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PREFACE

This issue of Discrete and Continuous Dynamical Systems–Series B, is dedicated to our professor and friend, Qishao Lu, on the occasion of his 70th birthday and in honor of his important and fundamental contributions to the fields of applied mathematics, theoretical mechanics and computational neurodynamics. His pleasant personality and ready helpfulness have won our hearts as his admirers, students, and friends.

Qishao Lu was born in Shaoguan City, Guangdong Province, China on June 13, 1940. He graduated from the Beijing University of Aeronautics and Astronautics (BUAA) in aerodynamics in 1960, since then he had worked in his mother university as lecturer, associate professor and full professor. In the first three years of 1980s, he visited the Department of Mathematics of Purdue University as a visiting professor. After his return in 1983, Qishao founded the Center for Nonlinear Dynamics and

organized related seminars in BUAA. Some famous mathematicians were invited to deliver lectures there in late 1980s, including L. Cesari, J. E. Marsden, M. Golubitsky, W. F. Langford and Shui-Nee Chow etc., and a close academic bridge was built between BUAA and the outside world. From then on he has established extensive collaboration in research work with more well-known mathematicians, physicists and scholars in China and other countries. He holds a number of visiting positions in universities and institutes of United States, United Kingdom, Russia, Canada, Germany and other countries or regions. He was the Chair of the Department of Applied Mathematics and the Director of the Center for Nonlinear Dynamics of BUAA, and served as the chair (or co-chair) of organizing committees for more than ten international conferences.

Qishao Lu has been one of the most productive and distinguished scientists in BUAA over a period of fifty years. His research work covers a wide range of subjects on nonlinear ordinary and partial differential equations, dynamical systems, as well as applications in theoretical physics, mechanics, biology and engineering. He has provided a number of effective mathematical techniques for the study of stability, bifurcation and chaos in higher dimensional nonlinear systems, time-delay systems and non-smooth systems, which are also successfully applied to mathematical modeling, theoretical analysis and numerical simulations in structural vibrations, rotor dynamics, ecological control, etc. In recent ten years, he dedicated himself to the study of neurodynamics, in which the complex dynamic behaviors and mechanisms of biological neuronal firing activities and network features were investigated by the bifurcation theory, multi-scale dynamics analysis and complex networks as well as numerical simulations. These results have been published in over three hundred research papers in national and international journals and six monographs and books. He has also served on several editorial boards of national and international journals.

Qishao Lu has won several prestigious prizes during his scientific career, including the first place of China Aerospace Science and Technology Award in 1995, the first place of Tianjin Natural Science Award in 2002, the second place of China National Natural Science Award in 2003 and others. He was elected BUAA Distinguished Professor in 2007 and is Honorary Professors of several universities in China, Canada and UK.

Qishao Lu has performed dozens of grants as the primary investigator at the national level, including several key projects from the Natural Science Foundation of China and the Ministry of Science and Technology of China. He has supervised and collaborated with about fifty Ph.D students and postdocs in applied mathematics and mechanics at BUAA. Qishao has deeply influenced many of his students and colleagues in their academic careers. To celebrate his 70th birthday, a symposium on the advances of methods and applications in nonlinear dynamics was held at the South China University of Technology, Guangzhou, China, August 7–9, 2010.

The fifteen papers herein are contributed by some of his admirers, friends and collaborators, who come from many persuasions within the mathematical enterprise. They address and present some of advances with emphasis on newly developed techniques that bear on further progress in nonlinear systems, as well as applications in biology and engineering. These fifteen papers make notable contributions to quite various branches of this field, which include

