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Thoroughly revised and updated, The Art of Modeling in Science and Engineering with Mathematica(R), Second Edition explores the mathematical tools and procedures used in modeling based on the laws of conservation of mass, energy, momentum, and electrical charge. The authors have culled and consolidated the best from the first edition and expanded the range

of applied examples to reach a wider audience. The text proceeds, in measured steps, from simple models of real-world problems at the algebraic and ordinary differential equations (ODE) levels to more sophisticated models requiring partial differential equations. The traditional solution methods are supplemented with Mathematica, which is used throughout the text to arrive at solutions for many of the problems presented. The text is enlivened with a host of illustrations and practice problems drawn from classical and contemporary sources. They range from Thomson's famous experiment to determine e/m and Euler's model for the buckling of a strut to an analysis of the propagation of emissions and the performance of wind turbines. The mathematical tools required are first explained in separate chapters and then carried along throughout the text to solve and analyze the models. Commentaries at the end of each illustration draw attention to the pitfalls to be avoided and, perhaps most important, alert the reader to unexpected results that defy conventional wisdom. These features and more make the book the perfect tool for resolving three common difficulties: the proper choice of model, the absence of precise solutions, and the need to make suitable simplifying assumptions and approximations. The book covers a wide range of physical processes and phenomena drawn from various disciplines and clearly illuminates the link between the physical system being modeled and the mathematical expression that results. Water Engineering Modeling and Mathematic Tools provides an informative resource for practitioners who want to learn more about different techniques and

models in water engineering and their practical applications and case studies. The book provides modelling theories in an easy-to-read format verified with on-site models for specific regions and scenarios. Users will find this to be a significant contribution to the development of mathematical tools, experimental techniques, and data-driven models that support modern-day water engineering applications. Civil engineers, industrialists, and water management experts should be familiar with advanced techniques that can be used to improve existing systems in water engineering. This book provides key ideas on recently developed machine learning methods and AI modelling. It will serve as a common platform for practitioners who need to become familiar with the latest developments of computational techniques in water engineering. Includes firsthand experience about artificial intelligence models, utilizing case studies Describes biological, physical and chemical techniques for the treatment of surface water, groundwater, sea water and rain/snow Presents the application of new instruments in water engineering As organizations and research institutions continue to emphasize model-driven engineering (MDE) as a first-class approach in the software development process of complex systems, the utilization of software in multiple domains and professional networks is becoming increasingly vital. Advances and Applications in Model-Driven Engineering explores this relatively new approach in software development that can increase the level of abstraction of development of tasks. This publication covers the issues of bridging the gaps between various

disciplines within software engineering and computer science. Professionals, researchers, and students will discover the most current tools and techniques available in the field to maximize efficiency of model-driven software development. This practical book presents fundamental concepts and issues in computer modeling and simulation (M&S) in a simple and practical way for engineers, scientists, and managers who wish to apply simulation successfully to their real-world problems. It offers a concise approach to the coverage of generic (tool-independent) M&S concepts and enables engineering practitioners to easily learn, evaluate, and apply various available simulation concepts. Worked out examples are included to illustrate the concepts and an example modeling application is continued throughout the chapters to demonstrate the techniques. The book discusses modeling purposes, scoping a model, levels of modeling abstraction, the benefits and cost of including randomness, types of simulation, and statistical techniques. It also includes a chapter on modeling and simulation projects and how to conduct them for customer and engineer benefit and covers the stages of a modeling and simulation study, including process and system investigation, data collection, modeling scoping and production, model verification and validation, experimentation, and analysis of results. This book places particular emphasis on issues of model quality and ideas of model testing and validation. Mathematical and computer-based models provide a foundation for explaining complex behaviour, decision-making, engineering design and for real-time

