

Fundamentals Of Performance Modeling

An accessible introduction to probability, stochastic processes, and statistics for computer science and engineering applications. Second edition now also available in Paperback. This updated and revised edition of the popular classic first edition relates fundamental concepts in probability and statistics to the computer sciences and engineering. The author uses Markov chains and other statistical tools to illustrate processes in reliability of computer systems and networks, fault tolerance, and performance. This edition features an entirely new section on stochastic Petri nets—as well as new sections on system availability modeling, wireless system modeling, numerical solution techniques for Markov chains, and software reliability modeling, among other subjects. Extensive revisions take new developments in solution techniques and applications into account and bring this work totally up to date. It includes more than 200 worked examples and self-study exercises for each section. Probability and Statistics with Reliability, Queuing and Computer Science Applications, Second Edition offers a comprehensive introduction to probability, stochastic processes, and statistics for students of computer science, electrical and computer engineering, and applied mathematics. Its wealth of practical examples and up-to-date information makes it an excellent resource for practitioners as well. An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department.

Performance evaluation is at the foundation of computer architecture research and development. Contemporary microprocessors are so complex that architects cannot design systems based on intuition and simple models only. Adequate performance evaluation methods are absolutely crucial to steer the research and development process in the right direction. However, rigorous performance evaluation is non-trivial as there are multiple aspects to performance evaluation, such as picking workloads, selecting an appropriate modeling or simulation approach, running the model and interpreting the results using meaningful metrics. Each of these aspects is equally important and a performance evaluation method that lacks rigor in any of these crucial aspects may lead to inaccurate performance data and may drive research and development in a wrong direction. The goal of this book is to present an overview of the current state-of-the-art in computer architecture performance evaluation, with a special emphasis on methods for exploring processor architectures. The book focuses on fundamental concepts and ideas for obtaining accurate performance data. The book covers various topics in performance evaluation, ranging from performance metrics, to workload selection, to various modeling approaches including mechanistic and empirical modeling. And because simulation is by far the most prevalent modeling technique, more than half the book's content is devoted to simulation. The book provides an overview of the simulation techniques in the computer designer's toolbox, followed by various simulation acceleration techniques including sampled simulation, statistical simulation, parallel simulation and hardware-accelerated simulation. Table of Contents: Introduction / Performance Metrics / Workload Design / Analytical Performance Modeling / Simulation / Sampled Simulation / Statistical Simulation / Parallel Simulation and Hardware Acceleration / Concluding Remarks

This is a graduate level textbook that covers the fundamental topics in queuing theory. The book has a broad coverage of methods to calculate important probabilities, and gives attention to proving the general theorems. It includes many recent topics, such as server-vacation models, diffusion approximations and optimal operating policies, and more about bulk-arrival and bulk-service models than other general texts. * Current, clear and comprehensive coverage * A wealth of interesting and relevant examples and exercises to reinforce concepts * Reference lists provided after each chapter for further investigation

Statistical performance evaluation has assumed an increasing amount of importance as we seek to design more and more sophisticated communication and information processing systems. The ability to predict a proposed system's performance without actually having to construct it is an extremely cost effective design tool. This book is meant to be a first year graduate level introduction to the field of statistical performance evaluation. As such, it covers queueing theory (chapters 1-4) and stochastic Petri networks (chapter 5). There is a short appendix at the end of the book which reviews basic probability theory. At Stony Brook, this material would be covered in the second half of a two course sequence (the first half is a computer networks course using a text such as Schwartz's Telecommunications Networks). Students seem to be encouraged to pursue the analytical material of this book if they first have some idea of the potential applications. I am grateful to B.L. Bodnar, J. Blake, J.S. Emer, M. Garrett, W. Hagen, Y.C. Jenq, M. Karol, J.F. Kurose, S.-Q. Li, A.C. Liu, J. McKenna, H.T. Mouftah and W.G. Nichols, I.Y. Wang, the IEEE and Digital Equipment Corporation for allowing previously published material to appear in this book.

This book introduces the fundamental concepts and practical simulation techniques for modeling different aspects of operating systems to study their general behavior and their performance. The approaches applied are object-oriented modeling and process interaction approach to discrete-event simulation. The book depends on the basic modeling concepts and is more specialized than my previous book: Practical Process Simulation with Object-Oriented Techniques and C++, published by Artech House, Boston 1999. For a more detailed description see the Web location: <http://science.kennesaw.edu/~jgarrido/mybook.html>. Most other books on performance modeling use only analytical approaches, and very few apply these concepts to the study of operating systems. Thus, the unique feature of the book is that it concentrates on design aspects of operating systems using practical simulation techniques. In addition, the book illustrates the dynamic behavior of different aspects of operating systems using the various simulation models, with a general hands-on approach.

