

Structural Engineering Concrete

In Finite Element Design of Concrete Structures: practical problems and their solutions the author addresses this blind belief in computer results by offering a useful critique that important details are overlooked due to the flood of information from the output of computer calculations. Indeed, errors in the numerical model may lead in extreme cases to structural failures as the collapse of the so-called Sleipner platform has demonstrated.

Increases in computer power have now enabled engineers to combine materials science with structural mechanics in the design and the assessment of concrete structures. The techniques developed have become especially useful for the performance assessment of such structures under coupled mechanistic and environmental actions. This allows effective management of infrastructure over a much longer life cycle, thus satisfying the requirements for durability and sustainability. This ground-breaking new book draws on the fields of materials and structural mechanics in an integrated way to address the questions of management and maintenance. It proposes a realistic way of simulating both constituent materials and structural responses under external loading and under ambient conditions. Where the research literature discusses component or element technology related to performance assessment, this book uniquely covers the subject at the level of the whole system including soil foundation, showing engineers how to model changes in

concrete structures over time and how to use this for decision making in infrastructure maintenance and asset management.

The response of concrete under tensile loading is crucial for most applications because concrete is much weaker in tension than in compression. Understanding the response mechanisms of concrete under tensile conditions is therefore key to understanding and using concrete in structural applications. Understanding the tensile properties of concrete summarises key recent research in this important subject. After an introduction to concrete, the book is divided into two parts: part one on static response and part two on dynamic response. Part one starts with a summary chapter on the most important parameters that affect the tensile response of concrete. Chapters show how multi scale modelling is used to relate concrete composition to tensile properties. Part two focuses on dynamic response and starts with an introduction to the different regimes of dynamic loading, ranging from the low frequency loading by wind or earthquakes up to the extreme dynamic conditions due to explosions and ballistic impacts. Following chapters review dynamic testing techniques and devices that deal with the various regimes of dynamic loading. Later chapters highlight the dynamic behaviour of concrete from different viewpoints, and the book ends with a chapter on practical examples of how detailed knowledge on tensile properties is used by engineers in structural applications. Drawing on the work of some of the leading experts in the field, Understanding the tensile properties of concrete is a valuable reference for civil

and structural engineers as well as those researching this important material. Summarises key recent research in the areas of understanding the response mechanisms of concrete under tensile conditions Provides a summary of the most important parameters that affect the tensile response of concrete and shows how multi scale modeling is used to relate concrete composition to tensile properties Highlights the dynamic behaviour of concrete from different viewpoints and provides practical examples of how detailed knowledge on tensile properties is used by engineers in structural applications In recent years knowledge of concrete and concrete structures has increased, as has its applications. New types of concrete challenged scientists and engineers, and ecological constraints encouraged the implementation of life cycle design of concrete structures, moving the focus more and more to maintenance and uprating of structures. And since buildings are not only designed for safety and serviceability, but also for flexibility and adaptability, the design of performance based materials and structures has become more and more important. Tailor Made Concrete Structures. New Solutions for our Society comprises the proceedings of the International fib Symposium 2008 (Amsterdam, 19-22 May 2008), and considers these new perspectives and developments, including sections on new materials (i.e. fire resisting concrete, ultra-high performance fibered concrete, textile reinforced concrete, bacteria-based self healing concrete) and codes for the future (i.e. the American P2P Initiative, fibre-reinforced polymer (FRP) applications in

construction, Codes for SFRC Structures). The book includes contributions from leading scientists and professionals in concrete and concrete structures worldwide, and covers: – Life cycle design – Design strategies for the future – Underground structures – Monitoring and Inspection – Diagnosis – Innovative materials – Codes for the future – Modifying and adapting structures – Architectural Concrete – Developing a modern infrastructure – Designing structures against extreme loads – Increasing the speed of construction Tailor Made Concrete Structures. New Solutions for our Society includes the state-of-the-art in research on concrete and concrete structures, and will be invaluable to professionals, structural engineers and scientists.

