

Concrete International Journal

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Numerical Modeling of Concrete Cracking Guenter Hofstetter 2011-10-08 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 as hygro-mechanical problems as required in computational durability analyses of concrete structures.

fib Model Code for Concrete Structures 2010 fib - federation internationale du beton 2013-12-04 The International Federation for Structural Concrete (fib)

is a pre-normative organization. 'Pre-normative' implies pioneering work in codification. This work has now been realized with the fib Model Code 2010. The objectives of the fib Model Code 2010 are to serve as a basis for future codes for concrete structures, and present new developments with regard to concrete structures, structural materials and new ideas in order to achieve optimum behaviour. The fib Model Code 2010 is now the most comprehensive code on concrete structures, including their complete life cycle: conceptual design, dimensioning, construction, conservation and dismantlement. It is expected to become an important document for both national and international code committees, practitioners and researchers. The fib Model Code 2010 was produced during the last ten years through an exceptional effort by Joost Walraven (Convener; Delft University of Technology, The Netherlands), Agnieszka Bigaj-van Vliet (Technical Secretary; TNO Built

Environment and Geosciences, The Netherlands) as well as experts out of 44 countries from five continents.

Journal of Ferrocement 2001

Computational Modelling of Concrete and Concrete

Structures Günther Meschke 2022-05-19 Computational

Modelling of Concrete and Concrete Structures contains the contributions to the EURO-C 2022 conference (Vienna, Austria, 23-26 May 2022). The papers review and discuss research advancements and assess the applicability and robustness of methods and models for the analysis and design of concrete, fibre-reinforced and prestressed concrete structures, as well as masonry structures.

Recent developments include methods of machine learning, novel discretisation methods, probabilistic models, and consideration of a growing number of micro-structural aspects in multi-scale and multi-physics settings. In addition, trends towards the material scale with new fibres and 3D printable concretes, and life-cycle oriented models for ageing and durability of existing and new concrete infrastructure are clearly visible.

Overall computational robustness of numerical predictions and mathematical rigour have further increased, accompanied by careful model validation based on respective experimental programmes. The book will serve as an important reference for both academics and professionals, stimulating new research directions in the field of computational modelling of concrete and its application to the analysis of concrete structures.

EURO-C 2022 is the eighth edition of the EURO-C conference series after Innsbruck 1994, Bad Gastein 1998, St. Johann im Pongau 2003, Mayrhofen 2006, Schladming 2010, St. Anton am Arlberg 2014, and Bad Hofgastein 2018. The overarching focus of the conferences is on computational methods and numerical

models for the analysis of concrete and concrete structures.

Interfacial Transition Zone in Concrete J.C. Maso 2004-03-01 An important new state-of-the-art report prepared by RILEM Technical Committee 108 ICC. It has been written by a team of leading international experts from the UK, USA, Canada, Israel, Germany, Denmark, South Africa, Italy and France. Research studies over recent years in the field of cement science have focused on the behaviour of the interfaces between the components of cement-based materials. The techniques used in other areas of materials science are being applied to the complex materials found in cements and concretes, and this book provides a significant survey of the present state of the art.

Integral Waterproofing of Concrete Structures Maher Al-Jabari 2022-06-24 Integral Waterproofing of Concrete Structures demonstrates how integral waterproofing technologies can solve concrete durability problems based on performance and characterization experimental results. This book first establishes a background about concrete structures and porosity linked with concrete hydration, then goes on to consider concrete durability problems from the perspective of water penetration including damages from freeze-thaw cycles, alkali silica reactions, and chloride ion penetration. The mechanisms, applications, performances, and limitations of waterproofing technologies including coatings and integral systems are compared. The book also showcases all application methods of crystallization waterproofing materials, including material spray on cured concrete and on fresh concrete, and their addition to concrete mix designs as enhancers or admixtures. Pore-blocking and lining waterproofing systems including silicate-

based and hygroscopic kinds, and other waterproofing materials are also discussed. Includes various, advanced, recent technologies in the field of waterproofing Presents and describes enhanced concrete characteristics and modified structures within the context of material engineering Summarizes the characteristics of waterproofing systems obtained from experimental results

