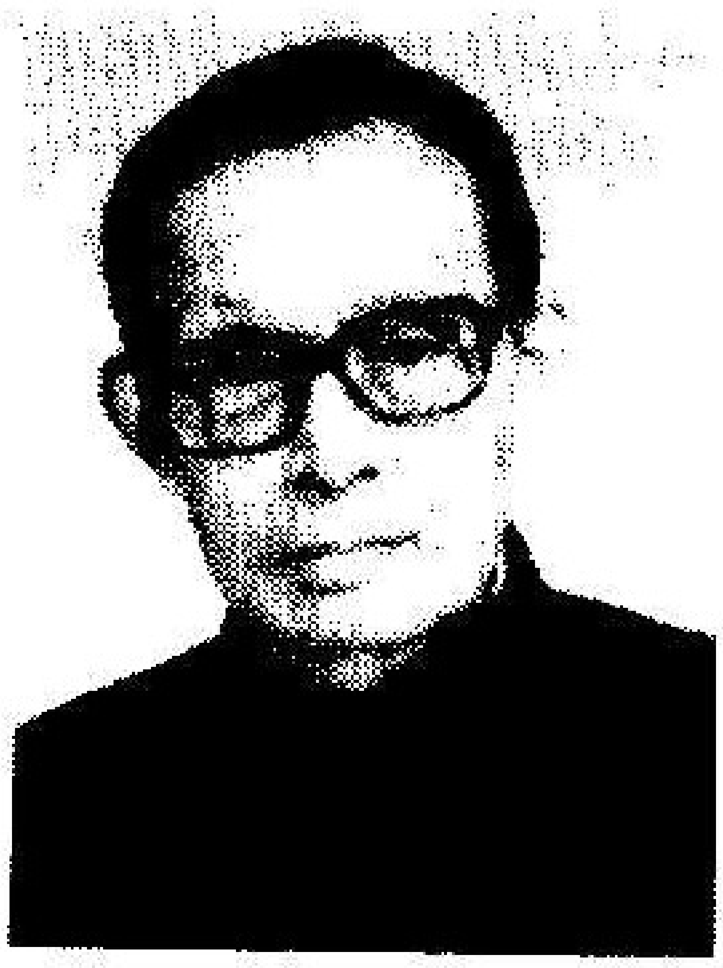
Journal of Computational Mathematics, Vol.11, No.2, 1993, 99–102.

HAPPY BIRTHDAY, PROFESSOR ZHOU YU-LIN!



February 12, 1993 is the 70th birthday of Professor Zhou Yu-lin, an outstanding mathematician, Member of the Chinese Academy of Sciences. We extend here our sincere congratulations to him.

Professor Zhou Yu-lin was born is Shanghai, with the ancestral home in Zhenhai, Zhejiang Province. As early as he studied in middle school, he had favored mathematics, especially plane geometry, and discovered the recurrence theorems. The simplest case of these results was published (in Chinese) on Bulletin of Mathematics later. This preliminary showed his talent in mathematics. In September, 1941, he entered the Department of Mathematics at Datong University in Shanghai, where he received his B.S.degree in 1945. Besides his major subjects, he studied all the courses on physics (theory and experiments); all these played an important role in his later remarkable achievements in partial differential equations and computational mathematics, etc.

Since 1946, he had been working for the Institute of Mathematics in the Chinese Central Academy of Sciences in Nanking, the Department of Mathematics at Tsinghua University in Beijing and the Department of Mathematics and Mechanics at Peking University, one after another. During this period, he had the opportunity to do some research work on manifold and topology under the guidance of Professor S.S.Chern.

From 1954 to 1957 he was a postgraduate student of the Department of Mathematics at Moscow University in U.S.S.R., to study the theory of partial differential equations, under the supervision of Professor O.A. Oleinik. He received a Candidate doctor's degree of physical and mathematical sciences there in 1957.

From August 1957 Professor Zhou worked in the Department of Mathematics and Mechanics at Peking University, where he was a associate director of the Teaching and Research Section of Partial Differential Equation. Later he served as a deputy director of the Institute of Applied Physics and Computational Mathematics.

Professor Zhou started his academic career from studying combinatorial topology in the late 40's. In 1957, he gave a course on nonlinear elliptic and parabolic equations at Peking University, organized seminars, taught the method of *a priori* estimates and researched the basic framework of nonlinear problems. This is a landmark in the PDE research in China. Professor Zhou is a pioneer and founder of the research on nonlinear partial differential equations, especially nonlinear elliptic and parabolic equations in our country.