simulators for research and training. Many engineering design techniques depend on suitable models, assessment of the adequacy of a given model for an intended application is therefore critically important. Generic model structures and dependable libraries of sub-models that can be applied repeatedly are increasingly important. Applications are drawn from the fields of mechanical, aeronautical and control engineering, and involve non-linear lumped-parameter models described by ordinary differential equations. Focuses on issues of model quality and the suitability of a given model for a specific application Multidisciplinary problems within engineering feature strongly in the applications The development and testing of nonlinear dynamic models is given very strong emphasis The development of new and effective analytical and numerical models is essential to understanding the performance of a variety of structures. As computational methods continue to advance, so too do their applications in structural performance modeling and analysis. Modeling and Simulation Techniques in Structural Engineering presents emerging research on computational techniques and applications within the field of structural engineering. This timely publication features practical applications as well as new research insights and is ideally designed for use by engineers, IT professionals, researchers, and graduate-level students. This book provides a working knowledge of the modeling and engineering applications of shape memory alloys (SMAs), beginning with a rigorous introduction to continuum mechanics and continuum

thermodynamics as they relate to the development of SMA modeling.Modern SMAs can recover from large amounts of bending and deformation, and millions of repetitions within recoverable ranges. SMAs are used in the medical industry to create stents, in the dental industry to create dental and orthodontic archwires, and in the aerospace industry to create fluid fittings. The text presents a unified approach to the constitutive modeling of SMAs, including modeling of magnetic and high temperature SMAs. 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 systems 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 model lifecycle management and analysis Supported by an online ancillary package that includes an instructors and student solutions manual Following the tradition of previous editions of the MODELS conference, many satellite events were organized in

co-location with the MODELS conference in Toulouse in 2008: 12 workshops, 3 symposia, 9 tutorials, a poster session, and a tools exhibition. The selection of the workshops was organized by a Workshop Selection Committee, which consisted of the following experts: – Michel R. V. Chaudron, Leiden University, The Netherlands (Chair) – Jochen Kuster ¨ , IBM Research Zurich, Switzerland – Henry Muccini, University of L'Aquila, Italy – Holger Giese, Hasso-Plattner-Institute, Germany – Hans Vangheluwe, McGill University, Canada Some workshops have been running for several years as MODELS satellite events, but each year some workshops end. Furthermore, there are always new developments,and hence there is roomfor new workshops. Therefore,the Wo- shop Selection Committee very much welcomes new proposals. The workshops enabled groups of participants to exchange recent and/or preliminary results, to conduct intensive discussions, or to coordinate e?orts between representatives of a technical community. They served as forums for lively discussion of innovative ideas, recent progress, or practical experience on model-driven engineering for speci?c aspects, speci?c problems, or doma- speci?c needs. The three symposia this year were: the Doctoral Symposium, the Educators' Symposium, and the Research Projects Symposium. The Doctoral Symposium provided speci?c support for PhD students to discuss their work and receive guidance for the completion of their dissertation research. Multiphysics Modeling: Numerical Methods and Engineering Applications: Tsinghua University Press Computational Mechanics Series

describes the basic principles and methods for multiphysics modeling, covering related areas of physics such as structure mechanics, fluid dynamics, heat transfer, electromagnetic field, and noise. The book provides the latest information on basic numerical methods, also considering coupled problems spanning fluid-solid interaction, thermal-stress coupling, fluid-solid-thermal coupling, electromagnetic solid thermal fluid coupling, and structure-noise coupling. Users will find a comprehensive book that covers background theory, algorithms, key technologies, and applications for each coupling method. Presents a wealth of multiphysics modeling methods, issues, and worked examples in a single volume Provides a go-to resource for coupling and multiphysics problems Covers the multiphysics details not touched upon in broader numerical methods references, including load transfer between physics, element level strong coupling, and interface strong coupling, amongst others Discusses practical applications throughout and tackles real-life multiphysics problems across areas such as automotive, aerospace, and biomedical engineering Constitutive Modeling of Engineering Materials provides an extensive theoretical overview of elastic, plastic, damage, and fracture models, giving readers the foundational knowledge needed to successfully apply them to and solve common engineering material problems. Particular attention is given to inverse analysis, parameter identification, and the numerical implementation of models with the finite element method. Application in practice is discussed in detail,

showing examples of working computer programs for simple constitutive behaviors. Examples explore the important components of material modeling which form the building blocks of any complex constitutive behavior. Addresses complex behaviors in a wide range of materials, from polymers, to metals and shape memory alloys Covers constitutive models with both small and large deformations Provides detailed examples of computer implementations for material models Explore the military and combat applications of modeling and simulation

