

Composites Modeler Siemens

This volume constitutes the proceedings of the 5th IFIP WG 8.1 Working Conference on the Practice of Enterprise Modeling, held in Rostock, Germany, during November 7-8, 2012. The focus of the PoEM conference series is on improving the understanding of the practice of enterprise modeling by offering a forum for sharing experiences and knowledge between the academic community and practitioners from industry and the public sector. The 15 papers presented were carefully reviewed and selected from 45 submissions, and reflect different facets of enterprise modeling, including organizational and social issues as well as methodological and technical aspects. The papers are organized in five thematic sessions on enterprise modeling, business modeling, process modeling, enterprise architecture, and model-driven development.

Due to their high stiffness and strength and their good processing properties short fibre reinforced thermoplastics are well-established construction materials. Up to now, simulation of engineering parts consisting of short fibre reinforced thermoplastics has often been based on macroscopic phenomenological models, but deformations, damage and failure of composite materials strongly depend on their microstructure. The typical modes of failure of short fibre thermoplastics enriched with glass fibres are matrix failure, rupture of fibres and delamination, and pure macroscopic consideration is not sufficient to predict those effects. The typical predictive phenomenological models are complex and only available for very special failures. A quantitative prediction on how failure will change depending on the content and orientation of the fibres is generally not possible, and the direct involvement of the above effects in a numerical simulation requires multi-scale modelling. On the one hand, this makes it possible to take into account the properties of the matrix material and the fibre material, the microstructure of the composite in terms of fibre content, fibre orientation and shape as well as the properties of the interface between fibres and matrix. On the other hand, the multi-scale approach links these local properties to the global behaviour and forms the basis for the dimensioning and design of engineering components. Furthermore, multi-scale numerical simulations are required to allow efficient solution of the models when investigating three-dimensional problems of dimensioning engineering parts. Bringing together mathematical modelling, materials mechanics, numerical methods and experimental engineering, this book provides a unique overview of multi-scale modelling approaches, multi-scale simulations and experimental investigations of short fibre reinforced thermoplastics. The first chapters focus on two principal subjects: the mathematical and mechanical models governing composite properties and damage description. The subsequent chapters present numerical algorithms based on the Finite Element Method and the Boundary Element Method, both of which make explicit use of the composite's microstructure. Further, the results of the numerical simulations are shown and compared to experimental results. Lastly, the book investigates deformation and failure of composite materials experimentally, explaining the applied methods and presenting the results for different volume fractions of fibres. This book is a valuable resource for applied mathematics, theoretical and experimental mechanical engineers as well as engineers in industry dealing with modelling and simulation of short fibre reinforced composites.

A collection of 23 papers from The American Ceramic Society's 40th International Conference on Advanced Ceramics and Composites, held in Daytona Beach, Florida, January 24-29, 2016. This issue includes papers presented in Symposium 1 - Mechanical Behavior and Performance of Ceramics and Composites.

This book collects the state-of-art and new trends in image analysis and biomechanics. It covers a wide field of scientific and cultural topics, ranging from remodeling of bone tissue under the mechanical stimulus up to optimizing the performance of sports equipment, through the patient-specific modeling in orthopedics, microtomography and its application in oral and implant research, computational modeling in the field of hip prostheses, image based model development and analysis of the human knee joint, kinematics of the hip joint, micro-scale analysis of compositional and mechanical properties of dentin, automated techniques for cervical cell image analysis, and biomedical imaging and computational modeling in cardiovascular disease. The book will be of interest to researchers, Ph.D students, and graduate students with multidisciplinary interests related to image analysis and understanding, medical imaging, biomechanics, simulation and modeling, experimental analysis

Topics in Experimental Dynamics Substructuring and Wind Turbine Dynamics, Volume 2, Proceedings of the 30th IMAC, A Conference and Exposition on Structural Dynamics, 2012, the second volume of six from the Conference, brings together 31 contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics.