His main work in the 50's can be classified into the following three aspects:

1) His joint work with O. A. Oleinik and A. C. Kalashnikov on porous media equation[3], which was considered to be the foundation work on quasilinear degenerate parabolic equations. For a long time large amount of research work in this field has been conducted within the framework of this paper all around the world.

2) His research work on the existence of global solutions of Neumann boundary value problems for quasilinear parabolic equations of second order, which is the main part of his dissertation[4]. Professor Zhou creatively chose a proper research framework-the Rothe's method, in this dissertation, where he ingeneously gave a method of *a priori* estimates for the derivatives of solutions and constructed the auxiliary functions featuring the nature of the problem. By this way, he successfully proved the existence of the global solution. This paper is still referenced frequently by the researchers studying the boundary value problems for nonlinear parabolic equations, at home and abroad.

3) His research work extends the classical results about the linear degenerate elliptic equations of second order in plane obtained by U.S.S.R. mathematician M.V.Keldish to quasilinear equations[6]. The condition on the nonlinear terms assumed in[6] is natural and nearly sharp. This work has greatly influenced the PDE researchers in China and a quite lot of new results have been obtained since then.

Since late 70's, Professor Zhou has done a lot of excellent research work on nonlinear evolution equations and systems, including equations of nonlinear Schrödinger type, Sine-Gordon type, Korteweg-de Vries type, Sobolev-Gal'pern type, pseudo-hyperbolic and nonlinear wave systems, the water wave equations of Benjamin-One type and Joseph type, and their generalizations; and various kinds of coupled systems, etc. He has studied the global existence, uniqueness, blow up, asymptotic behavior, etc. of solutions for these equations and systems. The said results especially the various results about global solutions for strongly degenerate and strongly coupled nonlinear systems of ferro-magnetic chain (Landau-Lifshitz type) are highly valued at home and abroad.

Finite difference methods are of universal applicability to the numerical computations for all types of nonlinear partial differential equations. Professor Zhou established the interpolation relations between the classes of discrete functions in the sense of norms, studied the finite difference schemes for various nonlinear evolution partial differential equations and, for many commonly used difference schemes, studied their basic properties such as the relative and absolute convergence and stability. It is Professor Zhou who makes the theoretical study of finite difference method form a new direction. These results are included in one of his monographs[17].

To meet the demands of large-scale scientific computations, Professor Zhou analysed the mechanism of the accumulation process of round-off errors, deduced the compatible relations between the main performance indicators such as speed, memory and word length, etc., thus provided a basis for efficiently designing and using supercomputers.

Since 1960, Professor Zhou studied systematically the numerical methods for one- and two-dimensional fluid dynamics and some physical equations, from theoretical analysis to mechanical and physical images. By way of analysing in detail the interaction of waves in the motion of fluids and the structure of the solutions for Riemann problem, he developed and enriched R.Courant's and K.O.Friedrichs's original results (for detail, see [18]). During the same period, he also proposed many concrete computational methods of practical values.

Since 1978, Professor Zhou has been a vice president, the president of the Chinese Society of Computational Mathematics, an advisor of Chinese Society of Computational Physics, associate editor in chief or executive editor or advisor of "Journal of Computational Mathematics", "Mathematica Numerica Sinica", "Journal on Numerical Methods and Computer Applications", "Chinese Journal of Numerical Mathematics and Applications", "Annual of Mathematics" and "Partial Differential Equations" etc. Professor Zhou is also a professor at Peking University, Tsinghua University, Xiaman University, and an honorary professor at Henan University and Yunnan University.

Professor Zhou's research results about the theory and numerical solutions of nonlinear partial differential equations are widely concerned and appreciated abroad. Owing to his academic achievement and leadership, his name was included in "Men and Women in the World", compiled by Cambridge International Biography Center. In addition he was invited to be one of its editors of the book Vol.8 (1990).

As a main researcher, Professor Zhou was awarded the first class prize of National Natural Science Prizes in 1982, an outstanding prize of National Science and Technology Progress Prizes in 1985 and the third class prize of National Natural Science Prizes in 1987.

Professor Zhou has long been working in the Department of Mathematics at Peking University and Institute of Applied Physics and Computational Mathematics, where he directed and trained many qualified scientific researchers, many of them are now noted scholars and academic leaders in universities and institutes. In a word, Professor Zhou has made great contributions to the development of the mathematical science in our country.

In moral character, Professor Zhou is a man of integrity, amiable and easy to approach, meticulous in scholarship, bold in making innovations and never satisfied with what has been done.

