Theory Modeling Simulation bernard zeigler

The increased computational power and software tools available to engineers have increased the use and dependence on modeling and computer simulation throughout the design process. These tools have given engineers the capability of designing highly complex systems and computer architectures that were previously unthinkable. Every complex design project, from integrated circuits, to aerospace vehicles, to industrial manufacturing processes requires these new methods. This book fulfills the essential need of system and control engineers at all levels in understanding modeling and simulation. This book, written as a text/reference has become a standard sr./graduate level course in all EE departments worldwide and all professionals in this area are required to update their skills. The book provides a rigorous mathematical foundation for modeling and computer simulation. It provides a comprehensive framework for modeling and simulation integrating the various simulation approaches. It covers model formulation, simulation model execution, and the model building process with its key activities model abstraction and model simplification, as well as the organization of model libraries. Emphasis of the book is in particular in integrating discrete event and continuous modeling approaches as well as a new approach for discrete event simulation of continuous processes. The book also discusses simulation execution on parallel and distributed machines and concepts for simulation model realization based on the high level architecture (hla) standard of the department of defense. Presents a working foundation necessary for compliance with high level architecture (hla) standards provides a comprehensive framework for continuous and discrete event modeling and simulation explores the mathematical foundation of simulation modeling discusses system morphisms for model abstraction and simplification presents a new approach to discrete event simulation of continuous processes includes parallel and distributed simulation of discrete event models presents a concept to achieve simulator interoperability in the form of the devs-bus theory of modeling and simulation bernard p. zeigler 1984 theory of modeling and simulation bernard p. zeigler 2018-08-14 the book describes how virtual build and test can be supported by the discrete event systems specification (devs) simulation model meta-formalism, and the system entity structure (ses) simulation model ontology. The book examines a wide variety of systems of systems (soS) problems, ranging from cloud computing systems to biological systems in agricultural food crops. Features: includes numerous exercises, examples and case studies throughout the text; presents a step-by-step introduction to devs concepts, encouraging hands-on practice to building sophisticated soS models; illustrates virtual build and test for a variety of soS applications using both commercial and open source devs simulation environments; introduces an approach based on activity concepts intrinsic to devs-based systems, that integrates both energy and information processing requirements; describes co-design modeling concepts and methods to capture separate and integrated software and hardware systems. discrete-event modeling and simulation-gabriel a. wainer 2018-09-03 collecting the work of the foremost scientists in the field, discrete-event modeling and simulation: theory and applications presents the state of the art in modeling discrete-event systems using the discrete-event system specification (devs) approach. It introduces the latest advances, recent extensions of formal techniques, and real-world examples of various applications. The book covers many topics that pertain to several layers of the modeling and simulation architecture. It discusses devs model development support and the interaction of devs with other methodologies. It describes different forms of simulation supported by devs, the use of real-time devs simulation, the relationship between devs and graph transformation, the influence of devs variants on simulation performance, and interoperability and composability with emphasis on devs standardization. The text also examines extensions to devs, new formalisms, and abstractions of devs models as well as the theory and analysis behind real-world system identification and control. To support the generation and search of optimal models of a system, a framework is developed based on the system entity structure and its transformation to devs simulation models. In addition, the book explores numerous interesting examples that illustrate the use of devs to build successful applications, including optical network-on-chip, construction/building design, process control, workflow systems, and environmental models. A one-stop resource on advances in devs theory, applications, and methodology, this volume offers a sampling of the best research in the area, a broad picture of the devs landscape, and trend-setting applications enabled by the devs approach. It provides the basis for future research discoveries and encourages the development of new applications. modeling & simulation-based data engineering-bernard p. zeigler 2007-08-07 data engineering has become a necessary and critical activity for business, engineering, and scientific organizations as the move to service oriented architecture and web services moves into full swing. Notably, the US department of defense is mandating that all of its agencies and contractors assume a defining presence on the net-centric global information grid. This book provides the first practical approach to data engineering and modeling, which supports interoperability with consumers of the data in a service-oriented architecture (SOA). Although XML (eXtensible modeling language) is the lingua franca for such interoperability, it is not sufficient on its own. The approach in this book addresses critical objectives such as creating a single representation for multiple applications, designing models capable of supporting dynamic processes, and harmonizing legacy data models for web-based co-existence. The approach is based on the system entity structure (ses) which is a well-defined structure, methodology, and practical tool with all of the functionality of UML (Unified Modeling Language) and few of the drawbacks. The ses originated in the formal representation of hierarchical simulation models. So it provides an axiomatic formalism that enables automatic generation of XML data, schemas, and other decompositions that allow for effective information exchange covers the interoperability standards mandated by national and international agencies complements zeigler's classic theory of modeling and simulation.
Model Engineering for Simulation-Lin Zhang 2019-02-27 Model Engineering for Simulation provides a systematic introduction to the implementation of generic, normalized and quantifiable modeling and simulation using DEVS formalism. It describes key technologies relating to model lifecycle management, including model description languages, complexity analysis, model management, service-oriented model composition, quantitative measurement of model credibility, and model validation and verification. The book clearly demonstrates how to construct computationally efficient, object-oriented simulations of DEVS models on parallel and distributed environments. Guides system and control engineers in the practical creation and delivery of simulation models using DEVS formalism. Provides practical methods to improve credibility of models and manage the model lifecycle. Helps readers gain an overall understanding of the DEVS lifecycle management and analysis supported by an online ancillary package that includes an instructors and student solutions manual.