A static compensator (STATCOM), also known as static synchronous compensator, is a member of the flexible alternating current transmission system (FACTS) devices. It is a power-electronics based regulating device which is composed of a voltage source converter (VSC) and is shunt-connected to alternating current electricity transmission and distribution networks. The voltage source is created from a DC capacitor and the STATCOM can exchange reactive power with the network. It can also supply some active power to the network, if a DC source of power is connected across the capacitor. A STATCOM is usually installed in the electric networks with poor power factor or poor voltage regulation to improve these problems. In addition, it is used to improve the voltage stability of a network. This book covers STATCOMs from different aspects. Different converter topologies, output filters and modulation techniques utilized within STATCOMs are reviewed. Mathematical modeling of STATCOM is presented in detail and different STATCOM control strategies and algorithms are discussed. Modified load flow calculations for a power system in the presence of STATCOMs are presented. Several applications of STATCOMs in transmission and distribution networks are discussed in different examples and optimization techniques for defining the optimal location and ratings of the STATCOMs in power systems are reviewed. Finally, the performance of the network protection scheme in the presence of STATCOMs is described. This book will be an excellent resource for postgraduate students and researchers interested in grasping the knowledge on STATCOMs.

Advances in Modeling and Simulation in Textile Engineering New Concepts, Methods, and Applications Woodhead Publishing

This book brings together real-world accounts of using voltage stability assessment (VSA) and transient stability assessment (TSA) tools for

grid management. Chapters are written by leading experts in the field who have used these tools to manage their grids and can provide readers with a unique and international perspective. Case studies and success stories are presented by those who have used these tools in the field, making this book a useful reference for different utilities worldwide that are looking into implementing these tools, as well as students and practicing engineers who are interested in learning the real-time applications of VSA and TSA for grid operation.

This book gathers the proceedings of the 15th IFToMM World Congress, which was held in Krakow, Poland, from June 30 to July 4, 2019. Having been organized every four years since 1965, the Congress represents the world's largest scientific event on mechanism and machine science (MMS). The contributions cover an extremely diverse range of topics, including biomechanical engineering, computational kinematics, design methodologies, dynamics of machinery, multibody dynamics, gearing and transmissions, history of MMS, linkage and mechanical controls, robotics and mechatronics, micro-mechanisms, reliability of machines and mechanisms, rotor dynamics, standardization of terminology, sustainable energy systems, transportation machinery, tribology and vibration. Selected by means of a rigorous international peer-review process, they highlight numerous exciting advances and ideas that will spur novel research directions and foster new multidisciplinary collaborations.

This book is a comprehensive source of information on various aspects of ceramic matrix composites (CMC). It covers ceramic and carbon fibers; the fiber-matrix interface; processing, properties and industrial applications of various CMC systems; architecture, mechanical behavior at room and elevated temperatures, environmental effects and protective coatings, foreign object damage, modeling, life prediction, integration and joining. Each chapter in the book is written by specialists and internationally renowned researchers in the field. This book will provide state-of-the-art information on different aspects of CMCs. The book will be directed to researchers working in industry, academia, and national laboratories with interest and professional competence on CMCs. The book will also be useful to senior year and graduate students pursuing degrees in ceramic science and engineering, materials science and engineering, aeronautical, mechanical, and civil or aerospace engineering. Presents recent advances, new approaches and discusses new issues in the field, such as foreign object damage, life predictions, multiscale modeling based on probabilistic approaches, etc. Caters to the increasing interest in the application of ceramic matrix composites (CMC) materials in areas as diverse as aerospace, transport, energy, nuclear, and environment. CMCs are considered an enabling technology for advanced aeropropulsion, space propulsion, space power, aerospace vehicles, space structures, as well as nuclear and chemical industries. Offers detailed descriptions of ceramic and carbon fibers; fiber-matrix interface; processing, properties and industrial applications of various CMC systems; architecture, mechanical behavior at room and elevated temperatures, environmental effects and protective coatings, foreign object damage, modeling, life prediction, integration/joining.

