Preface

Markov chains are widely used as stochastic models to study and estimate a broad spectrum of *performance and dependability characteristics*. In this monograph we address the issue of *compositional specification* and analysis of Markov chains. Based on principles known from *process algebra*, we develop an algebra of *Interactive Markov Chains* (IMC) arising as an *orthogonal* extension of both continuous-time Markov chains and process algebra. In this algebra the interrelation of delays and actions is governed by the notion of *maximal progress*: Internal actions are executed without letting time pass, while external actions are potentially delayed. IMC is more than 'yet another' formalism to describe Markov chains. This claim is substantiated by a number of distinguishing results of both theoretical and practical nature. Among others, we develop an *algebraic theory* of IMC, devise *algorithms* to mechanise *compositional aggregation* of IMC, and successfully apply these ingredients to analyse state spaces of several million states, resulting from a study of an ordinary telephone system.

The contents of this monograph is a revised version of my PhD thesis manuscript [96] which I completed in spring 1998 at the University of Erlangen, Germany. I am deeply indebted to Ulrich Herzog and Ed Brinksma for their enthusiastic support when preparing its contents, and when finalising this revision at the University of Twente, The Netherlands.

Many researchers had inspiring influence on this piece, or on myself in a broader context, and I take the opportunity to express my gratitude to all of them. I am particularly happy to acknowledge enjoyable joint research efforts with Christel Baier, Salem Derisavi, Joost-Pieter Katoen, Markus Lohrey, Michael Rettelbach, Marina Ribaudo, William H. Sanders, and Markus Siegle which have led to various cornerstones of this book. Henrik Bohnenkamp, Salem Derisavi, and Marielle Stoelinga read the manuscript carefully enough to spot many flaws, and gave me the chance to iron them out in this monograph. Cordial thanks go to Alfred Hofmann at Springer-Verlag for his support in the process of making the manuscript a part of the LNCS series. And finally, there is Sabine and the tiny crowd. Those who know her are able to assess how perfectly happy I account myself.

June 2002 Holger Hermanns