Object-Oriented Simulation with Hierarchical, Modular Models-Bernard P. Zeigler 2014-05-10 Object-Oriented Simulation with Hierarchical, Modular Models: Intelligent Agents and Endomorphic Systems describes an approach to object-oriented discrete event simulation and the concepts of hierarchical, modular model construction. The implementation of the concepts of multifaceted modeling methodology in the DEVS-Scheme modeling and simulation environment is discussed. The use of the DEVS-Scheme environment in modeling artificial intelligent agents is also considered, along with the concept of endomorphism to characterize the application of self-embedded models, including models of self. Comprised of 15 chapters, this book begins with an overview of the dimensions of knowledge representation in simulation environments, followed by a discussion on object-oriented programming as well as the concepts of modular, hierarchical models and the system entity structure. Subsequent chapters focus on diagram-models and experimental frames; DEVS formalism and DEVS-Scheme simulation environment; a model base for simple multi-computer architectures; and rule-based specification of atomic models. Model bases in endomorphic systems and intelligent agents are also examined. This monograph will be of interest to simulation theorists as well as practitioners and researchers in the fields of artificial intelligence, systems engineering, computer science and engineering, and operations research.

Concepts and Methodologies for Modeling and Simulation-Levent Yilmaz 2015-04-08 This comprehensive text presents cutting-edge advances in the theory and methodology of modeling and simulation (M&S) and reveals how this work has been influenced by the fundamental contributions of Prof. Tuncer Oren to this field. Exploring the synergies among the domains of M&S and systems engineering (SE), the book describes how M&S and SE can help address the complex problems identified as “Grand Challenges” more effectively under a model-driven and simulation-directed systems engineering framework. Features: examines frameworks for the development of advanced simulation methodologies; presents a focus on advanced modeling methodologies; reviews the reliability and quality assurance of models; discusses the specification and simulation of human, including models of personality, emotions, conflict management, perception and anticipation; provides a survey of the body of knowledge in M&S; highlights the foundations established by the pioneering work of Prof. Tuncer Oren.

Emergent Behavior in Complex Systems Engineering-Saurabh Mittal 2018-04-17 A comprehensive text that reviews the methods and technologies that explore emergent behavior in complex systems engineering in multidisciplinary fields. In Emergent Behavior in Complex Systems Engineering, the authors present the theoretical considerations and the tools required to enable the study of emergent behaviors in manmade systems. Information Technology is key to today's modern world. Scientific theories introduced in the last five decades can now be realized with the latest computational infrastructure. Modeling and simulation, along with Big Data technologies are at the forefront of such exploration and investigation. The text offers a number of simulation-based methods, technologies, and approaches that are designed to encourage the reader to incorporate simulation technologies to further their understanding of emergent behavior in complex systems. The authors present a resource for those designing, developing, managing, operating, and maintaining systems, including systems of systems. The guide is designed to help begin to capture and manage the emergent behavior inherent in complex system engineering in order to reap the benefits of innovation and avoid the dangers of unforeseen consequences. This vital resource: Presents coverage of a wide range of simulation technologies Explores the subject of emergence through the lens of Modeling and Simulation (M&S) Offers contributions from authors at the forefront of various related disciplines such as philosophy, science, engineering, sociology, and economics Contains information on the next generation of complex systems engineering Written for researchers, lecturers, and students, Emergent Behavior in Complex Systems Engineering provides an overview of the current discussions on complexity and emergence, and shows how systems engineering methods in general and simulation methods in particular can help in gaining new insights in complex systems engineering.