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

Introducing the Quality of Protection Modeling Language (QoP-ML), this book provides for the abstraction of security systems while maintaining emphasis on the details of quality protection . It delineates the steps used in cryptographic protocol and introduces a multilevel protocol analysis that expands current understanding. Every operation defined by QoP-ML is described within parameters of security metrics, therefore evaluating the impact of the operation on the entire system's security.

Composites Innovation: Perspectives on Advancing the Industry provides a panoramic view of innovations in the composites industry, including discussions from business leaders and the university research community on advanced applications in North America, advances in recycling of composites, the use of artificial intelligence, nanocomposites, and emerging smart composites technology. The book is arranged in five key segments including: how composites fit into our world; the basics of the technology; customer insights; pushing the boundaries with concepts from outside the world of composites and emerging composites technologies; and paths forward to find competitive and effective solutions in a timely manner. Key Features Considers sustainability and innovation as driving forces for the growth of composites Explores materials and process development, including chopped and continuous fiber systems Provides a landscape of the status of intellectual property and patents Discusses use of artificial intelligence to improve business systems with case studies and a new disciplined approach to ideation and innovation Features chapters by an accomplished group of global business and technology leaders With contributing authors spanning 15 time zones to pioneer new solutions with composite materials, this book provides an excellent resource for composites business leaders, researchers and educators, and industry professionals, as well as new entrants to this vibrant community. Composite structures are most efficient in performance and production cost when combined with smart materials making them adaptable to changing operational conditions. The specific production processes of composites offer the possibility to integrate more functions thus making the structure more valuable. Active functions can be realized by smart materials, e.g. morphing, active vibration control, active structure acoustic control or structure health monitoring. The foundation is a sound understanding of materials, design methods, design principles, production technologies and adaptronics. Along the complete process chain this disciplines together deliver advanced lightweight solutions for applications ranging from mechanical engineering to vehicles, airframe and finally space structures. This book provides the scientific foundations as well as inspiring new ideas for engineers working in the field of composite lightweight structures.

Model Validation and Uncertainty Quantification, Volume 3. Proceedings of the 34th IMAC, A Conference and Exposition on Dynamics of Multiphysical Systems: From Active Materials to Vibroacoustics, 2016, the third volume of ten from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics, including papers on: • Uncertainty Quantification & Model Validation • Uncertainty Propagation in Structural Dynamics • Bayesian & Markov Chain Monte Carlo Methods • Practical Applications of MVUQ • Advances in MVUQ & Model Updating • Robustness in Design & Validation • Verification & Validation Methods

This book presents current spatial and temporal multiscale approaches of materials modeling. Recent results demonstrate the

