Discrete Event Simulation First Course

A unique guide to the design and implementation of simulation software This book offers a concise introduction to the art of building simulation software, collecting the most important concepts and algorithms in one place. Written for both individuals new to the field of modeling and simulation as well as experienced practitioners, this guide explains the design and implementation of simulation software used in the engineering of large systems while presenting the relevant mathematical elements, concept discussions, and code development. The book approaches the topic from the perspective of Zeigler's theory of modeling and simulation, introducing the theory's fundamental concepts and showing how to apply them to engineering problems. Readers will learn five necessary skills for building simulations of complicated systems: Working with fundamental abstractions for simulating dynamic systems Developing basic simulation algorithms for continuous and discrete event models Combining continuous and discrete event simulations into a coherent whole Applying strategies for testing a simulation Understanding the theoretical foundations of the modeling constructs and simulation algorithms The central chapters of the book introduce, explain, and demonstrate the elements of the theory that are most important for building simulation tools. They are bracketed by applications to robotics, control and communications, and electric power systems; these comprehensive examples clearly illustrate how the concepts and algorithms are put to use. Readers will explore the design of object-oriented simulation programs, simulation using multi-core processors, and the integration of simulators into larger software systems. The focus on software makes this book particularly useful for computer science and computer engineering courses in simulation that focus on building simulators. It is indispensable reading for undergraduate and graduate students studying modeling and simulation, as well as for practicing scientists and engineers involved in the development of simulation tools. Operations Research (OR) began as an interdisciplinary activity to solve complex military problems during World War II. Utilizing principles from mathematics, engineering, business, computer science, economics, and statistics, OR has developed into a full fledged academic discipline with practical application in business, industry, government and military. Currently regarded as a body of established mathematical models and methods essential to solving complicated management issues, OR provides quantitative analysis of problems from which managers can make objective decisions. Operations Research and Management Science (OR/MS) methodologies continue to flourish in numerous decision making fields. Featuring a mix of international authors, Operations Research and Management Science Handbook combines OR/MS models, methods, and applications into one comprehensive, yet concise volume. The first resource to reach for when confronting OR/MS difficulties, this text – Provides a single source guide in OR/MS Bridges theory and

practice Covers all topics relevant to OR/MS Offers a quick reference guide for students, researchers and practitioners Contains unified and up-to-date coverage designed and edited with non-experts in mind Discusses software availability for all OR/MS techniques Includes contributions from a mix of domestic and international experts The 26 chapters in the handbook are divided into two parts. Part I contains 14 chapters that cover the fundamental OR/MS models and methods. Each chapter gives an overview of a particular OR/MS model, its solution methods and illustrates successful applications. Part II of the handbook contains 11 chapters discussing the OR/MS applications in specific areas. They include airlines, e-commerce, energy systems, finance, military, production systems, project management, quality control, reliability, supply chain management and water resources. Part II ends with a chapter on the future of OR/MS applications.

An insightful presentation of the key concepts, paradigms, and applications of modeling and simulation Modeling and simulation has become an integral part of research and development across many fields of study, having evolved from a tool to a discipline in less than two decades. Modeling and Simulation Fundamentals offers a comprehensive and authoritative treatment of the topic and includes definitions, paradigms, and applications to equip readers with the skills needed to work successfully as developers and users of modeling and simulation. Featuring contributions written by leading experts in the field, the book's fluid presentation builds from topic to topic and provides the foundation and theoretical underpinnings of modeling and simulation. First, an introduction to the topic is presented, including related terminology, examples of model development, and various domains of modeling and simulation. Subsequent chapters develop the necessary mathematical background needed to understand modeling and simulation topics, model types, and the importance of visualization. In addition, Monte Carlo simulation, continuous simulation, and discrete event simulation are thoroughly discussed, all of which are significant to a complete understanding of modeling and simulation. The book also features chapters that outline sophisticated methodologies, verification and validation, and the importance of interoperability. A related FTP site features color representations of the book's numerous figures. Modeling and Simulation Fundamentals encompasses a comprehensive study of the discipline and is an excellent book for modeling and simulation courses at the upper-undergraduate and graduate levels. It is also a valuable reference for researchers and practitioners in the fields of computational statistics, engineering, and computer science who use statistical modeling techniques.

