

Preface

This book is written for the practicing systems and reliability engineers engaged in designing complex redundant systems. It contains the necessary background material for probability theory and Markov analysis. It also contains an interactive Windows-based computer program suitable for solving small to medium-sized problems. The program is available from the Internet at the Web site location <http://umn.edu/~puk/carms.html>.

Chapter 1 contains an introduction to the field of fault-tolerant systems reliability modeling.

Chapter 2 defines the concept of system and identifies the analysis and modeling framework required to design a fault-tolerant system.

Chapter 3 discusses the foundations of probability theory and needed probability definitions.

Chapter 4 relates the concepts of probabilistic faults and failures to a state-based reliability model.

Chapter 5 reviews the basic probabilistic reliability models, including reliability block diagrams, fault trees, stochastic Petri nets, and Markov models.

Chapter 6 introduces the state-based Markov model through matrix evaluation, a state diagram mapping, and approximate solutions.

Chapter 7 applies the state diagram Markov modeling approach to various nonredundant and redundant hardware configurations to evaluate reliability.

Chapter 8 applies the state diagram Markov modeling approach to various redundant software configurations that can experience failure.

Chapter 9 applies the state diagram Markov modeling approach to combined hardware and software configurations.

Chapter 10 discusses approaches to reducing large and complex Markov models to a manageable size through system state partitioning and mapping.

Chapter 11 applies Markov modeling to the evaluation of maintainability for systems that can undergo failure and repair.

Chapter 12 defines the concepts of availability of systems and the distinction between dynamic and static availability.

Chapter 13 introduces the field of safety analysis.

Chapter 14 details the important factors in Markov model evaluation, in particular computer-aided solutions.

Chapter 15 discusses the current approaches to system effectiveness modeling, including availability, dependability, and capability.

Chapter 16 lists the important support analyses to reliability evaluation, including mission definition, failure mode analysis, and tradeoff evaluation.

Chapter 17 presents an extended system effectiveness evaluation example and other applications.

Chapter 18 gives practical advice for dealing with fault-tolerant system and software design and future directions that implementations will take.

Chapter 19 is the user's guide to the CARMS reliability evaluation program.

Chapter 20 is a model library of common redundant system configurations that can be evaluated through the CARMS program.

Chapter 21 is the reference manual for CARMS, listing all of the commands and keyboard functions.

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