# Preface

Nowadays system analysis of man-made systems, like computer systems, communication networks, and manufacturing plants, and also of natural systems, like biological or social systems, is often model based. To capture the complexity of real systems stochastic discrete event models are used in many application areas. One of the key aspects in building such models is the adequate description of real processes and event streams in a stochastic model. Often simple distributions are not sufficient for this purpose because observed distributions are multimodal and events are correlated.

One class of stochastic models, which allows one to describe multimodal distributions and correlated event times, are Markov processes with marked transitions. Since Markov processes can be analyzed with numerical methods and with stochastic simulation, they are an ideal candidate to describe event times in stochastic models. However, the big disadvantage of using Markov processes instead of simple distributions or stochastic processes, like autoregressive or moving average time series, is the parameterization effort. Usually, the finding of adequate parameters of a Markov model, to capture some observed behavior, is a non-linear optimization problem with many parameters and non-unique representations of a given stochastic distribution or process. This often prohibits the wider use of those models, in particular in stochastic simulation, and is the reason that only fairly simple phase-type distributions can be found in textbooks on stochastic modeling or simulation.

This books summarizes our work on the parameterization of phase-type distributions and Markovian arrival processes, which are the commonly used model types in modeling event streams. To the best of our knowledge it is the first time that the available methods are collected in a textbook. We hope that this helps to support the use of the mentioned models in stochastic modeling and in particular in stochastic simulation.

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Dortmund, Germany Peter Buchholz
Dortmund, Germany Iryna Felko
Dortmund, Germany Jan Kriege
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