The Structural Integrity of Recycled Aggregate Concrete Produced with Fillers and Pozzolans presents a review on the use of by-products, fillers and pozzolanic materials in the development of concrete, with an emphasis on structural integrity. The volume is broken down into key sections, including a review of the types of materials that are used as latent hydraulic supplements, fillers and pozzolans for making recycled aggregate concrete, rheology and hydration phenomenon, the mechanical and microscale nature of concrete, and the impact of fillers and pozzolans on the workability of concrete with case studies. Durability and strength development are also discussed. The final section looks at issues such as performance effect, LCA, environmental impact, sustainability and cost benefit analysis. With detailed case studies throughout, this

volume will provide useful information for all stakeholders involved in the built environment, including materials scientists, civil engineers, builders, architects and policymakers. Identifies several potential by-products, fillers and pozzolans for the development of durable concrete Acts as a guidebook for constructors and researchers working in the broad field of material science, engineering and in-situ application Presents the durability properties of concrete made of by-products, fillers and pozzolans

Introductory technical guidance for civil engineers, structural engineers and construction managers interested in engineering design and construction of concrete structures. Here is what is discussed: 1. CONSTRUCTION PLANNING 2. CONSTRUCTION METHODS 3. MATERIALS SELECTION 4. MIXTURE PROPORTIONING 5. ARCHITECTURAL CONCRETE 6. SHOTCRETE 7. VERIFICATION AND TESTING 8. CONCRETE PAVEMENTS 9. SLABS ON GRADE 10. SPECIAL CONCRETES 11. ALKALI/SILICATE AGGREGATE REACTIONS 12. EVALUATION OF CONCRETE STRUCTURES 13. CONCRETE STRUCTURES REPAIR 14. REINFORCED CONCRETE HYDRAULIC STRUCTURES

Civil engineers must assure that buildings have long and durable lives, and therefore structural assessment and repair are routinely required and must be performed with the utmost accuracy and professionalism. Assessment, Evaluation, and Repair of Concrete, Steel, and Offshore Structures presents the typical causes of structural failure and their mechanisms, discusses the most up-to-

date methods for evaluation and structural assessment, and explains the best project management strategies from the feasibility stage through operations and maintenance. Numerous types of structures are examined and are further illustrated by relevant case studies. Features: Examines the probability of several types of structural failure and includes reliability analysis. Presents best practices for predicting the structural lifetime for both onshore and offshore structures and reviews the most advanced methods for repair. Includes numerous practical case studies of structural failure and offers mitigation strategies depending of type of structure.

Timber, steel, and concrete are common engineering materials used in structural design. Material choice depends upon the type of structure, availability of material, and the preference of the designer. The design practices the code requirements of each material are very different. In this updated edition, the elemental designs of individual components of each material are presented, together with theory of structures essential for the design. Numerous examples of complete structural designs have been included. A comprehensive database comprising materials properties, section properties, specifications, and design aids, has been included to make this essential reading.

Structural engineers must focus on a structure's continued safety throughout its service life. Reinforced Concrete Structural Reliability covers the methods that enable engineers to keep structures reliable during all project phases, and presents a practical exploration of up-to-date techniques for predicting the lifetime of a structure. The book a

