Free pdf Principles of multiscale modeling princeton university (2023)

Principles of Multiscale Modeling Multiscale Modeling, Simulation and Visualization and Their Potential for Future Aerospace Systems Multiscale Modeling and Simulation in Science From Multiscale Modeling to Meso-Science Multiscale Modeling Computational Multiscale Modeling of Fluids and Solids Multiscale Modelling and Simulation Introduction To Multiscale Mathematical Modeling Multiscale Modeling for Process Safety Applications Multiscale Modeling in Solid Mechanics Multiscale Model Reduction Computational Materials Design Via Multiscale Modeling Integrated Computational Materials Engineering (ICME) for Metals Practical Multiscaling Issues in General Science and Scientific Theory and Method: 2011 Edition Multiscale Modeling and Simulation of Composite Materials and Structures Multiscale Modelling and Optimisation of Materials and Structures Multiscale Computer Modeling in Biomechanics and Biomedical Engineering Multiscale Simulation and Design Multiscale Modelling in Biomedical Engineering Multiscale Modelling and Simulation Imitation of Rigor Multiscale Modeling of Heterogeneous Structures An Introduction to Multiscale Modeling with Applications Kinetic Theory and Swarming Tools to Modeling Complex Systems—Symmetry problems in the Science of Living Systems Modeling Materials Modeling Materials Model Reduction and Coarse-Graining Approaches for Multiscale Phenomena Predicting Pandemics in a Globally Connected World, Volume 1 Handbook of Materials Modeling Multiscale Methods Multiscale Modeling of Pedestrian Dynamics From Microstructure Investigations to Multiscale Modeling Multiscale Methods SIAM Journal on Scientific Computing Extinction and Quasi-Stationarity in the Stochastic Logistic SIS Model Princeton Companion to Applied Mathematics Finite Element Modeling of Multiscale Transport Phenomena Mathematical Descriptions of Traffic Flow: Micro, Macro and Kinetic Models Parametric and Non-Parametric Methods of Data Analysis at Multiscale Modeling

Principles of Multiscale Modeling

2011-07-07

a systematic discussion of the fundamental principles written by a leading contributor to the field

Multiscale Modeling, Simulation and Visualization and Their Potential for Future Aerospace Systems

2002

most problems in science involve many scales in time and space an example is turbulent ow where the important large scale quantities of lift and drag of a wing depend on the behavior of the small vortices in the boundarylayer another example is chemical reactions with concentrations of the species varying over seconds and hours while the time scale of the oscillations of the chemical bonds is of the order of femtoseconds a third example from structural mechanics is the stress and strain in a solid beam which is well described by macroscopic equations but at the tip of a crack modeling details on a microscale are needed a common dif culty with the simulation of these problems and many others in physics chemistry and biology is that an attempt to represent all scales will lead to an enormous computational problem with unacceptably long computation times and large memory requirements on the other hand if the discretization at a coarse level ignoresthe nescale informationthenthesolutionwillnotbephysicallymeaningful the in uence of the ne scales must be incorporated into the model this volume is the result of a summer school on multiscale modeling and s ulation in science held at boso n lidingo outside stockholm sweden in june 2007 sixty phd students from applied mathematics the sciences and engineering parti pated in the summer school

Multiscale Modeling and Simulation in Science

2009-02-11

multiscale modeling is becoming essential for accurate rapid simulation in science and engineering this book presents the results of three decades of research on multiscale modeling in process engineering from principles to application and its generalization for different fields this book considers the universality of meso scale phenomena for the first time and provides insight into the emerging discipline that unifies them meso science as well as new perspectives for virtual process engineering multiscale modeling is applied in areas including multiphase flow and fluid dynamics chemical biochemical and process engineering mineral processing and metallurgical engineering energy and resources materials science and engineering jinghai li is vice president of the chinese academy of sciences cas a professor at the institute of process engineering cas and leader of the emms energy minimizing multiscale group wei

ge wei wang ning yang and junwu wang are professors at the emms group part of the institute of process engineering cas xinhua liu limin wang xianfeng he and xiaowei wang are associate professors at the emms group part of the institute of process engineering cas mooson kwauk is an emeritus director of the institute of process engineering cas and is an advisor to the emms group