This book provides an introduction to the cost modeling for electronic systems that is suitable for advanced undergraduate and graduate students in electrical, mechanical and industrial engineering, and professionals involved with electronics technology development and management. This book melds elements of traditional engineering

economics with manufacturing process and life-cycle cost management concepts to form a practical foundation for predicting the cost of electronic products and systems. Various manufacturing cost analysis methods are addressed including: process-flow, parametric, cost of ownership, and activity based costing. The effects of learning curves, data uncertainty, test and rework processes, and defects are considered. Aspects of system sustainment and life-cycle cost modeling including reliability (warranty, burn-in), maintenance (sparing and availability), and obsolescence are treated. Finally, total cost of ownership of systems, return on investment, cost-benefit analysis, and real options analysis are addressed.

Basic approaches to discrete simulation have been process simulation languages (e.g., GPSS) and event-scheduling type (e.g., SIMSCRIPT). The trade-offs are that event-scheduling languages offer more modeling flexibility and process-oriented languages are more intuitive to the user. With these considerations in mind, authors David Elizandro and Hamd Discrete Event Simulation is a process-oriented text/reference that utilizes an eleven-step model to represent the simulation process from problem formulation to implementation and documentation. The book presents the necessary level of detail required to fully develop a model that produces meaningful results and considers the tools necessary to interpret those results. Sufficient background information is provided so that the underlying concepts of simulation are understood. Major topics covered in Discrete Event Simulation include probability and distributional theory, statistical estimation and inference, the generation of random variates, verification and validation techniques, time management methods, experimental design, and programming language considerations. The book also examines distributed simulation and issues related to distributing the physical process over a network of tightly coupled processors. Topics covered in this area include deadlock, synchronization, rollback, event management, and communication processes. Fully worked examples and numerous practical exercises have been drawn from the engineering disciplines and computer science, although they have been structured so that they will be useful as well to other disciplines such as economics, business administration, and management science. The presentation of techniques and methods in Discrete Event Simulation make it an ideal text/reference for all practitioners of discrete event simulation.

From the exciting history of its development in ancient times to the present day, Introduction to Cryptography with Mathematical Foundations and Computer Implementations provides a focused tour of the central concepts of cryptography. Rather than present an encyclopedic treatment of topics in cryptography, it delineates cryptographic concepts in chronological order, developing the mathematics as needed. Written in an engaging yet rigorous style, each chapter introduces important concepts with clear definitions and theorems. Numerous examples explain key points while figures and tables help illustrate more difficult or subtle concepts. Each chapter is punctuated with "Exercises for the

Reader;" complete solutions for these are included in an appendix. Carefully crafted exercise sets are also provided at the end of each chapter, and detailed solutions to most odd-numbered exercises can be found in a designated appendix. The computer implementation section at the end of every chapter guides students through the process of writing their own programs. A supporting website provides an extensive set of sample programs as well as downloadable platform-independent applet pages for some core programs and algorithms. As the reliance on cryptography by business, government, and industry continues and new technologies for transferring data become available, cryptography plays a permanent, important role in day-to-day operations. This self-contained sophomore-level text traces the evolution of the field, from its origins through present-day cryptosystems, including public key cryptography and elliptic curve cryptography.

A practical guide to facilitate statistically well-founded decisions in the management of assets of an electricity grid Effective and economic electric grid asset management and incident management involve many complex decisions on inspection, maintenance, repair and replacement. This timely reference provides statistically well-founded, tried and tested analysis methodologies for improved decision making and asset management strategy for optimum grid reliability and availability. The techniques described are also sufficiently robust to apply to small data sets enabling asset managers to deal with early failures or testing with limited sample sets. The book describes the background, concepts and statistical techniques to evaluate failure distributions, probabilities, remaining lifetime, similarity and compliancy of observed data with specifications, asymptotic behavior of parameter estimators, effectiveness of network configurations and stocks of spare parts. It also shows how the graphical representation and parameter estimation from analysis of data can be made consistent, as well as explaining modern upcoming methodologies such as the Health Index and Risk Index. Key features: Offers hands-on tools and techniques for data analysis, similarity index, failure forecasting, health and risk indices and the resulting maintenance strategies. End-of-chapter problems and solutions to facilitate self-study via a book companion website. The book is essential reading for advanced undergraduate and graduate students in electrical engineering, quality engineers, utilities and industry strategists, transmission and distribution system planners, asset managers and risk managers.