Use of Foamed Concrete in Construction Ravindra K. Dhir 2005 - Preface - Introduction - Organising Committee - Scientific and Technical Committee - Collaborating Institutions - Sponsoring Organisations With Exhibition - Exhibiting Organisations - Supporting Institutions - Opening Paper - Introduction to Foamed Concrete (What? Why? How?) THEME 1 MATERIALS, PROPERTIES AND PRODUCTION CHARACTERISTICS Keynote Paper - Exploitation of Solid Wastes with Foamed Concrete - Challenges Ahead - Production of Foamed Concrete with High Calcium Fly Ash - Designing Mix Composition of Foamed Concrete with High Fly Ash Contents - Optimisation of Foamed Concrete Mix of Different Sand-Cement Ratio and Curing Conditions - New Innovative Lightweight Foam Concrete Technology - Investigations into the Air Void Characteristics of Foamed Concrete THEME 2 SPECIFICATION FOR FOAMED CONCRETE, APPLICATIONS AND CASE STUDIES Keynote Paper - Behaviour and Assessment of Foamed Concrete for Fill and Highway Applications - The Use of Foamed Concrete in Refractories - Heat-Resistant Cellular Concretes Based on Alkaline Cements - Major Road and Bridge Projects with Foam Concrete - Unautoclaved Foam Concrete and its Constructions, Adopted to the Regional Conditions - Assessment of Pre-Cast Foamed Concrete as Support Medium in Deep Level Mining - Stabilisation of Old Mine Workings: A Case Study of the Use of Foamed Concrete in

Combe Down Stone Mines - Closing Paper - Index of Authors - Subject Index
Finite-Element Modelling of Structural Concrete Michael D. Kotsovos 2015-05-20 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.

Magazine of Concrete Research 1990

Computational Methods for Reinforced Concrete Structures

Ulrich Häußler-Combe 2014-11-24 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 stress-strain 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.

Compressive Strength of Concrete Pavel Krivenko

2020-03-11 Concrete made using mineral cements, the raw materials which on earth are practically endless, is known as one of the oldest building materials and during the last decades of the twentieth century has become a dominant building material for general use. At the same time, the requirements of the quality of concrete and its performance properties, in particular compressive strength, durability, economical efficiency, and low

negative impact of its manufacture on the environment have not yet been completely met. Bearing these requirements in mind, researchers and engineers worldwide are working on how to satisfy these requirements. This book has been written by researchers and experts in the field and provides the state of the art on recent progress achieved on the properties of concrete, including concrete in which industrial by-products are utilized. The book is dedicated to graduate students, researchers, and practicing engineers in related fields.

Computational Modelling of Concrete Structures Nenad Bicanic 2010-02-24 Since 1984 the EURO-C conference series (Split 1984, Zell am See 1990, Innsbruck 1994, Badgastein 1998, St Johann im Pongau 2003, Mayrhofen 2006, Schladming 2010) has provided a forum for academic discussion of the latest theoretical, algorithmic and modelling developments associated with computational simulations of concrete and concrete structure

Recycled Ceramics in Sustainable Concrete Kwok Wei Shah 2020-12-24 Recycled Ceramics in Sustainable Concrete: Properties and Performance explores the use of novel waste materials in the construction industry as sustainable and environmentally friendly alternatives to traditional cement production technologies. It specifically focuses on using waste ceramics as a binder and aggregate replacement for concrete. Includes a lifecycle assessment Describes recycling of ceramic tile waste as fine and coarse aggregate replacement Discusses microstructure performance of sustainable concrete Evaluates performance of sustainable concrete exposed to elevated temperatures and corrosives Written for materials, chemical, and civil engineers as well as others who develop construction materials, this book

provides readers with a thorough understanding of the merits of using waste ceramics to produce sustainable concrete. .