From Multiscale Modeling to Meso-Science

2013-03-22

this highly useful book contains methodology for the analysis of data that arise from multiscale processes it brings together a number of recent developments and makes them accessible to a wider audience taking a bayesian approach allows for full accounting of uncertainty and also addresses the delicate issue of uncertainty at multiple scales these methods can handle different amounts of prior knowledge at different scales as often occurs in practice

Multiscale Modeling

2007-07-27

the idea of the book is to provide a comprehensive overview of computational physics methods and techniques that are used for materials modeling on different length and time scales each chapter first provides an overview of the physical basic principles which are the basis for the numerical and mathematical modeling on the respective length scale the book includes the micro scale the meso scale and the macro scale the chapters follow this classification the book will explain in detail many tricks of the trade of some of the most important methods and techniques that are used to simulate materials on the perspective levels of spatial and temporal resolution case studies are occasionally included to further illustrate some methods or theoretical considerations example applications for all techniques are provided some of which are from the author s own contributions to some of the research areas methods are explained if possible on the basis of the original publications but also references to standard text books established in the various fields are mentioned

Computational Multiscale Modeling of Fluids and Solids

2008

in august 2003 ethz computational laboratory colab together with the swiss center for scientific computing in manno and the universit della svizzera italiana usi organized the summer school in multiscale modelling and simulation in lugano switzerland this summer school brought together experts in different

disciplines to exchange ideas on how to link methodologies on different scales relevant examples of practical interest include structural analysis of materials flow through porous media turbulent transport in high reynolds number flows large scale molecular dynamic simulations ab initio physics and chemistry and a multitude of others though multiple scale models are not new the topic has recently taken on a new sense of urgency a number of hybrid approaches are now created in which ideas coming from distinct disciplines or modelling approaches are unified to produce new and computationally efficient techniques

Multiscale Modelling and Simulation

2012-12-06

this book introduces the reader to multiscale mathematical modeling that starts by describing a physical process at the microscopic level and is followed by the macroscopic description of that process there are two preliminary chapters introducing the main equations of mathematical physics and serves as revision of all of the necessary mathematical notions needed to navigate the domain of multiscale research the author gives a rigorous presentation of the tools of mathematical modeling as well as an evaluation of the errors of the method this allows readers to analyze the limitations and accuracy of the method the book is accessible to a wide range of readers from specialists in engineering to applied mathematicians working in the applications of materials science biophysics and medicine

Introduction To Multiscale Mathematical Modeling

2022-06-29

multiscale modeling for process safety applications is a new reference demonstrating the implementation of multiscale modeling techniques on process safety applications it is a valuable resource for readers interested in theoretical simulations and or computer simulations of hazardous scenarios as multi scale modeling is a computational technique for solving problems involving multiple scales such as how a flammable vapor cloud might behave if ignited this book provides information on the fundamental topics of toxic fire and air explosion modeling as well as modeling jet and pool fires using computational fluid dynamics the book goes on to cover nanomaterial toxicity qpsr analysis on relation of chemical structure to flash point molecular structure and burning velocity first principle studies of reactive chemicals water and air reactive chemicals and dust explosions chemical and process safety professionals as well as faculty and graduate researchers will benefit from the detailed coverage provided in this book provides the only comprehensive source addressing the use of multiscale modeling in the context of process safety bridges multiscale modeling with process safety enabling the reader to understand mapping between problem detail and effective usage of resources presents an overall picture of addressing safety problems in all

levels of modeling and the latest approaches to each in the field features worked out examples case studies and a question bank to aid understanding and involvement for the reader