Engineering Principles of Combat Modeling and Distributed Simulation is the first book of its kind to address the three perspectives that simulation engineers must master for successful military and defense related modeling: the operational view (what needs to be modeled); the conceptual view (how to do combat modeling); and the technical view (how to conduct distributed simulation). Through methods from the fields of operations research, computer science, and engineering, readers are guided through the history, current training practices, and

modern methodology related to combat modeling and distributed simulation systems. Comprised of contributions from leading international researchers and practitioners, this book provides a comprehensive overview of the engineering principles and state-of-the-art methods needed to address the many facets of combat modeling and distributed simulation and features the following four sections: Foundations introduces relevant topics and recommended practices, providing the needed basis for understanding

the challenges associated with combat modeling and distributed simulation. Combat Modeling focuses on the challenges in human, social, cultural, and behavioral modeling such as the core processes of "move, shoot, look, and communicate" within a synthetic environment and also equips readers with the knowledge to fully understand the related concepts and limitations. Distributed Simulation introduces the main challenges of advanced distributed simulation, outlines the basics of validation and verification, and exhibits how these systems can support the operational environment of the warfighter. Advanced Topics highlights new and developing special topic areas, including mathematical applications fo combat modeling; combat modeling with high-level architecture and base object models; and virtual and interactive digital worlds. Featuring practical examples and applications relevant to industrial and government audiences, Engineering Principles of Combat Modeling and Distributed Simulation is an excellent resource for researchers and practitioners in the fields of operations research, military modeling, simulation, and computer science. Extensively classroom tested, the book is also ideal for courses on modeling and simulation; systems engineering; and combat modeling at the graduate level. Scale Models in Engineering: Fundamentals and Applications provides a simple and fundamental method of designing scale model experiments. This book is divided into two parts. Part I explores the background of scale modeling and explains the design procedure of scale models and experiments. The relaxation method commonly applied

to conflicting requirements in model design is also analyzed. Part II is devoted to case studies selected from modern fields of model application. These studies have been interpreted uniformly. This publication is designed not only as a college textbook for senior and graduate levels but also as a working reference for practicing engineers. This book focuses on the role of modeling in the design of alloys and intermetallic compounds. It includes an introduction to the most important and most used modeling techniques, such as CALPHAD and ab-initio methods, as well as a section devoted to the latest developments in applications of alloys. The book emphasizes the correlation between modeling and technological developments while discussing topics such as wettability of Ultra High Temperature Ceramics by metals, active brazing of diamonds to metals in cutting tools, surface issues in medicine, novel Fe-based superconductors, metallic glasses, high entropy alloys, and thermoelectric materials. Advances in Modeling and Simulation in Textile Engineering: New Concepts, Methods, and Applications explains the advanced principles and techniques that can be used to solve textile engineering problems using numerical modeling and simulation. The book draws on innovative research and industry practice to explain methods for the modeling of all of these processes, helping readers apply computational power to more areas of textile engineering. Experimental results are presented and linked closely to processes and methods of implementation. Diverse concepts such as heat transfer, fluid dynamics, three-dimensional motion, and multi-phase flow are addressed. Finally, tools, theoretical

principles, and numerical models are extensively covered. Textile engineering involves complex processes which are not easily expressed numerically or simulated, such as fiber motion simulation, yarn to fiber formation, melt spinning technology, optimization of yarn production, textile machinery design and optimization, and modeling of textile/fabric reinforcements. Provides new approaches and techniques to simulate a wide range of textile processes from geometry to manufacturing Includes coverage of detailed mathematical methods for textiles, including neural networks, genetic algorithms, and the finite element method Addresses modeling techniques for many different phenomena, including heat transfer, fluid dynamics and multi-phase flow This book provides an open platform to establish and share knowledge developed by scholars, scientists, and engineers from all over the world, about various applications of the modeling and simulation in the design process of products, in various engineering fields. The book consists of 12 chapters arranged in two sections (3D Modeling and Virtual Prototyping), reflecting the multidimensionality of applications related to modeling and simulation. Some of the most recent modeling and simulation techniques, as well as some of the most accurate and sophisticated software in treating complex systems, are applied. All the original contributions in this book are jointed by the basic principle of a successful modeling and simulation process: as complex as necessary, and as simple as possible. The idea is to manipulate the simplifying assumptions in a way that reduces the complexity of the model (in order