This comprehensive textbook/reference provides an in-depth overview of the key aspects of transportation analysis, with an emphasis on modeling real transportation systems and executing the models. Topics and features: presents comprehensive review questions at the end of each chapter, together with detailed case studies, useful links, references and suggestions for further reading; supplies a variety of teaching support materials at the book’s webpage on Springer.com, including a complete set of lecture slides; examines the classification of models used for multimodal transportation systems, and reviews the models and evaluation methods used in transportation planning; explains traffic assignment to road networks, and describes computer simulation integration platforms and their use in the transportation systems sector;

provides an overview of transportation simulation tools, and discusses the critical issues in the design, development and use of the simulation models.

A comprehensive overview of Monte Carlo simulation that explores the latest topics, techniques, and real-world applications More and more of today's numerical problems found in engineering and finance are solved through Monte Carlo methods. The heightened popularity of these methods and their continuing development makes it important for researchers to have a comprehensive understanding of the Monte Carlo approach. Handbook of Monte Carlo Methods provides the theory, algorithms, and applications that helps provide a thorough understanding of the emerging dynamics of this rapidly-growing field. The authors begin with a discussion of fundamentals such as how to generate random numbers on a computer. Subsequent chapters discuss key Monte Carlo topics and methods, including: Random variable and stochastic process generation Markov chain Monte Carlo, featuring key algorithms such as the Metropolis-Hastings method, the Gibbs sampler, and hit-and-run Discrete-event simulation Techniques for the statistical analysis of simulation data including the delta method, steady-state estimation, and kernel density estimation Variance reduction, including importance sampling, latin hypercube sampling, and conditional Monte Carlo Estimation of derivatives and sensitivity analysis Advanced topics including cross-entropy, rare events, kernel density estimation, quasi Monte Carlo, particle systems, and randomized optimization The presented theoretical concepts are illustrated with worked examples that use MATLAB®, a related Web site houses the MATLAB® code, allowing readers to work hands-on with the material and also features the author's own lecture notes on Monte Carlo methods. Detailed appendices provide background material on probability theory, stochastic processes, and mathematical statistics as well as the key optimization concepts and techniques that are relevant to Monte Carlo simulation. Handbook of Monte Carlo Methods is an excellent reference for applied statisticians and practitioners working in the fields of engineering and finance who use or would like to learn how to use Monte Carlo in their research. It is also a suitable supplement for courses on Monte Carlo methods and computational statistics at the upper-undergraduate and graduate levels.

This easy to read text provides a broad introduction to the fundamental concepts of modeling and simulation (M&S) and systems engineering, highlighting how M&S is used across the entire systems engineering lifecycle. Features: reviews the full breadth of technologies, methodologies and uses of M&S, rather than just focusing on a specific aspect of the field; presents contributions from specialists in each topic covered; introduces the foundational elements and processes that serve as the groundwork for understanding M&S; explores common methods and methodologies used in M&S; discusses how best to design and execute experiments, covering the use of Monte Carlo techniques, surrogate modeling and distributed simulation; explores the use of M&S throughout the systems development lifecycle, describing a number of methods, techniques, and tools available to support systems engineering processes; provides a selection of case studies illustrating the use of M&S in systems engineering across a variety of domains.

This book provides a detailed study of the Thai rubber industry and its utilisation of renewable resources, focussing on the use of open source software in building supply chain models. By describing elements that the supply chain is composed of and relating this to Thailand's rubber industry, the authors then outline the construction of a Discrete Event Simulation (DES) model and use open source software to model renewable resources in this particular supply chain. Emphasis is placed on the way that modelling can aid the important decision-making required in the exploitation of natural resources. By taking a hands-on approach and offering a valuable guide for readers, this book not only appeals to academics in the fields of industrial engineering, operations, logistics and supply chain management, but also to practitioners, policy-makers and associations involved in the rubber industry.