Multiscale Modeling for Process Safety Applications

2015-11-29

this unique volume presents the state of the art in the field of multiscale modeling in solid mechanics with particular emphasis on computational approaches for the first time contributions from both leading experts in the field and younger promising researchers are combined to give a comprehensive description of the recently proposed techniques and the engineering problems tackled using these techniques the book begins with a detailed introduction to the theories on which different multiscale approaches are based with regards to linear homogenization as well as various nonlinear approaches it then presents advanced applications of multiscale approaches applied to nonlinear mechanical problems finally the novel topic of materials with self similar structure is discussed

Multiscale Modeling in Solid Mechanics

2010

this monograph is devoted to the study of multiscale model reduction methods from the point of view of multiscale finite element methods multiscale numerical methods have become popular tools for modeling processes with multiple scales these methods allow reducing the degrees of freedom based on local offline computations moreover these methods allow deriving rigorous macroscopic equations for multiscale problems without scale separation and high contrast multiscale methods are also used to design efficient solvers this book offers a combination of analytical and numerical methods designed for solving multiscale problems the book mostly focuses on methods that are based on multiscale finite element methods both applications and theoretical developments in this field are presented the book is suitable for graduate students and researchers who are interested in this topic

Multiscale Model Reduction

2023-06-07

this text delivers a comprehensive overview of the methods of integrated computational materials engineering icme and provides clear examples to demonstrate the multiscale modeling methodology it walks beginners through the various aspects of modeling and simulation related to materials processing

Computational Materials Design Via Multiscale Modeling

2012-07-23

practical multiscaling covers fundamental modelling techniques aimed at bridging diverse temporal and spatial scales ranging from the atomic level to a full scale product level it focuses on practical multiscale methods that account for fine scale material details but do not require their precise resolution the text material evolved from over 20 years of teaching experience at rensselaer and columbia university as well as from practical experience gained in the application of multiscale software this book comprehensively covers theory and implementation providing a detailed exposition of the state of the art multiscale theories and their insertion into conventional single scale finite element code architecture the robustness and design aspects of multiscale methods are also emphasised which is accomplished via four building blocks upscaling of information systematic reduction of information characterization of information utilizing experimental data and material optimization to ensure the reader gains hands on experience a companion website hosting a lite version of the multiscale design software mds lite is available key features combines fundamental theory and practical methods of multiscale modelling covers the state of the art multiscale theories and examines their practical usability in design covers applications of multiscale methods accompanied by a continuously updated website hosting the multiscale design software illustrated with colour images practical multiscaling is an ideal textbook for graduate students studying multiscale science and engineering it is also a must have reference for government laboratories researchers and practitioners in civil aerospace pharmaceutical electronics and automotive industries and commercial software vendors

Integrated Computational Materials Engineering (ICME) for Metals

2013-09-03

issues in general science and scientific theory and method 2011 edition is a scholarlyeditions ebook that delivers timely authoritative and comprehensive information about general science and scientific theory and method the editors have built issues in general science and scientific theory and method 2011 edition on the vast information databases of scholarlynews you can expect the information about general science and scientific theory and method in this ebook to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant the content of issues in general science and scientific theory and method 2011 edition has been produced by the world s leading scientists engineers analysts research institutions and companies all of the content is from peer reviewed sources and

all of it is written assembled and edited by the editors at scholarlyeditions and available exclusively from us you now have a source you can cite with authority confidence and credibility more information is available at scholarlyeditions com

Practical Multiscaling

2012-01-09

this book presents the state of the art in multiscale modeling and simulation techniques for composite materials and structures it focuses on the structural and functional properties of engineering composites and the sustainable high performance of components and structures the multiscale techniques can be also applied to nanocomposites which are important application areas in nanotechnology there are few books available on this topic