deduction of macroscopic properties at the device and component level by simulating structures and materials sequentially on atomic, micro- and mesostructural scales. The book covers precipitation strengthening and fracture processes in metallic alloys, materials that exhibit ferroelectric and magnetoelectric properties as well as biological, metal-ceramic and polymer composites. The progress which has been achieved documents the current state of art in multiscale materials modelling (MMM) on the route to full multi-scaling. Contents: Part I: Multi-time-scale and multi-length-scale simulations of precipitation and strengthening effects Linking nanoscale and macroscale Multiscale simulations on the coarsening of Cu-rich precipitates in γ -Fe using kinetic Monte Carlo, Molecular Dynamics, and Phase-Field simulations Multiscale modeling predictions of age hardening curves in Al-Cu alloys Kinetic Monte Carlo modeling of shear-coupled motion of grain boundaries Product Properties of a two-phase magneto-electric composite Part II: Multiscale simulations of plastic deformation and fracture Niobium/alumina bicrystal interface fracture Atomistically informed crystal plasticity model for body-centred cubic iron FE2AT ? finite element informed atomistic simulations Multiscale fatigue crack growth modeling for welded stiffened panels Molecular dynamics study on low temperature brittleness in tungsten single crystals Multi scale cellular automata and finite element based model for cold deformation and annealing of a ferritic-pearlitic microstructure Multiscale simulation of the mechanical behavior of nanoparticle-modified polyamide composites Part III: Multiscale simulations of biological and bio-inspired materials, bio-sensors and composites Multiscale Modeling of Nano-Biosensors Finite strain compressive behaviour of CNT/epoxy nanocomposites Peptide-zinc oxide interaction Computational Modeling in Bioengineering and Bioinformatics promotes complementary disciplines that hold great promise for the advancement of research and development in complex medical and biological systems, and in the environment, public health, drug design, and so on. It provides a common platform by bridging these two very important and complementary disciplines into an interactive and attractive forum. Chapters cover biomechanics and bioimaging, biomedical decision support system, data mining, personalized diagnoses, bio-signal processing, protein structure prediction, tissue and cell engineering, biomedical image processing, analysis and visualization, high performance computing and sports bioengineering. The book's chapters are the result of many international projects in the area of bioengineering and bioinformatics done at the Research and Development Center for Bioengineering BioIRC and by the Faculty of Engineering at the University of Kragujevac, Serbia. Presents recent advances at the crossroads of biomedical engineering and bioinformatics, one of the hottest areas in biomedical and clinical research Discusses a wide range of leading-edge research topics, including biomechanics and bioimaging, biomedical decision support systems, data mining, personalized diagnoses, bio-signal processing, protein structure prediction, tissue and cell engineering, amongst others Includes coverage of biomechanical, bioengineering and computational methods of treatment and diagnosis This book contains the proceedings of the IUTAM Symposium on Multiscale Modeling and Uncertainty Quantification of Materials and Structures that was held at Santorini, Greece, September 9 – 11, 2013. It consists of 20 chapters which are divided in five thematic topics: Damage and fracture, homogenization, inverse problems–identification, multiscale stochastic mechanics and stochastic dynamics. Over the last few years, the intense research activity at micro scale and nano scale reflected the need to

account for disparate levels of uncertainty from various sources and across scales. As even over-refined deterministic approaches are not able to account for this issue, an efficient blending of stochastic and multiscale methodologies is required to provide a rational framework for the analysis and design of materials and structures. The purpose of this IUTAM Symposium was to promote achievements in uncertainty quantification combined with multiscale modeling and to encourage research and development in this growing field with the aim of improving the safety and reliability of engineered materials and structures. Special emphasis was placed on multiscale material modeling and simulation as well as on the multiscale analysis and uncertainty quantification of fracture mechanics of heterogeneous media. The homogenization of two-phase random media was also thoroughly examined in several presentations. Various topics of multiscale stochastic mechanics, such as identification of material models, scale coupling, modeling of random microstructures, analysis of CNT-reinforced composites and stochastic finite elements, have been analyzed and discussed. A large number of papers were finally devoted to innovative methods in stochastic dynamics.

Towards Green Marine Technology and Transport covers recent developments in marine technology and transport. The book brings together a selection of papers reflecting fundamental areas of recent research and development in the fields of ship hydrodynamics, marine structures, ship design, shipyard technology, ship machinery, maritime transportation, The subject of optimum composite structures is a rapidly evolving field and intensive research and development have taken place in the last few decades. Therefore, this book aims to provide an up-to-date comprehensive overview of the current status in this field to the research community. The contributing authors combine structural analysis, design and optimization basis of composites with a description of the implemented mathematical approaches. Within this framework, each author has dealt with the individual subject as he/she thought appropriate. Each chapter offers detailed information on the related subject of its research with the main objectives of the works carried out as well as providing a comprehensive list of references that should provide a rich platform of research to the field of optimum composite structures.

Written as an extension of A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) Second Edition, this easy-to-understand, practical guide covers advanced content on PLS-SEM to help students and researchers apply techniques to research problems and accurately interpret results. Authors Joseph F. Hair, Jr., Marko Sarstedt, Christian Ringle, and Siegfried P. Gudergan provide a brief overview of basic concepts before moving to the more advanced material. Offering extensive examples on SmartPLS 3 software and accompanied by free downloadable data sets, the book emphasizes that any advanced PLS-SEM approach should be carefully applied to ensure that it fits the appropriate research context and the data characteristics that underpin the research.