This focuses on the developing field of building probability models with the power of symbolic algebra systems. The book combines the uses of symbolic algebra with probabilistic/stochastic application and highlights the applications in a variety of contexts. The research explored in each chapter is unified by the use of A Probability Programming Language (APPL) to achieve the modeling objectives. APPL, as a research tool, enables a probabilist or statistician the ability to explore new ideas, methods, and models. Furthermore, as an open-source language, it sets the foundation for future algorithms to augment the original code. Computational Probability Applications is comprised of fifteen chapters, each presenting a specific application of computational probability using the APPL modeling and computer language. The chapter topics include using inverse gamma as a survival distribution, linear approximations of probability density functions, and also moment-ratio diagrams for univariate distributions. These works highlight interesting examples, often done by undergraduate students and graduate students that can serve as templates for future work. In addition, this book should appeal to researchers and practitioners in a range of fields including probability, statistics, engineering, finance, neuroscience, and economics.

In any production environment, discrete event simulation is a powerful tool for the analysis, planning, and operating of a manufacturing facility. Operations managers can use simulation to improve their production systems by eliminating bottlenecks, reducing cycle time and cost, and increasing capacity utilization. Offering a hands-on tutorial on how to model traditional applications to optimize production operations, Simulation of Industrial Systems: Discrete Event Simulation Using Excel/VBA— · Introduces the Design Environment for Event Driven Simulation (DEEDS), an original simulator, which facilitates the modeling of complex situations using four (self-contained) nodes: source, queue, facility, and delay. · Demonstrates how to use discrete event simulation as a powerful tool for the analysis, planning, design, and operation of diverse production systems · Shows how to model application areas such as facilities layout, material handling, inventory control, scheduling, maintenance, quality control, and supply chain logistics · Integrates the design of experiments and optimization techniques for improving production systems With the comprehensive instruction provided within these pages, in combination with the flexibility of the DEEDS program environment, operations managers will be able to harness the power of discrete event simulation to streamline their production environments. The authors have created a website with a variety of teaching aids that professors will be able to access

The first book to cover simulation using the popular software WITNESS, Process Simulation Using WITNESS helps professionals understand the theory behind simulation in a simple and practical manner while learning how to build simulation models with the software. This book outlines the role of simulation in contemporary initiatives for lean systems design and operations as well as Six Sigma applications. Emphasizing real-world applications of simulation modeling in both services and manufacturing sectors, the book is suitable for a broad audience, including system, simulation, material handling, layout, and operations engineers.

A fast-growing area in the communications industry is the internetworking of an ever-increasing proliferation of computers, particularly via local area networks (LANs). The LAN is a resource-sharing data communications network being used by many offices to interchange information such as electronic mail, word processing, and files among computers and other devices. This unique book shows the user how to establish the performance characteristics of a LAN before putting it to use in a particular type of situation. Simulation of Local Area Networks consists of eight chapters, each with its own extensive list of references. The first chapter provides a brief review of local area networks, and the second chapter gives the analytical models of popular LANs-token-passing bus and ring networks, CSMA/CD LANs, and star networks. Chapter 3 covers general principles of simulation, and Chapter 4 discusses fundamental concepts in probability and statistics relating to

simulation modeling. Materials in Chapters 3 and 4 are specifically applied in developing simulation models on token-passing LANs, CSMA/CD LANs, and star LANs in Chapters 5 through 7. The computer code in Chapters 5, 6, and 7 is divided into segments, and a detailed explanation of each segment is provided. The last chapter reviews special-purpose languages such as GPSS, SIMSCRIPT, GASP, SIMULA, SLAM, and RESQ. Helpful criteria for language selection are included. The entire code is put together in the appendixes. This book has two major advantages over existing texts. First, it uses C, a well-developed general-purpose language that is familiar to most analysts. Second, the text specifically applies the simulation principles to local area networks. No other book available shows the systems analyst how to evaluate the performance of existing or proposed systems under different kinds of conditions.

Computer Performance Modeling Handbook

The Encyclopedia of Measurement and Statistics presents state-of-the-art information and ready-to-use facts from the fields of measurement and statistics in an unintimidating style. The ideas and tools contained in these pages are approachable and can be invaluable for understanding our very technical world and the increasing flow of information. Although there are references that cover statistics and assessment in depth, none provides as comprehensive a resource in as focused and accessible a manner as the three volumes of this Encyclopedia. Through approximately 500 contributions, experts provide an overview and an explanation of the major topics in these two areas.

