Discrete Continuum Coupling Method To Simulate Highly Dynamic Multi Scale Problems Simulation Of Laser Induced Damage In Silica Glass Volume 2 Of Continuous Materials Behavior Set

This book provides an updated review on the development of scanning probe microscopy and related techniques, and the availability of computational techniques not even imaginable a few decades ago. The 36 chapters cover instrumental aspects, theoretical models and selected experimental results, thus offering a broad panoramic view on fundamental issues in nanotribology which are currently being investigated. Compared to the first edition, several topics have been added, including triboluminescence, graphene mechanics, friction and wear in liquid environments, capillary condensation, and multiscale friction modeling. Particular care has been taken to avoid overlaps and guarantee the independence of the chapters. In this way, our book aims to become a key reference on this subject for the next five to ten years to come.

This work presents the mathematical methods widely used by workers in the field of quantum optics. It deals with the physical assumptions which lead to the

models and approximations employed, but the main purpose of the text is to give a firm grounding in those techniques needed to derive analytical solutions to problems.

In this paper, we compare three interpolation functions in a discretized continuum when used in coupled dynamic atomistic-to-continuum simulations. The focus is on assessing the ability of the discrete continuum model to capture and accurately represent transient effects, namely a travelling longitudinal wave, through both the mixed atomistic-continuum interface and the non-uniform continuum mesh beyond. We specifically examine the differences among Bubnov-Galerkin, partition of unity, and moving least squares finite element methods in the continuum part of the multiscale model. Our study shows that using partition of unity interpolation functions in the continuum produces superior results compared to the other two approaches.

Three-dimensional surface meshes are the most common discrete representation of the exterior of a virtual shape. Extracting relevant geometric or topological features from them can simplify the way objects are looked at, help with their recognition, and facilitate description and categorization according to specific criteria. This book adopts the point of view of discrete mathematics, the aim of which is to propose discrete counterparts to concepts mathematically defined in

continuous terms. It explains how standard geometric and topological notions of surfaces can be calculated and computed on a 3D surface mesh, as well as their use for shape analysis. Several applications are also detailed, demonstrating that each of them requires specific adjustments to fit with generic approaches. The book is intended not only for students, researchers and engineers in computer science and shape analysis, but also numerical geologists, anthropologists, biologists and other scientists looking for practical solutions to their shape analysis, understanding or recognition problems.

Complex behavior models (plasticity, cracks, visco elascticity) face some theoretical difficulties for the determination of the behavior law at the continuous scale. When homogenization fails to give the right behavior law, a solution is to simulate the material at a meso scale in order to simulate directly a set of discrete properties that are responsible of the macroscopic behavior. The discrete element model has been developed for granular material. The proposed set shows how this method is capable to solve the problem of complex behavior that are linked to discrete meso scale effects.

This book presents a systematic description and case studies of chemical engineering modelling and simulation based on the MATLAB/FEMLAB tools, in support of selected topics in undergraduate and postgraduate programmes that

require numerical solution of complex balance equations (ordinary differential equations, partial differential equations, nonlinear equations, integro-differential equations). These systems arise naturally in analysis of transport phenomena, process systems, chemical reactions and chemical thermodynamics, and particle rate processes. Templates are given for modelling both state-of-the-art research topics (e.g. microfluidic networks, film drying, multiphase flow, population balance equations) and case studies of commonplace design calculations -- mixed phase reactor design, heat transfer, flowsheet analysis of unit operations, flash distillations, etc. The great strength of this book is that it makes modelling and simulating in the MATLAB/FEMLAB environment approachable to both the novice and the expert modeller.

Quantum Systems in Chemistry and Physics contains a refereed selection of the papers presented at the first European Workshop on this subject, held at San Miniato, near Pisa, Italy, in April 1996. The Workshop brought together leading experts in theoretical chemistry and molecular physics with an interest in the quantum mechanical many-body problem. This volume provides an insight into the latest research in this increasingly important field. Throughout the Workshop, the emphasis was on innovative theory and conceptual developments rather than on computational implementation. The various contributions presented reflect this

emphasis and embrace topics such as density matrices and density functional theory, relativistic formulations, electron correlation, valence theory, nuclear motion, response theory, condensed matter, and chemical reactions. Audience: The volume will be of interest to those working in the molecular sciences and to theoretical chemists and molecular physicists in particular.

