

PREFACE

The goal of this fifth edition of *Simulation Modeling and Analysis* remains the same as that for the first four 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 and 13). 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, 9, and 13).

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 number of teaching support materials. These include a comprehensive set of solutions to the Problems 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 a 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 appendixes 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 the fourth edition of the book to arrive at this fifth edition, but the organization has remained mostly the same. I have moved the material on other types of simulation from Chap. 1 to a new Chap. 13, which is discussed below. Chapter 2 on modeling complex systems has been updated to reflect the latest research on efficient event-list management. Chapter 3 has been rewritten and expanded to reflect the current state of the art in simulation software. A common example is now given in three of the leading general-purpose simulation packages. The discussion of confidence intervals and hypothesis tests in Chap. 4 has been greatly enhanced, making the chapter a much more self-contained treatment of the basic probability and statistics needed for the remainder of the book. Chapter 5 makes clearer the distinction between validating and calibrating a model, which is often misunderstood. For Chap. 6 on input modeling, the latest developments in accounting for input-model uncertainty and in modeling arrival processes are discussed. Chapter 7 provides recommendations on the best-available random-number generators. Chapter 8 on generating random variates and processes has only had minor updates. Many of 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 fixed-sample-size and sequential methods for estimating the steady-state mean of a simulated system. The discussion of ranking-and-selection procedures in Chap. 10 has been expanded to include newer and more efficient methods that are not based on the classical indifference-zone approach. Chapter 11 on variance-reduction techniques has only had minor changes. In Chap. 12, I give a much more comprehensive and self-contained discussion of design of experiments and metamodeling, with a particular emphasis on what designs and metamodels to use specifically for simulation modeling. The discussion of simulating manufacturing systems is now in a new Chap. 14, which is available on the book's website www.mhhe.com/law, rather than in the book itself. It has been brought up to date in terms of the latest simulation-software packages and uses of simulation for manufacturing applications. There is a *new* Chap. 13 that discusses agent-based simulation and system dynamics, as well as other types of simulation that were previously discussed in Chap. 1 of the fourth edition. A student version of the ExpertFit distribution-fitting software is now available on the book's website; it can be used to analyze the data sets corresponding to the examples and problems in Chap. 6. 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. A large and thorough subject index enhances the book's value as a reference.

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