This Three-Volume-Set constitutes the refereed proceedings of the Second International Conference on Software Engineering and Computer Systems, ICSECS 2011, held in Kuantan, Malaysia, in June 2011. The 190 revised full papers presented together with invited papers in the three volumes were carefully reviewed and selected from numerous submissions. The papers are organized in topical sections on software engineering; network; bioinformatics and e-health; biometrics technologies; Web engineering; neural network; parallel and distributed e-learning; ontology; image processing; information and data management; engineering; software security; graphics and multimedia; databases; algorithms; signal processing; software design/testing; e- technology; ad hoc networks; social networks; software process modeling; miscellaneous topics in software engineering and computer systems.

Simulation is increasingly important for students in a wide variety of fields, from engineering and physical sciences to medicine, biology, economics, and applied mathematics. Current trends point toward interdisciplinary courses in simulation intended for all students regardless of their major, but most textbooks are subject-specific and consequently are not suitable for such a course. Simulation of Dynamic Systems with MATLAB® and Simulink® offers a unified introduction to continuous simulation that focuses on the common principles underlying the vast array of simulation models that describe very different phenomena. Written by accomplished expert Harold Klee, this text builds an in-depth and intuitive understanding of the basic concepts and mathematical tools that students can easily generalize to their own field of study. The author includes case studies, real-world examples, abundant homework problems, and thousands of equations to develop a practical understanding of the concepts. Moreover, he incorporates MATLAB® and Simulink® tools to help students gain experience with designing, implementing, and adjusting their simulations. This classroom-tested text works systematically through linear, continuous-time, and discrete-time dynamic systems

as well as basic, intermediate, and advanced topics in numerical integration. Supplying downloadable MATLAB M-files and Simulink model files, Simulation of Dynamic Systems with MATLAB® and Simulink® is ideal for a one- or two-semester course in continuous simulation, offering valuable flexibility for instructors.

For fast, easy modeling, this practical guide provides the essential information you need, plus step-by-step case studies and handy hints/tips.

Explores wide-ranging applications of modeling and simulationtechniques that allow readers to conduct research and ask "Whatif??" Principles of Modeling and Simulation: A MultidisciplinaryApproach is the first book to provide an introduction tomodeling and simulation techniques across diverse areas of study.Numerous researchers from the fields of social science,engineering, computer science, and business have collaborated onthis work to explore the multifaceted uses of computationalmodeling while illustrating their applications in commonspreadsheets. The book is organized into three succinct parts: Principles of Modeling and Simulation provides a briefhistory of modeling and simulation, outlines its many functions,and explores the advantages and disadvantages of using models inproblem solving. Two major reasons to employ modeling andsimulation are illustrated through the study of a specific problemin conjunction with the use of related applications, thus gaininginsight into complex concepts. Theoretical Underpinnings examines various modelingtechniques and introduces readers to two significant simulationconcepts: discrete event simulation and simulation of continuoussystems. This section details the two primary methods in whichhumans interface with simulations, and it also distinguishes themeaning, importance, and significance of verification andvalidation. Practical Domains delves into specific topics related totransportation, business, medicine, social science, and enterprisedecision support. The challenges of modeling and simulation arediscussed, along with advanced applied principles of modeling andsimulation such as representation techniques, integration into theapplication infrastructure, and emerging technologies. With its accessible style and wealth of real-world examples,Principles of Modeling and Simulation: A MultidisciplinaryApproach is a valuable book for modeling and simulation coursesat the upper-undergraduate and graduate levels. It is also anindispensable reference for researchers and practitioners workingin statistics, mathematics, engineering, computer science,economics, and the social sciences who would like to furtherdevelop their understanding and knowledge of the field.

This Festschrift honors George Samuel Fishman, one of the founders of the eld of computer simulation and a leader of the disciplines of operations research and the management sciences for the past ve decades, on the occasion of his seventieth birthday. The papers in this volume span the theory, methodology, and application of computer simulation. The lead article is appropriately titled “George Fishman’s Professional Career.” In this article we discuss George’s contributions to operations research and the m- agement sciences, with special emphasis on his role in the advancement of the eld of simulation since the 1960s. We also include a brief personal biography together with comments by several individuals about the extraordinary effect that George has had on all his students, colleagues, and friends.

