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KEY=DISCONTINUOUS - EDWARD VALENCIA

Continuous and Discontinuous Modelling of Fracture in Concrete Using FEM

Springer Science & Business Media **The book analyzes a quasi-static fracture process in concrete and reinforced concrete by means of constitutive models formulated within continuum mechanics. A continuous and discontinuous modelling approach was used. Using a continuous approach, numerical analyses were performed using a finite element method and four different enhanced continuum models: isotropic elasto-plastic, isotropic damage and anisotropic smeared crack one. The models were equipped with a characteristic length of micro-structure by means of a non-local and a second-gradient theory. So they could properly describe the formation of localized zones with a certain thickness and spacing and a related deterministic size effect. Using a discontinuous FE approach, numerical results of cracks using a**

cohesive crack model and XFEM were presented which were also properly regularized. Finite element analyses were performed with concrete elements under monotonic uniaxial compression, uniaxial tension, bending and shear-extension. Concrete beams under cyclic loading were also simulated using a coupled elasto-plastic-damage approach. Numerical simulations were performed at macro- and meso-level of concrete. A stochastic and deterministic size effect was carefully investigated. In the case of reinforced concrete specimens, FE calculations were carried out with bars, slender and short beams, columns, corbels and tanks. Tensile and shear failure mechanisms were studied. Numerical results were compared with results from corresponding own and known in the scientific literature laboratory and full-scale tests.

Modeling of concrete fracture applying the eXtended finite element method

Ph.D. thesis

Computational Modelling of Concrete Structures

CRC Press **The EURO-C conference series (Split 1984, Zell am See 1990, Innsbruck 1994, Badgastein 1998, St Johann im Pongau 2003, Mayrhofen 2006, Schladming 2010, St Anton am Alberg 2014) brings together researchers and practising engineers concerned with theoretical, algorithmic and validation aspects associated with computational simulations of concrete and concrete structures. The conference reviews and discusses research advancements and the applicability and robustness of methods and models for reliable analysis of complex concrete, reinforced concrete and pre-stressed concrete structures in engineering practice. Conference topics and invited papers cover both computational mechanics and computational modelling aspects of the analysis and design of concrete and concrete structures: * Constitutive and Multiscale Modelling of Concrete * Advances in Computational Modelling * Time Dependent and Multiphysics Problems * Performance of Concrete Structures The book is of special interest to researchers in computational concrete mechanics, as well as industry experts in complex nonlinear simulations of concrete structures.**

Concrete Fracture Models and Applications

Springer Science & Business Media **Cementitious materials, rocks and fibre-reinforced composites commonly termed as quasibrittle, need a different fracture mechanics approach to model the crack propagation study because of the presence of significant size of fracture process zone ahead of the crack-tip. Recent studies show that concrete structures manifest three important stages in fracture process: crack initiation, stable crack propagation and unstable fracture or failure. Fracture Mechanics concept can better explain the above various stages including the concepts of ductility, size-effect, strain softening and post-cracking behavior of concrete and concrete structures. The book presents a basic introduction on the various nonlinear concrete fracture models considering the respective fracture parameters. To this end, a thorough state-of-the-art review on various aspects of the material behavior and development of different concrete fracture models is presented. The development of cohesive crack model for standard test geometries using commonly used softening functions is shown and extensive studies on the behavior of cohesive crack fracture parameters are also carried out. The subsequent chapter contains the extensive study on the double-K and double-G fracture parameters in which some recent developments on the related fracture parameters are illustrated including introduction of weight function method to Double-K Fracture Model and formulization of size-effect behavior of the double-K fracture parameters. The application of weight function approach for determining of the KR-curve associated with cohesive stress distribution in the fracture process zone is also presented. Available test data are used to validate the new approach. Further, effect of specimen geometry, loading condition, size-effect and softening function on various fracture parameters is investigated. Towards the end, a comparative study between different fracture parameters obtained from various models is presented.**

Proceedings of XXIV AIMETA Conference 2019

Springer Nature **This book gathers the peer-reviewed papers presented at the XXIV Conference of the Italian Association of Theoretical and Applied Mechanics, held in Rome, Italy, on September 15-19, 2019 (AIMETA 2019). The conference topics encompass all aspects of general, fluid, solid and structural mechanics, as well as mechanics for machines and mechanical systems, including theoretical, computational and experimental techniques and technological applications. As such the book represents an invaluable, up-to-the-minute tool, providing an essential overview of the most recent**

advances in the field.

