

# Preface

Different problems make the study of the so-called Lyapunov-type inequalities of great interest, both in pure and applied mathematics. Although the original historical motivation was the study of the stability properties of Hill's equation, other questions that arise in systems at resonance, crystallography, isoperimetric problems, Rayleigh-type quotients, oscillation and intervals of disconjugacy, etc. lead to the study of this type of inequalities for differential equations. This classical area of mathematics plays a significant role in the current research and remains a source of inspiration to this day.

In this book we examine in a detailed way some of the main aspects of this topic, including the most relevant results obtained by the authors in the last 12 years, as well as many other related results. Obviously, the selection of material is partly conditioned by the interest of the authors.

In our opinion, the contents of the book concerning higher eigenvalues, partial differential equations, and systems of equations are particularly innovative and through the whole monograph, an especial emphasis is done in the variational characterization of the best Lyapunov constants. This unified variational point of view makes possible the study of many cases, featuring a systematic discussion of different types of equations and boundary conditions, both for ordinary and partial differential equations. The applications include nonlinear resonant problems, the study of the stability of linear periodic equations (both for scalar and systems of equations), and the analysis of the sign of the eigenvalues of certain eigenvalue problems.

This work can be considered self-contained, with detailed proofs and a special emphasis on motivation and understanding of the basic ideas. Taking in mind a balanced presentation of both pure and applied aspects, we have tried to write this work in a style accessible to a broad audience, although a great variety of methods from classical analysis, differential equations, and nonlinear functional analysis are used. However, some proofs (especially those referring to the PDE case) are particularly laborious.

The book is addressed to experienced researchers working in the subject and to young researchers who want to start on these topics. The expository content, with

detailed proofs and an appropriate list of references in each chapter, brings the reader quickly to the forefront of research. The volume contains numerous explanatory notes on the showed results and their relation to the existing literature.

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