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The book deals with the application of digital computers for power system analysis including fault analysis, load flows, stability assessment, economic operation and power system control. The book also covers extensively modeling of various power system components. The required mathematical background is presented at the appropriate sections in the book. A sincere attempt has been made to include a number of solved examples in every chapter, so that the students get an insight into the problems in practical power systems. Results from simulation are presented wherever applicable. The simulations have been carried out in MATLAB. The book covers more than a semester course. It can be used for UG courses on Power System Analysis, Computer applications in power system analysis, modeling of power system components, power system operation and control. It is also useful to postgraduate students of power engineering. Modeling and Simulation of Computer Networks and Systems: Methodologies and Applications introduces you to a broad array of modeling and simulation issues related to computer networks and systems. It focuses on the theories, tools, applications and uses of modeling and simulation in order to effectively optimize networks. It describes methodologies for modeling and simulation of new generations of wireless and mobiles networks and cloud and grid computing systems. Drawing upon years of practical experience and using numerous examples and illustrative applications recognized experts in both academia and industry, discuss: Important and emerging topics in computer networks and systems including but not limited to; modeling, simulation, analysis and security of wireless and mobiles networks especially as they relate to next generation wireless networks Methodologies, strategies and tools, and strategies needed to build computer networks and systems modeling and simulation from the bottom up Different network performance metrics including, mobility, congestion, quality of service, security and more... Modeling and Simulation of Computer Networks and Systems is a must have resource for network architects, engineers and researchers who want to gain insight into optimizing network performance through the use of modeling and simulation. Discusses important and emerging topics in computer networks and Systems including but not limited to; modeling, simulation, analysis and security of wireless and mobiles networks especially as they relate to next generation wireless networks Provides the necessary methodologies, strategies and tools needed to build computer networks and systems modeling and simulation from the bottom up Includes comprehensive review and evaluation of simulation tools and methodologies and different network performance metrics including mobility, congestion, quality of service, security and more This edited book is one of the first to describe how Autonomous Virtual Humans and Social Robots can interact with real people and be aware of the surrounding world using machine learning and AI. It includes: · Many algorithms related to the awareness of the surrounding world such as the recognition of objects, the interpretation of various sources of data provided by cameras, microphones, and wearable sensors · Deep Learning Methods to provide solutions to Visual Attention, Quality Perception, and Visual Material Recognition · How Face Recognition and Speech Synthesis will replace the traditional mouse and keyboard interfaces · Semantic modeling and rendering and shows how these domains play an important role in Virtual and Augmented Reality Applications. Intelligent Scene Modeling and Human-Computer Interaction explains how to understand the composition and build very complex scenes and emphasizes the semantic methods needed to have an intelligent interaction with them. It offers readers a unique opportunity to comprehend the rapid changes and continuous development in the fields of Intelligent Scene Modeling. A book for experts and practitioners, emphasizing the intuition and reasoning behind definitions and derivations related to evaluating computer systems performance. Markov random field (MRF) modeling provides a basis for the characterization of contextual constraints on visual interpretation and enables us to develop optimal vision algorithms systematically based on sound principles. This book presents a comprehensive study on using MRFs to solve computer vision problems, covering the following parts essential to the subject: introduction to fundamental theories, formulations of various vision models in the MRF framework, MRF parameter estimation, and optimization algorithms. Various MRF vision models are presented in a unified form, including image restoration and reconstruction, edge and region segmentation, texture, stereo and motion, object matching and recognition, and pose estimation. This book is an excellent reference for researchers working in computer vision, image processing, pattern recognition and applications of MRFs. It is also suitable as a text for advanced courses in the subject. Taking a novel, more appealing approach than current texts, An Integrated Introduction to Computer