New and not previously published U.S. and international research on composite and nanocomposite materials Focus on health monitoring/diagnosis, multifunctionality, self-healing, crashworthiness, integrated computational materials engineering (ICME), and more Applications to aircraft, armor, bridges, ships, and civil structures This fully searchable CD-ROM contains 270 original research papers on all phases of composite materials, presented by specialists from universities, NASA and private corporations such as Boeing. The

document is divided into the following sections: Aviation Safety and Aircraft Structures; Armor and Protection; Multifunctional Composites; Effects of Defects; Out of Autoclave Processing; Sustainable Processing; Design and Manufacturing; Stability and Postbuckling; Crashworthiness; Impact and Dynamic Response; Natural, Biobased and Green; Integrated Computational Materials Engineering (ICME); Structural Optimization; Uncertainty Quantification; NDE and SHM Monitoring; Progressive Damage Modeling; Molecular Modeling; Marine Composites; Simulation Tools; Interlaminar Properties; Civil Structures; Textiles. The CD-ROM displays figures and illustrations in articles in full color along with a title screen and main menu screen. Each user can link to all papers from the Table of Contents and Author Index and also link to papers and front matter by using the global bookmarks which allow navigation of the entire CD-ROM from every article. Search features on the CD-ROM can be by full text including all key words, article title, author name, and session title. The CD-ROM has Autorun feature for Windows 2000 or higher products and can also be used with Macintosh computers. The CD includes the program for Adobe Acrobat Reader with Search 11.0. One year of technical support is included with your purchase of this product.

This extensive collection of papers constitutes an invaluable source of information covering the current state of the art with regard to manufacturing science and engineering, and focussing on Advanced Composite Materials. These 534 peer-reviewed papers are grouped into 12 chapters: CAD/CAM; Ceramic-Matrix Composites; Coatings, Damage Mechanics; Design of Materials and Components, Environmental Effects; Metal-Matrix Composites; Modelling; Non-Destructive Evaluation; Polymer-Matrix Composites; Processing and Manufacturing, Properties and Performance; Prototyping Reinforcement Materials, Repair, Testing; Thermoplastic Composites; Nanotechnology.

Composite Reinforcements for Optimum Performance, Second Edition, has been brought fully up to date with the latest developments in the field. It reviews the materials, properties and modelling techniques used in composite production and highlights their uses in optimizing performance. Part I covers materials for reinforcements in composites, including chapters on fibers, carbon nanotubes and ceramics as reinforcement materials. In Part II, different types of structures for reinforcements are discussed, with chapters covering woven and braided reinforcements, three-dimensional fibre structures and two methods of modelling the geometry of textile reinforcements: WiseTex and TexGen. Part III focuses on the properties of composite reinforcements, with chapters on topics such as in-plane shear properties, transverse compression, bending and permeability properties. Finally, Part IV covers the characterization and modelling of reinforcements in composites, with chapters focusing on microscopic and mesoscopic approaches, X-ray tomography analysis and modelling reinforcement forming processes. With its distinguished editor and international team of contributors, Composite Reinforcements for Optimum Performance, Second Edition, is an essential reference for designers and engineers working in the composite and composite reinforcement manufacturing industry, as well as all those with an academic research interest in the subject. Discusses the characterization and modeling of reinforcements in composites, focusing on such topics as microscopic and mesoscopic approaches, X-ray tomography analysis, and modeling reinforcement forming processes Provides comprehensive coverage of the types and properties of reinforcement in composites, along with their production and performance optimization Includes sections on NCF (non-crimp fabrics), natural fiber reinforcements, tufting composite reinforcements, sustainability, multiscale modeling, knitted reinforcements, and more

The book summarizes the current state of the solid oxide fuel cell (SOFC) technology in power generation applications. It describes the single cells, SOFC stacks, micro-combined heat and power systems, large-scale stationary power generators and polygeneration units. The principles of modeling, simulation and controls of power systems with solid oxide fuel cells are presented and discussed. Authors provide theoretical background of the technology followed by the essential insights into the integrated power systems. Selected aspects of the design,

construction and operation of power units in range from single kilowatts to hundreds of kilowatts are presented. Finally, the book reports the selected studies on prototype systems which have been constructed in Europe. The book discusses the theoretical and practical aspects of operation of power generators with solid oxide fuel cells including fabrication of cells, design of stacks, system modeling, simulation of stationary and non-stationary operation of systems, fuel preparation and controls.

