

Preface

This book collects the recent development on the theory of continuous dynamical systems from a different point of view. From the author's 20 years researches and teaching experience, the author places materials in five chapters to provide a better understanding of stability, stability switching, bifurcation, complexity and chaos in nonlinear continuous dynamical systems. For completeness, the theory for discrete and switching systems with transports is presented in a different volume.

The stability theory of linear continuous dynamical systems is comprehensively discussed in Chapter 1 from the author's teaching experience. The materials presented in this book are a foundation to understand stability and bifurcation theory in nonlinear dynamical systems. In Chapter 2, the author used a different point of view to present the stability, stability switching and bifurcation of equilibriums for nonlinear continuous systems. Such presentation makes the stability and bifurcation theory much simpler, readable and doable. In Chapter 3, an analytical method is presented to obtain the analytical solutions of periodic flows and chaos in nonlinear dynamical systems. The analytical solution of chaos ends the history of chaos numerically simulated only. In Chapter 4, the global transversality of a flow to the generic separatrix in nonlinear dynamical systems is presented, and the theory of global transversality is the base to understand the complexity of flows in nonlinear dynamical systems. How to determine the separatrix and all possible first integral manifolds in n -dimensional dynamical systems is still unsolved. In Chapter 5, chaos in stochastic and resonant layers in nonlinear Hamiltonian systems is discussed. The physical mechanism of chaos in stochastic layers is the resonance interaction to form the hyperbolic characteristics.

Finally, I would like to appreciate my student, Jianzhe Huang for completing numerical computations in Chapter 3. Herein, I thank my wife (Sherry X. Huang) and my children (Yanyi Luo, Robin Ruo-Bing Luo, and Robert Zong-Yuan Luo) for tolerance, patience, understanding and support. I hope this book will be a good gift for them.

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