Issues in General Science and Scientific Theory and Method: 2011 Edition

2007-10-23

addresses the very topical crucial and original subject of parameter identification and optimization within multiscale modeling methods multiscale modelling and optimization of materials and structures presents an important and challenging area of research that enables the design of new materials and structures with better quality strength and performance parameters as well as the creation of reliable models that take into account structural material and topological properties at different scales the authors approach is four fold 1 the basic principles of micro and nano scale modeling techniques 2 the connection of micro and or nano scale models with macro simulation software 3 optimization development in the framework of multiscale engineering and the solution of identification problems 4 the computer science techniques used in this model and advice for scientists interested in developing their own models and software for multiscale analysis and optimization the authors present several approaches such as the bridging and homogenization methods as well as the general formulation of complex optimization and identification problems in multiscale modelling they apply global optimization algorithms based on robust bioinspired algorithms proposing parallel and multi subpopulation approaches in order to speed up computations and discuss several numerical examples of multiscale modeling optimization and identification of composite and functionally graded engineering materials and bone tissues multiscale modelling and optimization of materials and structures is thereby a valuable source of information for young scientists and students looking to develop their own models write their own computer programs and implement them into simulation systems describes micro and nano scale models developed by the authors along with case studies of analysis and optimization discusses the problems of computing costs efficiency of information transfer effective use of the

computer memory and several other aspects of development of multiscale models includes real physical chemical and experimental studies with modern experimental techniques provides a valuable source of information for young scientists and students looking to develop their own models write their own computer programs and implement them into simulation systems

Multiscale Modeling and Simulation of Composite Materials and Structures

2022-06-08

this book reviews the state of the art in multiscale computer modeling in terms of both accomplishments and challenges the information in the book is particularly useful for biomedical engineers medical physicists and researchers in systems biology mathematical biology micro biomechanics and biomaterials who are interested in how to bridge between traditional biomedical engineering work at the organ and tissue scales and the newer arenas of cellular and molecular bioengineering

Multiscale Modelling and Optimisation of Materials and Structures

2014-07-08

due to the increasing importance of multi scale computation in engineering stimulated by the dramatic development of computer technology and understanding of multi scale structures an issue on multi scale simulation and design or so called virtual process engineering is now edited ace published an issue with title of multi scale analysis in 2005 vol 35 the intention of the present volume is different trying to elucidate the bottlenecks and to identify the correct directions for the coming years from the process and product engineering point of view both fundamental and practical contributions will be provided from academia and industry updates and informs the reader on the latest research findings using original reviews written by leading industry experts and scholars reviews and analyzes developments in the field

Multiscale Computer Modeling in Biomechanics and Biomedical Engineering

2011-06-27

multiscale modelling in biomedical engineering discover how multiscale modeling can enhance patient treatment and outcomes in multiscale modelling in biomedical engineering an accomplished team of biomedical professionals delivers a robust treatment of the foundation and background of a general computational methodology for multi scale modeling the authors demonstrate how

this methodology can be applied to various fields of biomedicine with a particular focus on orthopedics and cardiovascular medicine the book begins with a description of the relationship between multiscale modeling and systems biology before moving on to proceed systematically upwards in hierarchical levels from the molecular to the cellular tissue and organ level it then examines multiscale modeling applications in specific functional areas like mechanotransduction musculoskeletal and cardiovascular systems multiscale modelling in biomedical engineering offers readers experiments and exercises to illustrate and implement the concepts contained within readers will also benefit from the inclusion of a thorough introduction to systems biology and multi scale modeling including a survey of various multi scale methods and approaches and analyses of their application in systems biology comprehensive explorations of biomedical imaging and nanoscale modeling at the molecular cell tissue and organ levels practical discussions of the mechanotransduction perspective including recent progress and likely future challenges in depth examinations of risk prediction in patients using big data analytics and data mining perfect for undergraduate and graduate students of bioengineering biomechanics biomedical engineering and medicine multiscale modelling in biomedical engineering will also earn a place in the libraries of industry professional and researchers seeking a one stop reference to the basic engineering principles of biological systems

Multiscale Simulation and Design

2023-06-07

mark wilson aims to reconnect analytic philosophy with the evolving practicalities within science from which many of its grander concerns originally sprang he offers an alternative history of how the subject might have developed had the insights of its philosopher scientist forebears not been cast aside in the vain pursuit of ersatz rigor

