

# Preface

This book is dedicated to Dr. C.S. Hsu, emeritus professor of University of California at Berkeley in honor of his 90th birthday in May 2012. In the past 50 years, Professor Hsu has made broad and significant contributions to the theory and practice of nonlinear dynamics. His publications have inspired and influenced many researchers around the world. We have invited a group of active researchers in the area of nonlinear dynamics to contribute chapters to this book. The authors of the chapters present their recent research that has been motivated by the work done by Professor Hsu.

Professor Hsu invented the cell-to-cell mapping method for the global analysis of nonlinear dynamical systems. This method has helped us to better understand the complex behavior of nonlinear dynamical systems including stable and unstable invariant sets, attraction domain, and strange attractors. Chapters 3–6 are devoted to the new developments of the cell mapping method with the help of graph theory and the multiple scale approach. The cell mapping method has also been applied to study control problems. Chapters 1–2 present studies of tuning feedback controls with the help of the cell mapping method, while Chapter 11 is devoted to optimal control problems of nonlinear stochastic systems with the generalized cell mapping method. The generalized cell mapping was extended to the fuzzy dynamical systems in the early 1990s. Chapter 7 presents a bifurcation study of nonlinear dynamical systems with fuzzy parameters or excitations. The set-oriented method represents a significant refinement of the cell mapping method for determining invariant sets and finding zeros of nonlinear vector functions. Chapter 10 presents an excellent study on this topic.

Professor Hsu has also done systematical studies on the Lyapunov stability of continuous structures and the stability of parametric dynamical systems. These studies laid a solid foundation for the subsequent development of the field of nonlinear mechanics and dynamics. Chapter 8 presents a study of stability and responses of nonlinear structures. Chapter 9 presents a comprehensive study of the chaos in parametric nonlinear dynamical systems.

This collection of recent developments in nonlinear dynamical systems brings new and different perspectives and can serve as a good reference to the community of nonlinear dynamics in different disciplines including engineering, applied mathematics, meteorology, life science, computational science, and medicine. It is our intention that this book will stimulate the interests in global analysis of complex and high-dimensional nonlinear dynamical systems, whose global properties are largely unexplored at this time.

Finally, we would like to thank all the chapter contributors and reviewers for their time and effort making this gift to Professor Hsu's 90th birthday under a tight schedule.

Merced, CA, USA  
Edwardsville, IL, USA

Jian-Qiao Sun  
Albert C.J. Luo

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Sun, J.-Q.; Luo, A.C.J. (Eds.)

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