Computational Methods For Reliability And Risk Analysis Series On Quality Reliability Engineering Statistics

This book contains the proceedings of the IUTAM Symposium held in Hanover, Germany, in November 2006. Coverage includes new mathematical techniques, new discretization techniques, advanced applications of unilateral contact to masonry structures, decohesion analysis and tractive rolling of tires. The book provides a good overview of modern techniques and state-of-the-art discretizations schemes applied in contact mechanics.

"This book contains the latest research developments in manufacturing technology and its optimization, and demonstrates the fundamentals of new computational approaches and the range of their potential application"--Provided by publisher.

This book is concerned with mathematical and numerical methods for compressible flow. It aims to provide the reader with a sufficiently detailed and extensive, mathematically precise, but comprehensible guide, through a wide spectrum of mathematical and computational methods used in Computational Fluid Dynamics (CFD) for the numerical simulation of compressible flow. Up-to-

date techniques applied in the numerical solution of inviscid as well as viscous compressible flow on unstructured meshes are explained, thus allowing the simulation of complex three-dimensional technically relevant problems. Among some of the methods addressed are finite volume methods using approximate Riemann solvers, finite element techniques, such as the streamline diffusion and the discontinuous Galerkin methods, and combined finite volume - finite element schemes. The book gives a complex insight into the numerics of compressible flow, covering the development of numerical schemes and their theoretical mathematical analysis, their verification on test problems and use in solving practical engineering problems. The book will be helpful to specialists coming into contact with CFD - pure and applied mathematicians, aerodynamists, engineers, physicists and natural scientists. It will also be suitable for advanced undergraduate, graduate and postgraduate students of mathematics and technical sciences.

This book gathers selected high-quality research papers from the International Conference on Computational Methods and Data Engineering (ICMDE 2020), held at SRM University, Sonipat, Delhi-NCR, India. Focusing on cutting-edge technologies and the most dynamic areas of computational intelligence and data engineering, the respective contributions address topics including

collective intelligence, intelligent transportation systems, fuzzy systems, data privacy and security, data mining, data warehousing, big data analytics, cloud computing, natural language processing, swarm intelligence, and speech processing.

The focus of this book deals with a cross cutting issue affecting all transport disciplines, whether it be photon, neutron, charged particle or neutrino transport. That is, verification and validation. In this book, we learn what the astrophysicist, atmospheric scientist, mathematician or nuclear engineer do to assess the accuracy of their code. What convergence studies, what error analysis, what problems do each field use to ascertain the accuracy of their transport simulations.

Computational intelligence is rapidly becoming an essential part of reliability engineering. This book offers a wide spectrum of viewpoints on the merger of technologies. Leading scientists share their insights and progress on reliability engineering techniques, suitable mathematical methods, and practical applications. Thought-provoking ideas are embedded in a solid scientific basis that contribute to the development the emerging field. This book is for anyone working on the most fundamental paradigm-shift in resilience engineering in decades. Scientists benefit from this book by gaining insight in the latest in the merger of reliability engineering and computational intelligence. Businesses and (IT)

suppliers can find inspiration for the future, and reliability engineers can use the book to move closer to the cutting edge of technology. .

Power system reliability is the focus of intensive study due to its critical role in providing energy supply to modern society. This comprehensive book describes application of some new specific techniques: universal generating function method and its combination with Monte Carlo simulation and with random processes methods, Semi-Markov and Markov reward models and genetic algorithm. The book can be considered as complementary to power system reliability textbooks.

This volume contains the best papers presented at the 2nd ECCOMAS International Conference on Multiscale Computations for Solids and Fluids, held June 10-12, 2015. Topics dealt with include multiscale strategy for efficient development of scientific software for large-scale computations, coupled probability-nonlinear-mechanics problems and solution methods, and modern mathematical and computational setting for multi-phase flows and fluid-structure interaction. The papers consist of contributions by six experts who taught short courses prior to the conference, along with several selected articles from other participants dealing with complementary issues, covering both solid mechanics and applied mathematics.

Reliability and safety are fundamental attributes of any modern technological system. To achieve this, diverse types of protection barriers are placed as safeguards

from the hazard posed by the operation of the system, within a multiple-barrier design concept. These barriers are intended to protect the system from failures of any of its elements, hardware, software, human and organizational. Correspondingly, the quantification of the probability of failure of the system and its protective barriers, through reliability and risk analyses, becomes a primary task in both the system design and operation phases. This exercise book serves as a complementary tool supporting the methodology concepts introduced in the books "An introduction to the basics of reliability and risk analysis" and "Computational methods for reliability and risk analysis" by Enrico Zio, in that it gives an opportunity to familiarize with the applications of classical and advanced techniques of reliability and risk analysis. This book is also available as a set with Computational Methods for Reliability and Risk Analysis and An Introduction to the Basics of Reliability and Risk Analysis.