Multiscale Modelling in Biomedical Engineering

2011-09-02

this book provides an overview of multiscale approaches and homogenization procedures as well as damage evaluation and crack initiation and addresses recent advances in the analysis and discretization of heterogeneous materials it also highlights the state of the art in this research area with respect to different computational methods software development and applications to engineering structures the first part focuses on defects in composite materials including their numerical and experimental investigations elastic as well as elastoplastic constitutive models are considered where the modeling has been performed at macro and micro levels the second part is devoted to novel computational schemes applied on different scales and discusses the validation of numerical results the third part discusses gradient enhanced modeling in

particular quasi brittle and ductile damage using the gradient enhanced approach the final part addresses thermoplasticity solid liquid mixtures and ferroelectric models the contents are based on the international workshop multiscale modeling of heterogeneous structures mumo 2016 held in dubrovnik croatia in september 2016

Multiscale Modelling and Simulation

2022-01-27

this book collects the slides prepared for the course of advanced engineering thermodynamics master of science in mechanical engineering and those for the course of multiscale modelling and simulation of molecular and mesoscopic dynamics phd program in energetics taught in english at turin polytechnic here we provide a broad overview on the different topics taught in our classes even though not all topics are presented in the same class students should be able to more easily reconstruct the connections among different phenomena and scales build their own mind map and eventually find their own way of deepening the subjects they are more interested in several engineering applications have been included this helps in stressing that very different phenomena are described by transport theory and obey the same underlying fundamental laws of engineering thermodynamics detailed tutorials are reported based on open source codes for the laboratories gromacs palabos openfoam and cantera

Imitation of Rigor

2018-08-31

this mpdi book comprises a number of selected contributions to a special issue devoted to the modeling and simulation of living systems based on developments in kinetic mathematical tools the focus is on a fascinating research field which cannot be tackled by the approach of the so called hard sciences specifically mathematics without the invention of new methods in view of a new mathematical theory the contents proposed by eight contributions witness the growing interest of scientists this field the first contribution is an editorial paper which presents the motivations for studying the mathematics and physics of living systems within the framework an interdisciplinary approach where mathematics and physics interact with specific fields of the class of systems object of modeling and simulations the different contributions refer to economy collective learning cell motion vehicular traffic crowd dynamics and social swarms the key problem towards modeling consists in capturing the complexity features of living systems all articles refer to large systems of interaction living entities and follow towards modeling a common rationale which consists firstly in representing the system by a probability distribution over the microscopic state of the said entities secondly in deriving a general mathematical structure deemed to provide the conceptual basis for the derivation of models and finally in implementing the said structure by models

of interactions at the microscopic scale therefore the modeling approach transfers the dynamics at the low scale to collective behaviors interactions are modeled by theoretical tools of stochastic game theory overall the interested reader will find in the contents a forward look comprising various research perspectives and issues followed by hints on to tackle these

Multiscale Modeling of Heterogeneous Structures

2013-09-01

explains many key theoretical ideas behind multiscale modeling for graduate students and researchers in physics materials science chemistry and engineering

An Introduction to Multiscale Modeling with Applications

2020-05-29

material properties emerge from phenomena on scales ranging from angstroms to millimeters and only a multiscale treatment can provide a complete understanding materials researchers must therefore understand fundamental concepts and techniques from different fields and these are presented in a comprehensive and integrated fashion for the first time in this book incorporating continuum mechanics quantum mechanics statistical mechanics atomistic simulations and multiscale techniques the book explains many of the key theoretical ideas behind multiscale modeling classical topics are blended with new techniques to demonstrate the connections between different fields and highlight current research trends example applications drawn from modern research on the thermo mechanical properties of crystalline solids are used as a unifying focus throughout the text together with its companion book continuum mechanics and thermodynamics cambridge university press 2011 this work presents the complete fundamentals of materials modeling for graduate students and researchers in physics materials science chemistry and engineering

Kinetic Theory and Swarming Tools to Modeling Complex Systems—Symmetry problems in the Science of Living Systems

2014-05-14

model reduction and coarse graining are important in many areas of science and engineering how does a system with many degrees of freedom become one with fewer how can a reversible micro description be adapted to the dissipative macroscopic model these crucial questions as well as many other related problems are discussed in this book all contributions are by experts whose specialities span a wide range of fields within science and engineering