to make a real-time simulation), but without altering the precision of the results. A comprehensive guide to the theory, methodology, and development for modeling systems of systems Modeling and Managing Interdependent Complex Systems of Systems examines the complexity of, and the risk to, emergent interconnected and interdependent complex systems of systems in the natural and the constructed environment, and in its critical infrastructures. For systems modelers, this book focuses on what constitutes complexity and how to understand, model and manage it.Previous modeling methods for complex systems of systems were aimed at developing theory and methodologies for uncoupling the interdependencies and interconnections that characterize them. In this book, the author extends the above by utilizing public- and private- sector case studies; identifies, explores, and exploits the core of interdependencies; and seeks to understand their essence via the states of the system, and their dominant contributions to the complexity of systems of systems. The book proposes a reevaluation of fundamental and practical systems engineering and risk analysis concepts on complex systems of systems developed over the past 40 years. This important resource: Updates and streamlines systems engineering theory, methodology, and practice as applied to complex systems of systems Introduces modeling methodology inspired by philosophical and conceptual thinking from the arts and sciences Models the complexity of emergent interdependent and interconnected complex systems of systems by analyzing their shared states, decisions, resources, and decisionmakers

Written for systems engineers, industrial engineers, managers, planners, academics and other professionals in engineering systems and the environment,this text is the resource for understanding the fundamental principles of modeling and managing complex systems of systems, and the risk thereto. Automotive systems engineering addresses the system throughout its life cycle, including requirement, specification, design, implementation, verification and validation of systems, modeling, simulation, testing, manufacturing, operation and maintenance. This book - the third in a series of four volumes on this subject - features 11 papers, published between 1999-2010, that address the challenges and importance of systems modeling, stressing the use of advanced tools and approaches. Topics covered include: Automotive systems modeling Model-based design culture Applications Modeling and Computation in Engineering II (CMCE 2013, Hong Kong, 22-23 June 2013) includes 50 contributions on modeling and simulation technology, which were presented at the 2nd SREE Conference on Modeling and Computation in Engineering (CMCE 2013) and the 3rd SREE Workshop on Applied Mechanics and Civil Engineering (AMCE 2013), both held in Hong Kong, 22-23 June 2013 . The topics covered include: - Modeling technology - Simulation technology and tools - Computation methods and their engineering applications - Mechanics in engineering Modeling and Computation in Engineering II reviews recent advances in multiple areas, including applied mechanics & civil engineering, modeling & simulation in

engineering, design theories, construction science and advanced material applications in building structures, underground structures, bridge structures, hydraulic engineering, municipal engineering, port and coastal engineering, road and transportation engineering, and will be invaluable to academics and professional interested in civil, hydraulic and mechanical engineering. In the electronics industry today consumer demand for devices with hyper-connectivity and mobility has resulted in the development of a complete system on a chip (SoC). Using the old 'rule of thumb' design methods of the past is no longer feasible for these new complex electronic systems. To develop highly successful systems that meet the requirements and quality expectations of customers, engineers now need to use a rigorous, model-based approach in their designs. This book provides the definitive guide to the techniques, methods and technologies for electronic systems engineers, embedded systems engineers, and hardware and software engineers to carry out model-based electronic system design, as well as for students of IC systems design. Based on the authors' considerable industrial experience, the book shows how to implement the methods in the context of integrated circuit design flows. Complete guide to methods, techniques and technologies of model-based engineering design for developing robust electronic systems Written by world experts in model-based design who have considerable industrial experience Shows how to adopt the methods using numerous industrial examples in the context of integrated circuit design The book

focuses on problem solving for practitioners and model building for academicians under multivariate situations. This book helps readers in understanding the issues, such as knowing variability, extracting patterns, building relationships, and making objective decisions. A large number of multivariate statistical models are covered in the book. The readers will learn how a practical problem can be converted to a statistical problem and how the statistical solution can be interpreted as a practical solution. Key features: • Links data generation process with statistical distributions in multivariate domain • Provides step by step procedure for estimating parameters of developed models • Provides blueprint for data driven decision making • Includes practical examples and case studies relevant for intended audiences The book will help everyone involved in data driven problem solving, modeling and decision making.