This book illustrates a number of modelling and computational techniques for addressing relevant issues in reliability and risk analysis. In particular, it provides: i) a basic illustration of some methods used in reliability and risk analysis for modelling the stochastic failure and repair behaviour of systems, e.g. the Markov and Monte Carlo simulation methods; ii) an introduction to Genetic Algorithms, tailored to their application for RAMS (Reliability, Availability, Maintainability and Safety) optimization; iii) an introduction to key issues of system reliability and risk analysis, like dependent failures and importance measures; and iv) a presentation of the issue

of uncertainty and of the techniques of sensitivity and uncertainty analysis used in support of reliability and risk analysis.The book provides a technical basis for senior undergraduate or graduate courses and a reference for researchers and practitioners in the field of reliability and risk analysis. Several practical examples are included to demonstrate the application of the concepts and techniques in practice.

Annotation Featuring 26 technical papers by engineers from Brazil, the Czech Republic, Iran, Japan, Korea, the United Kingdom, Germany, and the United States, this volume represents the proceedings of the August 2002 conference in Vancouver, British Columbia. The papers discuss meshless methods, novel fracture mechanics methods, damage mechanics, probabilistic methods, high-temperature mechanics, and creep damage and fatigue. Graphs, charts, diagrams, photographs, and other visual displays of information support the text throughout. Only authors are listed in the index. Annotation c. Book News, Inc., Portland, OR (booknews.com).

Computational Methods for Reliability and Risk AnalysisWorld Scientific

The broad use of composite materials and shell structural members with complex geometries in technologies related to various branches of engineering has gained increased attention from scientists and engineers for the development of even more refined approaches and investigation of their mechanical behavior. It is well known that composite materials are able to provide higher values of strength stiffness, and

thermal properties, together with conferring reduced weight, which can affect the mechanical behavior of beams, plates, and shells, in terms of static response, vibrations, and buckling loads. At the same time, enhanced structures made of composite materials can feature internal length scales and non-local behaviors, with great sensitivity to different staking sequences, ply orientations, agglomeration of nanoparticles, volume fractions of constituents, and porosity levels, among others. In addition to fiber-reinforced composites and laminates, increased attention has been paid in literature to the study of innovative components such as functionally graded materials (FGMs), carbon nanotubes (CNTs), graphene nanoplatelets, and smart constituents. Some examples of smart applications involve large stroke smart actuators, piezoelectric sensors, shape memory alloys, magnetostrictive and electrostrictive materials, as well as auxetic components and angle-tow laminates. These constituents can be included in the lamination schemes of smart structures to control and monitor the vibrational behavior or the static deflection of several composites. The development of advanced theoretical and computational models for composite materials and structures is a subject of active research and this is explored here for different complex systems, including their static, dynamic, and buckling responses; fracture mechanics at different scales; the adhesion, cohesion, and delamination of materials and interfaces. Large-scale changes are taking place in the way modelling is performed within the US EPA, and a new generation of environmental models is currently under

construction. The US EPA is engaging in several modelling efforts in response to Congressional mandates such as the Clean Air Act and the Clean Water Act. These mandates require the scientific modelling of the impact of pollutants on human health and the environment. The complexity of scale in environmental models has increased by several orders of magnitude, with a simultaneous demand for increased stability, accuracy and efficiency in the computed model solution. This book showcases numerical algorithms appropriate to the subject areas listed below and explores how new algorithmic methods would benefit the US EPA's environmental models and other environmental studies.

This book provides an insight in advanced methods and concepts for structural analysis and design against seismic loading. The book consists of 25 chapters dealing with a wide range of timely issues in contemporary Earthquake Engineering. In brief, the topics covered are: collapse assessment, record selection, effect of soil conditions, problems in seismic design, protection of monuments, earth dam structures and liquid containers, numerical methods, lifetime assessment, post-earthquake measures. A common ground of understanding is provided between the communities of Earth Sciences and Computational Mechanics towards mitigating seismic risk. The topic is of great social and scientific interest, due to the large number of scientists and practicing engineers currently working in the field and due to the great social and economic consequences of earthquakes.

This book focuses on the topics which provide the foundation for practicing engineering mathematics: ordinary differential equations, vector calculus, linear algebra and partial

differential equations. Destined to become the definitive work in the field, the book uses a practical engineering approach based upon solving equations and incorporates computational techniques throughout.

