

Preface

When we build a mathematical model of a real system we usually assume that we know the exact values of system parameters. However, in practice this assumption is not always satisfied for a variety of reasons, for example, difficulty in obtaining accurate model estimates or time variation of plant parameters. In case of time-invariant linear system to analyze the stability and stabilizability problems ([66]) the matrix theory results are useful ([49], [50]) and concept of interval matrices ([10]) may be applied to deal with uncertainties of the parameters. In case of time-varying systems the role of eigenvalues of matrix coefficients in characterization of system dynamics is played by Lyapunov exponents.

Since the works of A. M. Lyapunov ([57]) and O. Perron ([68], [69]) the theory of Lyapunov exponents has become the subject of intense research, as evidenced by the huge number of papers published on this subject.

This book is devoted to the influence of parametric perturbations and uncertainties on the Lyapunov exponents of discrete linear systems with time-varying coefficients. Different types of perturbations are considered, limited in terms of certain norms, tending to zero in a specified rate. For each of them, we describe their impact on the value of Lyapunov exponents.

There are several monographs devoted in whole or in a large part to the Lyapunov exponents: [5], [7], [14], [47], [58], [63]. Only in the last two, the problem of parametric perturbations is discussed. Both of them deal with continuous-time systems, and in addition, they are available only in Russian.

The purpose of this book is to present the current state of knowledge on the effects of parametric perturbations on the Lyapunov exponents of discrete time-varying linear systems. Our researches are focussed on the greatest and the smallest exponents.

The book is intended primarily for researchers interested in the theory of Lyapunov exponents. It may also be useful for graduate students and students of higher studies.

The book starts with a definition of different types of characteristic exponents and their basic properties. The concept of generalized spectral radius and its role in analysis of the Lyapunov exponents for bounded perturbations is presented in Chapter 2. Chapter 3 deals with perturbations that are arbitrary small in the sense of a norm. To describe the possible changes of Lyapunov exponents, caused by this types of perturbations, the concept of central exponents is introduced. In Chapter 4 we introduce regular coefficients and regular systems. In terms of regular coefficients the perturbations which do not change the spectrum of the system are described. The influence of perturbations tending to zero on Lyapunov exponents is presented in Chapter 5. In Chapter 6 the problem of stability by linear approximation is discussed.

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