This monograph presents a concise mathematical approach for modeling and analyzing the performance of communication networks with the aim of introducing an appropriate mathematical framework for modeling and analysis as well as understanding the phenomenon of statistical multiplexing. The models, techniques, and results presented form the core of traffic engineering methods used to design, control and allocate resources in communication networks. The novelty of the monograph is the fresh approach and insights provided by a sample-path methodology for queueing models that highlights the important ideas of Palm distributions associated with traffic models and their role in computing performance measures. The monograph also covers stochastic network theory including Markovian networks. Recent results on network utility optimization and connections to stochastic insensitivity are discussed. Also presented are ideas of large buffer, and many sources asymptotics that play an important role in understanding statistical multiplexing. In particular, the important concept of effective bandwidths as mappings from queueing level phenomena to loss network models is clearly presented along with a detailed discussion of accurate approximations for large networks. Table of Contents: Introduction to Traffic Models and Analysis / Queues and Performance Analysis / Loss Models for Networks / Stochastic Networks and Insensitivity / Statistical Multiplexing

Fundamentals of Performance Improvement, 3rd Edition Fundamentals of Performance Improvement is a substantially new version of the down-to-earth, how-to guide designed to help business leaders, practitioners, and students understand the science and art of performance technology and successfully implement organizational and societal change. Using the Performance Improvement / Human Performance Technology (HPT) model, the expert authors explain step-by-step how to spot performance indicators, analyze problems, identify underlying causes, describe desired results, and create workable solutions. "It does not matter what function you align yourself to in your organization, this book allows you to tap into the secrets that drive organizational success. Several books work to define what is performance improvement and performance technology. This one also provides insights into the Why? And How?" —CEDRIC T. COCO, CPT, SVP, Learning and Organizational Effectiveness, Lowe's Companies "Fundamentals of Performance Improvement is full of practical models and tools for improving the world by partnering with customers, clients, constituents, and colleagues. It provides a path forward for successful transformation and performance improvement at personal, group and collective levels. It is a must read for leaders and consultants seeking to advance opportunities in new and emerging situations." —DIANA WHITNEY, PhD, president, Corporation for Positive Change "If you have an interest in performance improvement, this is simply the best available book on the topic. It addresses the science and craft as well as the

intricacies of how to improve workplace performance. Van Tiem, Moseley, and Dessinger have incorporated into this work the best available research on the Certified Performance Technology (CPT) standards and process." —JAMES A. PERSHING, Ph.D., CPT, professor emeritus, Workplace Learning and Performance Improvement, Indiana University "Its international flavor, with practitioner comments and examples drawn from across the world, enhances its appeal as more and more professionals operate in an increasingly global context." —DALJIT SINGH, Asia Pacific Director of Talent Management, Baker & McKenzie, Sydney, Australia

A concise and clear guide to the concepts and applications of wireless sensor networks, ideal for students, practitioners and researchers. The only singular, all-encompassing textbook on state-of-the-art technical performance evaluation Fundamentals of Performance Evaluation of Computer and Telecommunication Systems uniquely presents all techniques of performance evaluation of computers systems, communication networks, and telecommunications in a balanced manner. Written by the renowned Professor Mohammad S. Obaidat and his coauthor Professor Nouredine Boudriga, it is also the only resource to treat computer and telecommunication systems as inseparable issues. The authors explain the basic concepts of performance evaluation, applications, performance evaluation metrics, workload types, benchmarking, and characterization of workload. This is followed by a review of the basics of probability theory, and then, the main techniques for performance evaluation—namely measurement, simulation, and analytic modeling—with case studies and examples. Contains the practical and applicable knowledge necessary for a successful performance evaluation in a balanced approach Reviews measurement tools, benchmark programs, design of experiments, traffic models, basics of queueing theory, and operational and mean value analysis Covers the techniques for validation and verification of simulation as well as random number generation, random variate generation, and testing with examples Features numerous examples and case studies, as well as exercises and problems for use as homework or programming assignments Fundamentals of Performance Evaluation of Computer and Telecommunication Systems is an ideal textbook for graduate students in computer science, electrical engineering, computer engineering, and information sciences, technology, and systems. It is also an excellent reference for practicing engineers and scientists.

