

Preface

This book has grown out of more than ten years of teaching an introductory course in system theory, control and identification for students in the areas of Business Mathematics and Computer Science, Econometrics and Mathematics at the ‘Vrije Universiteit’ in Amsterdam. The interests and mathematical background of our students motivated our choice to focus on systems in discrete time only, because the topics can then be studied and understood without preliminary knowledge of (deterministic and stochastic) differential equations. This book requires some preliminary knowledge of calculus, linear algebra, probability and statistics, and some parts use elementary results on Fourier series.

The book treats the standard topics of introductory courses in linear systems and control theory. Deterministic systems are discussed in the first five chapters, with the following main topics: realization theory, observability and controllability, stability and stabilization by feedback, and linear-quadratic optimal control. Stochastic systems are treated in Chapters six to eight, with main topics: realization, filtering and prediction (including the Kalman filter), and linear-quadratic Gaussian optimal control. Chapters nine and ten discuss system identification and modelling from data, and Chapter eleven concludes with a brief overview of further topics.

Exercises form an essential ingredient of any successful course in this area. The exercises are not printed in the book and are instead incorporated on the accompanying CD-Rom. The exercises are of two types, i.e., theory exercises to train mathematical skills in system theory and practical exercises applying system and control methods to data sets that are also included on the CD-Rom. Many exercises require the use of Matlab or a similar software package.

We benefitted greatly from comments of many colleagues who, over the years, participated in teaching from this book. In particular, we mention the contributions of (in alphabetical order) Sanne ter Horst, Rien Kaashoek, Derk Pik and Alistair Vardy. We thank them for their comments, which have improved the text considerably. In addition, many students helped us in improving the text by asking questions and pointing out misprints.