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This book is focused on the theoretical and practical design of reinforced concrete beams, columns and frame structures. It is based on an analytical approach of designing normal reinforced concrete structural elements that are compatible with most international design rules, including for instance the European design rules – Eurocode 2 – for reinforced concrete structures. The book tries to distinguish between what belongs to the structural design philosophy of such structural elements (related to strength of materials arguments) and what belongs to the design rule aspects associated with specific characteristic data (for the material or loading parameters). A previous book, entitled Reinforced Concrete Beams, Columns and Frames – Mechanics and Design, deals with the fundamental aspects of the mechanics and design of reinforced concrete in general, both related to the Serviceability Limit State (SLS) and the Ultimate Limit State (ULS), whereas the current book deals with more advanced ULS aspects, along with instability and second-order analysis aspects. Some recent research results including the use of non-local mechanics are also presented. This book is aimed at Masters-level students, engineers, researchers and teachers in the field of reinforced concrete design. Most of the books in this area are very practical or code-oriented, whereas this book is more theoretically based, using rigorous mathematics and mechanics tools. Contents 1. Advanced Design at Ultimate Limit State (ULS). 2. Slender Compression Members – Mechanics and Design. 3. Approximate Analysis Methods. Appendix 1. Cardano’s Method. Appendix 2. Steel Reinforcement Table. About the Authors Jostein Hellesland has been Professor of Structural Mechanics at the University of Oslo, Norway since January 1988. His contribution to the field of stability has been recognized and magnified by many high-quality papers in famous international journals such as Engineering Structures, Thin-Walled Structures, Journal of

Constructional Steel Research and Journal of Structural Engineering. Noël Challamel is Professor in Civil Engineering at UBS, University of South Brittany in France and chairman of the EMI-ASCE Stability committee. His contributions mainly concern the dynamics, stability and inelastic behavior of structural components, with special emphasis on Continuum Damage Mechanics (more than 70 publications in International peer-reviewed journals). Charles Casandjian was formerly Associate Professor at INSA (French National Institute of Applied Sciences), Rennes, France and the chairman of the course on reinforced concrete design. He has published work on the mechanics of concrete and is also involved in creating a web experience for teaching reinforced concrete design – BA-CORTEX. Christophe Lanos is Professor in Civil Engineering at the University of Rennes 1 in France. He has mainly published work on the mechanics of concrete, as well as other related subjects. He is also involved in creating a web experience for teaching reinforced concrete design – BA-CORTEX.

High strength fibre composites (FRPs) have been used with civil structures since the 1980s, mostly in the repair, strengthening and retrofitting of concrete structures. This has attracted considerable research, and the industry has expanded exponentially in the last decade. Design guidelines have been developed by professional organizations in a number of countries including USA, Japan, Europe and China, but until now designers have had no publication which provides practical guidance or accessible coverage of the fundamentals. This book fills this void. It deals with the fundamentals of composites, and basic design principles, and provides step-by-step guidelines for design. Its main theme is the repair and retrofit of un-reinforced, reinforced and prestressed concrete structures using carbon, glass and other high strength fibre composites. In the case of beams, the

focus is on their strengthening for flexure and shear or their stiffening. The main interest with columns is the improvement of their ductility; and both strengthening and ductility improvement of un-reinforced structures are covered.

Methods for evaluating the strengthened structures are presented. Step by step procedures are set out, including flow charts, for the various structural components, and design examples and practice problems are used to illustrate. As infrastructure ages worldwide, and its demolition and replacement becomes less of an option, the need for repair and retrofit of existing facilities will increase. Besides its audience of design professionals, this book suits graduate and advanced undergraduate students.

The in situ rehabilitation or upgrading of reinforced concrete members using bonded steel plates is an effective, convenient and economic method of improving structural performance. However, disadvantages inherent in the use of steel have stimulated research into the possibility of using fibre reinforced polymer (FRP) materials in its place, providing a non-corrosive, more versatile strengthening system. This book presents a detailed study of the flexural strengthening of reinforced and prestressed concrete members using fibre reinforced polymer composite plates. It is based to a large extent on material developed or provided by the consortium which studied the technology of plate bonding to upgrade structural units using carbon fibre / polymer composite materials. The research and trial tests were undertaken as part of the ROBUST project, one of several ventures in the UK Government's DTI-LINK Structural Composites Programme. The book has been designed for practising structural and civil engineers seeking to understand the principles and design technology of plate bonding, and for final year undergraduate and postgraduate engineers studying the principles of highway and bridge engineering

and structural engineering. Detailed study of the flexural strengthening of reinforced and prestressed concrete members using fibre reinforced polymer composites Contains in-depth case histories