The Scaled Boundary Finite Element Method

Introduction to Theory and Implementation

<u>John Wiley & Sons</u> **An informative look at the theory, computer implementation, and application of the scaled boundary finite element method This reliable resource, complete with MATLAB, is an easy-to-understand introduction to the fundamental principles of the scaled boundary finite element method. It establishes the theory of the scaled boundary finite element method systematically as a general numerical procedure, providing the reader with a sound knowledge to expand the applications of this method to a broader scope. The book also presents the applications of the scaled boundary finite element to illustrate its salient features and potentials. The Scaled Boundary Finite Element Method: Introduction to Theory and Implementation covers the static and dynamic stress analysis of solids in two and three dimensions. The relevant concepts, theory and modelling issues of the scaled boundary finite element method are discussed and the unique features of the method are highlighted. The applications in computational fracture mechanics are detailed with numerical examples. A unified mesh generation procedure based on quadtree/octree algorithm is described. It also presents examples of fully automatic stress analysis of geometric models in NURBS, STL and digital images. Written in lucid and easy to understand language by the co-inventor of the scaled boundary element method Provides MATLAB as an integral part of the book with the code cross-referenced in the text and the use of the code illustrated by examples Presents new developments in the scaled boundary finite element method with illustrative examples so that readers can appreciate the significant features and potentials of this novel method—especially in emerging technologies such as 3D printing, virtual reality, and digital image-based analysis The Scaled Boundary Finite Element Method: Introduction to Theory and Implementation is an ideal book for researchers, software developers, numerical analysts, and postgraduate students in many fields of engineering and science.**

Computational Modelling of Concrete Structures

Proceedings of the EURO-C 2006 Conference, Mayrhofen, Austria, 27-30 March 2006

CRC Press **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.**

Extended Finite Element Method

Theory and Applications

John Wiley & Sons **Introduces the theory and applications of the extended finite element method (XFEM) in the linear and nonlinear problems of continua, structures and geomechanics Extended Finite Element Method: Theory and Applications introduces the theory and applications of the extended finite element method (XFEM) in the linear and nonlinear problems of continua, structures and geomechanics. The XFEM approach is based on an extension of standard finite element method based on the partition of unity method. Extended Finite Element Method: Theory and Applications begins by introducing the concept of partition of unity, various enrichment functions, and fundamentals of**

XFEM formulation. It then covers the theory and application of XFEM in large deformations, plasticity and contact problems. The implementation of XFEM in fracture mechanics, including the linear, cohesive, and ductile crack propagation is also covered. The theory and applications of the XFEM in multiphase fluid flow, including the hydraulic fracturing in soil saturated media and crack propagation in thermo-hydro-mechanical porous media, is also discussed in detail. Introduces the theory and applications of the extended finite element method (XFEM) in the linear and nonlinear problems of continua, structures and geomechanics Explores the concept of partition of unity, various enrichment functions, and fundamentals of XFEM formulation. Covers numerous applications of XFEM including fracture mechanics, large deformation, plasticity, multiphase flow, hydraulic fracturing and contact problems Accompanied by a website hosting source code and examples

Fracture mechanics of concrete: Structural application and numerical calculation

Structural Application and Numerical Calculation

Springer Science & Business Media **Concrete has traditionally been known as a material used widely in the construction of roads, bridges and buildings. Since cost effectiveness has always been one of the more important aspects of design, concrete, when reinforced and/or prestressed, is finding more use in other areas of application such as floating marine structures, storage tanks, nuclear vessel containments and a host of other structures. Because of the demand for concrete to operate under different loading and environmen tal conditions, increasing attention has been paid to study concrete specimens and structure behavior. A subject of major concern is how the localized segregation of the constituents in concrete would affect its global behavior. The degree of nonhomogeneity due to material property and damage. by yielding and/or cracking depends on the size scale and loading rate under consideration. Segregation or clustering of aggregates at the macroscopic level will affect specimen behavior to a larger degree than it would to a large structure such as a dam. Hence, a knowledge of concrete behavior over a wide range of scale is desired. The parameters governing micro-and macro-cracking and the techniques for evaluating and observing the damage in concrete need to be better understood. This volume is intended to be an attempt in this direction. The application of**

Linear Elastic Fracture Mechanics to concrete is discussed in several of the chapters.