Reliable scheduling in cutting conditions is very important in machining processes, and this requires thorough understanding of the physical behaviors of the machining process, which cannot be achieved without understanding the underlying mechanism of the processes. The book describes the mechanics and dynamics together with the clamping principles in milling processes, and can be used as a guideline for graduate students and research engineers who wish to be effective manufacture engineers and researchers. Many books have focused on common principles, which are suitable for general machining processes, e.g., milling, turning and drilling, etc. This book specifically aims at exploring the mechanics and dynamics of milling processes. Original theoretical derivations and new observations on static cutting force models, dynamic stability models and clamping principles associated with milling processes are classified and detailed. The book is indented as a text for graduate students and machining engineers who wish to intensively learn milling mechanism and machine tool

vibration.

Modern engineering practice requires advanced numerical modeling because, among other things, it reduces the costs associated with prototyping or predicting the occurrence of potentially dangerous situations during operation in certain defined conditions. Thus far, different methods have been used to implement the real structure into the numerical version. The most popular uses have been variations of the finite element method (FEM). The aim of this Special Issue has been to familiarize the reader with the latest applications of the FEM for the modeling and analysis of diverse mechanical problems. Authors are encouraged to provide a concise description of the specific application or a potential application of the Special Issue.

Computational Finite Element Methods in Nanotechnology demonstrates the capabilities of finite element methods in nanotechnology for a range of fields. Bringing together contributions from researchers around the world, it covers key concepts as well as cutting-edge research and applications to inspire new developments and future interdisciplinary research. In particular, it emphasizes the importance of finite element methods (FEMs) for computational tools in the development of efficient nanoscale systems. The book explores a variety of topics, including: A novel FE-based thermo-electrical-mechanical-coupled model to study mechanical stress, temperature, and

electric fields in nano- and microelectronics The integration of distributed element, lumped element, and system-level methods for the design, modeling, and simulation of nano- and micro-electromechanical systems (N/MEMS) Challenges in the simulation of nanorobotic systems and macro-dimensions The simulation of structures and processes such as dislocations, growth of epitaxial films, and precipitation Modeling of self-positioning nanostructures, nanocomposites, and carbon nanotubes and their composites Progress in using FEM to analyze the electric field formed in needleless electrospinning How molecular dynamic (MD) simulations can be integrated into the FEM Applications of finite element analysis in nanomaterials and systems used in medicine, dentistry, biotechnology, and other areas The book includes numerous examples and case studies, as well as recent applications of microscale and nanoscale modeling systems with FEMs using COMSOL Multiphysics® and MATLAB®. A one-stop reference for professionals, researchers, and students, this is also an accessible introduction to computational FEMs in nanotechnology for those new to the field. Geomaterials exhibit complex but rich mechanical behaviour with a variety of failure modes ranging from diffuse to localized deformation depending on stress, density, microstructure, and loading conditions. These failure modes are a result of an instability of material and/or geometric nature that can be studied within the framework of bifurcation theory. Degradation is another related phenomenon arising from cyclic loading, ageing, weathering, chemical attack, and capillary effects, among others. The

methodology of analyzing the various types of instabilities is crucial in the adequate modelling and safe design of numerous problems in geomechanics. The present volume contains a sampling of enlarged versions of papers presented at the International Workshop on Bifurcation and Degradations in Geomaterials (IWBDG 2008) held in Lake Louise, Alberta, Canada, May 28-31, 2008. These papers capture the state-of-the-art in the specialized field of geomechanics and contemporary approaches to solving the central issue of failure. Some engineering applications are presented in the areas of energy resource extraction and soil-machine interaction.

This text contains a series of self-contained reviews on the state of the art in different areas of partial differential equations, presented by French mathematicians. Topics include qualitative properties of reaction-diffusion equations, multiscale methods coupling atomistic and continuum mechanics, adaptive semi-Lagrangian schemes for the Vlasov-Poisson equation, and coupling of scalar conservation laws.