This book presents a comprehensive compilation of practical systems engineering models. The application and recognition of systems engineering is spreading rapidly, however there is no book that addresses the availability and usability of systems engineering models. Notable among the models to be included are the V-Model, DEJI Model, and Waterfall Model. There are other models developed for specific organizational needs, which will be identified and presented in a practical template so that other organizations can learn and use them. A better understanding of the models, through a comprehensive book, will make these models more visible, embraced, and applied across the spectrum. Visit www.DEJImodel.com for model details. Features Covers applications to both small and large problems Displays

decomposition of complex problems into smaller manageable chunks Discusses direct considerations of the pertinent constraints that exist in the problem domain Presents systematic linking of inputs to goals and outputs Experimental Modelling in Engineering presents the principles of experimental modeling methodically and in such a generalized manner that they may lend themselves to application in practically all fields of technology. The book covers related topics such as modeling based on conditions of similarity; units and dimensions; the applications of homogeneity and dimensionally homogenous equations in the field; and the selection of variables in dimensional analysis. Also covered in the book are topics such as the use of models in experiments; the principle of similarity; examples in experimental modeling; and problems in dimensional analysis and model design. The text is recommended for engineers who would like to know more about the principles, concepts, behind experimental modeling, as well as its applications in engineering and other related fields. Model-Based Systems Engineering (MBSE), which tackles architecting and design of complex systems through the use of formal models, is emerging as the most critical component of systems engineering. This textbook specifies the two leading conceptual modeling languages, OPM—the new ISO 19450, composed primarily by the author of this book, and OMG SysML. It provides essential insights into a domain-independent, discipline-crossing methodology of developing or researching complex systems of any conceivable kind and size.

Combining theory with a host of industrial, biological, and daily life examples, the book explains principles and provides guidelines for architecting complex, multidisciplinary systems, making it an indispensable resource for systems architects and designers, engineers of any discipline, executives at all levels, project managers, IT professional, systems scientists, and engineering students. This succinct book focuses on computer aided design (CAD), 3-D modeling, and engineering analysis and the ways they can be applied effectively in research and industrial sectors including aerospace, defense, automotive, and consumer products. These efficient tools, deployed for R&D in the laboratory and the field, perform efficiently three-dimensional modeling of finished products, render complex geometrical product designs, facilitate structural analysis and optimal product design, produce graphic and engineering drawings, and generate production documentation. Written with an eye toward green energy installations and novel manufacturing facilities, this concise volume enables scientific researchers and engineering professionals to learn design techniques, control existing and complex issues, proficiently use CAD tools, visualize technical fundamentals, and gain analytic and technical skills. This book also: · Equips practitioners and researchers to handle powerful tools for engineering design and analysis using many detailed illustrations · Emphasizes important engineering design principles in introducing readers to a range of techniques · Includes tutorials providing readers

with appropriate scaffolding to accelerate their learning process · Adopts a product development, cost-consideration perspective through the book's many examples The significance of modeling in managing the environment is well recognized from scientific and engineering perspectives as well as in the political arena. Environmental concerns and issues of sustainability have permeated both public and private sectors, particularly the need to predict, assess and mitigate against adverse impacts that arise from continuing development and use of resources. Students need to be made aware of these issues. Practitioners should enrich their knowledge and skills in these areas. This book focuses on the modeling, rather than on data collection or visualization. 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 . . . . This easy to read text provides a broad introduction to the fundamental concepts of modeling and simulation (M&S) and systems engineering, highlighting how M&S is used across the entire systems engineering lifecycle. Features: reviews the full breadth of technologies, methodologies and uses of M&S, rather than just focusing on a specific aspect of the field; presents contributions from specialists in each topic covered; introduces the foundational elements and processes that serve as the groundwork for understanding M&S; explores common methods and methodologies used in M&S; discusses how best to design and execute experiments, covering the use of Monte Carlo techniques, surrogate modeling and distributed simulation; explores the use of M&S throughout the systems development lifecycle, describing a number of methods, techniques, and tools available to support systems engineering processes; provides a selection of case studies illustrating the use of M&S in systems engineering across a variety of domains. The present text sets itself in relief to