Finite Elements in Civil Engineering Applications

Proceedings of the Third Diana World Conference, Tokyo, Japan, 9-11 October 2002

CRC Press **These proceedings present high-level research in structural engineering, concrete mechanics and quasi-brittle materials, including the prime concern of durability requirements and earthquake resistance of structures.**

Numerical Modeling Strategies for Sustainable Concrete Structures

SSCS 2022

Springer Nature **This volume highlights the latest advances, innovations, and applications in the field of sustainable concrete structures, as presented by scientists and engineers at the RILEM International Conference on Numerical Modeling Strategies for Sustainable Concrete Structures (SSCS), held in Marseille, France, on July 4-6, 2022. It demonstrates that numerical methods (finite elements, finite volumes, finite differences) are a relevant response to the challenge to optimize the utilization of cement in concrete constructions while checking that these constructions have a lifespan compatible with the stakes of sustainable development. They are indeed accurate tools for an optimized design of concrete constructions, and allow us to consider all types of complexities: for example, those linked to rheological, physicochemical and mechanical properties of concrete, those linked to the geometry of the structures or even to the environmental boundary conditions. This optimization must also respect constraints of time, money, security, energy, CO2 emissions, and, more generally, life cycle more reliably than the codes and analytical**

approaches currently used. Numerical methods are, undoubtedly, the best calculation tools at the service of concrete eco-construction. The contributions present traditional and new ideas that will open novel research directions and foster multidisciplinary collaboration between different specialists.

Computational Modelling of Concrete Structures

Proceedings of the Conference on Computational Modelling of Concrete and Concrete Structures (EURO-C 2018), February 26 - March 1, 2018, Bad Hofgastein, Austria

CRC Press **The EURO-C conference series (Split 1984, Zell am See 1990, Innsbruck 1994, Badgastein 1998, St. Johann im Pongau 2003, Mayrhofen 2006, Schladming 2010, St. Anton am Arlberg 2014, and Bad Hofgastein 2018) brings together researchers and practising engineers concerned with theoretical, algorithmic and validation aspects associated with computational simulations of concrete and concrete structures. Computational Modelling of Concrete Structures reviews and discusses research advancements and the applicability and robustness of methods and models for reliable analysis of complex concrete, reinforced concrete and pre-stressed concrete structures in engineering practice. The contributions cover both computational mechanics and computational modelling aspects of the analysis and design of concrete and concrete structures: Multi-scale cement and concrete research: experiments and modelling Aging concrete: from very early ages to decades-long durability Advances in material modelling of plain concrete Analysis of reinforced concrete structures Steel-concrete interaction, fibre-reinforced concrete, and masonry Dynamic behaviour: from seismic retrofit to impact simulation Computational Modelling of Concrete Structures is of special interest to academics and researchers in computational concrete mechanics, as well as industry experts in complex nonlinear simulations of concrete structures.**

Nonlinear Finite Element Analysis of Solids and Structures

<u>John Wiley & Sons</u> **Built upon the two original books by Mike Crisfield and theirown lecture notes, renowned scientist René de Borst and histeam offer a thoroughly updated yet condensed edition that retainsand builds upon the excellent reputation and appeal amongststudents and engineers alike for which Crisfield's first edition isacclaimed. Together with numerous additions and updates, the new authorshave retained the core content of the original publication, whilebringing an improved focus on new developments and ideas. Thisedition offers the latest insights in non-linear finite elementtechnology, including non-linear solution strategies, computationalplasticity, damage mechanics, time-dependent effects,hyperelasticity and large-strain elasto-plasticity. The authors' integrated and consistent style and unrivalledengineering approach assures this book's unique position within thecomputational mechanics literature. Key features: Combines the two previous volumes into one heavily revised textwith obsolete material removed, an improved layout and updatedreferences and notations Extensive new material on more recent developments incomputational mechanics Easily readable, engineering oriented, with no more details inthe main text than necessary to understand the concepts. Pseudo-code throughout makes the link between theory andalgorithms, and the actual implementation. Accompanied by a website (www.wiley.com/go/deborst) with aPython code, based on the pseudo-code within the book and suitablefor solving small-size problems. Non-linear Finite Element Analysis of Solids and Structures, 2ndEdition is an essential reference for practising engineers andresearchers that can also be used as a text for undergraduate andgraduate students within computational mechanics.**

