

Preface

The study of queuing control began in the 1960s and gave rise to a vast amount of literature. The basic tools of this field were drawn from dynamic programming and the theory of Markov processes. Such issues as the operational characteristics of controlled systems as well as questions of existence of optimal controls and their structural properties were and still are being studied.

The experience of four decades, however, is not encouraging. Most queuing control problems cannot be solved explicitly because of their complexity and enormous computational demands. Queuing control is mathematically more demanding than the analysis of queues, which also reaches its limits when non-Markovian problems are studied.

To overcome analytical difficulties, researchers turned to approximate or heuristic methods. Lately fuzzy logic was employed to problems of queuing control.

This book provides a number of results in queuing control from the point of view of fuzzy logic. Fuzzy control is an effective approach in nonlinear or large-scale systems control, especially when mathematical models are difficult to obtain or do not exist at all. It turns out that fuzzy control is computationally efficient and, in conjunction with analytical results, precise.

A number of control problems will be presented, which were developed by the authors in the past decade. This is the first systematic effort of solving queuing control problems using the tools of fuzzy logic.

The material of this book can be useful to advanced undergraduate and graduate students. Also, researchers and practitioners in the field of queuing control, systems analysis, manufacturing, and communications may benefit from it.

The material is organized into nine chapters. The introductory chapter outlines the book and discusses background. Chapters 2 and 3 provide technical background on fuzzy logic and fuzzy control. Chapters 4–7 cover fuzzy queueing control. These chapters are organized along the lines of problem description, architecture of the fuzzy logic controllers, and numerical examples. Comparisons are provided whenever feasible. Chapter 8 presents applications to the Internet. Chapter 9 concludes with suggestions for further investigations. The Appendix provides a brief introduction to Markov queuing models and simulation, which were used to validate the performance of the fuzzy algorithms. A list of references is given at the end, which is by no means exhaustive.

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