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## Preface

The close connection between automata and logic has ever been a fascinating subject of theoretical computer science. The origins of that area go back to Büchi and Elgot, who showed at the beginning of the 60's that formulas from monadic second-order logic and finite automata have the same expressive power.

Since then, a large amount of research has been accomplished to extend those results to other settings such as infinite words, trees, traces, and grids. The benefits of precise characterizations of state-based, *operational* automata models in terms of *descriptive* logical formalisms are twofold. On the one hand, they allow us to derive algorithmic and logical properties of the model. On the other hand, from a software engineer's perspective, fragments of monadic second-order logic might be used to *specify* the desired system behavior, which is then reflected in an automata implementation.

This book studies the relation between automata and monadic second-order logic. In doing so, it focuses on classes of automata that describe the concurrent behavior of a distributed system. For example, we will bridge the gap between monadic second-order logic and channel systems, which communicate via reliable or faulty fifo ("first-in, first-out") queues. Moreover, we will study systems that synchronize when simultaneously accessing a common device. Due to the complexity of those communication paradigms, the formal treatment of related systems in terms of automata models and equivalent logical formalisms plays an important role in their synthesis and verification.

The reader is assumed to have only some basic knowledge in theoretical computer science (e.g., about finite automata and formal languages) and to be familiar with mathematical terminology and notation. Thus, the book should be accessible to senior undergraduate or graduate students. Please note that any relevant information in conjunction with this book, such as course material, solutions to selected exercises, list of errata, etc., will be provided on its homepage, which is located at

<http://www.lsv.ens-cachan.fr/~bollig/fmcs/>

A large part of this book is based on my Ph.D. thesis “Automata and Logics for Message Sequence Charts”, which I wrote at RWTH Aachen University.

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