

PREFACE

The goal of this fourth edition of *Simulation Modeling and Analysis* remains the same as that for the first three editions: to give a comprehensive and state-of-the-art treatment of all the important aspects of a simulation study, including modeling, simulation software, model verification and validation, input modeling, random-number generators, generating random variates and processes, statistical design and analysis of simulation experiments, and to highlight major application areas such as manufacturing. The book strives to motivate intuition about simulation and modeling, as well as to present them in a technically correct yet clear manner. There are many examples and problems throughout, as well as extensive references to the simulation and related literature for further study.

The book can serve as the primary text for a variety of courses, for example

- A first course in simulation at the junior, senior, or beginning-graduate-student level in engineering, manufacturing, business, or computer science (Chaps. 1 through 4 and parts of Chaps. 5 through 9). At the end of such a course, the student will be prepared to carry out complete and effective simulation studies, and to take advanced simulation courses.
- A second course in simulation for graduate students in any of the above disciplines (most of Chaps. 5 through 12). After completing this course, the student should be familiar with the more advanced methodological issues involved in a simulation study, and should be prepared to understand and conduct simulation research.
- An introduction to simulation as part of a general course in operations research or management science (parts of Chaps. 1, 3, 5, 6, and 9).

For instructors who have adopted the book for use in a course, I have made available for download from the website www.mhhe.com/law a variety of teaching support materials. These include a comprehensive set of solutions to the Problems, lecture PowerPoint slides, and all the computer code for the simulation models and random-number generators in Chaps. 1, 2, and 7. Adopting instructors should contact their local McGraw-Hill representative for login identification and a password to gain access to the material on this site; local representatives can be identified by calling 1-800-338-3987 or by using the representative locator at www.mhhe.com.

The book can also serve as a definitive reference for simulation practitioners and researchers. To this end I have included detailed discussion of many practical examples gleaned in part from my own experiences and consulting projects. I have also made major efforts to link subjects to the relevant research literature, both in print and on the Web, and to keep this material up to date.

Prerequisites for understanding the book are knowledge of basic calculus-based probability and statistics (although I give a review of these topics in Chap. 4) and some experience with computing. For Chaps. 1 and 2 the reader should also be familiar with a general-purpose programming language such as C. Occasionally I will also make use of a small amount of linear algebra or matrix theory. More advanced or technically difficult material is located in starred sections or in appendices to chapters. At the beginning of each chapter, I suggest sections for a first reading of that chapter.

I have made numerous changes and additions to (and some deletions from) the third edition of the book to arrive at this fourth edition, but the organization has remained the same, as have the basic outline and the numbering of the chapters. Following current practice in programming languages, I have deleted FORTRAN from Chap. 1, which now contains C. (However, the FORTRAN code remains available for download from www.mhhe.com/law.) Chapter 2 on modeling complex systems has not changed. Chapter 3 has been rewritten to reflect the current state of the art in simulation software. Since Chap. 4 is basic background on probability and statistics, it is largely unchanged. The practice of model validation has improved considerably, and so Chap. 5 has been rewritten and updated to reflect this. For Chap. 6 on input modeling, I have expanded greatly my discussion of how to model a source of system randomness in the absence of corresponding data, and I also discuss current research on a number of other topics. New and greatly improved random-number generators are discussed in Chap. 7, and code is given (and can be downloaded from the website); a more comprehensive discussion of testing random-number generators is also given. I have updated the material in Chap. 8 on variate and process generation, including the introduction of the general-purpose ratio-of-uniforms method for generating random values from continuous and discrete distributions. The statistical design-and-analysis methods of Chaps. 9 through 12 have been expanded and updated extensively to reflect current practice and recent research. In particular, Chap. 9 contains a comprehensive discussion of the latest methods for estimating the steady-state mean of a simulated system, as well as new material on constructing confidence intervals for probabilities and percentiles. The discussion of ranking-and-selection procedures in Chap. 10 has been brought up to date to reflect newer methods that allow common random numbers (CRN) to be used across different system configurations. Chapter 11 gives a more detailed and practical discussion of how to implement the variance-reduction technique CRN in practice. In Chap. 12, I give a much more comprehensive and self-contained discussion of classical design of experiments and response-surface methodology, with a particular discussion of how to implement these techniques in the context of simulation modeling. Several examples of the application of simulation-based optimization are also given. The discussion of simulating manufacturing

systems in Chap. 13 has been brought up to date in terms of the latest simulation-software packages. A CD containing the Student Version of the ExpertFit distribution-fitting software is now included with the book. The references for all the chapters are collected together at the end of the book, to make this material more compact and convenient to the reader; I have also listed with each reference the page number(s) in the book on which each reference item is cited, to aid the reader in identifying potentially helpful links between topics in different parts of the book (and to eliminate the need for a separate author index). A large and thorough subject index enhances the book's value as a reference.

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