The Third Edition of *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* guides readers through learning and mastering the techniques of this approach. The authors use their teaching experience to communicate the fundamentals of PLS-SEM with limited emphasis on equations and symbols, relying on straightforward language instead.

If you're interested in engineering analysis applications for various product development tasks, then you need to add this technical guide to your bookshelf. Written by a team of engineers at Siemens PLM Software, it provides deep insights about finite element analysis and will help anyone interested in computer-aided engineering. NX Advanced Simulation is a feature-rich system for multi-physics calculations that can be used to study strength and dynamics, aerodynamic performance, internal and external flow of liquids and gases, cooling systems, experimental engineering, and more. Whether you're just starting out as an engineer or are an experienced professional, you'll be delighted by the insights and practical knowledge in *Engineering Analysis with NX Advanced Simulation*.

Full coverage of electronics, MEMS, and instrumentation and control in mechanical engineering This second volume of *Mechanical Engineers' Handbook* covers electronics, MEMS, and instrumentation and control, giving you accessible and in-depth access to the topics you'll encounter in the discipline: computer-aided design, product design for manufacturing and assembly, design optimization, total quality management in mechanical system design, reliability in the mechanical design process for sustainability, life-cycle design, design for remanufacturing processes, signal processing, data acquisition and display systems, and much more. The book provides a quick guide to specialized areas you may encounter in your work, giving you access to the basics of each and pointing you toward trusted resources for further reading, if needed. The accessible information inside offers discussions, examples, and analyses of the topics covered, rather than the straight data, formulas, and calculations you'll find in other handbooks. Presents the most comprehensive coverage of the entire discipline of Mechanical Engineering anywhere in four interrelated books Offers the option of being purchased as a four-book set or as single books Comes in a subscription format through the Wiley Online Library and in electronic and custom formats Engineers at all levels will find *Mechanical Engineers' Handbook, Volume 2* an excellent resource they can turn to for the basics of electronics, MEMS, and instrumentation and control.

This book covers several aspects of the fatigue behavior of textile and short fiber reinforced composites. The first part is dedicated to 2D and 3D reinforced textile composites and includes a systematic description of the damage evolution for quasi-static and tensile-tensile fatigue loadings. Acoustic emissions and digital image correlation are considered in order to detect the damage modes' initiation and development. The acoustic emission thresholds of the quasi-static loading are connected to the "fatigue limit" of the materials with distinctions for glass and carbon reinforcements. The second part is devoted to the fatigue behavior of injection molded short fiber reinforced composites. Experimental evidence highlights the dependence of their fatigue response on various factors: fiber and matrix materials, fiber distribution, environmental and loading conditions are described. A hybrid (experimental/simulations) multi-scale method is presented, which drastically reduces the amount of experimental data necessary for reliable fatigue life predictions.

This book systematically introduces the development of simulation models as well as the implementation and evaluation of simulation

experiments with Tecnomatix Plant Simulation. It deals with all users of Plant Simulation, who have more complex tasks to handle. It also looks for an easy entry into the program. Particular attention has been paid to introduce the simulation flow language SimTalk and its use in various areas of the simulation. The author demonstrates with over 200 examples how to combine the blocks for simulation models and how to deal with SimTalk for complex control and analysis tasks. The contents of this book ranges from a description of the basic functions of the material flow blocks to demanding topics such as the realization of a database-supported warehouse control by using the SQLite interface or the exchange of data by using XML, ActiveX, COM or DDE.