Transport Properties of Concrete: Modelling the Durability of Structures, Second Edition, covers how to measure transport properties and use the results to model performance. The transport properties of concrete and measurements of the ability of ions and fluids to move through the material. These properties largely determine the durability of concrete and of steel embedded within it, as well as the effectiveness of structures such as waste containment barriers. The book provides a comprehensive examination of the subject and will be of use to all concerned with the durability and effectiveness of concrete structures. Includes a new chapter on modelling the durability of concrete structures showing how both diffusion and pressure driven flow should be included Covers the problems that occur when carrying out transport tests on concrete incorporating both traditional and newer cement replacements Shows how properties such as permeability which are needed for modelling may be derived from in situ tests on structures

Eco-efficient concrete is a comprehensive guide to the characteristics and environmental performance of key concrete types. Part one discusses the eco-efficiency and life cycle assessment of Portland cement concrete, before part two goes on to consider concrete with supplementary cementitious materials (SCMs). Concrete with non-reactive wastes is the focus of part three, including municipal solid waste incinerator (MSWI) concrete, and concrete with polymeric, construction and demolition wastes (CDW). An eco-efficient approach to concrete carbonation is also reviewed, followed by an investigation in part four of future alternative binders and the use of nano and biotech in concrete

production. With its distinguished editors and international team of expert contributors, Eco-efficient concrete is a technical guide for all professionals, researchers and academics currently or potentially involved in the design, manufacture and use of eco-efficient concrete. The first part of the book examines the eco-efficiency and life cycle assessment of Portland cement concrete Chapters in the second part of the book consider concrete with supplementary cementitious materials, including properties and performance Reviews the eco-efficient approach to concrete carbonation

This second edition of Precast Concrete Structures introduces the conceptual design ideas for the prefabrication of concrete structures and presents a number of worked examples that translate designs from BS 8110 to Eurocode EC2, before going into the detail of the design, manufacture, and construction of precast concrete multi-storey buildings. Detailed structural analysis of precast concrete and its use is provided and some details are presented of recent precast skeletal frames of up to forty storeys. The theory is supported by numerous worked examples to Eurocodes and European Product Standards for precast reinforced and prestressed concrete elements, composite construction, joints and connections and frame stability, together with extensive specifications for precast concrete structures. The book is extensively illustrated with over 500 photographs and line drawings.

This book examines the application of strut-and-tie models (STM) for the design of structural concrete. It presents state-of-the-art information, from fundamental theories to practical engineering applications, and also

provides innovative solutions for many design problems that are not otherwise achievable using the traditional methods.

From China to Kuala Lumpur to Dubai to downtown New York, amazing buildings and unusual structures create attention with the uniqueness of their design. While attractive to developers and investors, the safe and economic design and construction of reinforced concrete buildings can sometimes be problematic. Advanced Materials and Techniques for Rein

Serviceability failures of concrete structures involving excessive cracking or deflection are relatively common, even in structures that comply with code requirements. This is often as a result of a failure to adequately account for the time-dependent deformations of concrete in the design of the structure. The serviceability provisions embodied in codes of practice are relatively crude and, in some situations, unreliable and do not adequately model the in-service behaviour of structures. In particular, they fail to adequately account for the effects of creep and shrinkage of the concrete. Design for serviceability is complicated by the non-linear and inelastic behaviour of concrete at service loads. Providing detailed information, this book helps engineers to rationally predict the time-varying deformation of concrete structures under typical in-service conditions. It gives analytical methods to help anticipate time-dependent cracking, the gradual change in tension stiffening with time, creep induced deformations and the load independent strains caused by shrinkage and temperature changes. The calculation procedures are illustrated with many worked examples.

