Preface

Many accidents have happened this year in the whole world: A big earthquake in Japan caused heavy damage to a nuclear power plant. An automobile company that produces a small but important part stopped its operation due to the earthquake. This shut down all automobile companies for several days because of the lack of parts. A free way bridge in the US fell into a river. Most such serious matters might be prevented if practical methods of reliability and maintenance were correctly and effectively used.

I have already published the first monograph *Maintenance Theory of Reliability* [1] that summarizes maintenance policies for system reliability models and the second monograph *Shock and Damage Models in Reliability Theory* [3] that introduces reliability engineers to kinds of damage models and their maintenance policies. Since then, our research group in Nagoya has continued to study reliability and maintenance theoretically and to apply them practically to some actual models. Some useful methods may be applicable to other fields in management science and computer systems.

Reliability becomes of more concerns to engineers and managers engaged in making high quality products, designing reliable systems, and preventing serious accidents. This book deals primarily with a variety of advanced stochastic and probability models related to reliability: Redundancy, maintenance, and partition techniques can improve system reliability, and using these methods, various policies that optimize some appropriate measures of management and computer systems are discussed analytically and numerically.

This book is composed of ten chapters: From the viewpoints of maintenance, we take up maintenance policies for a finite time span in Chap. 4 and replacement policies with continuous and discrete variables in Chap. 8. Furthermore, Chap. 5 has another look at reliability models from the points of forward time to the future and backward time to the past. Next, referring to the classification of redundancy, we summarize the reliability properties of some parallel systems and redundant models of data transmission in Chap. 2, and discuss optimum policies of retries as recovery techniques of computer systems in Chap. 6 and of checkpoint schemes for fault detection database

systems in Chap. 7. Finally, we apply some optimization problems in management science in Chap. 10 by using reliability techniques.

New subjects of study such as traceability, system complexity, service reliability, and entropy model are proposed. A golden ratio for the first time in reliability is presented twice. It is of interest in partition policies that the summation of integers from 1 to N plays an important role in solving optimization problems with discrete variables. In addition, the contrasts with forward and backward times, redundancy and partition, and continuous and discrete variables presented in this book are like a study in opposites. These will be helpful for graduate students and researchers who search for new themes of study in reliability theory, and for reliability engineers who engage in maintenance work. Furthermore, many applications to management science and computer systems are useful for engineers and managers who work in banks, stock companies, and computer industries.

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