List of participants; Elliptic equations; Parabolic equations; Hyperbolic equations.

This book constitutes the proceedings of the 12th International Conference on Computational Methods in Systems Biology, CMSB 2014, held in Manchester, UK, in November 2014. The 16 regular papers presented together with 6 poster papers were carefully reviewed and selected from 31 regular and 18 poster submissions. The papers are organized in topical sections on formalisms for modeling biological processes, model inference from experimental data, frameworks for model verification, validation, and analysis of biological systems, models and their biological applications, computational approaches for synthetic biology, and flash posters.

The book covers the application of numerical methods to reinforced concrete structures. To analyze reinforced concrete structures linear elastic theories are inadequate because of cracking, bond and the nonlinear and time dependent behavior of both concrete and reinforcement. These effects have to be considered for a realistic assessment of the behavior of reinforced concrete structures with respect to ultimate limit states and serviceability limit states. The book gives a compact review of finite element and other numerical methods. The key to these methods is through a proper description of material behavior. Thus, the book summarizes the essential material properties of concrete and reinforcement and their interaction through bond. These basics are applied to different structural types such as bars, beams, strut and tie models, plates, slabs and shells. This includes prestressing of structures, cracking,

nonlinear stressstrain relations, creeping, shrinkage and temperature changes. Appropriate methods are developed for each structural type. Large displacement and dynamic problems are treated as well as short-term quasi-static problems and long-term transient problems like creep and shrinkage. Most problems are illustrated by examples which are solved by the program package ConFem, based on the freely available Python programming language. The ConFem source code together with the problem data is available under open source rules at concrete-fem.com. The author aims to demonstrate the potential and the limitations of numerical methods for simulation of reinforced concrete structures, addressing students, teachers, researchers and designing and checking engineers.

Section titles include ...(1) Introduction ...(2) Definitions ...(3) Seals and Gaskets ...(4) Springs ...(5) Solenoids ...(6) Valve Assemblies ...(7) Bearings ...(8) Gears and Splines ...(9) Actuators ...(10) Pumps ...(11) Filters ...(12) Brakes and Clutches ...(13) Compressors ...(14) Electric Motors ...(15) Accumulators, Reservoirs and Pressure Vessels ...(16) Threaded Fasteners ...(17) Mechanical Couplings ...(18) Slider-Crank Mechanisms ...(19) References.

Volume One of this two-volume sequence focuses on the basic characterization of known protein structures, and structure prediction from protein sequence information. Eleven chapters survey of the field, covering key topics in modeling, force fields, classification, computational methods, and structure prediction. Each chapter is a self contained review covering definition of the problem and historical perspective; mathematical formulation; computational methods and algorithms; performance results; existing software; strengths, pitfalls, challenges, and future research.

This book covers a variety of topics in mechanics, with a

special emphasis to fluid mechanics and energy transfer. Chapters are based on selected contributions presented during the Algerian Congress of Mechanics (CAM 2017), held on November 26 - 30, 2017, in Constantine, Algeria. The book covers theoretical analysis, modeling, and numerical treatment of performance-related problems of new refrigeration systems, heating and cooling. It reports on experimental research to solve problems related to the flow of microfluids, and relevant applications in the areas of chemical engineering, biochemistry, biomedicine and renewable energy. Further topics include methods for maintenance of mechanical structures, strength, wear, fracture, damage and life of structures, and image processing solutions for the design and 3D manufacturing of mechanical parts. Improvement, control and regulation of urban road traffic are also discussed in this book, thus offering a comprehensive, practice-oriented reference guide for academics and professionals.

The book is addressed to statisticians working at the forefront of the statistical analysis of complex and high dimensional data and offers a wide variety of statistical models, computer intensive methods and applications: network inference from the analysis of high dimensional data; new developments for bootstrapping complex data; regression analysis for measuring the downsize reputational risk; statistical methods for research on the human genome dynamics; inference in non-euclidean settings and for shape data; Bayesian methods for reliability and the analysis of complex data; methodological issues in using administrative data for

clinical and epidemiological research; regression models with differential regularization; geostatistical methods for mobility analysis through mobile phone data exploration. This volume is the result of a careful selection among the contributions presented at the conference "S.Co.2013: Complex data modeling and computationally intensive methods for estimation and prediction" held at the Politecnico di Milano, 2013. All the papers published here have been rigorously peer-reviewed.

