

# Preface

The following topics of mathematical analysis have been developed in the last fifty years: the theory of linear canonical differential equations with periodic Hamiltonians, the theory of matrix polynomials with selfadjoint coefficients, linear differential and difference equations of higher order with selfadjoint constant coefficients, and algebraic Riccati equations. All of these theories, and others, are based on relatively recent results of linear algebra in spaces with an indefinite inner product, i.e., linear algebra in which the usual positive definite inner product is replaced by an indefinite one. More concisely, we call this subject *indefinite linear algebra*.

This book has the structure of a graduate text in which chapters of advanced linear algebra form the core. The development of our topics follows the lines of a usual linear algebra course. However, chapters giving comprehensive treatments of differential and difference equations, matrix polynomials and Riccati equations are interwoven as the necessary techniques are developed.

The main source of material is our earlier monograph in this field: *Matrices and Indefinite Scalar Products*, [40]. The present book differs in objectives and material. Some chapters have been excluded, others have been added, and exercises have been added to all chapters. An appendix is also included. This may serve as a summary and refresher on standard results as well as a source for some less familiar material from linear algebra with a definite inner product. The theory developed here has become an essential part of linear algebra. This, together with the many significant areas of application, and the accessible style, make this book useful for engineers, scientists and mathematicians alike.

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