Netcentric System of Systems Engineering with DEVS Unified Process-Saurabh Mittal 2018-09-03 In areas such as military, security, aerospace, and disaster management, the need for performance optimization and interoperability among heterogeneous systems is increasingly important. Model-driven engineering, a paradigm in which the model becomes the actual software, offers a promising approach toward systems of systems (SoS) engineering. However, model-driven engineering has largely been unachieved in complex dynamical systems and netcentric SoS, partly because modeling and simulation (M&S) frameworks are stove-piped and not designed for SoS composability. Addressing this gap, Netcentric System of Systems Engineering with DEVS Unified Process presents a methodology for realizing the model-driven engineering vision and netcentric SoS using DEVS Unified Process (DUNIP). The authors draw on their experience with Discrete Event Systems Specification (DEVS) formalism, System Entity Structure (SES) theory, and applying model-driven engineering in the context of a netcentric SoS. They describe formal model-driven engineering methods for netcentric M&S using standards-based approaches to develop and test complex dynamic models with DUNIP.

The book is organized into five sections: Section I introduces undergraduate students and novices to the world of DEVS. It covers systems and SoS M&S as well as DEVS formalism, software, modeling language, and DUNIP. It also assesses DUNIP with the requirements of the Department of Defense’s (DoD) Open Unified Technical Framework (OpenUTF) for netcentric Test and Evaluation (T&E). Section II delves into M&S-based systems engineering for graduate students, advanced practitioners, and industry professionals. It provides methodologies to apply M&S principles to SoS design and reviews the development of executable architectures based on a framework such as the Department of Defense Architecture Framework (DoDAF). It also describes an approach for building netcentric knowledge-based contingency-driven systems. Section III guides graduate students, advanced DEVS users, and industry professionals who are interested in building DEVS virtual machines and netcentric SoS. It discusses modeling standardization, the deployment of models and simulators in a netcentric environment, event-driven architectures, and more. Section IV explores real-world case studies that realize many of the concepts defined in the previous chapters. Section V outlines the next steps and looks at how the modeling of netcentric complex adaptive systems can be attempted using DEVS concepts. It touches on the boundaries of DEVS formalism and the future work needed to utilize advanced concepts like weak and strong emergence, self-organization, scale-free systems, run-time modularity, and event interoperability. This groundbreaking work details how DUNIP offers a well-structured, platform-independent methodology for the modeling and simulation of netcentric system of systems.