High Performance Concrete Pierre-Claude Aïtcin 1998-07-02 A complete review of the fast-developing topic of high performance concrete (HPC) by one of the leading researchers in the field. It covers all aspects of HPC from materials, properties and technology, to construction and testing. The book will be valuable for all concrete technologists and construction engineers wishing to take advantage of the re

Mechanical damage and crack growth in concrete Alberto Carpinteri 2012-12-06 Following Volumes III and IV that dealt with the fracture mechanics of concrete emphasizing both material testing and structural application in general, it was felt that specimen size and loading rate effects for concrete require further attention. The only criterion that has thus far successfully linearized the highly nonlinear crack growth data of concrete is the strain energy density theory. In particular, the crack growth resistance curves plotting the strain energy density factor versus crack growth known as the SR-curves are straight lines as specimen size and loading steps or rates are altered. This allows the extrapolation of data and provides a useful design methodology. This book is unique in that it is devoted specifically to the application of the strain energy density theory to civil engineering structural members made of concrete. Analyzed in detail is the strain softening behavior of concrete for a variety of different components including the influence of steel reinforcement. Permanent damage of the material is accounted for each increment of loading by invoking the mechanism of elastic unloading. This assumption is

justified in concrete structures where the effective stiffness depends primarily on the crack growth rate and load history. Crack growth data are presented in terms of SR-curves with emphases placed on scaling specimen size which alone can change the mode of failure from plastic collapse to brittle fracture. Loading rate effects can also be scaled to control failure by yielding and fracture.

Crack Analysis in Structural Concrete Zihai Shi

2009-06-17 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

Creep and Hygrothermal Effects in Concrete Structures

Zdeněk P. Bažant 2018-01-17 This comprehensive treatise covers in detail practical methods of analysis as well as advanced mathematical models for structures highly sensitive to creep and shrinkage. Effective computational algorithms for century-long creep effects in structures, moisture diffusion and high temperature effects are presented. The main design codes and recommendations (including RILEM B3 and B4) are critically compared. Statistical uncertainty of century-long predictions is analyzed and its reduction by extrapolation is discussed, with emphasis on updating based on short-time tests and on long-term measurements on existing structures. Testing methods and the statistics of large randomly collected databases are critically appraised and improvements of predictions of multi-decade relaxation of prestressing steel, cyclic creep in bridges, cracking damage, etc., are demonstrated. Important research directions, such as nanomechanical and probabilistic modeling, are identified, and the need for separating the long-lasting autogenous shrinkage of modern concretes from the creep and drying shrinkage data and introducing it into practical prediction models is emphasized. All the results are derived mathematically and justified as much as possible by extensive test data. The theoretical background in linear viscoelasticity with aging is

covered in detail. The didactic style makes the book suitable as a textbook. Everything is properly explained, step by step, with a wealth of application examples as well as simple illustrations of the basic phenomena which could alternate as homeworks or exams. The book is of interest to practicing engineers, researchers, educators and graduate students.

Computational Modelling of Concrete Structures Günther Meschke 2018-01-31 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.

Sustainable Construction and Building Materials Bibhuti Bhusan Das 2018-12-30 This book presents select proceedings of the International Conference on Sustainable Construction and Building Materials (ICSCBM 2018), and examines a range of durable, energy-efficient, and next-generation construction and building materials produced from industrial wastes and byproducts. The topics covered include alternative, eco-friendly construction and building materials, next-generation concretes, energy efficiency in construction, and sustainability in construction project management. The book also discusses various properties and performance attributes of modern-age concretes including their durability, workability, and carbon footprint. As such, it offers a valuable reference for beginners, researchers, and professionals interested in sustainable construction and allied fields.

Structural Investigation for Reinforcing Congestion Alleviation in Concrete Members and Connections Yu Huang 2014-01-03 In this book, three potential solutions to the issue of steel congestion in reinforced concrete (RC) structures are researched. The first method examines RC mixed with steel fibers. The use of steel fibers instead of stirrups results in the reduction of reinforcing congestion in a manner which is both effective in reducing the effects of congestion and practical to implement. In the second method, reinforcing congestion in RC or prestressed concrete (PC) structures is effectively reduced by t ...