Graphics and Geometric Modeling focuses on graphics, modeling, and mathematical methods, including ray tracing, polygon shading, radiosity, fractals, freeform curves and surfaces, vector methods, and transformation techniques. The author begins with fractals, rather than the typical line-drawing algorithms found in many standard texts. He also brings the turtle back from obscurity to introduce several major concepts in computer graphics. Supplying the mathematical foundations, the book covers linear algebra topics, such as vector geometry and algebra, affine and projective spaces, affine maps, projective transformations, matrices, and quaternions. The main graphics areas explored include reflection and refraction, recursive ray tracing, radiosity, illumination models, polygon shading, and hidden surface procedures. The book also discusses geometric modeling, including planes, polygons, spheres, quadrics, algebraic and parametric curves and surfaces, constructive solid geometry, boundary files, octrees, interpolation, approximation, Bezier and B-spline methods, fractal algorithms, and subdivision techniques. Making the material accessible and relevant for years to come, the text avoids descriptions of current graphics hardware and special programming languages. Instead, it presents graphics algorithms based on well-established physical models of light and cogent mathematical methods. Addresses the major issues involved in computer design and architectures. Dealing primarily with theory, tools, and techniques as related to advanced computer systems, it provides tutorials and surveys and relates new important research results. Each chapter provides background information, describes and analyzes important work done in the field, and provides important direction to the reader on future work and further readings. The topics covered include hierarchical design schemes, parallel and distributed modeling and simulation, parallel simulation tools and techniques, theoretical models for formal and performance modeling, and performance evaluation techniques. This volume focuses on the biomechanical modeling of biological tissues in the context of Computer Assisted Surgery (CAS). More specifically, deformable soft tissues are addressed since they are the subject of the most recent developments in this field. The pioneering works on this CAS topic date from the 1980's, with applications in orthopaedics and biomechanical models of bones. More recently, however, biomechanical models of soft tissues have been proposed since most of the human body is made of soft organs that can be deformed by the surgical gesture. Such models are much more complicated to handle since the tissues can be subject to large deformations (non-linear geometrical framework) as well as complex stress/strain relationships (non-linear mechanical framework). Part 1 of the volume presents biomechanical models that have been developed in a CAS context and used during surgery. This is particularly new since most of the soft tissues models already proposed concern Computer Assisted Planning, with a pre-operative use of the models. Then, the volume addresses the two key issues raised for an intra-operative use of soft tissues models, namely (Part 2) "how to estimate the in vivo mechanical behavior of the tissues?" (i.e. what are the values of the mechanical parameters that can deliver realistic patient-specific behavior?) and (Part 3) "how to build a modeling platform that provides generic real-time (or at least interactive-time) numerical simulations?" This book presents a brief description of what constitutes computer modeling and simulation with techniques given to get a feel for how some of the simulation software packages involving hundreds of thousands of lines of code were developed. This book covers a wide range of applications and uses of simulation and modeling techniques in polymer injection molding, filling a noticeable gap in the literature of design, manufacturing, and the use of plastics injection molding. The authors help readers solve problems in the advanced control, simulation, monitoring, and optimization of injection molding processes. The book provides a tool for researchers and engineers to calculate the mold filling, optimization of processing control, and quality estimation before prototype molding. Computer simulation or a computer model has the task of simulating the behaviour of an abstract model of a particular system. Computer simulations have become a useful part of mathematical modeling of many natural systems in physics, quantum mechanics, chemistry, biology, economic systems, psychology, and social sciences, as well as in the engineering process of new technologies. The authors of the five chapters have presented various applications of computer simulations as well as their advantages and disadvantages. They describe the process of modeling and its simulation of heat recovery steam generators, the chronometer detent escapement mechanism, relevant sociotechnical processes with regard to new housing and building law and regional management trends in the European Union, and the agent-based model for biological systems. 3. 8 Problems . . . 66 4 ENABLING REUSE 69 4. 1 Concepts . . . . 