Now in spite of his old age, Professor Zhou is still working hard to make new achievements, to train young professionals. We whole-heartedly wish him good health and a long life, and much more achievements.

The Editorial Committees of
Journal of Computational Mathematics
Mathematica Numerica Sinica
Journal on Numerical Methods and Computer Applications
Chinese Journal of Numerical Mathematics and Applications

List of Main Publications

[1] (with S.S.Chern) On the Orientability of Differentiable Manifolds, *Science Reports, Tsinghua Univ.*, **5** (1948), 1-5.

[2] Pseudomanifold and Manifold Homotopy Groups, *J. Chin. Math. Soc.*, (N.S.), **1** (1951), 164-206.

[3] (with O.A. Oleĭnik, A.C. Kalašnikov) Cauchy Problem and Boundary Problems for Equations of Unstational Filtration Type, *Izv. Akad. Nauk SSSR*, ser. mat. **22** (1958), 667-704. (in Russian).

[4] Boundary Problems for Nonlinear Parabolic Equations, *Mat. Sb.*, **47** (89) (1959), 431-484. (in Russian).

[5] Some Problems for Nonlinear Equations Elliptic and Parabolic Types, *Science Record (N.S.)*, **3** (1959), 538-543. (in Russian); *Science Record* (Chin. ser.) *(N.S.)*, **3** (1959), 433-437. (in Chinese).

[6] Selected Lectures on Theory of Nonlinear Elliptic and Parabolic Equations, Peking Univ., Department of Mechanics and Mathematics, Lecture Notes for Special Courses in Partial Differential Equations. (1959), pp. 1-194. (in Chinese).

[7] (with Sun Hesheng) On a limiting Case for Imbedding Theorem of Sobolev's Spaces, *J. Wuhan Univ.* (Natural Sciences), (1980), No.2, 1-8. (in Chinese).

[8] (with Li Deyuan) Some Problems for Numerical Methods of Unsteady Fluid Dynamics, *Advances in Math.*, **10** (1981) 48-56; (continued) 131-143. (in Chinese).

[9] Boundary Value Problems for Some Nonlinear Evolutional Systems of Partial Differential Equations, *Lecture Notes in Num. Appl. Anal.*, **5** (1982), 435-457. Nonlinear PDE in Applied Science, US-Japan Seminar, Tokyo, 1982.

[10] (with Fu Hongyuan) Higher-Order Nonlinear Hyperbolic Systems of Generalized Sine-Gordon Type, *Acta Math. Sinica*, **26** (1983), 234-249. (in Chinese).

[11] (with Guo Boling) The Periodic Boundary Problems and the Initial Value Problems for the System of the Generalized Korteweg-de Vries Type of High Order, *Acta Math. Sinica*, **27** (1984), 154-176. (in Chinese).

[12] Interpolation Formulas of Intermediate Quotients for Discrete Functions with Several Indices, *J. Comput. Math.*, **2** (1984), 376-381.

[13] Initial Value Problems for Nonlinear Degenerate Systems of Filtration Type, *Chin. Ann. of Math.*, **5 B** (4) (1984), 633-652.

[14] Finite Difference Method of First Boundary Problem for Quasilinear Parabolic Sytstems, *Scientia Sinica* (ser. A), **28** (1985), 368-385; *Scientia Sinica* (ser. A) (Chin. ser.) (1985), 206-220. (in Chinese).

[15] (with Guo Boling) Weak Solution of System of Ferro-Magnetic Chain with Several Variables, *Scientia Sinica* (ser. A), **30** (1987), 1251-1266; *Scientia Sinica* (ser. A) (Chin. ser.) (1986), 337-349. (in Chinese).

[16] (with Guo Boling) Initial Value Problems for a Nonlinear Singular Integral-Differential Equation of Deep Water, *Proc. of Symposium PDE*, Tianjin, 1986, pp. 278-290.

[17] Applications of Discrete Functional Analysis to Finite Difference Method, International Academic Publishers, Beijing, China, 1990, pp. 1-260.

[18] One Dimentional Unsteady Fluid Mechanics, Sciencs, Beijing, China, 1990, pp. 1-419. (in Chinese).

[19] Matching Relations of Computers with Byte-Decimal Notation of Words for Scientific Computations, *Chin. J. of Num. Math. & Appl.*, **12** (1990), 83-94.

[20] (with Guo Boling, Tan Shaobin) Existence and Uniqueness of Smooth Solution of System of Ferro-Magnetic Chain, Scientia Sinica (ser. A) 34 (1991), 257-266.