Professor Philip G. Burke, CBE, FRS formally retired on 30 September 1998. To recognise this occasion some of his colleagues, friends, and former students decided to hold a conference in his honour and to present this volume as a dedication to his enormous contribution to the theoretical atomic physics community. The conference and this volume of the invited talks reflect very closely those areas with which he has mostly been asso- ated and his influence internationally on the development of atomic physics coupled with a parallel growth in supercomputing. Phil’s wide range of interests

include electron-atom/molecule collisions, scattering of photons and electrons by molecules adsorbed on surfaces, collisions involving oriented and chiral molecules, and the development of non-perturbative methods for studying multiphoton processes. His devel- ment of the theory associated with such processes has enabled important advances to be made in our understanding of the associated physics, the interpretation of experimental data, has been invaluable in application to fusion processes, and the study of astrophysical plasmas (observed by both ground- and space-based telescopes). We therefore offer this volume as our token of affection and respect to Philip G. Burke, with the hope that it may also fill a gap in the literature in these important fields.

Complex behavior models (plasticity, crack, visco-elascticity) are facing several theoretical difficulties in determining the behavior law at the continuous (macroscopic) scale. When homogenization fails to give the right behavior law, a solution is to simulate the material at a mesoscale using the discrete element model (DEM) in order to directly simulate a set of discrete properties that are responsible for the macroscopic behavior. Originally, the discrete element model was developed for granular material. This book, the second in the Discrete Element Model and Simulation of Continuous Materials Behavior set of books, shows how to choose the adequate coupling parameters to avoid spurious wave reflection and to allow the passage of all the dynamic information both from the fine to the coarse model and vice versa. The authors

demonstrate the coupling method to simulate a highly nonlinear dynamical problem: the laser shock processing of silica glass.

This book presents a unique combination of chapters that together provide a practical introduction to multiscale modeling applied to nanoscale materials mechanics. The goal of this book is to present a balanced treatment of both the theory of the methodology, as well as some practical aspects of conducting the simulations and models. The first half of the book covers some fundamental modeling and simulation techniques ranging from ab-inito methods to the continuum scale. Included in this set of methods are several different concurrent multiscale methods for bridging time and length scales applicable to mechanics at the nanoscale regime. The second half of the book presents a range of case studies from a varied selection of research groups focusing either on a the application of multiscale modeling to a specific nanomaterial, or novel analysis techniques aimed at exploring nanomechanics. Readers are also directed to helpful sites and other resources throughout the book where the simulation codes and methodologies discussed herein can be accessed. Emphasis on the practicality of the detailed techniques is especially felt in the latter half of the book, which is dedicated to specific examples to study nanomechanics and multiscale materials behavior. An instructive avenue for learning how to effectively apply these simulation tools to solve nanomechanics problems is to study previous endeavors. Therefore, each chapter is written by a unique team of experts who have used multiscale materials modeling to

solve a practical nanomechanics problem. These chapters provide an extensive picture of the multiscale materials landscape from problem statement through the final results and outlook, providing readers with a roadmap for incorporating these techniques into their own research.

Four years after a first meeting in BADDECK, Canada, on the Physics of Ion-Ion and Electron-Ion collisions, a second Nato Advanced Study Institute, in HAl~/Lesse, Belgium, reexamined the subject which had become almost a new one, in consideration of the many important developments that had occured in the mean time. The developments have been particularly impressive in two areas : the di-electronic recombination of electrons with ions and the collisional processes of mUltiply charged ions. For dielectronic recombination, a major event was the obtainment, in 1983, of the first experimental data. This provided, at last, a non speculative basis for the study of that intricate and subtle process and strongly stimulated the theoretical activities. Multiply charged ions, on the other hand, have become popular, thanks to the development of powerful ion sources. This circumstance, together with a pressing demand from thermonuclear research for ionisation and charge exchange cross sections, has triggered systematic experimental investigations and new theoretical studies, which have contributed to considerably enlarge, over the last five years, our understanding of the collisional processes of multiply charged ions. Dielectronic recombination and multiply charged ions were therefore central points in the

programme of the A.S.I. in HAN/Lesse and are given a corresponding emphasis in the present book.

This book stems from the American Chemical Society symposium, Large Scale Molecular Dynamics, Nanoscale, and Mesoscale Modeling and Simulation: Bridging the Gap, that delved into the latest methodologies and applications for largescale, multiscale, and mesoscale modeling and simulation. It presents real-world applications of simulated and synthesized materials, including organic-, inorganic-, bio-, and nanomaterials, and helps readers determine the best method for their simulation. It gets novices up to speed quickly and helps experienced practitioners discover novel approaches and alternatives.