69 4. 2 Exploiting commonality 70 4. 3 Reusable building blocks 71 4. 4 Allowing replaceable components 75 4. 5 Other replaceable entities 79 4. 6 Limiting flexibility . . . 82 4. 7 Other considerations . . 84 4. 8 Language fundamentals 85 4. 9 Problems . . . . 88 5 FUNCTIONS 91 5. 1 Concepts . . . . 91 5. 2 Introduction to functions 92 5. 3 An interpolation function 94 5. 4 Multiple return values 96 97 5. 5 Passing records as arguments 5. 6 Using extemal subroutines 100 5. 7 Language fundamentals 102 5. 8 Problems . . . . 110 6 USING ARRAYS 113 6. 1 Concepts . . . . 113 6. 2 Planetary motion: Arrays of components . . 113 6. 3 Simple ID heat transfer: Arrays of variables 120 6. 4 Using arrays with chemical systems 132 6. 5 Language fundamentals 143 6. 6 Problems . . . . 152 7 HYBRID MODELS 155 7. 1 Concepts . . . . 155 7. 2 Modeling digital circuits 155 7. 3 Bouncing ball . . . . . . 162 7. 4 Sensor modeling . . . . 166 7. 5 Language fundamentals 178 7. 6 Problems . . . . 186 8 EXPLORING NONLINEAR BEHAVIOR 189 8. 1 Concepts . . . 189 8. 2 An ideal diode 189 8. 3 Backlash . . . 193 8. 4 Thermal properties 199 Contents vii 8. 5 Hodgkin-Huxley nerve cell models 203 8. 6 Language fundamentals 206 8. 7 Problems . . . . 210 9 MISCELLANEOUS 213 9. 1 Lookup rules 213 9. 2 Annotations . . 225 Part II Effective Modelica 10 MULTI-DOMAIN MODELING 231 10. 1 Concepts . . . . 231 231 10. 2 Conveyor system . . . . . Role of modeling and computer simulation in biology; Simple model equations; Analytical models based on differential equations; Analytical models based on stable states; Estimating model coefficients from experimental data; Planning and problems of programming; Numerical solution of rate equations; Models with multiple components; Kinetics of biochemical reactions; Models of homogeneous populations of organisms; Simple models of microbial growth; Population models based on age-specific events; Simulations of population genetics; Models of light and photosynthesis; Temperature and biological activity; Compartmental models of biogeochemical cycling; Diffusion models; Compartmental models in Physiology; Application of matrix methods to simulations; Physiological control systems; Probabilistic models; Monte Carlo modeling of simple stochastic processes; Modeling of sampling processes; Random walks and related stochastic processes; Markov chain simulations in biology; Supplementary models; Models of cellular function; Models of development and morphogenesis; Models of epidemics; Appendixes; Literature cited; Index. This book contains a collection of papers that were presented at the IUTAM Symposium on "Computer Models in Biomechanics: From Nano to Macro" held at Stanford University, California, USA, from August 29 to September 2, 2011. It contains state-of-the-art papers on: - Protein and Cell Mechanics: coarse-grained model for unfolded proteins, collagen-proteoglycan structural interactions in the cornea, simulations of cell behavior on substrates - Muscle Mechanics: modeling approaches for Ca^{2+}–regulated smooth muscle contraction, smooth muscle modeling using continuum thermodynamical frameworks, cross-bridge model describing the mechanoenergetics of actomyosin interaction, multiscale skeletal muscle modeling - Cardiovascular Mechanics: multiscale modeling of arterial adaptations by incorporating molecular mechanisms, cardiovascular tissue damage, dissection properties of aortic aneurysms, intracranial aneurysms, electromechanics of the heart, hemodynamic alterations associated with arterial remodeling following aortic coarctation, patient-specific surgery planning for the Fontan procedure - Multiphasic Models: solutes in hydrated biological tissues, reformulation of mixture theory-based poroelasticity for interstitial tissue growth, tumor therapies of brain tissue, remodeling of microcirculation in liver lobes, reactions, mass transport and mechanics of tumor growth, water transport modeling in the brain, crack modeling of swelling porous media - Morphogenesis, Biological Tissues and Organs: mechanisms of brain morphogenesis, micromechanical modeling of anterior cruciate ligaments, mechanical characterization of the human liver, in vivo validation of predictive models for bone remodeling and mechanobiology, bridging scales in respiratory mechanics This book is an introduction to analytical performance modeling for computer systems, i.e., writing equations to describe their performance behavior. It is accessible to readers who have taken college-level courses in calculus and probability, networking and operating systems. This is not a training manual for becoming an expert performance analyst. Rather, the objective is to help the reader construct simple models for analyzing and understanding the systems that they are interested in. Describing a complicated system abstractly with mathematical equations requires a careful choice of assumptions and approximations. They make the model tractable, but they must not remove essential characteristics of the system, nor introduce spurious properties. To help the reader understand the choices and their implications, this book discusses the analytical models for 30 research papers. These papers cover a broad range of topics: processors and disks, routers and crawling, databases and multimedia, worms and wireless, multicore and cloud, etc. An appendix provides many questions for readers to exercise their understanding of the models in these papers. Table of Contents: Preface / Preliminaries / Concepts and Little's Law / Single Queues / Open Systems / Markov Chains / Closed Systems / Bottlenecks and Flow Equivalence / Deterministic Approximations / Transient Analysis / Experimental Validation and Analysis / Analysis with an Analytical Model / Bibliography / Author's Biography Models that include a notion of time are ubiquitous in disciplines such as the natural sciences, engineering, philosophy, and linguistics, but in computing the abstractions provided by the traditional models are problematic and the discipline has spawned many novel models. This book is a systematic thorough presentation of the results of several decades of research on developing, analyzing, and applying time models to computing and engineering. After an opening motivation introducing the topics, structure and goals, the authors introduce the notions of formalism and model in general terms along with some of their fundamental classification criteria. In doing so they present the fundamentals of propositional and predicate logic, and essential issues that arise when modeling time across all types of system. Part I is a summary of the models that are traditional in engineering and the natural sciences, including fundamental computer science: dynamical systems and control theory; hardware design; and software algorithmic and complexity analysis. Part II covers advanced and specialized formalisms dealing with time modeling in heterogeneous software-intensive systems: formalisms that share finite state machines as common “ancestors”; Petri nets in many variants; notations based on mathematical logic, such as temporal logic; process algebras; and “dual-language approaches” combining two notations with different characteristics to model and verify complex systems, e.g., model-checking frameworks. Finally, the book concludes with summarizing remarks and hints towards future developments and open challenges. The presentation uses a rigorous, yet not overly technical, style, appropriate for readers with heterogeneous backgrounds, and each chapter is supplemented with detailed bibliographic remarks and carefully chosen exercises of varying difficulty and scope. The book is aimed at graduate students and researchers in computer science, while researchers and practitioners in other scientific and engineering disciplines interested in time modeling with a computational flavor will also find the book of value, and the comparative and conceptual approach makes this a valuable introduction for non-experts. The authors assume a basic knowledge of calculus, probability theory, algorithms, and programming, while a more advanced knowledge of automata, formal languages, and mathematical logic is useful. Computer simulation techniques are now having a major impact on almost all areas of the physical and biological sciences. This book concentrates on the application of these methods to inorganic materials, including topical and industrially relevant systems including zeolites and high Tc superconductors. The central theme of the book is the use of modern simulation techniques as a structural tool in solid state science. Computer Modelling in Inorganic Crystallography describes the current range of techniques used in modeling crystal structures, and strong emphasis is given to the use of modeling in predicting new crystal structures and refining partially known structures. It also reviews new opportunities being opened up by electronic structure calculation and explains the ways in which these techniques are illuminating our knowledge of bonding in solids. Includes a thorough review of the technical basis of relevant contemporary methodologies including minimization, Monte-Carlo, molecular dynamics, simulated annealing methods, and electronic structure methods Highlights applications to amorphous and crystalline solids Surveys simulations of surface and defect properties of solids Discusses applications to molecular and inorganic solids This second edition describes the fundamentals of modelling and simulation of continuous-time, discrete time, discrete-event and large-scale systems. Coverage new to this edition includes: a chapter on non-linear systems analysis and modelling, complementing the treatment of of continuous-time and discrete-time systems and a chapter on the computer animation and visualization of dynamical systems motion. Simulation is the art of using tools – physical or conceptual models, or computer hardware and software, to attempt to create the illusion of reality. The discipline has in recent years expanded to include the modelling of systems that rely on human factors and therefore possess a large proportion of uncertainty, such as social, economic or commercial systems. These new applications make the discipline of modelling and simulation a field of dynamic growth and new research. Stanislaw Raczynski outlines the considerable and promising research that is being conducted to counter the problems of uncertainty