- for Lagrangian equations and planar Hamiltonian systems, the fundamental ideas of the method of third order approximation are sketched and twist criteria are presented. Examples of stable periodic solutions are illustrated, and some open problems are proposed (J.F. Chu, J.Z. Lei and M.R. Zhang);
- various firing patterns in the Chay neuronal model are classified by the fast-slow dynamical method and the bifurcation analysis. The relationship between the bursting modes and the two-parameter bifurcation structures of the fast subsystem is presented (L.X. Duan, Z.Q. Yang, S.Q. Liu and D.W. Gong);
- global Hopf bifurcation analysis is explored on a six-dimensional FitzHugh-Nagumo neural network with time delay. The existence of local Hopf bifurcations of the system and the explicit formulae which can determine the direction of the bifurcations and the stability of the periodic solutions are obtained by using the normal form method and the center manifold theory (F. Han, B. Zhen, Y. Du, Y.H. Zheng and M. Wiercigroch);
- a 3-D autonomous quadratic system is converted to an extended Lorenz-type system which contains a large class of chaotic dynamical systems. Canonical forms are obtained with the aid of various nonsingular linear transformations and normalization techniques (C.C. Hua, G. Chen, Q.H. Li and J.H. Ge);
- the consensus of discrete-time multi-agent systems with a directed communication topology is cast into the stability of a set of matrices with the same low dimension as that of a single agent. For neurally stable agents, it is shown that there exists an observer-type protocol having a bounded consensus region in the form of an open unit disk (Z.K. Li, Z.S. Duan and G. Chen);
- a three dimensional Ginzburg-Landau type equation is considered. Two families of new traveling wave solutions in term of explicit functions are presented by using the homogeneous balance method, in which one consists of variable-amplitude solutions and the other constant-amplitude solutions (S.J. Lu, C.B. Gan, B.H. Wang, L.N. Qian and M.S. Li);
- the firing properties are introduced for the ink gland motor cells and the ink gland motor cell model. The main results including the underlying dynamical mechanism of the firing behavior, the contribution of the two transient potassium currents and the calcium current, and firing control are presented (X.Y. Meng, Q.B. Ji and J. Rinzel);
- a class of generalized piecewise smooth maps is studied, which is linear at one side and nonlinear with power dependence at the other side. The occurrence conditions are found for border collision bifurcation and smooth fold and flip bifurcation. Different bifurcation scenarios are shown for individual cases (Z.Y. Qin, J.C. Yang, S. Banerjee and G.R. Jiang);
- The reliability of networks of beta-cells coupled by gap junctions or synaptic excitation is investigated. Simulations of the network of beta-cells reveal that increasing noise level decreases the reliability. Reliability will decrease when coupling strength is small and increase when coupling strength is large (J.Y. Wang, J.Z. Su, H.P. Gonzalez and J. Rubin);
- a constraint-stabilized numerical method is presented for the planar rigid multibody system with friction-affected translational joints, in which the sliders and the guides are treated as particles and bilateral constraints. The normal forces of bilateral constraints are expressed by the Lagrange multipliers (Q. Wang, H.L. Peng and F.F. Zhuang);

- the small-world Hodgkin-Huxley neuronal networks are investigated. It is shown that small delays can detriment synchronization in the network due to a dynamic clustering anti-phase synchronization transition, and the fraction of sodium and potassium channels has different impacts on spatiotemporal dynamics of neuronal networks (Q.Y. Wang, X. Shi and G. Chen);
- a p-Laplacian equation with nonlinear boundary condition is considered. Results on the existence of positive solutions are obtained by the sub-supersolution method and Mountain Pass Lemma (Z.D. Yang, J. Mo and S.B. Li);
- the dynamic behavior of a system of two coupled Hindmarsh-Rose neurons is considered. The emerging of periodic patterns is related to topological changes of its underlying bifurcations. A pathway is found from chaotic bursting behavior to regular bursting (F. Zhang, W. Zhang, P. Meng and J. Su);
- a proportionally-fair controller with time delay is presented. The time delay is chosen to be a controllable parameter. The method of multiple scales is employed to obtain the periodic solution arising from the Hopf bifurcation in the congestion control model (S. Zhang and J. Xu);
- a class of nonlinear degenerate elliptic equations under the natural growth is studied. It is proved that each bounded weak solution of A-harmonic type equations belongs to local Holder continuity (S.Z. Zheng, X.L. Zheng and Z. Feng).

As the reader may notice, some of these contributions not only present a number of results, ideas and techniques in physics, applied mathematics and neurodynamics, but also formulate a few open questions which may stimulate further study in these areas. We hope that these works will help the reader to gain an adequate information and impression of the diversity of nonlinear systems and their applications in biology and engineering.

Finally, we would like to express our gratitude to all authors and referees for their critical contributions and valuable assistance. We also wish to thank AIMS, especially the DCDS-B editorial board, for providing us this opportunity to publish this issue to honor Qishao.

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