The Advances in Chemical Physics series provides the chemical physics and physical chemistry fields with a forum for critical, authoritative evaluations of advances in every area of the discipline. Filled with cutting-edge research reported in a cohesive manner not found elsewhere in the literature, each volume of the Advances in Chemical Physics series serves as the perfect supplement to any advanced graduate class devoted to the study of chemical physics.

The volume presents a selection of in-depth studies and state-of-the-art surveys of several challenging topics that are at the forefront of modern applied mathematics, mathematical modeling, and computational science. These three areas represent the foundation upon which the methodology of mathematical modeling and computational

experiment is built as a ubiquitous tool in all areas of mathematical applications. This book covers both fundamental and applied research, ranging from studies of elliptic curves over finite fields with their applications to cryptography, to dynamic blocking problems, to random matrix theory with its innovative applications. The book provides the reader with state-of-the-art achievements in the development and application of new theories at the interface of applied mathematics, modeling, and computational science. This book aims at fostering interdisciplinary collaborations required to meet the modern challenges of applied mathematics, modeling, and computational science. At the same time, the contributions combine rigorous mathematical and computational procedures and examples from applications ranging from engineering to life sciences, providing a rich ground for graduate student projects.

Landslides and debris flows belong to the most dangerous natural hazards in many parts of the world. Despite intensive research, these events continue to result in human suffering, property losses, and environmental degradation every year. Better understanding of the mechanisms and processes of landslides and debris flows will help make reliable predictions, develop mitigation strategies and reduce vulnerability of infrastructure. This book presents contributions to the workshop on Recent Developments in the Analysis, Monitoring and Forecast of Landslides and Debris Flow, in Vienna, Austria, September 9, 2013. The contributions cover a broad spectrum of topics from material behavior, physical modelling over numerical simulation to

applications and case studies. The workshop is a joint event of three research projects funded by the European Commission within the 7th Framework Program: MUMOLADE (Multiscale modelling of landslides and debris flows, www.mumolade.com), REVENUES (Numerical Analysis of Slopes with Vegetations, http://www.revenues-eu.com) and HYDRODRIL (Integrated Risk Assessment of Hydrologically-Driven Landslides, www.boku.ac.at/igt/).

This conference proceedings brings together the work of researchers and practising engineers concerned with computational modelling of complex concrete, reinforced concrete and prestressed concrete structures in engineering practice. The subjects considered include computational mechanics of concrete and other cementitious materials, including masonry. Advanced discretisation methods and microstructural aspects within multi-field and multi-scale settings are discussed, as well as modelling formulations and constitutive modelling frameworks and novel experimental programmes. The conference also considered the need for reliable, high-quality analysis and design of concrete structures in regard to safety-critical structures, with a view to adopting these in codes of practice or recommendations. The book is of special interest to researchers in computational mechanics, and industry experts in complex nonlinear simulations of concrete structures.

Numerical Methods in Geotechnical Engineering contains 153 scientific papers presented at the 7th European Conference on Numerical Methods in Geotechnical

Engineering, NUMGE 2010, held at Norwegian University of Science and Technology (NTNU) in Trondheim, Norway, 2 4 June 2010.The contributions cover topics from emerging research to engineering pra

Numerical simulation is a technique of major importance in various technical and scientific fields. Whilst engineering curricula now include training courses dedicated to it, numerical simulation is still not well-known in some economic sectors, and even less so among the general public. Simulation involves the mathematical modeling of the real world, coupled with the computing power offered by modern technology. Designed to perform virtual experiments, digital simulation can be considered as an "art of prediction". Embellished with a rich iconography and based on the testimony of researchers and engineers, this book shines a light on this little-known art. It is the second of two volumes and gives examples of the uses of numerical simulation in various scientific and technical fields: agriculture, industry, Earth and universe sciences, meteorology and climate studies, energy, biomechanics and human and social sciences.

Discrete-continuum Coupling Method to Simulate Highly Dynamic Multi-scale ProblemsSimulation of Laser-induced Damage in Silica GlassJohn Wiley & Sons

This book pursues optimal design from the perspective of mechanical properties and resistance to failure caused by cracks and fatigue. The book abandons the scale separation hypothesis and takes up phase-field modeling, which is at the cutting edge

of research and is of high industrial and practical relevance. Part 1 starts by testing the limits of the homogenization-based approach when the size of the representative volume element is non-negligible compared to the structure. The book then introduces a non-local homogenization scheme to take into account the strain gradient effects. Using a phase field method, Part 2 offers three significant contributions concerning optimal placement of the inclusion phases. Respectively, these contributions take into account fractures in quasi-brittle materials, interface cracks and periodic composites. The topology optimization proposed has significantly increased the fracture resistance of the composites studied.