Thesecondarticle,titled“AConversationwithGeorgeFishman,”isthetranscript of an extended interview with George that we

conducted in October 2007. In the article titled “Computer Intensive Statistical Model Building,” Russell Cheng studies resampling methods for building parsimonious multiple linear regr- sion models so as to represent accurately the behavior of the dependent variable in terms of the smallest possible subset of explanatory (independent) variables. The author shows how bootstrap resampling can be used not only for rapid identi cation of good models but also for ef cient comparison of competing models.
This book aims to clarify exactly how simulation studies can be carried out in the system theory paradigm, while providing a realistically complete coverage of (discrete event) simulation in its more traditional aspects. It focuses on the subclass of predictive, generative and dynamic system models.
A single source guide to operations research (OR) techniques, this book covers emerging OR methodologies in a clear, concise, and unified manner. Building a bridge between theory and practice, it begins with coverage of fundamental models and methods such as linear, nonlinear, integer, and dynamic programming, networks, simulation, queuing, inventory, stochastic processes, and decision analysis. The book then explores emerging techniques including multiple criteria optimization, meta heuristics, robust optimization, and complexity and large scale networks. Each chapter gives an overview of a particular methodology, illustrates successful applications, and provides references to computer software availability.
CONTENIDO: Models - Random-number generation - Discrete-event simulation - Statistics - Next-event simulation - Discrete random variables - Continuous random variables - Output analysis - Input modeling - Projects.
Discrete-event SimulationA First CoursePrentice Hall
Complex artificial dynamic systems require advanced modeling techniques that can accommodate their asynchronous, concurrent, and highly non-linear nature. Discrete Event systems Specification (DEVS) provides a formal framework for hierarchical construction of discrete-event models in a modular manner, allowing for model re-use and reduced development time. Discrete Event Modeling and Simulation presents a practical approach focused on the creation of discrete-event applications. The book introduces the CD++ tool, an open-source framework that enables the simulation of discrete-event models. After setting up the basic theory of DEVS and Cell-DEVS, the author focuses on how to use the CD++ tool to define a variety of models in biology, physics, chemistry, and artificial systems. They also demonstrate how to map different modeling techniques, such as Finite State Machines and VHDL, to DEVS. The in-depth coverage elaborates on the creation of simulation software for DEVS models and the 3D visualization environments associated with these tools. A much-needed practical approach to creating discrete-event applications, this book offers world-class instruction on the field’s most useful modeling tools.
Discrete-event simulation is an important tool for the modeling of complex systems. Simulation is used to represent manufacturing, transportation, and service systems in a computer program to perform experiments on a computer. Simulation modeling involves elements of system modeling, computer programming, probability and statistics, and engineering design. Simulation Modeling and Arena, by Dr. Manuel Rossetti, is an introductory textbook for a first course in discrete-event simulation modeling and analysis for upper-level undergraduate students as well as entering graduate students. The text is focused on engineering students (primarily

industrial engineering); however, the text is also appropriate for advanced business majors, computer science majors, and other disciplines where simulation is practiced. Practitioners interested in learning simulation and Arena could also use this book independently of a course.

Introduction to Discrete Event Systems is a comprehensive introduction to the field of discrete event systems, offering a breadth of coverage that makes the material accessible to readers of varied backgrounds. The book emphasizes a unified modeling framework that transcends specific application areas, linking the following topics in a coherent manner: language and automata theory, supervisory control, Petri net theory, Markov chains and queuing theory, discrete-event simulation, and concurrent estimation techniques. This edition includes recent research results pertaining to the diagnosis of discrete event systems, decentralized supervisory control, and interval-based timed automata and hybrid automata models.