Handbook of advances in Alkali-activated Concrete Fernando Pacheco-Torgal 2021-12-16 *Advances on Alkali-activated Concrete*, provides comprehensive information

on materials, structural properties and realistic potential for the application of alkali-activated concretes and cements. Divided over seven key parts, including the design of alkali-activated concrete, their fabrication and curing, rheology, properties of alkali-activated concrete, durability, dynamic performance and LCA, the book will be an essential reference resource for academic and industrial researchers, materials scientists, chemists, manufacturers and civil engineers working with alkali-activated materials and concrete structures. Provides an essential guide on the latest developments in alkali-activated concrete

Comprehensively examines alkali-activated concrete performance under cyclic loading Includes concrete systems containing coarser aggregates Presents several important cases studies of application

Significance of Tests and Properties of Concrete and Concrete-making Materials Joseph F. Lamond 2006

Geopolymers as Sustainable Surface Concrete Repair

Materials Ghasan Fahim Huseien 2022-08-11 The progressive deterioration of concrete surface structures is a major concern in construction engineering that requires precise repairing. While a number of repair materials have been developed, geopolymer mortars have been identified as potentially superior and environmentally friendly high-performance construction materials, as they are synthesized by selectively combining waste materials containing alumina and silica compounds which are further activated by a strong alkaline solution. *Geopolymers as Sustainable Surface Concrete Repair Materials* offers readers insights into the synthesis, properties, benefits and applications of geopolymer-based materials for concrete repair. • Discusses manufacturing and design methods of

geopolymer-based materials • Assesses mechanical strength and durability of geopolymer-based materials under different aggressive environmental conditions • Characterizes the microstructure of these materials using XRD, SEM, EDX, TGA, DTG and FTIR measurements • Describes application of geopolymer-based materials as surface repair materials • Compares environmental and cost benefits against those of traditional OPC and commercial repair materials This book is written for researchers and professional engineers working with concrete materials, including civil and materials engineers.

International Journal for Housing Science and Its Applications 1985

Computational Modelling of Concrete Structures Gunther Meschke 2020-11-25 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.

Magazine of Concrete Research 1983

Continuous and Discontinuous Modelling of Fracture in Concrete Using FEM Jacek Tejchman 2012-07-28 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.

Applications of Computational Intelligence in Concrete

Technology Sakshi Gupta 2022-06-23 Computational intelligence (CI) in concrete technology has not yet been fully explored worldwide because of some limitations in data sets. This book discusses the selection and separation of data sets, performance evaluation parameters for different types of concrete and related materials, and sensitivity analysis related to various CI techniques. Fundamental concepts and essential analysis for CI techniques such as artificial neural network, fuzzy system, support vector machine, and how they work together for resolving real-life problems, are explained. Features: It is the first book on this fast-growing research field. It discusses the use of various computation intelligence techniques in concrete technology applications. It explains the effectiveness of the methods used and the wide range of available techniques. It integrates a wide range of disciplines from civil engineering, construction technology, and concrete technology to computation intelligence, soft computing, data science, computer science, and so on. It brings together the experiences of contributors from around the world who are doing research in this field and explores the different aspects of their research. The technical content included is beneficial for researchers as well as practicing engineers in the concrete and construction industry.

