Reliability Part C

Part C Reliability Models and Survival Analysis

Part C focuses on reliability models, statistical accelerated testing and survival analysis. The first five chapters in this part emphasize general system modeling while the last four chapters emphasize software systems. The first chapter in this part, Chapt. 19, discusses variations of the statistical survival model and the step-stress accelerated-failure-time model and their important applications to both biomedical and engineering studies, followed by Chapt. 20, which focuses on failure-rate modeling with respect to heterogeneous populations and presents the concepts and properties of mixture failure rates, proportional hazards, additive hazards and accelerated life tests in heterogeneous populations. Chapter 21 provides an overview of various proportional hazard regression (PHR) models, including the stratified Cox model, the Cox model with time-dependent covariates and various hypothesis-testing methods for validating PHR models. Several extended models such as nonproportional random effects are also discussed. Chapter 22 outlines various statistical models for describing lifetime distributions, such as the log-normal and Weibull, with the inclusion of multiple accelerating variables in accelerated-life tests, and discusses some of the potential difficulties of accelerated testing in practice. Chapter 23 details the statistical methods for designing various types of accelerated reliability tests, including constant-stress tests, step-stress tests, and step-stress accelerated degradation tests under harsher environments with multiple-step stress levels.

The next four chapters focus on statistical models in software systems, starting with Chapt. 24, which focuses on aspects of technology evolution for high-assurance systems, including dynamic verification and validation, reliability and security issues, safety assurance, automated dependency analysis, model checking on system specifications and model checking based on test-case generation. Chapter 25 discusses in detail and reviews software reliability growth modeling and optimization problems including software testing effort, growth models, parameter estimation, optimal release policies, and resource allocation, while Chapt. 26 focuses on a software development design-review process based on a quality engineering approach to analyze the relationships among the quality of the design-review activities, including software reliability and human factors in the development process. Chapter 27 discusses a generalized prediction model based on a nonhomogeneous Poisson process framework for evaluating the reliability and its corresponding confidence intervals for software systems in a random field environment.