

Preface

This book covers the recent developments in modern reliability theory, mainly in such important areas as signatures and multi-state systems and their influence on statistical inference. Research in these areas is growing rapidly due to many successful applications in very diverse problems. As the result, many industries have benefited from adopting the corresponding methods.

These methods have attracted increasing attention in recent years for solving many complex problems which were inspired by nature and technology. New methods have been successfully applied to solving many complex problems where traditional problem-solving methods have failed.

This book presents new theoretical issues that were not previously presented in the literature, as well as the solutions of important practical problems and case studies illustrating the application methodology.

The book provides an overview of the recent developments in the theory of signatures and demonstrates their role in the study of dynamic reliability and nonparametric inference for lifetime distribution of monotone systems. New properties of system signatures (D-spectra) and component importance D-spectra have been investigated. It was demonstrated how component Birnbaum importance measures can be expressed via these spectra and how bounds on lifetime variances for coherent and mixed systems can be found by using signatures. In addition, it was pointed out on the connection between several aspects of probability-signature and structure-signature.

Concerning multi-state system (MSS) reliability, the book introduces a special transform for a discrete-states continuous-time Markov process, so-called L_Z -transform and demonstrates the benefits of its applications. In MSS context, there issues such as practical availability modeling, a case-study for supermarket refrigerating system, finding optimal reserve structure for power generating system, determination of vital activities in reliability program, optimal incomplete maintenance, optimal multi-objective reliability allocation, importance analysis based on multiple-valued logic methods, and optimal replacement and protection strategy were also considered. A separate chapter is devoted to the novel issue of continuous-state system reliability. Absorbing controllable Markov processes were

considered as the models of aging and degradation for some technical and/or biological objects, as well as a semi-Markov model of MSS operation reliability.

The book aims to be repository for modern theoretical methods and their applications in real-world reliability analysis and optimization. Recent advances in statistical inference are presented in this volume by reliability analysis of redundant systems with unimodal hazard rate functions, nonparametric estimation of marginal temporal functionals, frailty models in survival analysis and reliability, goodness of fit tests for reliability modeling and nonparametric estimators of the transition probabilities for three-state Markov model.

All chapters are written by leading experts in the corresponding areas. This book will be useful to postgraduate and doctoral students, researchers, reliability practitioners, engineers and industrial managers with interest in reliability theory and its applications.

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