Finite-Element Modelling of Structural Concrete

Short-Term Static and Dynamic Loading Conditions

<u>CRC Press</u> **A Powerful Tool for the Analysis and Design of Complex Structural Elements Finite-Element Modelling of Structural Concrete: Short-Term Static and Dynamic Loading Conditions presents a finite-element model of structural**

concrete under short-term loading, covering the whole range of short-term loading conditions, from static (monotonic and cyclic) to dynamic (seismic and impact) cases. Experimental data on the behavior of concrete at both the material and structural levels reveal the unavoidable development of triaxial stress conditions prior to failure which dictate the collapse and ductility of structural concrete members. Moreover, and in contrast with generally accepted tenets, it can be shown that the post-peak behavior of concrete as a material is realistically described by a complete and immediate loss of load-carrying capacity. Hence rational analysis and design of concrete components in accordance with the currently prevailing limit-state philosophy requires the use of triaxial material data consistent with the notion of a fully brittle material, and this approach is implemented in the book by outlining a finite-element method for the prediction of the strength, deformation, and cracking patterns of arbitrary structural concrete forms. Presents a Unified Approach to Structural Modeling Numerous examples are given that show both the unifying generality of this proposed approach and the reliability of the ensuing numerical procedure for which the sole input is the specified uniaxial cylinder compressive strength of concrete and the yield stress of the steel. This not only offers a better understanding of the phenomenology of structural concrete behavior but also illustrates, by means of suitable examples, the type of revision required for improving design methods in terms of both safety and economy. This book: Highlights the significance of valid experimental information on the behavior of concrete under triaxial stress conditions for interpreting structural behavior Describes the techniques used for obtaining valid test data and modeling concrete behavior Discusses the modeling of steel properties as well as the interaction between concrete and steel Presents numerical techniques for incorporating the material models into nonlinear finite-element analysis for the case of short-term static loading Provides numerical techniques adopted for extending the use of the numerical analysis scheme for the solution of dynamic problems Predicts the response of a wide range of structural-concrete configurations to seismic and impact excitations Using relevant case studies throughout, Finite-Element Modelling of Structural Concrete: Short-Term Static and Dynamic Loading Conditions focuses on the realistic modeling of structural concrete on the basis of existing and reliable material data and aids in the research and study of structural concrete and concrete materials.

Fracture Mechanics of Concrete Structures

Proceedings of the First International Conference on Fracture Mechanics of Concrete Structures (FraMCoS1), held at Beaver Run Resort, Breckenridge, Colorado, USA, 1-5 June 1992.

CRC Press **This conference is the first in a series of conferences dedicated to Fracture Mechanics of Concrete Structures. Due to the recent explosion of interest in research on fracture in concrete, the conference has brought together the world's leading researchers in fracture of concrete and this book contains the proceedings.**

Computational Modelling of Concrete Structures

CRC Press **The EURO-C conference series (Split 1984, Zell am See 1990, Innsbruck 1994, Badgastein 1998, St Johann im Pongau 2003, Mayrhofen 2006, Schladming 2010, St Anton am Alberg 2014) brings together researchers and practising engineers concerned with theoretical, algorithmic and validation aspects associated with computational simulations of concrete and**

Current Trends in Concrete Fracture Research

Springer Science & Business Media **From time to time the International Journal of Fracture has presented matters thought to be of special interest to its readers. The last special topic review was presented by Drs W.G. Knauss and AJ. Rosakis as Guest Editors in four issues, January-April 1990, under the general title of Non Linear Fracture. It contained sections on damage mechanisms, interfaces and creep, time depen dence, and continuum plasticity insofar as they affect the mechanisms of the fracture process. Continuing this policy, which is consistent with our stated objectives, the two September issues deal with the behavior of concrete and cementious materials during fracture initiation and**

propagation. We hope that the ensuing state-of-the-art review will yield another instructive and timely product which readers will find useful. To assist us in presenting this subject, we have prevailed upon a well-known international expert in concrete behavior, Dr. Z.P. Bazant, Walter P. Murphy Professor of Civil Engineering, of Northwes tern University to act as Guest Editor. On behalf of the editors and publishers, I wish to thank Professor BaZant and his invited authors for undertaking this special effort. M.L. WILLIAMS Pittsburgh, Pennsylvania Editor-in-Chief September 1991 International Journal of Fracture 51: ix-xv, 1991. Z.P. Bafant (ed.), Current Trends in Concrete Fracture Research.