A vital guide for practising engineers and advanced students of structural engineering on the design of concrete structures for serviceability and provides a penetrating insight into the time-dependent behaviour of reinforced and prestressed concrete structures. Selected chapters from the German concrete yearbook are now being published in the new English "Beton-Kalender Series" for the benefit of an international audience. Since it was founded in 1906, the Ernst & Sohn "Beton-Kalender" has been supporting developments in reinforced and prestressed concrete. The aim was to publish a yearbook to reflect progress in "ferro-concrete" structures until - as the book's first editor, Fritz von Emperger (1862-1942), expressed it - the "tempestuous development" in this form of construction came to an end. However, the "Beton-Kalender" quickly became the chosen work of reference for civil and structural engineers, and apart from the years 1945-1950 has been published annually ever since. Ultra high performance concrete (UHPC) is a milestone in concrete technology and application. It permits the construction of both more slender and more durable concrete structures with a prolonged service life and thus improved sustainability. This book is a comprehensive overview of UHPC - from the principles behind its production and its mechanical properties to design and detailing aspects. The focus is on the material behaviour of steel fibre-reinforced UHPC. Numerical modelling and detailing of the connections with reinforced concrete elements are featured as well. Numerous examples worldwide - bridges, columns,

facades and roofs - are the basis for additional explanations about the benefits of UHPC and how it helps to realise several architectural requirements. The authors are extensively involved in the testing, design, construction and monitoring of UHPC structures. What they provide here is therefore a unique synopsis of the state of the art with a view to practical applications. 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

Structural Concrete discusses the design and analysis of reinforced and prestressed concrete structural components and structures. Each of the eight chapters of the book tackles a specific area of concern in structural concrete. The text first deals with the serviceability and safety, and then proceeds to the properties of materials and mix designs. The next two chapters cover reinforced concrete beams and slabs. Chapter 5 discusses column and walls, while Chapter 6 tackles reinforced concrete frames and continuous beams and slabs. The next chapter discusses design structures, while the last chapter covers prestressed concrete. The text will be of great use to undergraduate students of civil and structural engineering. Professionals whose work involves concrete technology will also find the book useful.

Reinforced concrete is the most widely used construction material in the world, and extended performance is rightly expected. Many structures are in aggressive environments, of critical importance and may be irreplaceable, so repair and protection are vital. This book surveys deterioration of concrete, particularly corrosion of the steel reinforcement, and the various chemical, biological, physical and mechanical causes of

deterioration. It outlines condition survey and diagnosis techniques by on-site and laboratory measurements. It sets out mechanical methods of protection and repair, such as patching, inhibitors, coatings, penetrants and structural strengthening as well as cathodic protection and other electrochemical methods. This book also gives guidance on preventative measures including concrete technology and construction considerations, coatings and penetrants, alternate reinforcement, permanent corrosion monitoring and durability planning aspects. Asset managers, port engineers, bridge maintenance managers, building managers, heritage structure engineers, plant engineers, consulting engineers, architects, specialist contractors and construction material suppliers who have the task of resolving problems of corrosion of steel reinforced concrete elements will find this book an extremely useful resource. It will also be a valuable reference for students at postgraduate level. Authors The late Professor Brian Cherry of Monash University, Melbourne, Australia was one of the world's leading corrosion science and engineering educators and researchers. Warren Green of Vinsi Partners, Sydney, Australia is a corrosion engineer and materials scientist. He is also an Adjunct Associate Professor.

Emphasizing a conceptual understanding of concrete design and analysis, this revised and updated edition builds the student's understanding by presenting design methods in an easy to understand manner supported with the use of numerous examples and problems. Written in intuitive, easy-to-understand language, it

includes SI unit examples in all chapters, equivalent conversion factors from US customary to SI throughout the book, and SI unit design tables. In addition, the coverage has been completely updated to reflect the latest ACI 318–11 code.

In our fast paced era, it is essential to have reference materials that are relevant, current and userfriendly for any design professional. This book represents indeed the above referenced items. It is userfriendly, since the chapters are being layed out in way that make it easy to follow the materials.