Multi-functional Concrete with Recycled Aggregates Yidong Xu 2022-10-04 Multi-functional Concrete with Recycled Aggregates consists of chapters covering multiple aspects of sustainable concrete materials, inclusive of engineering, environmental, policy, and management factors. With contributing authors worldwide from a variety of disciplines bridged by the theme of

sustainability of concrete, this book aims to provide an overview of existing research and practices of traditional recycled aggregate concrete; introduce the latest studies of high-performance concrete adopting recycled aggregates from C&D wastes; disseminate the latest findings of multifunctional recycled aggregate concrete by achieving the waste reuse while realizing other environmental sustainability goals; and link the multipurpose sustainable concrete technical development into the C&D waste management. Features state-of-the-art research and practices on adopting construction and demolition (C&D) wastes for production of recycled aggregate concrete (RAC) Discusses the managerial aspects of C&D waste management by promoting the usage of different types of RAC from technical, policy, and managerial perspectives Covers the entire waste reuse model to enhance the reuse and recycling rate of C&D wastes Includes recent developments in high-performance RAC and other new functions in RAC (e.g., pervious RAC designed to absorb air pollutants) are also presented Covers state-of-the art research and developments in engineering applications and properties of RAC, such as pervious RAC, self-cleaning RAC and High-performance RAC

Computational Structural Concrete Ulrich Haussler-Combe
2022-11-21 Concrete is by far the most used building material due to its advantages: it is shapeable, cost-effective and available everywhere. Combined with reinforcement it provides an immense bandwidth of properties and may be customized for a huge range of purposes. Thus, concrete is the building material of the 20th century. To be the building material of the 21th century its sustainability has to move into focus. Reinforced concrete structures have to be designed expending less material whereby their load carrying

potential has to be fully utilized. Computational methods such as Finite Element Method (FEM) provide essential tools to reach the goal. In combination with experimental validation, they enable a deeper understanding of load carrying mechanisms. A more realistic estimation of ultimate and serviceability limit states can be reached compared to traditional approaches. This allows for a significantly improved utilization of construction materials and a broader horizon for innovative structural designs opens up. However, sophisticated computational methods are usually provided as black boxes. Data is fed in, the output is accepted as it is, but an understanding of the steps in between is often rudimentary. This has the risk of misinterpretations, not to say invalid results compared to initial problem definitions. The risk is in particular high for nonlinear problems. As a composite material, reinforced concrete exhibits nonlinear behaviour in its limit states, caused by interaction of concrete and reinforcement via bond and the nonlinear properties of the components. Its cracking is a regular behaviour. The book aims to make the mechanisms of reinforced concrete transparent from the perspective of numerical methods. In this way, black boxes should also become transparent. Appropriate methods are described for beams, plates, slabs and shells regarding quasi-statics and dynamics. Concrete creeping, temperature effects, prestressing, large displacements are treated as examples. State of the art concrete material models are presented. Both the opportunities and the pitfalls of numerical methods are shown. Theory is illustrated by a variety of examples. Most of them are performed with the ConFem software package implemented in Python and available under open-source conditions.

ACI Manual of Concrete Practice American Concrete Institute 2002

Concrete Solutions 2011 Michael Grantham 2011-09-08 The Concrete Solutions series of International Conferences on Concrete Repair began in 2003, with a conference held in St. Malo, France in association with INSA Rennes, followed by the second conference in 2006 (with INSA again, at St. Malo, France), and the third conference in 2009 (in Padova and Venice, in association with the University of Padova). Now in 2011, the event is being held in Dresden in Germany and has brought together some 112 papers from 33 countries. Whereas electrochemical repair tended to dominate the papers in earlier years, new developments in structural strengthening with composites have been an increasingly important topic, with a quarter of the papers now focusing on this area. New techniques involving Near Surface Mounted (NSM) carbon fibre rods, strain hardening composites, and new techniques involving the well established carbon fibre and polyimide wrapping and strengthening systems are presented. Seventeen papers concentrate on case studies which are all-important in such conferences, to learn about what works (and what doesn't work) on real structures. Thirteen papers are devoted to new developments in Non-Destructive Testing (NDT). Other topics include service life modelling, fire damage, surface protection methods and coatings, patch repair, general repair techniques and whole life costing. This book is essential reading for anyone engaged in the concrete repair field, from engineers, to academics and students and also to clients, who, as the end user, are ultimately responsible for funding these projects and making those difficult decisions about which system or method to use.