We will occasionally footnote a portion of text with a "***", to indicate Notes on the that this portion can be initially bypassed. The reasons for bypassing a Text portion of the text include: the subject is a special topic that will not be referenced later, the material can be skipped on first reading, or the level of mathematics is higher than the rest of the text. In cases where a topic is self-contained, we opt to collect the material into an appendix that can be read by students at their leisure. The material in the text cannot be fully assimilated until one makes it Notes on "their own" by applying the material to specific problems. Self-discovery Problems is the best teacher and although they are no substitute for an inquiring mind, problems that explore the subject from different viewpoints can often help the student to think about the material in a uniquely personal way. With this in mind, we have made problems an integral part of this work and have attempted to make them interesting as well as informative.

Advances the understanding of management methods, information technology, and their joint application in business processes.

Fundamentals of Performance Improvement is a substantially new version of the down-to-earth, how-to guide designed to help business leaders, practitioners, and students understand the science and art of performance technology and successfully implement organizational and societal change. Using the Performance Improvement / Human Performance Technology (HPT) model, the expert authors explain step-by-step how to spot performance indicators, analyze problems, identify underlying causes, describe desired results, and create workable solutions. "It does not matter what function you align yourself to in your organization, this book allows you to tap into the secrets that drive organizational success. Several books work to define what is performance improvement and performance technology. This one also provides insights into the Why? And How?" —Cedric T. Coco, CPT, SVP, Learning and Organizational Effectiveness, Lowe's Companies

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This book constitutes the thoroughly refereed proceedings of the 5th International Workshop, PMBS 2014 in New Orleans, LA, USA in November 2014. The 12 full and 2 short papers presented in this volume were carefully reviewed and selected from 53 submissions. The papers cover topics on performance benchmarking and optimization; performance analysis and prediction; and power, energy and checkpointing.

Fundamentals of Performance Modeling Prentice Hall Fundamentals of Performance Improvement Optimizing Results through People, Process, and Organizations John Wiley & Sons

"This comprehensive reference work provides immediate, fingertip access to state-of-the-art technology in nearly 700 self-contained articles written by over 900 international authorities. Each article in the Encyclopedia features current developments and trends in computers, software, vendors, and applications...extensive bibliographies of leading figures in the field, such as Samuel Alexander, John von Neumann, and Norbert Wiener...and in-depth analysis of future directions."

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.

Computer system performance evaluation is a key discipline for the understanding of the behavior and limitations of large scale computer systems and networks. This volume provides an overview of the milestones and major developments of

the field. The contributions to the book include many of the principal leaders from industry and academia with a truly international coverage, including several IEEE and ACM Fellows, two Fellows of the US National Academy of Engineering and a Fellow of the European Academy, and a former President of the Association of Computing Machinery. This open access book comprehensively covers the fundamentals of clinical data science, focusing on data collection, modelling and clinical applications. Topics covered in the first section on data collection include: data sources, data at scale (big data), data stewardship (FAIR data) and related privacy concerns. Aspects of predictive modelling using techniques such as classification, regression or clustering, and prediction model validation will be covered in the second section. The third section covers aspects of (mobile) clinical decision support systems, operational excellence and value-based healthcare. Fundamentals of Clinical Data Science is an essential resource for healthcare professionals and IT consultants intending to develop and refine their skills in personalized medicine, using solutions based on large datasets from electronic health records or telemonitoring programmes. The book's promise is "no math, no code" and will explain the topics in a style that is optimized for a healthcare audience.

Over the last century, medicine has come out of the black bag and emerged as one of the most dynamic and advanced fields of development in science and technology. Today, biomedical engineering plays a critical role in patient diagnosis, care, and rehabilitation. As such, the field encompasses a wide range of disciplines, from biology and physiology to engineering. Queueing analysis is a vital tool used in the evaluation of system performance. Applications of queueing analysis cover a wide spectrum from bank automated teller machines to transportation and communications data networks. Fully revised, this second edition of a popular book contains the significant addition of a new chapter on Flow & Congestion Control and a section on Network Calculus among other new sections that have been added to remaining chapters. An introductory text, Queueing Modelling Fundamentals focuses on queueing modelling techniques and applications of data networks, examining the underlying principles of isolated queueing systems. This book introduces the complex queueing theory in simple language/proofs to enable the reader to quickly pick up an overview to queueing theory without utilizing the diverse necessary mathematical tools. It incorporates a rich set of worked examples on its applications to communication networks. Features include: Fully revised and updated edition with significant new chapter on Flow and Congestion Control as well as a new section on Network Calculus. A comprehensive text which highlights both the theoretical models and their applications through a rich set of worked examples, examples of applications to data networks and performance curves. Provides an insight into the underlying queueing principles and features step-by-step derivation of queueing results. Written by experienced Professors in the field. Queueing Modelling Fundamentals is an introductory text for undergraduate or entry-level post-graduate students who are taking courses on network performance analysis as well as those practicing network administrators who want to understand the essentials of network operations. The detailed step-by-step derivation of queueing results also makes it an excellent text for professional engineers.