3D Analysis of Fracture Processes in Concrete

Eburon Uitgeverij B.V.

ACI Manual of Concrete Practice

Numerical Modeling of Concrete Cracking

Springer Science & Business Media **The book presents the underlying theories of the different approaches for modeling cracking of concrete and provides a critical survey of the state-of-the-art in computational concrete mechanics. It covers a broad spectrum of topics related to modeling of cracks, including continuum-based and discrete crack models, meso-scale models, advanced discretization strategies to capture evolving cracks based on the concept of finite elements with embedded discontinuities and on the extended finite element method, and extensions to coupled problems such a hygro-mechanical problems as required in computational durability analyses of concrete structures.**

Computational Modeling for the Assessment of the Biomechanical Properties of the Healthy, Diseased and

Treated Spine

Frontiers Media SA

Numerical simulation of fracture processes in concrete structures combining the discrete and the smeared approaches

O presente trabalho consiste na elaboração de um modelo para simulação numérica do fraturamento em estruturas de concreto utilizando-se o Método dos Elementos Finitos econceitos da Mecânica da Fratura aplicada ao concreto. A característica mais importante deste modelo está na transição do processo de fraturamento distribuído para o processo discreto à medida em que as deformações se localizam em uma certa região da estrutura. Com isto, pode-se tirar proveito das principais vantagens apresentadas pelos dois processos, ao mesmo tempo em que se eliminam algumas de suas maiores desvantagens. A simulação é suportada por um pré-processador para geração automática da malha de elementos finitos e por uma sofisticada estrutura de dados topológica que assegura a consistência da malha gerada. A fissura discreta é inserida em uma região de comportamento plástico selecionada pelo programa, e somente esta região é rediscretizada após a inserção e propagaçãoda fissura. Todo o processo é monitorado pelo usuário através da mesma interface gráfica. A análise pelo processo distribuído é desenvolvida através de um modelo plástico não-associado e algumas dificuldades numéricas são encontradas na tentativa de representar o comportamento da estrutura nas proximidades da carga máxima e no regime pós-pico. Um procedimento numérico é proposto para contornar estas dificuldades.

Recent Advances on Green Concrete for Structural Purposes

The contribution of the EU-FP7 Project EnCoRe

Springer **This book is mainly based on the results of the EU-funded UE-FP7 Project EnCoRe, which aimed to characterize the key physical and mechanical properties of a novel class of advanced cement-based materials incorporating recycled powders and aggregates and/or natural ingredients in order to allow partial or even total replacement of conventional constituents. More specifically, the project objectives were to predict the physical and mechanical performance of concrete with recycled aggregates; to understand the potential contribution of recycled fibers as a dispersed reinforcement in concrete matrices; and to demonstrate the feasibility and possible applications of natural fibers as a reinforcement in cementitious composites. All of these aspects are fully covered in the book. The opening chapters explain the material concept and design and discuss the experimental characterization of the physical, chemical, and mechanical properties of the recycled raw constituents, as well as of the cementitious composite incorporating them. The numerical models with potentialities for describing the behavior at material and structural level of constructions systems made by these composites are presented. Finally, engineering applications and guidelines for production and design are proposed.**