The Profession of Modeling and Simulation-Andreas Tolks 2017-07-24 The definitive guide to the theory, knowledge, technical expertise, and ethical considerations that define the M&S profession From traffic control to disaster management, supply chain analysis to military logistics, healthcare management to new drug discovery, modeling and simulation (M&S) has become an essential tool for solving countless real-world problems. M&S professionals are now indispensable to how things get done across virtually every aspect of modern life. This makes it all the more surprising that, until now, no effort has been made to systematically codify the core theory, knowledge, and technical expertise needed to succeed as an M&S professional. This book brings together contributions from experts at the leading edge of the modeling and simulation profession, worldwide, who share their priceless insights into issues which are fundamental to professional success and career development in this critically important field. Running as a common thread throughout the book is an emphasis on several key aspects of the profession, including the essential body of knowledge underlying the M&S profession; the technical discipline of M&S; the ethical standards that should guide professional conduct; and the economic and commercial challenges today’s M&S professionals face. Demonstrates applications of M&S tools and techniques in a variety of fields — such as engineering, operations research, and...
cyber environments—with over 500 types of simulations • Highlights professional and academic aspects of the field, including preferred programming languages, professional academic and certification programs, and key international societies • Shows why M&S professionals must be fully versed in the theory, concepts, and tools needed to address the challenges of cyber environments The Profession of Modeling and Simulation is a valuable resource for M&S practitioners, developers, and researchers working in industry and government. Simulation professionals, including administrators, managers, technologists, faculty members, and scholars within the physical sciences, life sciences, and engineering fields will find it highly useful, as will students planning to pursue a career in the M&S profession. ... nearly three dozen experts in Modeling and Simulation (M&S) come together to make a compelling case for the recognition of M&S as a profession. Important reading for anyone seeking to elevate the standing of this vital field.” Alfred (Al) Grasso, President & CEO, The MITRE Corporation Andreas Tolk, PhD, is Technology Integrator for the Modeling, Simulation, Experimentation, and Analytics Division of The MITRE Corporation, an adjunct professor in the Department of Engineering Management and Systems Engineering and the Department for Modeling, Simulation, and Visualization Engineering at Old Dominion University, and an SCS fellow. Tuncer Ören, PhD, is Professor Emeritus of Computer Science at the University of Ottawa. He is an SCS fellow and an inductee to SCS Modeling and Simulation Hall of Fame. His research interests include advancing methodologies, ethics, body of knowledge, and terminology of modeling and simulation.

TOWARDS A FORMAL THEORY OF MODELING AND SIMULATION. 11-BERNARD P. ZEIGLER 1971

Modeling and Simulation of Discrete Event Systems-Byoung Kyo Choi 2013-09-30 Computer modeling and simulation (M&S) allows engineers to study and analyze complex systems. Discrete-event system (DES)-M&S is used in modern management, industrial engineering, computer science, and the military. As computer speeds and memory capacity increase, so DES-M&S tools become more powerful and more widely used in solving real-life problems. Based on over 20 years of evolution within a classroom environment, as well as on decades-long experience in developing simulation-based solutions for high-tech industries, Modeling and Simulation of Discrete Event Systems-Byoung Kyo Choi is the only book on DES-M&S that ties together activity-based, process-oriented, state-based, and event-based approaches. It covers fundamental concepts and techniques for modeling and simulating a wide variety of systems, such as computer systems, manufacturing systems, communications networks, and transportation systems. The book is intended for researchers, practitioners, and students in various fields, including computer science, engineering, operations research, economics, and management.

Simulation and Model-Based Methodologies: An Integrative View-Tuncer I. Ören 2012-12-06 NATO Advanced Institute Ottawa, Ontario/ Canada, July 26 - August 6, 1982

This book outlines how, for these and other undertakings, engineers must assimilate real-time data with computational tools for rapid decision making under uncertainty. Clarifying the central concepts behind real-time simulation tools and techniques, this one-of-a-kind resource discusses the state of the art, important challenges, and high-impact developments in simulation technologies Provides a basis for the study of real-time modeling as a fundamental and foundational technology Helps readers develop and refine principles that are applicable across a wide variety of application domains As science moves toward more advanced technologies, unconventional design approaches, and unproven regions of the design space, simulation tools are increasingly critical to successful design and operation of technical systems in a growing number of application domains. This must-have resource presents detailed coverage of real-time simulation for system design, parallel and distributed simulations, industry tools, and a large set of applications.

