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PREFACE: DIFFERENTIAL EQUATIONS AND DYNAMICAL SYSTEMS

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This special issue on *Differential Equations and Dynamical Systems* is dedicated to Professor Peter Kloeden on the occasion of his 70th birthday.

Peter Kloeden (born 1949 in Australia) is an outstanding German mathematician who is known for his important fundamental contributions to dynamical systems theory. His research interests cover most areas in dynamical systems (including attractors, chaos, control, fuzzy dynamics, nonautonomous dynamics, numerics, random dynamics, set-valued dynamics, synchronisation, and stability), and its applications to engineering, meteorology, oceanography and biological sciences. Particularly in the fields of metric spaces of fuzzy sets, nonautonomous and random dynamical systems, and of numerical methods for solving stochastic differential equations, he is highly regarded for his influential pioneering work. Peter Kloeden wrote more than 400 research articles and thirteen books, and he has more than 160 co-authors.

Peter Kloeden obtained his BSc degree in Mathematics from the Macquarie University in 1972 and he defended his PhD thesis with the title *On General Semi-Dynamical Systems*, supervised by Rudolf Vyborny, in 1975 at the University of Queensland. In his thesis, he generalised Sharkovsky's theorem to higher-dimensional triangular mappings, and he made early contributions to chaos theory by showing that the set of chaotic mappings is a dense subset in the space of continuous functions. He subsequently made important contributions to quasi-geostrophic

equations used in meteorology, regarding existence and uniqueness of solutions. This research was also influential for numerical practice in meteorology.

In the 1980s and early 1990s, Peter Kloeden worked with Phil Diamond on the fundamental theory of metric spaces of fuzzy sets, which led to several highly-cited papers and a highly-regarded book on the subject, published in 1994. Since the 1980s, he made significant contributions to the development of the theory of random dynamical systems that was initiated by Ludwig Arnold and his Bremen group. In particular, he has recognised the need for numerical tools for investigating random dynamical systems, and together with Eckhard Platen, he wrote a book on numerical methods for solving stochastic differential equations, published by Springer in 1992. This book was the basis for a new research area and substantially influenced many new developments on stochastic systems and its applications to computational finance and other areas. The book continues to be the standard reference for the field and has more than 11,000 citations.

After lecturing twenty years at various Australian institutions (Monash University, Murdoch University, University of Western Australia and Deakin University), Peter Kloeden was appointed in 1997 to the Chair in Applied and Instrumental Mathematics at the Goethe University in Frankfurt (Germany). Around this time, he was one of the first to recognise the importance of nonautonomous dynamical systems and started to work on the theoretical foundations of a nonautonomous dynamical systems theory with both random and topological driving systems. His ideas and numerous papers have been influential for the development of various types of attractors in different settings and their behaviour under discretisation, and its importance for the upcoming nonautonomous bifurcation theory cannot be overstated.

In 2005, Peter Kloeden was awarded the W.T. and Idalia Reid prize by the Society for Industrial and Applied Mathematics (SIAM) for his fundamental contributions to the theoretical and computational analysis of differential equations, and he was elected as a Fellow of SIAM in 2009. He worked until the retirement age of 65 at the Goethe University Frankfurt, and subsequently was awarded a Thousand Talent Award for Foreign Experts that enabled him to continue his career at Huazhong University in Wuhan, where he stayed from 2014 until 2017. He is currently Visiting Professor at the University of Tübingen and as active as ever.

It is quite extraordinary that despite his remarkable scientific productivity, Peter Kloeden has served the mathematical community beyond comparison. He is still Associate Editor of five journals and Co-Editor-in-Chief of Discrete and Continuous Dynamical Systems B, and he has been as Associate Editor for further 15 journals. He has also served as a referee for an almost uncountable number of papers. His passion for mathematics is infinite and it is a pleasure for him to share his ideas with friends and colleagues. He takes great care in communicating mathematics and making his mathematical insights accessible for the community. He has a very friendly personality and a great sense of humour.

The editors and authors of this special issue wish to thank Peter for his friendship, support and his numerous mathematical insights. The papers collected here have been contributed by collaborators, friends and colleagues of Peter who were

influenced by his scientific work. The special issue contains eighteen papers contributed by researchers from China, Czech Republic, Finland, France, Germany, Israel, Japan, Portugal, Russia, Spain, Switzerland, Vietnam, United Kingdom, and the USA.

These papers cover a wide spectrum of important problems and topics of current research interest, including effects of delays in mathematical models of cancer chemotherapy, a sensitivity analysis of the optimal drug dosing algorithm optidose, the robustness of pullback attractors for a nonlocal reaction-diffusion equation under perturbation, instability of mixing in the Kuramoto model, an application of Ito-Follmer calculus to bilinear rough evolution equation, the interval turnpike property for adjoints, local unstable manifolds for stochastic dynamical systems with fractional noise, controlled differential equations as rough integrals, rough Weierstrass functions and the smoothness of the SBR measure, a computer-assisted study of red coral population dynamics, asymptotic decomposition of solutions to parabolic equations with a random microstructure, noise-induced strong stabilization, uniform attractors for a time-dependent damped wave equation with supercritical growth, asymptotic stability and steady states of an oscillating polymerization model, dynamic theory of fluctuations and critical exponents of thermodynamic phase transitions, random attractors of supercritical stochastic wave equations, basic theory of differential equations with fractional substantial derivative in Banach spaces, and turnpike properties of solutions of a differential inclusion with a Lyapunov function.

We feel that this special issue will be highly important for many mathematicians and applied scientists, who are interested in recent developments in dynamical system theory, as well as in its numerous applications.

Happy birthday Peter!

Martin Rasmussen, Simeon Reich and Alexander Zaslavski, Editors

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