The mechanisms by which buildings and infrastructures degrade are complex, as are the procedures and methods for inspection and for rehabilitation. This book examines the various problems caused by non-uniform deformation changes, poor durability, and natural and human disasters such as earthquakes and fire. Attention is given to the causes and mechanisms of the deterioration. General procedures and commonly used techniques for inspection and evaluation of existing infrastructures are introduced. The desk study, destructive test, and non-destructive test are discussed – in particular the newly developed non-destructive methods for deterioration monitoring. The book then moves on to conventional renovation techniques such as patch and steel plate strengthening, which meet the requirements of normal practice. Special attention is paid to compatibility between repair materials and degraded materials. Fibrous composite materials are then introduced as a basis for innovative repair techniques, and different fibre and matrix properties are outlined, as

are newly developed inorganic binders as a matrix for fibrous composites. Finally, advanced rehabilitation techniques using fibrous composite are described. Fundamental issues such as bonding and failure mechanisms are then discussed in detail. Fibrous composite strengthening techniques for beam, wall, column and slabs are covered, including shear strengthening, flexural strengthening, and fillet winding, as are codes of practice for retrofitting with fibrous composites. This caters to students and academics world-wide and serves as a "tool book" for concrete and structural engineering professionals.

Challenges, Opportunities and Solutions in Structural Engineering and Construction addresses the latest developments in innovative and integrative technologies and solutions in structural engineering and construction, including: Concrete, masonry, steel and composite structures; Dynamic impact and earthquake engineering; Bridges and

Structural Concrete Theory and Design John Wiley & Sons

Principle of Reinforced Concrete introduces the main properties of structural concrete and its mechanical behavior under various conditions as well as all aspects of the combined function of reinforcement and concrete. Based on the experimental investigation, the variation regularity of mechanical behavior, working mechanism, and calculation method are presented for the structural member under various internal forces. After examining the basic principle and analysis method of reinforced concrete, the book covers some extreme circumstances,

including fatigue load, earthquake, explosion, high temperature (fire accident), and durability damage, and the special responses and analysis methods of its member under these conditions. This work is valuable as a textbook for post-graduates, and can be used as a reference for university teachers and under-graduates in the structural engineering field. It is also useful for structural engineers engaged in scientific research, design, or construction. Focuses on the principles of reinforced concrete, providing professional and academic readers with a single volume reference. Experimental data enables readers to make full use of the theory presented. The mechanical behavior of both concrete and reinforcement materials, plus the combined function of both are covered, enabling readers to understand the behaviors of reinforced concrete structures and their members. Covers behavior of the materials and members under normal and extreme conditions.

The first edition of this comprehensive work quickly filled the need for an in-depth handbook on concrete construction engineering and technology. Living up to the standard set by its bestselling predecessor, this second edition of the Concrete Construction Engineering Handbook covers the entire range of issues pertaining to the construction

Concrete structures must be designed not only to be safe against failure but also to perform satisfactorily in use. This book is written for practising engineers and students, and focuses on design methods for

checking deflections and cracking which can affect the serviceability of reinforced and prestressed concrete structures. The authors present accurate and easy-to-apply methods of analysing immediate and long-term stresses and deformations. These methods allow designers to account for variations of concrete properties from project to project and from country to country, making the book universally applicable. Comprehensively updated, this third edition of Concrete Structures also includes four new chapters covering such topics as: non-linear analysis of plane frames, design for serviceability of prestressed concrete, serviceability of members reinforced with fibre polymer bars, and the analysis of time-dependent internal forces with linear computer programs that are routinely used by structural designers. A website accompanies the book, featuring three design calculation programs related to stresses in cracked sections, creep coefficients and time-dependent analysis. The book contains numerous examples, some of which are worked out in the SI units and others in the Imperial units. The input data and the main results are given in both SI and Imperial units. The book is not tied to any specific code, although the latest American and European codes of practice are covered in the appendices.