Modeling Materials

2011-11-24

this contributed volume investigates several mathematical techniques for the modeling and simulation of viral pandemics with a special focus on covid 19 modeling a pandemic requires an interdisciplinary approach with other fields such as epidemiology virology immunology and biology in general spatial dynamics and interactions are also important features to be considered and a multiscale framework is needed at the level of individuals and the level of virus particles and the immune system chapters in this volume address these items as well as offer perspectives for the future

Modeling Materials

2006-09-22

the first reference of its kind in the rapidly emerging field of computational approachs to materials research this is a compendium of perspective providing and topical articles written to inform students and non specialists of the current status and capabilities of modelling and simulation from the standpoint of methodology the development follows a multiscale approach with emphasis on electronic structure atomistic and mesoscale methods as well as mathematical analysis and rate processes basic models are treated across traditional disciplines not only in the discussion of methods but also in chapters on crystal defects microstructure fluids polymers and soft matter written by authors who are actively participating in the current development this collection of 150 articles has the breadth and depth to be a major contributor toward defining the field of computational materials in addition there are 40 commentaries by highly respected researchers presenting various views that should interest the future generations of the community subject editors martin bazant mit bruce boghosian tufts university richard catlow royal institution long qing chen pennsylvania state university william curtin brown university tomas diaz de la rubia lawrence livermore national laboratory nicolas hadjiconstantinou mit mark f horstemeyer mississippi state university efthimios kaxiras harvard university l mahadevan harvard university dimitrios maroudas university of massachusetts nicola marzari mit horia metiu university of california santa barbara gregory c rutledge mit david j srolovitz princeton university bernhardt l trout mit dieter wolf argonne national laboratory

Model Reduction and Coarse-Graining Approaches for Multiscale Phenomena

2022-09-22

this introduction to multiscale methods gives you a broad overview of the methods many uses and applications the book begins by setting the theoretical

foundations of the methods and then moves on to develop models and prove theorems extensive use of examples shows how to apply multiscale methods to solving a variety of problems exercises then enable you to build your own skills and put them into practice extensions and generalizations of the results presented in the book as well as references to the literature are provided in the discussion and bibliography section at the end of each chapter with the exception of chapter one all chapters are supplemented with exercises

Predicting Pandemics in a Globally Connected World, Volume 1

2007-11-17

this book presents mathematical models and numerical simulations of crowd dynamics the core topic is the development of a new multiscale paradigm which bridges the microscopic and macroscopic scales taking the most from each of them for capturing the relevant clues of complexity of crowds the background idea is indeed that most of the complex trends exhibited by crowds are due to an intrinsic interplay between individual and collective behaviors the modeling approach promoted in this book pursues actively this intuition and profits from it for designing general mathematical structures susceptible of application also in fields different from the inspiring original one the book considers also the two most traditional points of view the microscopic one in which pedestrians are tracked individually and the macroscopic one in which pedestrians are assimilated to a continuum selected existing models are critically analyzed the work is addressed to researchers and graduate students

Handbook of Materials Modeling

2008-01-18

small scale features and processes occurring at nanometer and femtosecond scales have a profound impact on what happens at a larger scale and over an extensive period of time the primary objective of this volume is to reflect the state of the art in multiscale mathematics modeling and simulations and to address the following barriers what is the information that needs to be transferred from one model or scale to another and what physical principles must be satisfied during thetransfer of information what are the optimal ways to achieve such transfer of information how can variability of physical parameters at multiple scales be quantified and how can it be accounted for to ensure design robustness the multiscale approaches in space and time presented in this volume are grouped into two main categories information passing and concurrent in the concurrent approaches various scales are simultaneously resolved whereas in the information passing methods the fine scale is modeled and its gross response is infused into the continuum scale the issue of reliability of multiscale modeling and simulation tools which focus on a hierarchy of multiscale models and an a posteriori model of errorestimation

including uncertainty quantification is discussed in several chapters component software that can be effectively combined to address a wide range of multiscale simulations is also described applications range from advanced materials to nanoelectromechanical systems nems biologicalsystems and nanoporous catalysts where physical phenomena operates across 12 orders of magnitude in time scales and 10 orders of magnitude in spatial scales this volume is a valuable reference book for scientists engineers and graduate students practicing in traditional engineering and science disciplines as well as in emerging fields of nanotechnology biotechnology microelectronics and energy

