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ON THE OCCASION OF THE SEVENTIETH BIRTHDAY OF PROFESSOR GUO BOLING

Professor Guo Boling

Resume of Professor Guo Boling

Professor Boling Guo, Academician of Chinese Academy of Sciences, born on October 23, 1936, in Longyan, Fujian, China, is now working in Beijing Institute of Applied Physics and Computational Mathematics (IAPCM).

After four years' studies, he graduated from the department of mathematics, Fudan University in September, 1958. He was an assistant professor of this department after his graduation until January, 1963 when he joined the institute which he is now working in. He was first an assistant professor from February, 1963, to October, 1982, in

IAPCM, then an associate professor from December, 1982, to October, 1987, and finally a professor from October, 1987 up to now. Professor Guo began to supervise Ph.D students in 1990.

From 1989 to 1995, he was a member of the mathematical division, appraising committee of the National Natural Scientific Foundation Committee of China. He was also the director of the Nonlinear Center, IAPCM, from 1994 to 1998 and now the vice director of the academic committee of this center. From 1988 to 1996, he was one of the councilors of the Chinese Mathematical Society. He was also the standing councilor and then vice chairman of Beijing Mathematical Society from 1994 to 2000.

In November, 2001, professor Guo was elected to be an Academician of Chinese Academy of Sciences. Up to now he has published over 300 research papers and seven books.

Scientific Achievements

Professor Guo has made great contributions in his research fields, nonlinear evolutionary equations and their numerical solutions, solitons and infinite dimensional dynamical systems.

He has made systematical and deep studies for some important nonlinear evolutionary equations arising from mechanics and physics, including the global existence, uniqueness, regularity, asymptotic behavior and blow-up phenomenon. Such results have formed an integrated theoretical system as included in his books.

Infinite Dimensional Dynamical Systems

The first aspect of his researches is the studies on a series important dynamical systems of infinite dimensions. His contributions in this field are the theories to establish existences of global attractors, inertial manifolds and approximate inertial manifolds, fine estimate for their fractal dimensions. He created a new method to prove the existence of strong and compact attractors. Then he used discrete and numerical methods to make theoretical analysis and simulations and showed us the figures of the constructions of the attractors.

New Explorations on the Theory of Infinite Dimensional Dynamical Systems and New Results on Approximate Integrable Infinite Dimensional Dynamical Systems

For the nonlinear quintic Ginzburg-Landau equations, Guo transformed them into finite dimensional problem by spatial discretion and then proved that this problem admits discrete attractors. Then he considered the constructions of the steady state solutions, slow time periodic solutions and heteroclinic orbits. Combining the theory and method of finite dimensional dynamical systems with numerical simulations, he obtained the constructions and fractal dimension (less than 4) of the attractors and showed us the figures of the process how the system becomes chaos and finally goes into turbulence. This was viewed a new exploration to understand the fine constructions of the global attractors which will give us many enlightenments to study other equations.

Since 1999, Professor Guo has been paid much attention to the studies on approximate integrable dissipative systems and Hamitonian dynamical systems. In this aspect, by the theories of soliton, singular perturbations, Fenichel fibre and Melinkov function, he proved the invariance of homoclinic orbit for the cubic-quintic nonlinear Schrödinger equations with small dissipative. At the same time, he obtained the existence of Smale Saddle. Now he is using this method to the studies of Hamitonian systems with small perturbations.

All of above works have got high appraising by mathematicians. They think that these works are important lasting contributions to the theory of infinite dimensional dynamical systems and produce important international influences.

Landau-Lifshitz Equations

On the other hand, his works on Landau-Lifshitz equations may be viewed as one of his most important contributions. As it is well known, this equation was first suggested by Landau and Lifshitz in 1935 to describe the non-equilibrium motion of magnetizations. The systematically mathematical studies on Landau-Lifshitz equations are duo to professor Guo. Since 1982, Guo and Zhou began their researches on this equation. In 1986, Guo and Zhou obtained the global existence of weak solutions to multidimensional LL equation, 6 years earlier than the similar results appeared in abroad in 1992. In 1991, Guo, Zhou and Tan established the existence and uniqueness of smooth solution to 1-dimensional LL equations. The uniqueness problem, as we know, was a long time unsolved challenging question. Another important progress in this field is the discovery that the LL equation with Gilbert damping has intrinsic relations with harmonic map and harmonic map heat flow, this was first observed by Guo and Hong in 1993. They also proved for 2D problem that LL equation admits a Chen-Struwe like solution which was name for a work by Chen and Struwe for harmonic map heat flow. Such solution is unique and smooth away from finitely many singularities. This discovery stimulated many succeed studies on LL equations and provided us a basic physical background for harmonic maps. It was just this reason that now LL equation is called LL flow, a new flow for harmonic maps. Further progresses were made in recent years. In 1996 and 1998, it was proved that weak solution with finite energy is unique and smooth away from finitely many singularities for 2-D problem which is similar to Freire's work (1995) on harmonic map heat flow. In 1998, for LL equation with Gilbert damping, Guo obtained the long time behavior and proved the global existence of attractor. For Landau-Lifshitz-Maxwell system from 1-dimension to 3-dimensions, he not only proved the existence of generalized solutions and smooth solutions, but also obtained the existence of global attractors by multi-parameter Lyapnov functionals, and made fine estimates for the dimensions of attractors which shows that under certain conditions, the fractal dimensions are less than 2. Recently, Guo proved the partial regularities for high dimensional problems and constructed blow-up solutions to multidimensional LL equations without damping.

Now, it is commonly believed that it is due to Guo's discovery of the relationships between LL and harmonic maps that makes the researches on Landau-Lifshitz equations break a new path. His works are creative, initiative, integrated and systematical and have been cited by many mathematicians.

Books

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Awards

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[2] Global solutions and numerical analysis for some nonlinear evolutionary equations in Plasma, Progress of Science and Technology First Class Prize, National Defense Scientific and Industrial Committee, 1994, No.1;
[3] Theoretical Studies and Applications of Infinite Dimensional Dynamical Systems, Progress of Science and Technology First Class Prize, National Defense Scientific and Industrial Committee, 1998, No.1.

Ding Shijin, Miao Changxing, Tan Shaobin, Wang Baoxiang

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