Computational Frameworks-Mamadou Kaba Traore 2017-07-07 Computational Frameworks: Systems, Models and Applications provides an overview of advanced perspectives that bridges the gap between frontline research and practical efforts. It is unique in showing the interdisciplinary nature of this area and the way in which it interacts with emerging technologies and techniques. As computational systems are a dominating part of daily lives and a required support for most of the engineering sciences, this book explores their usage (e.g. big data, high performance clusters, databases and information systems, integrated and embedded hardware/software components, smart devices, mobile and pervasive networks, cyber physical systems, etc.). Provides a unique presentation on the views of frontline researchers on computational systems theory and applications. The framework covers both computational science and engineering and brings the gap between fundamental research and practical engineering. The book is unique in bringing together various fields of research, such as computational science, engineering, artificial intelligence, and artificial intelligence, from different perspectives.
Computational Science and Its Applications - ICCSA 2004-Antonio Laganà 2004-05-07 The natural mission of Computational Science is to tackle all sorts of human problems and to work out intelligent automata aimed at alleviating the burden of working out tools for solving complex problems. For this reason Computational Science, though originating from the need to solve thorny problems in science and engineering (computational science is the key player in the quest to gain fundamental advances in astronomy, biology, chemistry, environmental science, physics, and several other scientific and engineering disciplines) is increasingly turning its attention to all fields of human activity. In all activities, in fact, intensive computation, information handling, knowledge synthesis, the use of ad-hoc devices, etc. increasingly need to be exploited and coordinated regardless of the location of both the users and the various (and heterogeneous) computing platforms. As a result the key to understanding the explosive growth of this discipline lies in two adjectives that more and more appropriately refer to Computational Science and its applications: interoperable and ubiquitous. Numerous examples of ubiquitous software/hardware tools and applications are given in the presentation at the conference delivered at the 2004 International Conference on Computational Science and its Applications (ICCSA 2004) held in Assisi, Italy, May 14-17, 2004.

Modelling and Simulation-Louis G. Birta 2007-09-07 This book provides a balanced and integrated presentation of modelling and simulation activity for both discrete event dynamic systems (DEDS) and continuous time dynamic systems (CTDS). The authors establish a clear distinction between the activity of modelling and that of simulation, maintaining this distinction throughout. The text offers a novel project-oriented approach for developing the modelling and simulation methodology, providing a solid basis for demonstrating the dependency of model structure and granularity on project goals. Comprehensive presentation of the verification and validation activities within the modelling and simulation context is also shown.

Advances in Multimedia Modeling-Tat-Jen Cham 2007-07-07 The two volume set LNCS 4351 and LNCS 4352 constitutes the refereed proceedings of the 13th International Multimedia Modeling Conference, MMM 2007, held in Singapore in January 2007. Based on rigorous reviewing, the program committee selected 123 carefully revised full papers of the main technical sessions and 33 revised full papers of four special sessions from a total of 392 submissions for presentation in two volumes.

Computer Aided Systems Theory - EUROCAST '93-Franz Pichler 1994-01-28 This volume contains a selection of papers presented at the third European Computer Aided Systems Theory workshop, EUROCAST '93, held in Spain in February 1993. The workshop emphasizes interdisciplinary problems with the specific goal of creating a synergy between fields such as systems theory, computer science, systems engineering and related areas. The contributions in this volume are strongly related to current problems in CAST research. They provide new insights into the theoretical and technological research conducted in IT in relation to culture and society

Handbook of Research on Culturally-Aware Information Technology: Perspectives and Models-Blanchard, Emmanuel G. 2010-07-31 This book provides readers with the possibility of acquiring in-depth knowledge of the theoretical and technological research conducted in IT in relation to culture and society

System of Systems Engineering-Mohammad Jamshidi 2011-09-20 Discover the emerging science and engineering of System of Systems Many challenges of the twenty-first century, such as fossil fuel energy resources, require a new approach. The emergence of System-of-Systems (SoS) and System of Systems Engineering (SoSE) presents engineers and professionals with the potential for solving many of the challenges facing our world today. This groundbreaking book brings together the viewpoints of key global players in the field to not only define these challenges, but to provide possible solutions. Each chapter has been contributed by an international expert, and topics covered include modeling, simulation, architecture, and management of SoS and SoSE, net-centricity, standards, management, and optimization, with various applications to defense, transportation, energy, the environment, healthcare, service industry, aerospace, robotics, infrastructure, and information technology. The book has been complemented with several case studies— Space Exploration, Future Energy Resources, Commercial Airlines Maintenance, Manufacturing Sector, Service Sector, Intelligent Transportation, Future Combat Missions, Global Earth Observation System of Systems project, and many more—taking readers on an understanding of the real-world applications of this relatively new technology. System of Systems Engineering is an indispensable resource for aerospace and defense engineers and professionals in related fields.