surrounding the methods used to approach these new applications. It aims to stimulate the reader into seeking out new tools for modelling and simulation. Examines the state-of-the-art in recent research into methods of approaching new applications in the field of modelling and simulation Provides an introduction to new modelling tools such as differential inclusions, metric structures in the space of models, semi-discrete events, and use of simulation in parallel optimization techniques Discusses recently developed practical applications: for example the PASION simulation system, stock market simulation, a new fluid dynamics tool, manufacturing simulation and the simulation of social structures Illustrated throughout with a series of case studies Modelling and Simulation: The Computer Science of Illusion will appeal to academics, postgraduate students, researchers and practitioners in the modelling and simulation of industrial computer systems. It will also be of interest to those using simulation as an auxiliary tool. Physically-Based Modeling for Computer Graphics: A Structured Approach addresses the challenge of designing and managing the complexity of physically-based models. This book will be of interest to researchers, computer graphics practitioners, mathematicians, engineers, animators, software developers and those interested in computer implementation and simulation of mathematical models. * Presents a philosophy and terminology for "Structured Modeling" * Includes mathematicl and programming techniques to support and implement the methodology * Covers a library of model components, including rigid-body kinematics, rigid-body dynamics, and force-based constraint methods * Includes illustrations of several ample models created from these components * Foreword by Al Barr The Art of Computer Systems Performance Analysis "At last, a welcome and needed text for computer professionals who require practical, ready-to-apply techniques for performance analysis. Highly recommended!" -Dr. Leonard Kleinrock University of California, Los Angeles "An entirely refreshing text which has just the right mixture of theory and real world practice. The book is ideal for both classroom instruction and self-study." -Dr. Raymond L. Pickholtz President, IEEE Communications Society "An extraordinarily comprehensive treatment of both theoretical and practical issues." -Dr. Jeffrey P. Buzen Internationally recognized performance analysis expert ". it is the most thorough book available to date" -Dr. Erol Gelenbe Université René Descartes, Paris ". an extraordinary book.. A worthy addition to the bookshelf of any practicing computer or communications engineer" -Dr. Vinton G. Cer??? Chairman, ACM SIGCOMM "This is an unusual object, a textbook that one wants to sit down and peruse. The prose is clear and fluent, but more important, it is witty." -Allison Mankin The Mitre Washington Networking Center Newsletter Computer simulations based on mathematical models have become ubiquitous across the engineering disciplines and throughout the physical sciences. Successful use of a simulation model, however, requires careful interrogation of the model through systematic computer experiments. While specific theoretical/mathematical examinations of computer experim Computer-based mathematical modeling - the technique of representing and managing models in machine-readable form - is still in its infancy despite the many powerful mathematical software packages already available which can solve astonishingly complex and large models. On the one hand, using mathematical and logical notation, we can formulate models which cannot be solved by any computer in reasonable time - or which cannot even be solved by any method. On the other hand, we can solve certain classes of much larger models than we can practically handle and manipulate without heavy programming. This is especially true in operations research where it is common to solve models with many thousands of variables. Even today, there are no general modeling tools that accompany the whole modeling process from start to finish, that is to say, from model creation to report writing. This book proposes a framework for computer-based modeling. More precisely, it puts forward a modeling language as a kernel representation for mathematical models. It presents a general specification for modeling tools. The book does not expose any solution methods or algorithms which may be useful in solving models, neither is it a treatise on how to build them. No help is intended here for the modeler by giving practical modeling exercises, although several models will be presented in order to illustrate the framework. Nevertheless, a short introduction to the modeling process is given in order to expound the necessary background for the proposed modeling framework. As computers become more complex, the number and complexity of the tasks facing the computer architect have increased. Computer performance often depends in complex way on the design parameters and intuition that must be supplemented by performance studies to enhance design productivity. This book introduces computer architects to computer system performance models and shows how they are relatively