Fundamentals of Building Performance Simulation pares the theory and practice of a multi-disciplinary field to the essentials for classroom learning and real-world applications. Authored by a veteran educator and researcher, this textbook equips graduate students and emerging and established professionals in engineering and architecture to predict and optimize buildings' energy use. It employs an innovative pedagogical approach, introducing new concepts and skills through previously mastered ones and deepening understanding of familiar themes by means of new material. Covering topics from indoor airflow to the effects of the weather, the book's 19 chapters empower learners to: Understand the models and assumptions underlying popular BPS tools. Compare models, simulations, and modelling tools and make appropriate selections. Recognize the effects of modelling choices and input data on simulation predictions. And more. Each subject is introduced without reference to particular modelling tools, while practice problems at the end of each chapter provide hands-on experience with the tools of the reader's choice. Curated reading lists orient beginners in a vast, cross-disciplinary literature, and the critical thinking skills stressed throughout prepare them to make contributions of their own. Fundamentals of Building Performance Simulation provides a much-needed resource for new and aspiring members of the building science community.

The progress of science and technology has placed Queueing Theory among the most popular disciplines in applied mathematics, operations research, and engineering. Although queueing has been on the scientific market since the beginning of this century, it is still rapidly expanding by capturing new areas in technology. Advances in Queueing provides a comprehensive overview of problems in this enormous area of science and focuses on the most significant methods recently developed. Written by a team of 24 eminent scientists, the book examines stochastic, analytic, and generic methods such as approximations, estimates and bounds, and simulation. The first chapter presents an overview of classical queueing methods from the birth of queues to the seventies. It also contains the most comprehensive bibliography of books on queueing and telecommunications to date. Each of the following chapters surveys recent methods applied to classes of queueing systems and networks followed by a discussion of open problems and future research directions. Advances in Queueing is a practical reference that allows the reader quick access to the latest methods.

Computer system performance evaluation is a key discipline for the understanding of the behavior and limitations of large scale computer systems and networks. This volume provides an overview of the milestones and major developments of the field. The contributions to the book include many of the principal leaders from industry and academia with a truly international coverage, including several IEEE and ACM Fellows, two Fellows of the US National Academy of Engineering and a Fellow of the European Academy, and a former President of the Association of Computing Machinery. Contents: Ken Sevcik as an Advisor and Mentor (E Lazowska et al.) Shadow Servers and Priority Scheduling (J P Buzen) On the Chronology of Dynamic Allocation Index Policies: The Pioneering Work of K C Sevcik (E Coffman) Operational Analysis (P J Denning) Function Approximation by Random Neural Networks with a Bounded

Number of Layers (E Gelenbe et al.)The Achilles' Heel of Computer Performance Modeling and the Model Building Shield (V De Nitto Personè & G Lazeolla)Wireless Network Simulation: Towards a Systematic Approach (S K Tripathi et al.)Location- and Power-Aware Protocols for Wireless Networks with Asymmetric Links (G Wang et al.)Multi-Threaded Servers with High Service Time Variation for Layered Queueing Networks (G Franks et al.)Quantiles of Sojourn Times (P G Harrison & W J Knottenbelt)Asymptotic Solutions for Two Non-Stationary Problems in Internet Reliability (Y Kogan & G Choudhury)Burst Loss Probabilities in an OBS Network with Dynamic Simultaneous Link Possession (T Battestilli & H Perros)Stochastic Analysis of Resource Allocation in Parallel Processing Systems (M S Squillante)Periodic Task Cluster Scheduling in Distributed Systems (H Karatza)

Readership: Graduate students, Internet engineers, computer scientists, system engineers, and computer designers. Also suitable for use in professional development seminars in computers and networks. Keywords:Computer Networks;Distributed Systems;Performance Analysis of Computer

Systems;Performance Control and Optimization;System Performance Evaluation;Analytic Models;Simulation Methods

