Preface

This book is about discrete and switching dynamical systems from a different point of view. From the author's 20 year research and teaching experience, the author hopes this book can provide a better understanding of stability, bifurcation, complexity and chaos in discrete and switching dynamical systems. The materials in this book are presented in five chapters. For completeness, the theory for continuous dynamical systems is presented in a different volume.

The stability theory of linear discrete dynamical systems is comprehensively discussed in Chapter 1, which is a base to understand the stability and bifurcation of period-m fixed points in the nonlinear discrete systems. In Chapter 2, the author used a different point of view to present the stability, stability switching and bifurcation of fixed points for nonlinear discrete systems. To understand the complexity in nonlinear discrete dynamical systems, the fractality of chaos caused by period doubling in a 1-dimensional discrete dynamical system is presented first in Chapter 3. How to construct a discrete map is presented through a ball bouncing on a vibrating table. From implicit maps, the negative and positive dynamics of discrete dynamical systems are presented as a simple version of Ying-Yang theory in nonlinear discrete dynamical systems. In Chapter 4, nonlinear dynamics of switching systems is presented, and a linear switching system is discussed for a better understanding of the stability of switching systems with/without transports. In Chapter 5, mapping dynamics of discrete dynamical systems for discontinuous dynamical systems is presented as an extension of symbolic dynamics. The Semi-active MR suspension system is discussed to demonstrate the application of mapping dynamics in discontinuous and switching systems, and the grazing phenomenon is discussed as a key to understand the strange attractor fragmentation in discontinuous dynamics. The author believes such arrangement can help readers understand discrete dynamics and complexity.

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