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ON THE OCCASION OF THE SEVENTIETH BIRTHDAY OF PROFESSOR JIANG LISHANG

Professor Jiang Lishang

Professor Jiang Lishang was born in Shanghai in October 1935 in a family migrated from Suzhou. He graduated from Department of Mathematics, Beijing University in 1954, and then began his teaching career at Beijing Aviation College. In the spring of 1957, he returned to Beijing University to study partial differential equations as a graduate student of Professor Zhou Yulin. He graduated in 1961 and began his teaching career at Beijing University. He later taught in Suzhou University and now is teaching at Tongji University. Between 1989 and 1996, he was the president of Suzhou University. From 2001 to 2005, he was the chairman of Shanghai Mathematical Society.

In his more than 50 years' research and teaching career, Professor Jiang has many great achievements.

In the early 1960s, Professor Jiang published a series of papers on the two-phase Stefan problem. He solved the existence of a global classical solution and the infinite differentiability of the free boundary. This result predated similar researches in other countries by 13 years. This achievement has been widely recognized as a ground breaking and pioneering work in the research of the free boundary and has exerted huge influence on the later development of the field. Since then his research results have been frequently quoted and played a fundamental role in many publications. After 1982, his collaboration with A. Friedman led to the solution of the Stefan-Signorini problem theoretically. They thoroughly investigated the structure of the solution and introduced a new way to study the control problem related to the free boundaries. On the study of the Masket problem, Professor Jiang introduced a new unknown function similar to the "saturation" which satisfies a quasi-linear hyperbolic equation from a viewpoint of Senior Engineer Chen Zhongxiang. He transferred the interface of the two replacing and replaced fluids (free boundary) into an equivalent system of "shock wave", so that he obtained the weak formula and the numerical method of Masket problem successfully. This work also started a series of follow-up researches. These outstanding works have established Professor Jiang's important position in the research of free boundary. In 1991, the project "Free Boundary Problem" led by him won the third prize of the National Natural Science Award of China.

Besides free boundary, Professor Jiang also contributed to the understanding of quasi-linear degenerate elliptic and parabolic equations (systems). In this area, he extended famous Keldysh's paper to the quasi-linear case, in which degeneration was caused by vanishing of the solutions. Under the complete natural conditions, he obtained the uniqueness of the solution and the optimal estimates. These results, as part of the project "quasi-linear degenerate elliptic and parabolic equations (systems)" had been awarded the second prize of the 1986 Science and Technology Progress by the State Education Commission in China.

Between 1979 and 1982, Professor Jiang concentrated on the research of the finite element method. He collaborated with Professor Lin Qun and gave a variational difference algorithm of a 4th order elliptic equation, independent of the related works from overseas. This result revealed the variational structure of a difference scheme of the bi-harmonic operator. They also proved the convergence of the variational difference algorithm of the ordinary Navier-Stokes equation. Professor Jiang's book "Fundamental Theory of Finite Element" was awarded the first prize of 1987 "Distinguished Teaching Book" by the State Education Commission.

Professor Jiang Lishang's contribution to sciences also lies in his great efforts on the application of the mathematics to the real physical and economic worlds. Over the decades, he has not only advocated loudly but also practiced rigorously on these applications. His research on applied mathematics extended across a great range of fields

such as petroleum exploration, water conservancy, mechanics, masteries, electricity and finance.

From 1963 to 1976, Professor Jiang went to Daqing Oil Field many times. He collaborated with Senior Engineer Chen Zhongxiang in inducing an exact solution in closed form of double-porosity, double-permeability system, which gave a theoretical foundation to the analysis of porosity stratum in wellbore hydraulics. This solution also has been widely used in the estimation of underground water resources. This work won the first prize of the 1980 award for "Distinguished Science and Technology Accomplishment" from the State Energy Commission. As a part of the project "2 phase & double permeability fluids through porous media", it also won the third prize of the 1982 National Natural Science Award. The book "Mathematical Theory in Well-test Analysis" written by Chen Zhongxiang and Professor Jiang had been recommended to be published in a serial books of "Petrol Exploration".

He joined the analysis of the rock stress of weak interlayer in the design of Gezhou Dam, where, with his colleagues, he established a model, did its theoretical research and studied the convergence of numerical algorithms. A numerical program from these algorithms had been widely used in water conservancy. This work had been awarded by National Science and Technology Progress in 1985.

On the research of superconductivity, joined with his colleagues, Professor Jiang investigated the layer style superconductivity and derived formula for layer electrical current, from which, they had built a model of a sandwich "superconductivity - normal - superconductivity".

After 1996, in spite of being over 60, he is still active in his research and leads his research team into a complete new and very demanded area - financial mathematics. With his strong expertise of partial differential equation and free boundary, he has pioneered a new path to do research in this area and has obtained many outstanding results. Using PDEs, he and his colleagues have solved many problems for option pricing, especially on BTM of many American-style options. They proved convergence with the error estimates under the PDE framework. Moreover, with his colleagues, he solved the problem of rebuilding an implied volatility from market option data in a stable framework, and solved this inverse problem theoretically with a well-posed algorithm, which can be also applied in practice. Therefore, under Brownian motion, a new method of measuring underling asset from the information of the option markets has been found. This result is expected to be important in practical applications. Now he and his team are working on the frontier of the financial world - risk analysis. His monograph "Mathematical Modeling of Option Pricing" was the first book which uses PDE of viewpoints to explain the theory of Black-Scholes option pricing. Since its publication both in Chinese and English, it has been widely used.

In his long teaching career, Professor Jiang has worked hard on training his students. His book "Teaching Note of Mathematical Physics Equations" has been highly used and was awarded in 1991 the first prize of "Distinguished Teaching Book" from the

State Education Commission. After many revisions and perfections, this book has been chosen as textbook by many colleges, and had been recommended to be college mathematical teaching material of "Facing 21 Century". Professor Jiang has supervised more than 40 doctoral and master level graduate students. He has paid great attention to the development of PDE research and has made many efforts to nurture young scientists. Now, his students are everywhere in the world. Many young outstanding mathematicians in partial differential equations have benefited from his teaching. His comprehensive understanding and devotion have influenced his students profoundly.

Professor Jiang Lishang was chief editor of Journal of Partial Differential Equation for 15 years. He made a great effort in the development of this journal. Through the excellent works of him and his colleagues, this journal is playing a more and more important role in the research on partial differential equations in China.

In 2005, Professor Jiang Lishang has been awarded the prize for life achievement - "HUA LOU-KENG Mathematics Award" from Chinese Mathematical Society.

Here, we sincerely send our best wishes to our dear Professor Jiang Lishang for his continuous leadership and his health!

Jin Liang and Lihe Wang on behalf of Professor Jiang's students.

List of Publications of Professor Jiang Lishang Papers

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