Traditionally, models and methods for the analysis of the functional correctness of reactive systems, and those for the analysis of their performance (and - pendability) aspects, have been studied by di?erent research communities. This has resulted in the development of successful, but distinct and largely unrelated modeling and analysis techniques for both domains. In many modern systems, however, the di?erence between their functional features and their performance properties has become blurred, as relevant functionalities become inextricably linked to performance aspects, e.g. isochronous data transfer for live video tra- mission. During the last decade, this trend has motivated an increased interest in c- bining insights and results from the ?eld of formal methods – traditionally - cused on functionality – with techniques for performance modeling and analysis. Prominent examples of this cross-fertilization are extensions of process algebra and Petri nets that allow for the automatic generation of performance models, the use of formal proof techniques to assess the correctness of randomized - gorithms, and extensions of model checking techniques to analyze performance requirements automatically. We believe that these developments markthe - ginning of a new paradigm for the modeling and analysis of systems in which qualitative and quantitative aspects are studied from an integrated perspective. We are convinced that the further worktowards the realization of this goal will be a growing source of inspiration and progress for both communities.

This book describes methods to improve software performance and safety using advanced mathematical and computational analytics. The main focus is laid on the increase of software reliability by preventive and predictive maintenance with efficient usage of modern testing resources. The editors collect contributions from international researchers in the field.

With the fast development of networking and software technologies, information processing infrastructure and applications have been growing at an impressive rate in both size and complexity, to such a degree that the design and development of high performance and scalable data processing systems and networks have become an ever-challenging issue. As a result, the use of performance modeling and m- surementtechniquesas a critical step in designand developmenthas becomea c- mon practice. Research and developmenton methodologyand tools of performance modeling and performance engineering have gained further importance in order to improve the performance and scalability of these systems. Since the seminal work of A. K. Erlang almost a century ago on the mod- ing of telephone traf c, performance modeling and measurement have grown into a discipline and have been evolving both in their methodologies and in the areas in which they are applied. It is noteworthy that various mathematical techniques were brought into this eld, including in particular probability theory, stochastic processes, statistics, complex analysis, stochastic calculus, stochastic comparison, optimization, control theory, machine learning and information theory. The app- cation areas extended from telephone networks to Internet and Web applications, from computer systems to computer software, from manufacturing systems to s- ply chain, from call centers to workforce management.

Object Oriented Simulation will qualify as a valuable resource to students and accomplished professionals and researchers alike, as it provides an extensive, yet comprehensible introduction to the basic principles of object-oriented modeling, design and implementation of simulation models. Key features include an introduction to modern commercial graphical simulation and animation software, accessible breakdown of OOSimL language constructs through various programming principles, and extensive tutorial materials ideal for undergraduate classroom use.

Fundamentals of Surgical Simulation explains in detail, from a behavioural science/human factors perspective, why modern image guided medicine such as surgery, interventional cardiology and interventional radiology are difficult to learn and practice. Medicine is currently at a tipping point in terms of how physicians in procedural based medicine are trained. Fundamentals of Surgical Simulation helps drive this change and is a valuable resource for medical trainers and trainees alike. For trainers, this book gives explicit theoretical and applied information on how this new training paradigm works thus allowing them to tailor the application of simulation training to their program, no matter where in the world they work. For the trainee, it allows them to see and understand the rules of this new training paradigm thus allowing them to optimize their approach to training and reaching proficiency in as efficient a manner as possible. For the simulation researcher, engineer and medical profession Fundamentals of Surgical Simulation poses some difficult questions that require urgent unambiguous and agreed answers.

This revised and updated Second Edition presents a practical introduction to operating systems and illustrates these principles through a hands-on approach using accompanying simulation models developed in Java and C++. This text is appropriate for upper-level undergraduate courses in computer science. Case studies throughout the text feature the implementation of Java and C++ simulation models, giving students a thorough look at both the theoretical and the practical concepts discussed in modern OS courses. This pedagogical approach is designed to present a clearer, more practical look at OS concepts, techniques, and methods without sacrificing the theoretical rigor that is necessary at this level. It is an ideal choice for those interested in gaining comprehensive, hands-on experience using the modern techniques and methods necessary for working with these complex systems. Every new printed copy is accompanied with a CD-ROM containing simulations (eBook version does not include CD-ROM). New material added to the Second Edition: - Chapter 11 (Security) has been revised to include the most up-to-date information - Chapter 12 (Firewalls and Network Security) has been updated to include material on middleware that allows applications on separate machines to communicate (e.g. RMI, COM+, and Object Broker) - Includes a new chapter dedicated to Virtual Machines - Provides introductions to various types of scams - Updated to include information on Windows 7 and Mac OS X