Smart Nanoconcretes and Cement-Based Materials Mohd Shahir Liew 2019-11-16 Smart Nanoconcretes and Cement-Based Materials: Properties, Modelling and Applications explores the fundamental concepts and applications of smart nanoconcretes with self-healing, self-cleaning, photocatalytic, antibacterial, piezoelectrical, heating and conducting properties and how they are used in modern high-rise buildings, hydraulic engineering, highways, tunnels and bridges. This book is an important reference source for materials scientists and civil engineers who are looking to enhance the properties of smart nanomaterials to create stronger, more durable concrete. Explores the mechanisms through which active agents are released from nanocontainers inside concrete Shows how embedded smart nanosensors, including carbon cement-based smart sensors and micro/nano strain-sensors, are used to increase concrete performance Discusses the major challenges of integrating smart nanomaterials into concrete composites

Specifications for Structural Concrete, ACI 301-05, with Selected ACI References American Concrete Institute 2005

Concrete Surface Engineering Benoit Bissonnette 2018-10-09 Applying any material to an existing concrete surface intrinsically entails the development of a bond. Considering the ever increasing importance of concrete repair and protection, which imply the creation of an interface between two materials, an improved knowledge of concrete surface characteristics is paramount. Surface engineering, which has evolved from the world of metallurgy, addresses all surface-related considerations, notably adhesion. It provides a fundamental understanding of what will make the contact between two materials effective or not, allowing for interactions of variable intensity. It also comes with a

variety of scientific tools for characterizing the quality of the substrate, the properties of the new material layer and their interface. In the case of concrete surface treatment, this is especially important for achieving lasting results. This book addresses the essentials of concrete surface engineering in view of a wide variety of concrete surface treatments, from protective coatings to repairs. It provides a leading-edge source of information for practicing engineers, architects, repair specialists, and researchers on the following topics: Surface engineering principles applied to concrete Methods and techniques for assessing concrete surface characteristics Fundamentals of adhesion between concrete and surface repairs/treatments Compatibility requirements for concrete surface repairs/treatments Review of surface preparation techniques available for concrete Achievement and appraisal of bond between existing concrete and surface repairs/treatments Benoît Bissonnette is professor of civil engineering at Laval University in Quebec City, Canada. Luc Courard is professor of building materials at the University of Liège in Belgium. Andrzej Garbacz is professor of building materials engineering in the Department of Building Materials Engineering at the Warsaw University of Technology in Poland.

Concrete for the Modern Age Developments in materials and processes Dr Atef Badr 2017 This volume presents a wide-ranging review of the latest developments in concrete technology that have been largely missing from the global conference circuit. It the first major international event under the auspices of the Institute of Concrete Technology (ICT) and is appropriately located in the Middle East at the heart of a construction boom. Themes covered include admixture

technology, durability, mix design, special cements and supplementary materials, reinforced concrete and sustainability. The 39 papers provide interesting theory and applicable practice blended with research findings – from the application of 3D printing to performance-based specifications and the role of concrete in the development of Oman – to produce a volume of value to many engineers and technologists. Founded in 1972, The Institute of Concrete Technology (ICT)'s mission is to preserve and promote concrete technology as a recognised engineering discipline and consolidate the professional status of practising concrete technologists worldwide. It is the concrete sector's professional development body, operating internationally, with some 500 members in more than 30 countries. It is an awarding body for qualifications in concrete technology and a facilitator of continuing professional development (CPD) and networking opportunities. Our partner in this conference, The Military Technical College in Muscat, Oman, was established with the intent of becoming a Center of Excellence in engineering education. Located in one purpose-built, state-of-the-art, well-resourced center, the intent is that MTC will be amongst the world's best in the field of military and applied non-military technological education and training providers in the world.