Emission Tomography-Miles N. Wernick 2004-12-07 PET and SPECT are two of today's most important medical-imaging methods, providing images that reveal subtle information about physiological processes in humans and animals. Emission Tomography: The Fundamentals of PET and SPECT explains the physics and engineering principles of these important imaging technologies. The technology of emission tomography is covered in detail, including historical origins, scientific and mathematical foundations, imaging systems and their components, image reconstruction and analysis, simulation techniques, and clinical and laboratory applications. The book describes the state of the art of emission tomography, including all facets of conventional SPECT and PET, as well as contemporary topics such as iterative image reconstruction, small-animal imaging, and PET/CT systems. This book is intended as a textbook and reference resource for graduate students, researchers, medical physicists, biomedical engineers, and professional engineers and physicists in the medical-imaging industry. Thorough tutorials of fundamental and advanced topics are presented by dozens of the leading researchers in PET and SPECT. SPECT has long been a mainstay of clinical imaging, and PET is now one of the world's fastest growing medical imaging techniques, owing to its dramatic contributions to cancer imaging and other applications. Emission Tomography: The Fundamentals of PET and SPECT is an essential resource for understanding the technology of PET and SPECT, and the book provides comprehensive coverage of all major topics. The book is divided into two parts: Part I provides basic information about PET and SPECT, including their physical foundations, while Part II covers more advanced topics such as iterative reconstruction, small-animal imaging, and PET/CT systems. The book is an important resource for students, researchers, and practitioners in all fields related to medical imaging.

Modeling and Simulation-Bernard P. Zeigler 2017-09-21 Easy-to-follow textbook. This book provides an exercise-driven guide to the use of the Discrete Event Systems Specification (DEVS) methodology. The authors establish a clear distinction between the activity of modelling and that of simulation, maintaining this distinction throughout. The text offers a novel project-oriented approach for developing the modelling and simulation methodology, providing a solid basis for demonstrating the dependency of model structure and granularity on project goals. Comprehensive presentation of the verification and validation activities within the modelling and simulation context is also shown. The authors provide a balanced and integrated presentation of modelling and simulation activity for both discrete event dynamic systems (DEDS) and continuous time dynamic systems (CTDS). The text offers a novel project-oriented approach for developing the modelling and simulation methodology, providing a solid basis for demonstrating the dependency of model structure and granularity on project goals. Comprehensive presentation of the verification and validation activities within the modelling and simulation context is also shown.

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design for SoS, and activity concepts that bridge information-level requirements and energy consumption in the implementation; demonstrates how the DEVS formalism supports Markov modeling within an advanced modeling and simulation environment (NEW). This accessible and hands-on textbook/reference provides invaluable practical guidance for graduate students interested in simulation software development and cyber-systems engineering design, as well as for practitioners in these, and related areas.

Technology for the United States Navy and Marine Corps, 2000-2035 Becoming a 21st-Century Force-National Research Council 1997-10-16 The future national security environment will present the naval forces with operational challenges that can best be met through the development of military capabilities that effectively leverage rapidly advancing technologies in many areas. The panel envisions a world where the naval forces will perform missions in the future similar to those they have historically undertaken. These missions will continue to include sea control, deterrence, power projection, sea lift, and so on. The missions will be accomplished through the use of platforms (ships, submarines, aircraft, and spacecraft), weapons (guns, missiles, bombs, torpedoes, and information), manpower, materiel, tactics, and processes (acquisition, logistics, and so on). Accordingly, the Panel on Technology attempted to identify those technologies that will be of greatest importance to the future development of the naval forces and to project trends in their development out to the year 2035. The primary objective of the panel was to determine which are the most critical technologies for the Department of the Navy to pursue to ensure U.S. dominance in future naval operations and to determine the future trends in these technologies and their impact on Navy and Marine Corps superiority. A vision of future naval operations ensued from this effort. These technologies form the base from which products, platforms, weapons, and capabilities are built. By combining multiple technologies with their future attributes, new systems and subsystems can be envisioned. Technology for the United States Navy and Marine Corps, 2000-2035 Becoming a 21st-Century Force: Volume 2: Technology identifies those technologies that are unique to the naval forces and whose development the Department of the Navy clearly must fund, as well as commercially dominated technologies that the panel believes the Navy and Marine Corps must learn to adapt as quickly as possible to naval applications. Since the development of many of the critical technologies is becoming global in nature, some consideration is given to foreign capabilities and trends as a way to assess potential adversaries’ capabilities. Finally, the panel assessed the current state of the science and technology (S&T) establishment and processes within the Department of the Navy and makes recommendations that would improve the efficiency and effectiveness of this vital area. The panel’s findings and recommendations are presented in this report.