simple, inexpensive to implement, and sufficiently accurate for most purposes. It discusses the development of performance models based on queuing theory and probability. The text also shows how they are used to provide quick approximate calculations to indicate basic performance tradeoffs and narrow the range of parameters to consider when determining system configurations. It illustrates how performance models can demonstrate how a memory system is to be configured, what the cache structure should be, and what incremental changes in cache size can have on the miss rate. A particularly deep knowledge of probability theory or any other mathematical field to understand the papers in this volume is not required. Introduction to Mathematical Modeling and Computer Simulations is written as a textbook for readers who want to understand the main principles of Modeling and Simulations in settings that are important for the applications, without using the profound mathematical tools required by most advanced texts. It can be particularly useful for applied mathematicians and engineers who are just beginning their careers. The goal of this book is to outline Mathematical Modeling using simple mathematical descriptions, making it accessible for first- and second-year students. As the field of computer graphics develops, techniques for modeling complex curves and surfaces are increasingly important. A major technique is the use of parametric splines in which a curve is defined by piecing together a succession of curve segments, and surfaces are defined by stitching together a mosaic of surface patches. An Introduction to Splines for Use in Computer Graphics and Geometric Modeling discusses the use of splines from the point of view of the computer scientist. Assuming only a background in beginning calculus, the authors present the material using many examples and illustrations with the goal of building the reader's intuition. Based on courses given at the University of California, Berkeley, and the University of Waterloo, as well as numerous ACM Siggraph tutorials, the book includes the most recent advances in computer-aided geometric modeling and design to make spline modeling techniques generally accessible to the computer graphics and geometric modeling communities. Teaching the science and the technology of programming as a unified discipline that shows the deep relationships between programming paradigms. This innovative text presents computer programming as a unified discipline in a way that is both practical and scientifically sound. The book focuses on techniques of lasting value and explains them precisely in terms of a simple abstract machine. The book presents all major programming paradigms in a uniform framework that shows their deep relationships and how and where to use them together. After an introduction to programming concepts, the book presents both well-known and lesser-known computation models ("programming paradigms"). Each model has its own set of techniques and each is included on the basis of its usefulness in practice. The general models include declarative programming, declarative concurrency, message-passing concurrency, explicit state, object-oriented programming, shared-state concurrency, and relational programming. Specialized models include graphical user interface programming, distributed programming, and constraint programming. Each model is based on its kernel language—a simple core language that consists of a small number of programmer-significant elements. The kernel languages are introduced progressively, adding concepts one by one, thus showing the deep relationships between different models. The kernel languages are defined precisely in terms of a simple abstract machine. Because a wide variety of languages and programming paradigms can be modeled by a small set of closely related kernel languages, this approach allows programmer and student to grasp the underlying unity of programming. The book has many program fragments and exercises, all of which can be run on the Mozart Programming System, an Open Source software package that features an interactive incremental development environment. In this book we give an overview of modeling techniques used to describe computer systems to mathematical optimization tools. We give a brief introduction to various classes of mathematical optimization frameworks with special focus on mixed integer linear programming which provides a good balance between solver time and expressiveness. We present four detailed case studies -- instruction set customization, data center resource management, spatial architecture scheduling, and resource allocation in tiled architectures -- showing how MILP can be used and quantifying by how much it outperforms traditional design exploration techniques. This book should help a skilled systems designer to learn techniques for using MILP in their problems, and the skilled optimization expert to understand the types of computer systems problems that MILP can be applied to. This second edition describes the fundamentals of modelling and simulation of continuous-time, discrete time, discrete-event and large-scale systems. Coverage new to this edition includes: a chapter on