This book is a result of teaching stochastic processes to junior and senior undergr- uates and beginning graduate students over many years. In teaching such a course, we have realized a need to furnish students with material that gives a mathematical presentation while at the same time providing proper foundations to allow students to build an intuitive feel for probabilistic reasoning. We have tried to maintain a b- ance in presenting advanced but understandable material that sparks an interest and challenges students, without the discouragement that often comes as a consequence of not understanding the material. Our intent in this text is to develop stochastic p- cesses in an elementary but mathematically precise style and to provide suf?cient examples and homework exercises that will permit students to understand the range of application areas for stochastic processes. We also practice active learning in the classroom. In other words, we believe that the traditional practice of lecturing continuously for 50 to 75 minutes is not a very effective method for teaching. Students should somehow engage in the subject m- ter during the teaching session. One effective method for active learning is, after at most 20 minutes of lecture, to assign a small example problem for the students to work and one important tool that the instructor can utilize is the computer. So- times we are fortunate to lecture students in a classroom containing computers with a spreadsheet program, usually Microsoft’s Excel.

Fault-Tolerant Systems is the first book on fault tolerance design with a systems approach to both hardware and software. No other text on the market takes this approach, nor offers the comprehensive and up-to-date treatment that Koren and Krishna provide. This book incorporates case studies that highlight six different computer systems with fault-tolerance techniques implemented in their design. A complete ancillary package is available to lecturers, including online solutions manual for instructors and PowerPoint slides. Students, designers, and architects of high performance processors will value this comprehensive overview of the field. The first book on fault tolerance design with a systems approach Comprehensive coverage of both hardware and software fault tolerance, as well as information and time redundancy Incorporated case studies highlight six different computer systems with fault-tolerance techniques implemented in their design Available to lecturers is a complete ancillary package including online solutions manual for instructors and PowerPoint slides

The definitive guide to queueing theory and its practical applications—features numerous real-world examples of scientific, engineering, and

business applications Thoroughly updated and expanded to reflect the latest developments in the field, Fundamentals of Queueing Theory, Fifth Edition presents the statistical principles and processes involved in the analysis of the probabilistic nature of queues. Rather than focus narrowly on a particular application area, the authors illustrate the theory in practice across a range of fields, from computer science and various engineering disciplines to business and operations research. Critically, the text also provides a numerical approach to understanding and making estimations with queueing theory and provides comprehensive coverage of both simple and advanced queueing models. As with all preceding editions, this latest update of the classic text features a unique blend of the theoretical and timely real-world applications. The introductory section has been reorganized with expanded coverage of qualitative/non-mathematical approaches to queueing theory, including a high-level description of queues in everyday life. New sections on non-stationary fluid queues, fairness in queueing, and Little's Law have been added, as has expanded coverage of stochastic processes, including the Poisson process and Markov chains. • Each chapter provides a self-contained presentation of key concepts and formulas, to allow readers to focus independently on topics relevant to their interests • A summary table at the end of the book outlines the queues that have been discussed and the types of results that have been obtained for each queue • Examples from a range of disciplines highlight practical issues often encountered when applying the theory to real-world problems • A companion website features QtsPlus, an Excel-based software platform that provides computer-based solutions for most queueing models presented in the book. Featuring chapter-end exercises and problems—all of which have been classroom-tested and refined by the authors in advanced undergraduate and graduate-level courses—Fundamentals of Queueing Theory, Fifth Edition is an ideal textbook for courses in applied mathematics, queueing theory, probability and statistics, and stochastic processes. This book is also a valuable reference for practitioners in applied mathematics, operations research, engineering, and industrial engineering.

This book is for any telecommunications-convergence professional who needs to understand the structure of the industry, the structure of telephony networks and services, and the equipment involved.With the growing variety of networks and technologies now on offer it is inevitable that some convergence will take place between different networks, services and products. New VOIP (voice over internet protocol) networks must interwork with traditional networks. For instance, mobile phones can offer data services; wireless broadband connections to laptops will allow VOIP phone calls away from base; users could have the option of 'convergent phones' that can be used on a landline when at home or business, but which can be used as a mobile when on the move, and so on.

This cutting-edge volume is the first book that provides you with practical guidance on the use of medical device data for bioinformatics modeling purposes. You learn how to develop original methods for communicating with medical devices within healthcare enterprises and assisting with bedside clinical decision making. The book guides in the implementation and use of clinical decision support methods within the context of electronic health records in the hospital environment.This highly valuable reference also teaches budding biomedical engineers and bioinformaticists the practical benefits of using medical device data. Supported with over 100 illustrations, this all-in-one resource discusses key concepts in detail and then presents clear implementation examples to give you a complete understanding of how to use this knowledge in the field.