Advances of Science and Technology

9th EAI International Conference, ICAST 2021, Hybrid

Event, Bahir Dar, Ethiopia, August 27–29, 2021, Proceedings, Part II

Springer Nature

Finite Element Analysis for Building Assessment

Advanced Use and Practical Recommendations

Taylor & Francis **Existing structures represent a heterogeneous category in the global built environment as often characterized by the presence of archaic materials, damage and disconnections, uncommon construction techniques and subsequent interventions throughout the building history. In this scenario, the common linear elastic analysis approach adopted for new buildings is incapable of an accurate estimation of structural capacity, leading to overconservative results, invasive structural strengthening, added intervention costs, excessive interference to building users and possible losses in terms of aesthetics or heritage values. For a rational and sustainable use of the resources, this book deals with advanced numerical simulations, adopting a practical approach to introduce the fundamentals of Finite Element Method, nonlinear solution procedures and constitutive material models. Recommended material properties for masonry, timber, reinforced concrete, iron and steel are discussed according to experimental evidence, building standards and codes of practice. The examples examined throughout the book and in the conclusive chapter support the analyst's decision-making process toward a safe and efficient use of finite element analysis. Written primarily for practicing engineers, the book is of value to students in engineering and technical architecture with solid knowledge in the field of continuum mechanics and structural design.**

Recent Developments in Sustainable Infrastructure (ICRDSI-2020)—Structure and Construction Management

Conference Proceedings from ICRDSI-2020 Volume 1

Springer Nature **This book includes selected papers from the International Conference on Recent Developments in Sustainable Infrastructure (ICRDSI-2020) and consists of themes pertaining to structural engineering and construction technology and management.**

Finite Element Analysis for Civil Engineering with DIANA Software

Springer Nature **This book systematically introduces readers to the finite element analysis software DIANA (DIsplacement ANAlyzer) and its applications in civil engineering. Developed by TNO Corporation in the 1970s, DIANA is frequently used in civil engineering and engineering mechanics. Unlike the software user's manual, which provides a comprehensive introduction and theoretical analysis, this book presents a simplified overview of the basic background theory to help beginners master the software quickly. It also discusses GUI operation and the command console in Python language, and includes examples involving classical modeling operations to help readers review each section. Both the book and DIANA itself are valuable resources for students and researchers in all the structural engineering fields, such as civil engineering, bridge engineering, geotechnical engineering, tunnel engineering, underground structural engineering, irrigation, municipal engineering and fire engineering.**

Fracture and Size Effect in Concrete and Other Quasibrittle Materials

Routledge **Fracture and Size Effect in Concrete and Other Quasibrittle Materials is the first in-depth text on the application of fracture mechanics to the analysis of failure in concrete structures. The book synthesizes a vast number of recent research results in the literature to provide a comprehensive treatment of the topic that does not give merely the facts - it provides true understanding. The many recent results on quasibrittle fracture and size effect, which were scattered throughout many periodicals, are compiled here in a single volume. This book presents a well-rounded discussion of the theory of size effect and scaling of failure loads in structures. The size effect, which is the most important practical manifestation of fracture behavior, has become a hot topic. It has gained prominence in current research on concrete and quasibrittle materials. The treatment of every subject in Fracture and Size Effect in Concrete and Other Quasibrittle Materials proceeds from simple to complex, from specialized to general, and is as concise as possible using the simplest level of mathematics necessary to treat the subject clearly and accurately. Whether you are an engineering student or a practicing engineer, this book provides you with a clear presentation, including full derivations and examples, from which you can gain real understanding of fracture and size effect in concrete and other quasibrittle materials.**

Structural Engineering and Geomechanics - Volume 1

EOLSS Publications **An understanding of dynamic effects on structures is critical to minimize losses from earthquakes and other hazards. These three books provide an overview of essential topics in structural and geotechnical engineering with an additional focus on related topics in earthquake engineering to enable readers gain such an understanding. One of the ultimate objectives of these books is to provide readers with insights into seismic analysis and design. However, in order to accomplish that objective, background material on structural and geotechnical engineering is necessary. Hence the first two sections of the book provide this background material followed by selected topics in earthquake engineering. The material is organized into three major parts. The first section covers topics in structural engineering. Beginning with fundamental mechanics of materials, the book includes chapters on linear and nonlinear**

analysis as well as topics on modeling of structures from different perspectives. In addition to traditional design of structural systems, introductions to important concepts in structural reliability and structural stability are discussed. Also covered are subjects of recent interest, viz., blast and impact effects on structures as well as the use of fiber reinforced polymer composites in structural applications. Given the growing interest in urban renewal, an interesting chapter on restoration of historic cities is also included. The second part of the book covers topics in geotechnical engineering, covering both shallow and deep foundations and issues and procedures for geotechnical modeling. The final part of the book focuses on earthquake engineering with emphasis on both structures and foundations. Here again, the material covered includes both traditional seismic design and innovative seismic protection. And more importantly, concepts in modeling for seismic analysis are highlighted.