Multiscale Methods

2014-09-12

this volume presents explicit approximations of the quasi stationary distribution and of the expected time to extinction from the state one and from quasi stationarity for the stochastic logistic sis model the approximations are derived separately in three different parameter regions and then combined into a uniform approximation across all three regions subsequently the results are used to derive thresholds as functions of the population size n

Multiscale Modeling of Pedestrian Dynamics

2017

the must have compendium on applied mathematics this is the most authoritative and accessible single volume reference book on applied mathematics featuring numerous entries by leading experts and organized thematically it introduces readers to applied mathematics and its uses explains key concepts describes important equations laws and functions looks at exciting areas of research covers modeling and simulation explores areas of application and more modeled on the popular princeton companion to mathematics this volume is an indispensable resource for undergraduate and graduate students researchers and practitioners in other disciplines seeking a user friendly reference book on applied mathematics features nearly 200 entries organized thematically and written by an international team of distinguished contributors presents the major ideas and branches of applied mathematics in a clear and accessible way explains important mathematical concepts methods equations and applications introduces the language of applied mathematics and the goals of applied mathematical research gives a wide range of examples of mathematical modeling covers continuum mechanics dynamical systems numerical analysis discrete and combinatorial mathematics mathematical physics and much more explores the connections between applied mathematics and other disciplines includes suggestions for further reading cross references and a comprehensive index

From Microstructure Investigations to Multiscale Modeling

2010

complex multiscale systems such as combined free or porous flow regimes and transport processes governed by combined diffusion convection and reaction mechanisms which cannot be readily modeled using traditional methods can be solved by multiscale or stabilized finite element schemes due to the importance of the described multiscale processes in applications such as separation processes reaction engineering and environmental systems analysis a sound knowledge of such methods is essential for many researchers and design engineers who wish to develop reliable solutions for industrially relevant problems the main scope of this book is to provide an authoritative description of recent developments in the field of finite element analysis with a particular emphasis on the multiscale finite element modeling of transport phenomena and flow problem

Multiscale Methods

2008

the book originates from the mini symposium mathematical descriptions of traffic flow micro macro and kinetic models organised by the editors within the iciam 2019 congress held in valencia spain in july 2019 the book is composed of five chapters which address new research lines in the mathematical modelling of vehicular traffic at the cutting edge of contemporary research including traffic automation by means of autonomous vehicles the contributions span the three most representative scales of mathematical modelling the microscopic scale of particles the mesoscopic scale of statistical kinetic description and the macroscopic scale of partial differential equations the work is addressed to researchers in the field

SIAM Journal on Scientific Computing

2011-07-06

the minisymposium parametric and non parametric methods of data analysis at multiscale modeling provided an opportunity to exchange ideas and experiences at the crossroads of three disciplines materials science image analysis and statistical data analysis where new research possibilities have appeared with the rapid development of computer hardware an increase in the processing speed and the size of the memory available there has been a rapid development of data analysis methods that were previously not possible to use in practice due to the required computing power the minisymposium was organized as part of the wccm 2014 11th world congress on computational mechanics which was held in barcelona spain on 20 25 july 2014

Extinction and Quasi-Stationarity in the Stochastic Logistic SIS Model

2015-09-09

Princeton Companion to Applied Mathematics

2011

Finite Element Modeling of Multiscale Transport Phenomena

2021-03-31

Mathematical Descriptions of Traffic Flow: Micro, Macro and Kinetic Models

2015-07-10

Parametric and Non-Parametric Methods of Data Analysis at Multiscale Modeling

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