

Preface

This book is the first book talking about discrete dynamical systems with memory. Such memorized discrete systems extensively exist in bio-systems and financial systems, and economical systems. In addition, time-delay systems can be discretized into the memorized discrete dynamical systems. Further, stability and bifurcations of time-delay dynamical systems can be investigated through the memorized dynamical systems. Currently, one has difficulty to determine periodic motions in time-delay nonlinear systems. Thus, the discretization of time-delay systems can be adopted, and the corresponding memorized discrete systems can be used to investigate periodic motions to chaos in time-delay nonlinear systems. In this book, systematical discussions on stability and bifurcations of memorized nonlinear dynamical systems are first presented, and then discretization methods of time-delay systems are also presented. Periodic motions to chaos in time-delay nonlinear dynamical systems can be investigated through the memorized, nonlinear, discrete systems.

This book consists of five chapters. The first chapter briefly discusses solutions and stability in memorized linear discrete systems. In Chap. 2, stability and bifurcations of fixed points in memorized nonlinear discrete systems are discussed. Discretization methods of time-delay nonlinear systems are presented in Chap. 3. Semi-analytical methods for periodic motions in time-delay nonlinear dynamical systems are presented through the theory of memorized discrete systems in Chap. 4. In Chap. 5, bifurcation trees of periodic motions to chaos in time-delayed Duffing oscillator are discussed through the semi-analytical method. With discrete Fourier series theory, frequency–amplitude curves can be obtained, which can be compared with analytical methods for periodic motions to chaos and motion complexity in time-delay nonlinear systems.

Finally, I would like to thank my student (Siyuan Xing) for computing numerical results. In addition, I would like to thank my family's support for this work. I hope the materials presented herein would last long for science and engineering.

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