The aim of the book is to provide engineers with a practical guide to Finite Element Modelling (FEM) in Abaqus CAE software. The guide is in the form of step-by-step procedures concerning yarns, woven fabric and knitted fabrics modelling, as well as their contact with skin so that the simulation of haptic perception between textiles and skin can be

This book presents new results in the knowledge and simulations for composite nano-materials. It includes selected, extended papers presented in the thematic ECCOMAS conference on Composites with Micro- and Nano-Structure (CMNS) – Computational Modelling and Experiments. It contains atomistic and continuum numerical methods and experimental validation for composite materials reinforced with particles or fibres, porous materials, homogenization and other important topics.

Multi-scale modelling of composites is a very relevant topic in composites science. This is illustrated by the numerous sessions in the recent European and International Conferences on Composite Materials, but also by the fast developments in multi-scale modelling software tools, developed by large industrial players such as Siemens (Virtual Material Characterization toolkit and MultiMechanics virtual testing software), MSC/e-Xstream (Digimat software), Simulia (micromechanics plug-in in Abaqus), HyperSizer (Multi-scale design of composites), Altair (Altair Multiscale Designer) This book is intended to be an ideal reference on the latest advances in multi-scale modelling of fibre-reinforced polymer composites, that is accessible for both (young) researchers and end users of modelling software. We target three main groups: This book aims at a complete introduction and overview of the state-of-the-art in multi-scale modelling of composites in three axes: • ranging from prediction of homogenized elastic properties to nonlinear material behaviour • ranging from geometrical models for random packing of unidirectional fibres over meso-scale geometries for textile composites to orientation tensors for short fibre composites • ranging from damage modelling of unidirectionally reinforced composites over textile composites to short fibre-reinforced composites The book covers the three most important scales in multi-scale modelling of composites: (i) micro-scale, (ii) meso-scale and (iii) macro-scale. The nano-scale and related atomistic and molecular modelling approaches are deliberately excluded, since the book wants to focus on continuum mechanics and there are already a lot of dedicated books about polymer nanocomposites. A strong focus is put on physics-based damage modelling, in the sense that the chapters devote attention to modelling the different damage mechanisms (matrix cracking, fibre/matrix debonding, delamination, fibre fracture,...) in such a way that the underlying physics of the initiation and growth of these damage modes is respected. The book also gives room to not only discuss the finite element based approaches for multi-scale modelling, but also much faster methods that are popular in industrial software, such as Mean Field Homogenization methods (based on Mori-Tanaka and Eshelby solutions) and variational methods (shear lag theory and more advanced theories). Since the book targets a wide audience, the focus is put on the most common numerical approaches that are used in multi-scale modelling. Very specialized numerical methods like peridynamics modelling, Material Point Method, eXtended Finite Element Method (XFEM), isogeometric analysis, SPH (Smoothed Particle Hydrodynamics),... are excluded. Outline of the book The book is divided in three large parts, well balanced with each a similar number of chapters:

The use of composite materials has grown exponentially in the last decades and has affected many engineering fields due to their enhanced mechanical properties and improved features with respect to conventional materials. For instance, they are employed in civil engineering (seismic isolators, long-span bridges, vaults), mechanical engineering (turbines, machine components), aerospace and naval engineering (fuselages, boat hulls and sails), automotive engineering (car bodies, tires), and biomechanical engineering (prostheses). Nevertheless, the greater use of composites requires a rapid progress in gaining the needed knowledge to design and manufacture composite structures. Thus, researchers and designers devote their own efforts to develop new analysis techniques, design methodologies, manufacturing procedures, micromechanics approaches, theoretical models, and numerical methods. For these purpose, it is extremely easy to find many recent journal papers, books, and technical notes, focused on the mechanics of composites. In particular, several studies are presented to take advantage of their superior features by varying some typical structural parameters (such as geometry, fiber orientations, volume fraction, structural stiffness, weight, lamination scheme). Therefore, this Conference aims to collect contributions from every part of the globe that can increase the knowledge of composite materials and their applications, by engaging researches and professional engineers and designers from different sectors. The same aims and scopes have been reached by the previous editions of Mechanics of Composites International Conferences (MECHCOMP), which occurred in 2014 at Stony Brook University (USA) and in 2016 at University of Porto (Portugal).

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