Fracture Scaling

Springer Science & Business Media **This volume is a collection of the papers given at the workshop on Fracture Scaling, held at the University of Maryland, USA, 10-12 June 1999, under the sponsorship of the Office of Naval Research, Arlington, VA, USA. These papers can be grouped under five major themes: Micromechanical analysis Size effects in fiber composites Scaling and heterogeneity Computational aspects and nonlocal or gradient models Size effects in concrete, ice and soils . This workshop is the result of a significant research effort, supported by the Office of Naval Research, into the problems of scaling of fracture in fiber composites, and generally into the problems of scaling in solid mechanics. These problems, which are of interest for many materials, especially all quasibrittle materials, share similar characteristics. Thus, progress in the understanding of scaling problems for one material may help progress for another material. This makes it clear that a dialogue between researchers in various fields of mechanics is highly desirable and should be promoted. In view of this, this volume should be of interest to researchers and advanced graduate students in materials science, solid mechanics and civil engineering.**

Computational Mechanics

Proceedings of the 2007 International Symposium on Computational Mechanics in Beijing

Springer Science & Business Media **Computational Mechanics is the proceedings of the International Symposium on Computational Mechanics, ISCM 2007. This conference is the first of a series created by a group of prominent scholars from the Mainland of China, Hong Kong, Taiwan, and overseas Chinese, who are very active in the field. The book includes 22 full papers of plenary and semi-plenary lectures and approximately 150 one-page summaries.**

Crack Analysis in Structural Concrete

Theory and Applications

Butterworth-Heinemann **This new book on the fracture mechanics of concrete focuses on the latest developments in computational theories, and how to apply those theories to solve real engineering problems. Zihai Shi uses his extensive research experience to present detailed examination of multiple-crack analysis and mixed-mode fracture. Compared with other mature engineering disciplines, fracture mechanics of concrete is still a developing field with extensive new research and development. In recent years many different models and applications have been proposed for crack analysis; the author assesses these in turn, identifying their limitations and offering a detailed treatment of those which have been proved to be robust by comprehensive use. After introducing stress singularity in numerical modelling and some basic modelling techniques, the Extended Fictitious Crack Model (EFCM) for multiple-crack analysis is explained with numerical application examples. This theoretical model is then applied to study two important issues in fracture mechanics - crack interaction and localization, and fracture modes and maximum loads. The EFCM is then reformulated to include the shear transfer mechanism on crack surfaces and the method is used to study experimental problems. With a carefully balanced mixture of theory, experiment and application, Crack Analysis in Structural Concrete is an important contribution to this fast-developing field of structural analysis in concrete. Latest theoretical models analysed and tested Detailed assessment of multiple crack analysis and multi-mode fractures**

Applications designed for solving real-life engineering problems

Management of Concrete Structures for Long-term Serviceability

Proceedings of the International Seminar Held at the University of Sheffield, England, UK on 13 November 1997

<u>Thomas Telford</u> **This book presents the proceedings of the international seminar organised by the Centre for Cement and Concrete at the University of Sheffield to bring together information on the major issues concerning through-life management of major concrete structures.**

The Finite Element Method Set

<u>Elsevier</u> **The sixth editions of these seminal books deliver the most up to date and comprehensive reference yet on the finite element method for all engineers and mathematicians. Renowned for their scope, range and authority, the new editions have been significantly developed in terms of both contents and scope. Each book is now complete in its own right and provides self-contained reference; used together they provide a formidable resource covering the theory and the application of the universally used FEM. Written by the leading professors in their fields, the three books cover the basis of the method, its application to solid mechanics and to fluid dynamics. * This is THE classic finite element method set, by two the subject's leading authors * FEM is a constantly developing subject, and any professional or student of engineering involved in understanding the computational modelling of physical systems will inevitably use the techniques in these books * Fully up-to-date; ideal for teaching and reference**