Research on photon and electron collisions with atomic and molecular targets and their ions has seen a rapid increase in interest, both experimentally and theoretically, in recent years. This is partly because these processes provide an ideal means of investigating the dynamics of many particle systems at a fundamental level and partly because their detailed understanding is required in many other fields, particularly astrophysics, plasma physics and controlled thermonuclear fusion, laser physics, atmospheric processes, isotope separation, radiation physics and chemistry and surface science. In recent years a number of important advances have been made, both on the experimental side and on the theoretical side. On the experimental side these include absolute measurements of cross sections, experiments using coincidence techniques, the use of polarised beams and targets, the development of very high

energy resolution electron beams, the use of synchrotron radiation sources and ion storage rings, the study of laser assisted atomic collisions, the interaction of super-intense lasers with atoms and molecules and the increasing number of studies using positron beams.

Complex behavior models (plasticity, cracks, visco elascticity) face some theoretical difficulties for the determination of the behavior law at the continuous scale. When homogenization fails to give the right behavior law, a solution is to simulate the material at a meso scale in order to simulate directly a set of discrete properties that are responsible of the macroscopic behavior. The discrete element model has been developed for granular material. The proposed set shows how this method is capable to solve the problem of complex behavior that are linked to discrete meso scale effects. The first book solves the local problem, this second title presents a coupling approach to link the structural effects to the local ones, the third book presents the software workbench that includes all the theoretical developments.

Advances in Quantum Chemistry presents surveys of current developments in this rapidly developing field. With invited reviews written by leading international researchers, each presenting new results, it provides a single vehicle for following progress in this interdisciplinary area. Publishes articles, invited reviews and proceedings of major international conferences and workshops Written by leading international researchers in quantum and theoretical chemistry Highlights important interdisciplinary developments

Multi-scale Theory and Computation, Volume 52, the latest release in the Advances in Applied

Mechanics series, draws together recent, significant advances in various topics in applied mechanics. Published since 1948, the book aims to provide authoritative review articles on topics in the mechanical sciences. While the book is ideal for scientists and engineers working in various branches of mechanics, it is also beneficial to professionals who use the results of investigations in mechanics in various applications, such as aerospace, chemical, civil, environmental, mechanical and nuclear engineering. Includes contributions from world-leading experts that are acquired by invitation only Beneficial to scientists, engineers and professionals who use the results of investigations in mechanics in various applications, such as aerospace, chemical, civil, environmental, mechanical and nuclear engineering Covers not only traditional topics, but also important emerging fields

Harmonising Rock Mechanics and the Environment comprises the proceedings (invited and contributed papers) of the 12th ISRM International Congress on Rock Mechanics (Beijing, China, 18-21 October 2011). The contributions cover the entire scope of rock mechanics and rock engineering, with an emphasis on the critical role of both disciplines in sustai

Numerical simulation is a technique of major importance in various technical and scientific fields. Used to understand diverse physical phenomena or to design everyday objects, it plays a major role in innovation in the industrial sector. Whilst engineering curricula now include training courses dedicated to it, numerical simulation is still not well-known in some economic sectors, and even less so among the general public. Simulation involves the mathematical modeling of the real world, coupled with the computing power offered by modern technology. Designed to perform virtual experiments, digital simulation can be considered as an "art of prediction". Embellished with a rich iconography and based on the testimony of researchers

and engineers, this book shines a light on this little-known art. It is the first of two volumes and focuses on the principles, methods and industrial practice of numerical modeling.

The purpose of the Workshop is to have intensive discussions on both theoretical and phenomenological aspects of strong coupling gauge theories (SCGTs), with particular emphasis on the model buildings to be tested in the LHC experiments. Dynamical issues are discussed in lattice simulations and various analytical methods. This proceedings volume is a collection of the presentations made at the Workshop by many leading scientists in the field.

Particle methods have seen increasing use in several engineering and scientific fields, both because of their unique modelling capabilities and the availability of the necessary computational power. This title focuses on their theory and application.

