a deep analysis of the Loewner theory of operator monotone functions. The theory of operator means has a strong connection with realization of resistive linear electrical networks. An initial concept of this theory, he said, originated from his joint research on operator ranges with K. Nishio, a research associate. In connection with this theory he established many operator inequalities, including the concavity theorem of Dyson-Yanase. Having published such inequalities in a journal of matrix theory, he has been recognized as a matrix expert among matrix theorists.

On several occasions Ando resided abroad and has established a large circle of colleagues in the field of mathematical research. In early 1960's he spent a year with Professor W.A.J. Luxemburg and A.C. Zaanen at the California Institute of Technology. In the late 1960's he worked with Professor H.H. Schaefer at the University of Tübingen in Germany. In the middle 1970's he worked with Professor B.Sz.-Nagy at the Szeged University in Hungary.

In 1969 Ando was promoted to full professor as a division chief of the interdisciplinary institute, he has been interested in systems and networks from the standpoint of operator means and inequalities. From the analytic standpoint he has been involved in Toeplitz and Hankel operators. His work in analytic direction is now being developed by his former students, T. Nakazi and K. Takahashi.

For more than twenty years Ando has been running a functional analysis seminar and inspiring students and young colleagues. He himself has been a frequent speaker, presenting new ideas and introducing new results. Among his former students and research associates are M. Takaguchi, K. Nishio, T. Nakazi, M. Uchiyama, K. Okubo, F. Kubo, F. Hiai and others, who are now active mathematicians in their respective fields.

Ando has been a member of the faculty of the graduate school of mathematicians of the university, and is indeed an inspiring educator. He has presented a one semester special course every other year. Surprisingly he focused on a different topic every course, ranging from general operator theory, operator algebra, Hankel operators, Krein spaces, de Branges spaces, etc. Apparently he prepared his lectures so well that despite the complexity of the subject his lectures were always clear and instructive. He says "I could have been a lecturer like I. Schur". Most of his lectures have been published in the form of lecture notes from the institute.

Since 1988 Ando has been the director of the research institute. Japanese universities are now under severe pressure to reform. Research institutes have particularly been requested to reform. As the institute director, he has devoted a great amount time to designing the future of the institute. From the academic year of 1992 his institute has changed its name to the Research Institute for Electronic Science, and its Division of Applied Mathematics is now known as the Laboratory of Information Mathematics. He is still serving as the director of the new research institute.

Although Ando has precious little time for research these years, he is still very active in mathematics. He is on the editorial board of five international journals, and in 1991 he organized the International Workshop on Operator Theory and Complex Analysis in Sapporo.

Takahiko Nakazi