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The considerable influence of inherent uncertainties on structural behavior has led the engineering community to recognize the importance of a stochastic approach to structural problems. Issues related to uncertainty quantification and its influence on the reliability of the computational models are continuously gaining in significance. In particular, the problems of dynamic response analysis and reliability assessment of structures with uncertain system and excitation parameters have been the subject of continuous research over the last two decades as a result of the increasing availability of powerful computing resources and technology. This book is a follow up of a previous book with the same subject (ISBN 978-90-481-9986-0) and focuses on advanced computational methods and software tools which can highly assist in tackling complex problems in stochastic dynamic/seismic analysis and design of structures. The selected chapters are authored by some of the most active scholars in their respective areas and represent some of the most recent

developments in this field. The book consists of 21 chapters which can be grouped into several thematic topics including dynamic analysis of stochastic systems, reliability-based design, structural control and health monitoring, model updating, system identification, wave propagation in random media, seismic fragility analysis and damage assessment. This edited book is primarily intended for researchers and post-graduate students who are familiar with the fundamentals and wish to study or to advance the state of the art on a particular topic in the field of computational stochastic structural dynamics. Nevertheless, practicing engineers could benefit as well from it as most code provisions tend to incorporate probabilistic concepts in the analysis and design of structures.

This book presents the latest developments in both qualitative and quantitative computational methods for reliability and statistics, as well as their applications. Consisting of contributions from active researchers and experienced practitioners in the field, it fills the gap between theory and practice and explores new research challenges in reliability and statistical computing. The book consists of 18 chapters. It covers (1) modeling in and methods for reliability computing, with chapters dedicated to predicted reliability modeling, optimal maintenance models, and mechanical reliability and safety analysis; (2) statistical computing methods, including machine learning techniques and deep learning approaches for sentiment analysis and recommendation systems; and (3) applications and case studies, such as modeling innovation paths of European firms, aircraft

components, bus safety analysis, performance prediction in textile finishing processes, and movie recommendation systems. Given its scope, the book will appeal to postgraduates, researchers, professors, scientists, and practitioners in a range of fields, including reliability engineering and management, maintenance engineering, quality management, statistics, computer science and engineering, mechanical engineering, business analytics, and data science.

Containing edited versions of most of the papers presented at the Fourteenth International Conference on Computational Methods and Experimental Measurements, this book reviews the latest work on these two approaches, and the interaction between them.

Computational Methods in Elasticity and Plasticity: Solids and Porous Media presents the latest developments in the area of elastic and elasto-plastic finite element modeling of solids, porous media and pressure-dependent materials and structures. The book covers the following topics in depth: the mathematical foundations of solid mechanics, the finite element method for solids and porous media, the theory of plasticity and the finite element implementation of elasto-plastic constitutive models. The book also includes: -A detailed coverage of elasticity for isotropic and anisotropic solids. -A detailed treatment of nonlinear iterative methods that could be used for nonlinear elastic and elasto-plastic analyses. -A detailed treatment of a kinematic hardening von Mises model that could be used to simulate cyclic behavior of solids. -Discussion of recent advances in the analysis of

porous media and pressure-dependent materials in more detail than other books currently available.
Computational Methods in Elasticity and Plasticity: Solids and Porous Media also contains problem sets, worked examples and a solutions manual for instructors.
This book offers unique insight on structural safety and reliability by combining computational methods that address multiphysics problems, involving multiple equations describing different physical phenomena and multiscale problems, involving discrete sub-problems that together describe important aspects of a system at multiple scales. The book examines a range of engineering domains and problems using dynamic analysis, nonlinear methods, error estimation, finite element analysis and other computational techniques. This book also: · Introduces novel numerical methods · Illustrates new practical applications · Examines recent engineering applications · Presents up-to-date theoretical results · Offers perspective relevant to a wide audience, including teaching faculty/graduate students, researchers and practicing engineers.
This book constitutes the refereed proceedings of the International Workshop on Computational Methods in Systems Biology, CMSB 2003, held in Rovereto, Italy, in February 2003. The 11 revised full papers presented together with 2 invited papers, 7 position papers, and 11 abstracts were carefully reviewed and selected from 30 submissions. Among

the topics addressed are modeling languages for systems biology, concurrency in biological systems, constraint programming, logical methods in systems biology, formal methods for the analysis of biomolecular systems, quantitative analysis of biomolecular systems, and simulation and modeling techniques for systems biology.

