Performance and Reliability Analysis of Computer Systems

(An Example-Based Approach Using the SHARPE Software Package)

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The increasing reliance of today's society on computers makes the field of performance & reliability evaluation of computer systems increasingly important. Mathematical models of computer systems, that are solved either analytically(numerically) or through discrete event simulation, are used to allow system designers to predict system behavior without having to build or measure the actual system. This book deals with the analytic (numerical) evaluation of performance & reliability measures in such models.

Part-I describes several modeling paradigms that are used in modeling computer systems: fault trees, block diagrams, reliability & task graphs, Markov & semi-Markov chains, stochastic Petrinets, *etc*. It gives the input parameter specifications, the output performance, and reliability measures that can be obtained, and solution procedures that are used, for each of these modeling paradigms.

Part-II then solves a series of examples using a software package where these modeling paradigms and solution procedures have been implemented.

The two main distinctive features of this book are:

1. It is one of the first books on reliability that combines basic concepts/algorithms with illustrative examples that are solved using an actual implementation of these algorithms in a software package. I wish that more books, not only in reliability, but in other technical areas too, would follow this style. In the fast-paced industrial world it helps if students come armed not only with the basic algorithms, but also with a tool where these algorithms have been implemented. Access to such a tool enables them to tackle more complex models (that might be more representative of the real world) and have an appreciation for the difficulties involved, rather than just working on toy models due to the restriction of a manual solution procedure. Chapter 13 also gives the limitations and the instabilities in the computational algorithms which arise especially in the reliability context due to the large difference in the time scales of the events (*eg*, failure-times and repair-times of components).

2. The computer-performance modeling community and the computer-dependability modeling community have so far remained segregated. Most people in the computer-performance modeling area evaluate the performance of a computer system (*eg*, average waiting time of a job) assuming that it is *up* all the time. Most people in the computer-dependability modeling area model the computer system as either being *up* or *down*, without any leeway for partial or degraded performance. Recently, the concept of *performability* was introduced to model such partial-performance behavior. Although there have been many journal & conference papers that deal with the concept of *performability*, this is perhaps one of the first books which deals with this concept.

Perhaps the only drawback of this book, which makes it difficult to use as a classroom textbook, is the lack of practice exercises. Practice exercises in part I (Modeling Theory) would have helped to solidify the basic reliability concepts in the minds of the readers. Having exercises in part-II is less crucial, as this part has several examples which are solved in detail using the SHARPE interface and solution procedures; the readers can solve some of the examples on their own to gain familiarity. Hence practitioner & researchers who have already had some grounding in conceptual reliability, will be the main beneficiaries from this work. (Dr. Trivedi recently informed me that he is preparing a manual of exercises for this book.)

— Perwez Shahabuddin
Associate Editor • *IEEE Trans. Reliability*

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Performance and Reliability Analysis of Computer Systems: An Example-Based Approach Using the SHARPE Software Package provides a variety of probabilistic, discrete-state models used to assess the reliability and performance of computer and communication systems. The models included are combinatorial reliability models (reliability block diagrams, fault trees and reliability graphs), directed, acyclic task precedence graphs, Markov and semi-Markov Read More.