Modeling and Simulation: Theory and Practice-George A. Bekey 2012-12-06 Modeling and Simulation: Theory and Practice provides a comprehensive review of both methodologies and applications of simulation and modeling. The methodology section includes such topics as the philosophy of simulation, inverse problems in simulation, simulation model compilers, treatment of ill-defined systems, and a survey of simulation languages. The application section covers a wide range of topics, including applications to environmental management, biology and medicine, neural networks, collaborative visualization and intelligent interfaces. The book consists of 13 invited chapters written by former colleagues and students of Professor Karplus. Also included are several short ‘reminiscences’ describing Professor Karplus’ impact on the professional careers of former colleagues and students who worked closely with him over the years.

Continuous System Modeling-François E. Cellier 1991-05-23 Modeling and Simulation have become endeavors central to all disciplines of science and engineering. They are used in the analysis of physical systems where they help us gain a better understanding of the functioning of our physical world. They are also important to the design of new engineering systems where they enable us to predict the behavior of a system before it is ever actually built. Modeling and simulation are the only techniques available that allow us to analyze arbitrarily non-linear systems accurately and under varying experimental conditions. Continuous System Models are based on the fundamental laws of nature, so the analysis of systems described through a set of ordinary or partial differential equations is performed through a set of difference equations. This volume introduces concepts of modeling physical systems through a set of differential and/or difference equations. The purpose is twofold: it enhances the scientific understanding of our physical world by codifying (organizing) knowledge about this world, and it supports engineering design by allowing us to assess the consequences of a particular design alternative before it is actually built. This text has a flavor of the mathematical discipline of dynamical systems, and is strongly oriented towards Newtonian physical science.

Research Challenges in Modeling and Simulation for Engineering Complex Systems-Richard Fujimoto 2017-08-18 This illuminating text/reference presents a review of the key aspects of the modeling and simulation (M&S) life cycle, and examines the challenges of M&S in different application areas. The authoritative book offers valuable perspectives on the future of research in M&S, and its role in engineering complex systems. Topics and features: reviews the challenges of M&S for urban infrastructure, healthcare delivery, automated vehicle manufacturing, deep space missions, and acquisitions enterprise; outlines research issues relating to conceptual modeling, covering the development of explicit and unambiguous models, communication and decision-making, and architecture and services; considers key computational challenges in the execution of simulation models, in order to best exploit emerging computing platforms and technologies, examines efforts to understand and manage uncertainty inherent in M&S processes, and how these can be unified under a consistent theoretical and philosophical foundation; discusses the reuse of models and simulations to accelerate the simulation model development process. This thought-provoking volume offers important insights for all researchers involved in modeling and simulation across the full spectrum of disciplines and applications, defining a common research agenda to support the entire M&S research community.

Building Software for Simulation-James J. Nutaro 2011-03-23 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 individual users 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.

Formal Languages for Computer Simulation: Transdisciplinary Models and Applications-Fonseca i Casas, Pau 2013-07-31 Models and simulations are an important first step in developing computer applications to solve real-world problems. However, in order to be truly effective, computer programmers must use formal modeling languages to evaluate these simulations. Formal Languages for Computer Simulation: Transdisciplinary Models and Applications investigates a variety of programming languages used in validating and verifying models in order to assist these simulations. Formal Languages for Computer Simulation: Transdisciplinary Models and Applications is an important first step in developing computer applications to solve real-world problems.
Priority Challenges for Social and Behavioral Research and Its Modeling-Paul K. Davis 2018-04-30 Social-behavioral modeling is famously hard. This report examines shortcomings and obstacles--some inherent to complex adaptive systems broadly and some due to current methods and practices--then discusses steps that deserve priority attention.
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Engineering Principles of Combat Modeling and Distributed Simulation-Andreas Tolk 2012-03-20 Chapters 1-15 written by Andreas Tolk; chapters 16-32 written by various authors.
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