non-linear systems analysis and modelling, complementing the treatment of of continuous-time and discrete-time systems; and a chapter on the computer animation and visualization of dynamical systems motion.;College or university bookstores may order five or more copies at a special student price, available on request from Marcel Dekker Inc. Daniel Maki and Maynard Thompson provide a conceptual framework for the process of building and using mathematical models, illustrating the uses of mathematical and computer models in a variety of situations. Generative Modeling for Computer Graphics and Cad: Symbolic Shape Design Using Interval Analysis presents a symbolic approach to shape representation that is useful to the CAD/CAM and computer graphics communities. This book discusses the kinds of operators useful in a geometric modeling system, including arithmetic operators, vector and matrix operators, integration, differentiation, constraint solution, and constrained minimization. Associated with each operator are several methods that compute properties about the parametric functions represented with the operators. This text also elaborates how numerous rendering and analytical operations can be supported with only three methods—evaluation of the parametric function at a point, symbolic differentiation of the parametric function, and evaluation of an inclusion function for the parametric function. This publication is intended for people working in the area of computational geometry who are interested in a robust class of algorithms for manipulating shapes and those who want to know how human beings can specify and manipulate shape. This must-read text/reference provides a practical guide to processes involved in the development and application of dynamic simulation models, covering a wide range of issues relating to testing, verification and validation. Illustrative example problems in continuous system simulation are presented throughout the book, supported by extended case studies from a number of interdisciplinary applications. Topics and features: provides an emphasis on practical issues of model quality and validation, along with questions concerning the management of simulation models, the use of model libraries, and generic models; contains numerous step-by-step examples; presents detailed case studies, often with accompanying datasets; includes discussion of hybrid models, which involve a combination of continuous system and discrete-event descriptions; examines experimental modeling approaches that involve system identification and parameter estimation; offers supplementary material at an associated website. Written with computer scientists and engineers in mind, this book brings queueing theory decisively back to computer science. Accessible text features over 100 reality-based examples pulled from the science, engineering, and operations research fields. Prerequisites: ordinary differential equations, continuous probability. Numerous references. Includes 27 black-and-white figures. 1978 edition. Computer graphics systems are capable of generating stunningly realistic images of objects that have never physically existed. In order for computers to create these accurately detailed images, digital models of appearance must include robust data to give viewers a credible visual impression of the depicted materials. In particular, digital models demonstrating the nuances of how materials interact with light are essential to this capability. Digital Modeling of Material Appearance is the first comprehensive work on the digital modeling of material appearance: it explains how models from physics and engineering are combined with keen observation skills for use in computer graphics rendering. Written by the foremost experts in appearance modeling and rendering, this book is for practitioners who want a general framework for understanding material modeling tools, and also for researchers pursuing the development of new modeling techniques. The text is not a "how to" guide for a particular software system. Instead, it provides a thorough discussion of foundations and detailed coverage of key advances. Practitioners and researchers in applications such as architecture, theater, product development, cultural heritage documentation, visual simulation and training, as well as traditional digital application areas such as feature film, television, and computer games, will benefit from this much needed resource. ABOUT THE AUTHORS Julie Dorsey and Holly Rushmeier are professors in the Computer Science Department at Yale University and co-directors of the Yale Computer Graphics Group. François Sillion is a senior researcher with INRIA (Institut National de Recherche en Informatique et Automatique), and director of its Grenoble Rhône-Alpes research center. First comprehensive treatment of the digital modeling of material appearance Provides a foundation for modeling appearance, based on the physics of how light interacts with materials, how people perceive appearance, and the implications of rendering appearance on a digital computer An invaluable, one-stop resource for practitioners and researchers in a variety of fields dealing with the digital modeling of material appearance