other titles on the subject in that it addresses the means and methodologies versus a narrow specific-task oriented approach. Concepts and their developments which evolved to meet the changing needs of applications are addressed. This approach provides the reader with a general tool-box to apply to their specific needs. Two important tools are presented: dimensional analysis and the similarity analysis methods. The fundamental point of view, enabling one to sort all models, is that of information flux between a model and an original expressed by the similarity and abstraction Each chapter includes original examples and applications. In this respect, the models can be divided into several groups. The following models are dealt with separately by chapter; mathematical and physical models, physical analogues, deterministic, stochastic, and cybernetic computer models. The mathematical models are divided into asymptotic and phenomenological models. The phenomenological models, which can also be called experimental, are usually the result of an experiment on an complex object or process. The variable dimensionless quantities contain information about the real state of boundary conditions, parameter (non-linearity) changes, and other factors. With satisfactory measurement accuracy and experimental strategy, such models are highly credible and can be used, for example in control systems. Engineering Modeling and Design is a comprehensive systems engineering text that focuses on systematic principles for designing systems. Concurrent engineering, which requires that from the very start of a project all players (e.g., engineering,

maintenance, marketing, customers) are involved as all facets of the system life cycle are considered, is skillfully illustrated through the use of two major case studies. The text describes how a product design proceeds parallel to the process design, explains key duties of systems engineers throughout the product life cycle, and examines the process of system design in terms of life cycle requirements. Projects and problems are presented throughout the text. A homework solutions/instructor's manual is available from the publisher upon request. Engineering Modeling and Design is an excellent text for engineering design courses in industry and upper division courses on concurrent engineering or total quality management. Engineering Graphic Modelling: A Practical Guide to Drawing and Design covers how engineering drawing relates to the design activity. The book describes modeled properties, such as the function, structure, form, material, dimension, and surface, as well as the coordinates, symbols, and types of projection of the drawing code. The text provides drawing techniques, such as freehand sketching, bold freehand drawing, drawing with a straightedge, a draughting machine or a plotter, and use of templates, and then describes the types of drawing. Graphic designers, design engineers, mechanical engineers, and draughtsmen will find this book invaluable. Written by foremost experts in the field, Engineering Modeling Languages provides end-to-end coverage of the engineering of modeling languages to turn domain knowledge into tools. The book provides a definition of different kinds of modeling

languages, their instrumentation with tools such as editors, interpreters and generators, the integration of multiple modeling languages to achieve a system view, and the validation of both models and tools. Industrial case studies, across a range of application domains, are included to attest to the benefits offered by the different techniques. The book also includes a variety of simple worked examples that introduce the techniques to the novice user. The book is structured in two main parts. The first part is organized around a flow that introduces readers to Model Driven Engineering (MDE) concepts and technologies in a pragmatic manner. It starts with definitions of modeling and MDE, and then moves into a deeper discussion of how to express the knowledge of particular domains using modeling languages to ease the development of systems in the domains. The second part of the book presents examples of applications of the model-driven approach to different types of software systems. In addition to illustrating the unification power of models in different software domains, this part demonstrates applicability from different starting points (language, business knowledge, standard, etc.) and focuses on different software engineering activities such as Requirement Engineering, Analysis, Design, Implementation, and V&V. Each chapter concludes with a small set of exercises to help the reader reflect on what was learned or to dig further into the examples. Many examples of models and code snippets are presented throughout the book, and a supplemental website features all of the models and programs (and their associated tooling) discussed in the book. 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 work 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. Uniquely focusing on dynamic modeling, this volume incorporates metabolic regulation as a survival mechanism for cells, by driving metabolism through optimal investment of its resources for control of enzyme synthesis and activity. Consequently, the models have a proven record of describing various uptake patterns of