Uncertainty analysis of a system response is an important part of engineering probabilistic analysis. Uncertainty analysis includes: (a) to evaluate moments of the response; (b) to evaluate reliability analysis of the system; (c) to assess the complete probability distribution of the response; (d) to conduct the parametric sensitivity analysis of the output. The actual model of system response is usually a high-dimensional function of input variables. Although Monte Carlo simulation is a quite general approach for this purpose, it may require an inordinate amount of resources to achieve an acceptable level of accuracy. Development of a computationally efficient method, hence, is of great importance. First of all, the study proposed a moment method for uncertainty quantification of structural systems. However, a key departure is the use of fractional moment of response function, as opposed to integer moment used so far in literature. The advantage of using fractional moment over integer moment was illustrated from the relation of one fractional moment with a couple of integer

moments. With a small number of samples to compute the fractional moments, a system output distribution was estimated with the principle of maximum entropy (MaxEnt) in conjunction with the constraints specified in terms of fractional moments. Compared to the classical MaxEnt, a novel feature of the proposed method is that fractional exponent of the MaxEnt distribution is determined through the entropy maximization process, instead of assigned by an analyst in prior. To further minimize the computational cost of the simulation-based entropy method, a multiplicative dimensional reduction method (M-DRM) was proposed to compute the fractional (integer) moments of a generic function with multiple input variables. The M-DRM can accurately approximate a high-dimensional function as the product of a series low-dimensional functions. Together with the principle of maximum entropy, a novel computational approach was proposed to assess the complete probability distribution of a system output. Accuracy and efficiency of the proposed method for structural reliability analysis were verified by crude Monte Carlo simulation of several examples. Application of M-DRM was further extended to the variance-based global sensitivity analysis of a system. Compared to the local sensitivity analysis, the variance-based sensitivity index can provide significance information about an input random variable. Since each component

variance is defined as a conditional expectation with respect to the system model function, the separable nature of the M-DRM approximation can simplify the high-dimension integrations in sensitivity analysis. Several examples were presented to illustrate the numerical accuracy and efficiency of the proposed method in comparison to the Monte Carlo simulation method. The last contribution of the proposed study is the development of a computationally efficient method for polynomial chaos expansion (PCE) of a system's response. This PCE model can be later used uncertainty analysis. However, evaluation of coefficients of a PCE meta-model is computational demanding task due to the involved high-dimensional integrations. With the proposed M-DRM, the involved computational cost can be remarkably reduced compared to the classical methods in literature (simulation method or tensor Gauss quadrature method). Accuracy and efficiency of the proposed method for polynomial chaos expansion were verified by considering several practical examples.

This book gathers the refereed proceedings of the Artificial Intelligence and Bioinspired Computational Methods Section of the 9th Computer Science On-line Conference 2020 (CSOC 2020), held on-line in April 2020. Artificial intelligence and bioinspired computational methods now represent crucial areas of computer science research. The topics presented

here reflect the current discussion on cutting-edge hybrid and bioinspired algorithms and their applications.

This volume includes chapters presenting applications of different metaheuristics in reliability engineering, including ant colony optimization, great deluge algorithm, cross-entropy method and particle swarm optimization. It also presents chapters devoted to cellular automata and support vector machines, and applications of artificial neural networks, a powerful adaptive technique that can be used for learning, prediction and optimization. Several chapters describe aspects of imprecise reliability and applications of fuzzy and vague set theory.

The proceedings consists of 30 papers which have been selected and invited from the submissions to the 2nd International Conference on Computer Science, Applied Mathematics and Applications (ICCSAMA 2014) held on 8-9 May, 2014 in Budapest, Hungary. The conference is organized into 7 sessions: Advanced Optimization Methods and Their Applications, Queueing Models and Performance Evaluation, Software Development and Testing, Computational Methods for Mobile and Wireless Networks, Computational Methods for Knowledge Engineering, Logic Based Methods for Decision Making and Data Mining and Nonlinear Systems and Applications, respectively. All chapters

in the book discuss theoretical and practical issues connected with computational methods and optimization methods for knowledge engineering. The editors hope that this volume can be useful for graduate and Ph.D. students and researchers in Computer Science and Applied Mathematics. It is the hope of the editors that readers of this volume can find many inspiring ideas and use them to their research. Many such challenges are suggested by particular approaches and models presented in individual chapters of this book.

In the past few decades, many significant insights have been gained into several areas of computational methods in sciences and engineering. New problems and methodologies have appeared in some areas of sciences and engineering. There is always a need in these fields for the advancement of information exchange. The aim of this book is to facilitate the sharing of ideas, problems and methodologies between computational scientists and engineers in several disciplines. Extended abstracts of papers on the recent advances regarding computational methods in sciences and engineering are provided. The book briefly describes new methods in numerical analysis, computational mathematics, computational and theoretical physics, computational and theoretical chemistry, computational biology, computational mechanics, computational engineering, computational medicine,

high performance computing, etc.