



## METADATA

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### Abstract

In this book we present an introduction to Stochastic Operations Research, a discipline focused on creating mathematical techniques for assessing performance and optimizing systems and processes that operate under uncertainty. Our primary aim is to provide the reader with a thorough understanding of how to apply the fundamental methods of Stochastic Operations Research with precision, as well as to analyze numerous applications, without overwhelming complexity. To achieve this objective, we present the theoretical framework in an exact and concise manner, including assumptions and mathematical results, along with simplified proofs and explanations, without excessive technical details. From a mathematical perspective, the book focuses on two essential methodological tools: Stochastic Processes with Cost Structure and Stochastic Dynamic Programming. Within the first category we analyze some fundamental

models, such as renewal processes and Markovian processes with associated costs. We then extend this framework by introducing decision-making aspects, resulting in the exploration of Stochastic Dynamic Programming and Markov Decision Processes under different optimization criteria. In terms of practical applications, we present an introduction to two core areas: Queueing Theory and Inventory Management. We formulate and analyze problems in these areas utilizing the methods developed in first part. We include an introduction to Queueing Theory, with references to various problem types and an emphasis on modeling and performance assessment. We also consider problems related to the optimal design and dynamic control of service systems. Lastly, we present an introduction to Inventory Management Theory, covering essential concepts and highlighting stochastic models dealing with demand uncertainty.