mixed carbon substrates that have become significant in modern applications of biomass for the production of bioenergy. The models accurately describe dynamic behavior of microbes in nutrient environments with mixtures of complementary substrates, such as carbon and nitrogen. Modeling of large metabolic networks (including prospects for extension to genome scale) is enabled by lumped hybrid cybernetic models with an unparalleled capacity to predict dynamic behavior of knockout strains. This is an invaluable, must-have reference for bio-researchers and practicing engineers. Computing application to materials science is one of the fastest-growing research areas. This book introduces the concepts and methodologies related to the modeling of the complex phenomena occurring in materials processing. It is intended for undergraduate and graduate students in materials science and engineering, mechanical engineering and physics, and for engineering professionals or researchers. This book provides an overview of state-of-the-art uncertainty quantification (UQ) methodologies and applications, and covers a wide range of current research, future challenges and applications in various domains, such as aerospace and mechanical applications, structure health and seismic hazard, electromagnetic energy (its impact on systems and humans) and global environmental state change. Written by leading international experts from different fields, the book demonstrates the unifying property of UQ theme that can be profitably adopted to solve problems of different domains. The collection in one place of different

methodologies for different applications has the great value of stimulating the cross-fertilization and alleviate the language barrier among areas sharing a common background of mathematical modeling for problem solution. The book is designed for researchers, professionals and graduate students interested in quantitatively assessing the effects of uncertainties in their fields of application. The contents build upon the workshop “Uncertainty Modeling for Engineering Applications” (UMEMA 2017), held in Torino, Italy in November 2017. Environment Modeling-Based Requirements Engineering for Software Intensive Systems provides a new and promising approach for engineering the requirements of software-intensive systems, presenting a systematic, promising approach to identifying, clarifying, modeling, deriving, and validating the requirements of software-intensive systems from well-modeled environment simulations. In addition, the book presents a new view of software capability, i.e. the effect-based software capability in terms of environment modeling. Provides novel and systematic methodologies for engineering the requirements of software-intensive systems Describes ontologies and easily-understandable notations for modeling software-intensive systems Analyzes the functional and non-functional requirements based on the properties of the software surroundings Provides an essential, practical guide and formalization tools for the task of identifying the requirements of software-intensive systems Gives system analysts and requirements engineers insight into how to recognize and

structure the problems of developing software-intensive systems System modeling and analysis is a standard activity in every engineering discipline. This text offers a broad-based introduction to engineering systems, incorporating material from mechanical, electrical, aerospace, and chemical engineering. The overall theme that distinguishes the text from others is its unified treatment of disparate physical systems, emphasizing similarities in both the modeling and behaviour of lumped-element systems. Linear graph theory provides the framework for modeling engineering systems as lumped elements. The analysis of system dynamics that follows is organized by behavioral characteristics rather than by engineering subdisciplines. Next, the Laplace transform is introduced as a tool for understanding frequency response. The final chapter covers feedback systems. Every chapter includes a wide variety of examples, as well as exercise problems, drawn from real-world mechanical, electrical, hydraulic, chemical, and thermal systems. Aimed at second and third year undergraduates, this introductory text offers a unified entry to the multidisciplinary world of engineering. Modeling in Geotechnical Engineering is a one stop reference for a range of computational models, the theory explaining how they work, and case studies describing how to apply them. Drawing on the expertise of contributors from a range of disciplines including geomechanics, optimization, and computational engineering, this book provides an interdisciplinary guide to this subject which is suitable for readers

from a range of backgrounds. Before tackling the computational approaches, a theoretical understanding of the physical systems is provided that helps readers to fully grasp the significance of the numerical methods. The various models are presented in detail, and advice is provided on how to select the correct model for your application. Provides detailed descriptions of different computational modelling methods for geotechnical applications, including the finite element method, the finite difference method, and the boundary element method Gives readers the latest advice on the use of big data analytics and artificial intelligence in geotechnical engineering Includes case studies to help readers apply the methods described in their own work

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