The Finite Element Method for Solid and Structural Mechanics

Elsevier **This is the key text and reference for engineers, researchers and senior students dealing with the analysis and modelling of structures – from large civil engineering projects such as dams, to aircraft structures, through to small engineered components. Covering small and large deformation behaviour of solids and structures, it is an essential book for engineers and mathematicians. The new edition is a complete solids and structures text and reference in its own right and forms part of the world-renowned Finite Element Method series by Zienkiewicz and Taylor. New material in this edition includes separate coverage of solid continua and structural theories of rods, plates and shells; extended coverage of plasticity (isotropic and anisotropic); node-to-surface and 'mortar' method treatments; problems involving solids and rigid and pseudo-rigid bodies; and multi-scale modelling. Dedicated coverage of solid and structural mechanics by world-renowned authors, Zienkiewicz and Taylor New material including separate coverage of solid continua and structural theories of rods, plates and shells; extended coverage for small and finite deformation; elastic and inelastic material constitution; contact modelling; problems involving solids, rigid and discrete elements; and multi-scale modelling**

Mechanical Behavior of High-Strength Low-Alloy Steels

MDPI **This book is a printed edition of the Special Issue "Mechanical Behavior of High-Strength Low-Alloy Steels" that was published in Metals**

Nonlinear Crack Models for Nonmetallic Materials

Springer Science & Business Media **In this volume a survey of the most relevant nonlinear crack models is provided, with the purpose of analyzing the nonlinear mechanical effects occurring at the tip of macrocracks in quasi-brittle materials - such as concrete, rocks, ceramics, polymers, high-strength metallic alloys - and in brittle-matrix fibre-reinforced composites. Such local effects, as, for example, plastic deformation, yielding, strain-hardening, strain-softening,**

mechanical damage, matrix microcracking, aggregate debonding, fibre bridging, fibre slippage, crazing, and so on, are properly described through different simplified models, representing the peculiarities of the phenomena involved. The models are introduced and described separately and then compared in the last part of the book. This volume will be of interest to students, professionals and researchers in the field of nonlinear fracture mechanics.

Finite Element Modelling of Cracking in Concrete Gravity Dams

Concrete Fracture

A Multiscale Approach

CRC Press **The study of fracture mechanics of concrete has developed in recent years to the point where it can be used for assessing the durability of concrete structures and for the development of new concrete materials. The last decade has seen a gradual shift of interest toward fracture studies at increasingly smaller sizes and scales. Concrete Fracture: A Multiscale Approach explores fracture properties of cement and concrete based on their actual material structure. Concrete is a complex hierarchical material, containing material structural elements spanning scales from the nano- to micro- and meso-level. Therefore, multi-scale approaches are essential for a better understanding of mechanical properties and fracture in particular. This volume includes various examples of fracture analyses at the micro- and meso-level. The book presents models accompanied by reliable experiments and explains how these experiments are performed. It also provides numerous examples of test methods and requirements for evaluating quasi-brittle materials. More importantly, it proposes a new modeling approach based on multiscale interaction potential and examines the related experimental challenges facing research engineers and building professionals. The book's comprehensive coverage is poised to encourage new initiatives for overcoming the difficulties encountered when performing fracture experiments on cement at the micro-size/scale and smaller. The author demonstrates how the obtained results can fit into the larger picture of the material science of concrete—particularly the design of new high-**

performance concrete materials which can be put to good use in the development of efficient and durable structures.

Comprehensive Structural Integrity

Elsevier **The aim of this major reference work is to provide a first point of entry to the literature for the researchers in any field relating to structural integrity in the form of a definitive research/reference tool which links the various sub-disciplines that comprise the whole of structural integrity. Special emphasis will be given to the interaction between mechanics and materials and structural integrity applications. Because of the interdisciplinary and applied nature of the work, it will be of interest to mechanical engineers and materials scientists from both academic and industrial backgrounds including bioengineering, interface engineering and nanotechnology. The scope of this work encompasses, but is not restricted to: fracture mechanics, fatigue, creep, materials, dynamics, environmental degradation, numerical methods, failure mechanisms and damage mechanics, interfacial fracture and nano-technology, structural analysis, surface behaviour and heart valves. The structures under consideration include: pressure vessels and piping, off-shore structures, gas installations and pipelines, chemical plants, aircraft, railways, bridges, plates and shells, electronic circuits, interfaces, nanotechnology, artificial organs, biomaterial prostheses, cast structures, mining... and more. Case studies will form an integral part of the work.**