Triangulations, and more precisely meshes, are at the heart of many problems relating to a wide variety of scientific disciplines, and in particular numerical simulations of all kinds of physical phenomena. In numerical simulations, the functional spaces of approximation used to search for solutions are defined from meshes, and in this sense these meshes play a fundamental role. This strong link between meshes and functional spaces leads us to consider advanced simulation methods in which the meshes are adapted to the behaviors of the underlying physical phenomena. This book presents the basic elements of this vision of meshing. These mesh adaptations are generally governed by a posteriori error estimators representing an increase of the error with respect to a size or metric. Independently of this metric of calculation, compliance with a geometry can also be calculated using a so-called geometric metric. The notion of mesh thus finds its meaning in the metric of its elements.

Rock Characterisation, Modelling and Engineering Design Methods contains the contributions

presented at the 3rd ISRM SINOROCK Symposium (Shanghai, China, 18-20 June 2013). The papers contribute to the further development of the overall rock engineering design process through the sequential linkage of the three themes of rock characterisation, model

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 the transfer 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 error estimation 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), biological systems, 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. This book systematically introduces readers to computational granular mechanics and its relative engineering applications. Part I describes the fundamentals, such as the generation of irregular particle shapes, contact models, macro-micro theory, DEM-FEM coupling, and solid-fluid coupling of granular materials. It also discusses the theory behind various numerical methods developed in recent years. Further, it provides the GPU-based parallel algorithm to guide the programming of DEM and examines commercial and open-source codes and software for the analysis of granular materials. Part II focuses on engineering applications, including the latest advances in sea-ice engineering, railway ballast dynamics, and lunar landers. It also presents a rational method of parameter calibration and thorough analyses of DEM simulations, which illustrate the capabilities of DEM. The computational mechanics method for granular materials can be applied widely in various engineering fields, such as rock and soil mechanics, ocean engineering and chemical process engineering.

Offers a review of the newest methodologies for the characterization and modelling of lightweight materials and structures Advances in Multifunctional Lightweight Structures offers a text that provides and in-depth analyses of the thermal, electrical and mechanical responses of multi-functional lightweight structures. The authors, noted experts on the topic, address the most recent and innovative methodologies for the

characterization and modelling of lightweight materials and discuss various shell and plate theories. They present multifunctional materials and structures and offer detailed descriptions of the complex modelling of these structures. The text is divided into three sections that demonstrate a keen understanding and awareness for multi-functional lightweight structures by taking a unique approach. The authors explore multi-disciplinary modelling and characterization alongside benchmark problems and applications, topics that are rarely approached in this field. This important book: • Offers an analyses of the thermal, electrical and mechanical responses of multi-functional lightweight structures • Covers innovative methodologies for the characterization and modelling of lightweight materials and structures • Presents a characterization of a wide variety of novel materials • Considers multifunctional novel structures with potential applications in different high-tech industries • Includes efficient and highly accurate methodologies Written for professionals, engineers and researchers in industrial and other specialized research institutions, Advances in Multifunctional Lightweight Structures offers a much needed text to the design practices of existing engineering building services and how these methods combine with recent developments.

This series provides the chemical physics field with a forum for critical, authoritative evaluations of advances in every area of the discipline. This stand-alone special topics volume reports recent advances in electron-transfer research with significant, up-to-

date chapters by internationally recognized researchers.

The book helps to answer the following questions: How far have the understanding and mesoscale modeling advanced in recent decades, what are the key open questions that require further research and what are the mathematical and physical requirements for a mesoscale model intended to provide either insight or a predictive engineering tool? It is addressed to young researchers including doctoral students, postdocs and early career faculty,

This book constitutes the thoroughly refereed post-conference proceedings of the 9th International Conference on Large-Scale Scientific Computations, LSSC 2013, held in Sozopol, Bulgaria, in June 2013. The 74 revised full papers presented together with 5 plenary and invited papers were carefully reviewed and selected from numerous submissions. The papers are organized in topical sections on numerical modeling of fluids and structures; control and uncertain systems; Monte Carlo methods: theory, applications and distributed computing; theoretical and algorithmic advances in transport problems; applications of metaheuristics to large-scale problems; modeling and numerical simulation of processes in highly heterogeneous media; large-scale models: numerical methods, parallel computations and applications; numerical solvers on many-core systems; cloud and grid computing for resource-intensive scientific applications.