Challenges, Opportunities and Solutions in Structural Engineering and Construction addresses the latest

developments in innovative and integrative technologies and solutions in structural engineering and construction, including: Concrete, masonry, steel and composite structures; Dynamic impact and earthquake engineering; Bridges and special structures; Structural optimization and computation; Construction materials; Construction methods and management; Construction maintenance and infrastructure; Organizational behavior; Sustainability and energy conservation; Engineering economics; Information technology; Geotechnical engineering, foundation and tunneling. The book appeals to structural and construction engineers, architects, academics, researchers, students and those involved in the building and construction industry. This revised, fully updated second edition covers the analysis, design, and construction of reinforced concrete structures from a real-world perspective. It examines different reinforced concrete elements such as slabs, beams, columns, foundations, basement and retaining walls and pre-stressed concrete incorporating the most up-to-date edition of the American Concrete Institute Code (ACI 318-14) requirements for the design of concrete structures. It includes a chapter on metric system in reinforced concrete design and construction. A new chapter on the design of formworks has been added which is of great value to students in the construction engineering programs along with practicing

engineers and architects. This second edition also includes a new appendix with color images illustrating various concrete construction practices, and well-designed buildings. The ACI 318-14 constitutes the most extensive reorganization of the code in the past 40 years. References to the various sections of the ACI 318-14 are provided throughout the book to facilitate its use by students and professionals. Aimed at architecture, building construction, and undergraduate engineering students, the scope of concepts in this volume emphasize simplified and practical methods in the analysis and design of reinforced concrete. This is distinct from advanced, graduate engineering texts, where treatment of the subject centers around the theoretical and mathematical aspects of design. As in the first edition, this book adopts a step-by-step approach to solving analysis and design problems in reinforced concrete. Using a highly graphical and interactive approach in its use of detailed images and self-experimentation exercises, "Concrete Structures, Second Edition," is tailored to the most practical questions and fundamental concepts of design of structures in reinforced concrete. The text stands as an ideal learning resource for civil engineering, building construction, and architecture students as well as a valuable reference for concrete structural design professionals in practice. Everything civil and structural engineers in California

need to prepare for the seismic design topics of the Special Civil Engineering Exam and California Structural Engineering Exam. This guide emphasizes methods that lead to the quickest and simplest solution to any problem.

Comprehensive coverage of durability of concrete at both material and structural levels, with design related issues Links two active fields in materials science and structural engineering: the durability processes of concrete materials and design methods of concrete structures Facilitates communication between the two communities, helping to implement life-cycle concepts into future design methods of concrete structures Presents state-of-the-art information on the deterioration mechanism and performance evolution of structural concrete under environmental actions and the design methods for durability of concrete structures Provides efficient support and practical tools for life-cycle oriented structural design which has been widely recognized as a new generation of design philosophy for engineering structures The author has long experience working with the topic and the materials presented have been part of the author's current teaching course of Durability and Assessment of Engineering Structures for graduate students at Tsinghua University The design methods and approaches for durability of concrete structures are developed from newly finished high level research

projects and have been employed as recommended provisions in design code including Chinese Code and Eurocode 2

Developments in the Formulation and Reinforcement of Concrete, Second Edition, presents the latest developments on topics covered in the first edition.

In addition, it includes new chapters on supplementary cementitious materials, mass concrete, the sustainability of concrete, service life prediction, limestone cements, the corrosion of steel in concrete, alkali-aggregate reactions, and concrete as a multiscale material. The book's chapters introduce the reader to some of the most important issues facing today's concrete industry. With its distinguished editor and international team of contributors, users will find this to be a must-have reference for civil and structural engineers.

Summarizes a wealth of recent research on structural concrete, including material microstructure, concrete types, and variation and construction techniques Emphasizes concrete mixture design and applications in civil and structural engineering

Reviews modern concrete materials and novel construction systems, such as the precast industry and structures requiring high-performance concrete

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