Applications of Fracture Mechanics to Reinforced Concrete Alberto Carpinteri 2018-10-08 This volume emphasises the most recent advances in fracture mechanics as specifically applied to steel bar reinforced concrete. Fracture mechanics has been applied to plain and fibre reinforced concrete with increasing success over recent years. This workshop extended these concepts to steel bar reinforced and pre-stressed

concrete design. Particularly for high strength concrete, which is a very brittle material, and in the case of large structural members, the application of fracture mechanics appears to be very useful for improving the present design rules. The pre-eminent participants at the Turin workshop contributed extensive expert opinions in four selected areas for which a rational approach, using fracture mechanics, could introduce variations into the concrete design codes: size effects; anchorage and bond; minimum reinforcement for elements in flexure; and shear resistance. The 23 chapters logically address these themes and demonstrate the unique ability of fracture mechanics to capture all the experimentally observed characteristics. The book is primarily directed to the researchers in universities and institutions and will be of value to consultants and engineering companies.

Fracture Mechanics of Concrete Surendra P. Shah
 1995-09-28 FRACTURE MECHANICS OF CONCRETE AND ROCK This book offers engineers a unique opportunity to learn, from internationally recognized leaders in their field, about the latest theoretical advances in fracture mechanics in concrete, reinforced concrete structures, and rock. At the same time, it functions as a superb, graduate-level introduction to fracture mechanics concepts and analytical techniques. Reviews, in depth, the basic theory behind fracture mechanics * Covers the application of fracture mechanics to compression failure, creep, fatigue, torsion, and other advanced topics * Extremely well researched, applies experimental evidence of damage to a wide range of design cases * Supplies all relevant formulas for stress intensity * Covers state-of-the-art linear elastic fracture mechanics (LEFM) techniques for analyzing deformations and cracking

* Describes nonlinear fracture mechanics (NLFM) and the latest RILEM modeling techniques for testing nonlinear quasi-brittle materials * And much more Over the past few years, researchers employing techniques borrowed from fracture mechanics have made many groundbreaking discoveries concerning the causes and effects of cracking, damage, and fractures of plain and reinforced concrete structures and rock. This, in turn, has resulted in the further development and refinement of fracture mechanics concepts and tools. Yet, despite the field's growth and the growing conviction that fracture mechanics is indispensable to an understanding of material and structural failure, there continues to be a surprising shortage of textbooks and professional references on the subject. Written by two of the foremost names in the field, *Fracture Mechanics of Concrete* fills that gap. The most comprehensive book ever written on the subject, it consolidates the latest theoretical research from around the world in a single reference that can be used by students and professionals alike. *Fracture Mechanics of Concrete* is divided into two sections. In the first, the authors lay the necessary groundwork with an in-depth review of fundamental principles. In the second section, the authors vividly demonstrate how fracture mechanics has been successfully applied to failures occurring in a wide array of design cases. Key topics covered in these sections include: * State-of-the-art linear elastic fracture mechanics (LEFM) techniques for analyzing deformations and cracking * Nonlinear fracture mechanics (NLFM) and the latest RILEM modeling techniques for testing nonlinear quasi-brittle materials * The use of R-Curves to describe cracking and fracture in quasi-brittle materials * The application of fracture mechanics to compression

failure, creep, fatigue, torsion, and other advanced topics. The most timely, comprehensive, and authoritative book on this subject currently available, *Fracture Mechanics of Concrete* is both a complete instructional tool for academics and students in structural and geotechnical engineering courses, and an indispensable working resource for practicing engineers.

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Sustainability Improvements in the Concrete Industry

Carlo Pellegrino 2016-10-01 This book examines state-of-the-art techniques for using recycled materials for structural concrete production, and explores the use of concrete with metallurgical slag, rheology of fresh

recycled concrete, and life-cycle analysis of building materials. It reviews recent codes, guidelines and practices for using recycled materials in structural concrete application, and presents research recently carried out by the authors. Focusing on techniques that limit the environmental impacts of the concrete industry, the text explores the use of recycled components in the place of virgin aggregates and ordinary binders. Chapters focus on topics including processing procedures, mixture proportioning, mechanical properties, durability and structural applications. Providing a valuable resource to engineering postgraduates and researchers, this book is also intended for civil engineers, geologists, and concrete engineers.