This hands-on textbook/reference presents an introduction to the fundamental aspects of modelling and simulation, both for those wishing to learn about this methodology and also for those who have a need to apply it in their work. The text is supported by illustrative examples, drawn from projects formulated within the domains of discrete-event dynamic systems (DEDS) and continuous-time dynamic systems (CTDS). This updated new edition has been enhanced with new illustrative case studies, and additional examples demonstrating some new

features and the effectiveness of the ABCmod conceptual modelling framework. Changes that facilitate the development of simulation models with ABSmod/J are illustrated. New material includes a presentation of the experimentation strategy called “design of experiments” and three new chapters that explore the optimization-simulation interface. Topics and features: presents a goal-based and project-oriented perspective of modelling and simulation; describes the ABCmod framework, an activity-based conceptual modelling framework for DEDS; examines the simulation-optimization interface in both the CTDS and DEDS domains; provides numerous illustrative examples, case studies and useful algorithms, as well as exercises and projects at the end of most chapters; includes appendices on probability and statistics, the GPSS programming environment, and relevant MATLAB features; provides supplementary software and teaching support material at an associated website, including lecture slides and a methodology for organizing student projects. Serving as an essential guide to the foundations of modelling and simulation, this practical primer is ideal for senior undergraduate and junior graduate-level students. Also suitable for self-study, the book will be of great benefit to professionals seeking insight into the vast potential of this rapidly evolving problem-solving paradigm.

Discrete Event System Simulation is ideal for junior- and senior-level simulation courses in engineering, business, or computer science. It is also a useful reference for professionals in operations research, management science, industrial engineering, and information science. While most books on simulation focus on particular software tools, Discrete Event System Simulation examines the principles of modeling and analysis that translate to all such tools. This language-independent text explains the basic aspects of the technology, including the proper collection and analysis of data, the use of analytic techniques, verification and validation of models, and designing simulation experiments. It offers an up-to-date treatment of simulation of manufacturing and material handling systems, computer systems, and computer networks. Students and instructors will find a variety of resources at the associated website, www.bcnn.net/, including simulation source code for download, additional exercises and solutions, web links and errata.

Most books in reliability theory are dealing with a description of component and system states as binary: functioning or failed. However, many systems are composed of multi-state components with different performance levels and several failure modes. There is a great need in a series of applications to have a more refined description of these states, for instance, the amount of power generated by an electrical power generation system or the amount of gas that can be delivered through an offshore gas pipeline network. This book provides a descriptive account of various types of multistate system, bound-for multistate systems, probabilistic modeling of monitoring and maintenance of multistate systems with components along with examples of applications. Key Features: Looks at modern multistate reliability theory with applications covering a refined description of components and system states. Presents new research, such as Bayesian assessment of system availabilities and measures of component importance. Complements the methodological description with two substantial case studies. Reliability engineers and students involved in the field of reliability, applied mathematics and probability theory will benefit from this book.

Traditionally, there have been two primary types of simulation textbooks: those that emphasize the theoretical (and mostly statistical) aspects of simulation, and those that emphasize the simulation language or package.Simulation Modeling and Arena, Second Edition blends these two aspects of simulation textbooks together while adding and emphasizing the art of model building. This book features coverage of statistical analysis, which is integrated with the modeling to emphasize the importance of both topics. The Second Edition features new topical coverage, including static simulation and spreadsheet simulation; how simulation works and why it matters; and expanded use of Arena, specifically the use of strings in models, the Atribute module, the OnChange block, visual dashboards, and an introduction to 3-D

animation concepts. In addition, a running example is presented throghout each chapter to prepare readers to perform a realistic case study based on the IIE/RA contest problem. The new edition also contains expanded topical coverage on: simulation clock within discrete event modeling simulation; statistical modeling concepts with the theoretical basis and equationsneeded to perform the analysis by hand; increased use of Arena Run Controller, modeling non-stationary arrival processes; and the Wait-Signal constructs.