

Preface

This book provides a different view to look at complex dynamics of dynamical systems from the author's research and teaching experience. The author hopes this book can provide a better understanding of complexity and chaos caused by nonlinearity, discontinuity, switching and impulses. The materials in this book are scattered into six chapters plus two appendices.

The stability, stability switching and bifurcation of equilibriums and fixed points for nonlinear continuous and discrete dynamical systems are systemically presented in [Chaps. 1](#) and [2](#), which is different from the traditional presentation. In [Chap. 3](#), the fractal theory based on single and multiple generators with single and multiple measures are discussed, and the fractality of chaos in nonlinear discrete dynamical systems are presented from self-similar geometric structures. In [Chap. 4](#), the Ying–Yang theory of nonlinear discrete dynamical systems is presented for the complete dynamics of discrete dynamical systems. In addition, the companion and synchronization of discrete dynamical systems are discussed to describe dynamical relations between different discrete dynamical systems. In [Chap. 5](#), nonlinear dynamics of switching systems with impulses will be discussed. In [Chap. 6](#), mapping dynamics is presented as an extension of symbolic dynamics to describe periodic flows and chaos in discontinuous dynamical systems. The grazing phenomenon is a key to investigate the strange attractor fragmentation in discontinuous dynamics, which can be easily extended to chaos caused by global transversality in nonlinear continuous dynamical systems. To help one easily read the main body, linear continuous and discrete dynamical systems are discussed in Appendices A and B. The author believes that the presentation arrangement may not always be reasonable. The author sincerely hopes readers point out and criticize for improvement.

Finally, I would like to appreciate my students (Jianzhe Huang, Yu Guo, Yang Wang, Bing Xue) for applying the theories to practical systems and completing numerical computations. Herein, I would like to thank my wife (Sherry X. Huang) and my children (Yanyi Luo, Robin Ruo-Bing Luo and Robert Zong-Yuan Luo) again for tolerance, patience, understanding and support.

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