

Flexural Behavior Of Hybrid Fiber Reinforced Concrete Beams

Flexural members such as beams are typically made from wood, concrete, prestressed concrete, steel, and FRP. Built-up I-beams made from thin fiber reinforced plates are another group of beams that can provide an alternative to steel and reinforced concrete beams for various uses. The purpose of this research is to evaluate the potential of using built-up I-beams made of thin SIFCON plates in structural applications such as beams, lintels, and others. Several built-up I-beams were prepared and tested in flexure. The thin SIFCON plates were made with straight fibers (brass coated microfibers), hooked fibers, and a hybrid using both fibers. The plates were connected using organic epoxy resin with and without thin aluminum angles and with basalt fabrics using an inorganic epoxy. The built-up I-beams were tested in flexure to evaluate bending strength and their failure modes such as flange yielding, lateral torsional buckling, and web shear failure. The built-up I-beams were also strengthened using in tension using basalt fabrics to improve their tensile strength. The results showed that the use of basalt fabrics increases the flexural capacity of the built-up beams and can be used for retrofitting of these beams. The results of this study showed that these beams can be fabricated and can be used as structural members subjected to bending. The study also provided test data and information on the feasibility of these types of beams, methods of connecting plate components, their performance in flexure and their failure modes.

This book gathers peer-reviewed contributions presented at the 3rd National Conference on Structural Engineering and Construction Management (SECON'19), held in Angamaly, Kerala, India, on 15-16 May 2019. The meeting served as a fertile platform for discussion, sharing sound knowledge and introducing novel ideas on issues related to sustainable construction and design for the future. The respective contributions address various aspects of numerical modeling and simulation in structural engineering, structural dynamics and earthquake engineering, advanced analysis and design of foundations, BIM, building energy management, and technical project management. Accordingly, the book offers a valuable, up-to-date tool and essential overview of the subject for scientists and practitioners alike, and will inspire further investigations and research.

Engineering practice has revealed that innovative technologies' structural applications require new design concepts related to developing materials with mechanical properties tailored for construction purposes. This would allow the efficient use of engineering materials. The efficiency can be understood in a simplified and heuristic manner as the optimization of performance and the proper combination of structural components, leading to the consumption of the least amount of natural resources. The solution to the eco-optimization problem, based on the adequate characterization of the materials, will enable implementing environmentally friendly engineering principles when the efficient use of advanced materials guarantees the required structural safety. Identifying fundamental relationships between the structure of advanced composites and their physical properties is the focus of this book. The collected articles explore the development of sustainable composites with valorized manufacturability corresponding to Industrial Revolution 4.0 ideology. The publications, amongst others, reveal that the application of nano-particles improves the mechanical performance of composite materials; heat-resistant aluminium composites ensure the safety of overhead power transmission lines; chemical additives can detect the impact of temperature on concrete structures. This book demonstrates that construction materials' choice has considerable room for improvement from a scientific viewpoint, following heuristic approaches.

This book covers the basic principle and challenges of structural health monitoring system for natural fibre and the hybrid composites structural materials in industrial applications, such as building, automotive, aerospace and wind turbine. Structural health monitoring (SHM) has become crucial in evaluating the performance of structural application in recent trends, especially since it is in line with the high-tech strategy of Industry 4.0. It is a system that is operated in real time or in an online situation. Hence, it also has advantages for damage detection, damage localisation, damage assessment and life prediction compared to the non-destructive test (NDT) which is conducted offline. The book covers the monitoring of the composite materials in terms of structural properties and damage evaluation through modelling and prediction of failure in composite. It includes recent examples and real-world engineering application to illustrate the understanding of the current technology application. The book benefits lecturers, students, researchers, engineers and industrialist who are working in the civil, aerospace and wind turbine industries.

In the automotive industry, the need to reduce vehicle weight has given rise to extensive research efforts to develop aluminum and magnesium alloys for structural car body parts. In aerospace, the move toward composite airframe structures urged an increased use of formable titanium alloys. In steel research, there are ongoing efforts to design novel damage-controlled forming processes for a new generation of efficient and reliable lightweight steel components. All these materials, and more, constitute today's research mission for lightweight structures. They provide a fertile materials science research field aiming to achieve a better understanding of the interplay between industrial processing, microstructure development, and the resulting material properties. Advancements in the Processing, Characterization, and Application of Lightweight Materials provides the recent advancements in the lightweight materials processing, manufacturing, and characterization. This book identifies the need for modern tools and techniques for designing lightweight materials and addresses multidisciplinary approaches for applying their use. Covering topics such as numerical optimization, fatigue characterization, and process evaluation, this text is an essential resource for materials engineers, manufacturers, practitioners, engineers, academicians, chief research officers, researchers, students, and vice presidents of research in government, industry, and academia.

Reinforced Syntactic Foams: Effect of Nano and Micro-Scale Reinforcement examines the fabrication processes, mechanism of reinforcement, and structure-property correlations of reinforced syntactic foams. The authors present the state of the art in this field, compare the properties of various types of syntactic foam systems comprising different matrix, hollow particle, and reinforcement materials. The book further identifies theories useful in predicting the properties of reinforced syntactic foams and conducting parametric studies to understand the possibility for tailoring their properties.

This overview examines current issues of fiber reinforced polymer (FRP) composites in civil infrastructure. Part I engages topics related to durability and service life of FRP composites, and how they contribute to sustainability, while Part II highlights implementation and applications.

This book addresses different aspects of green biocomposite manufacture from natural fibres and bioplastics, including the manufacturing procedures and the physical, mechanical, thermal and electrical properties of green biocomposites. Featuring illustrations and tables that maximize reader insights into the current research on biocomposites, it emphasises the role of green technology in the manufacture of biocomposites and analysis of properties of biocomposites for different applications. It is a valuable resource for researchers and scientists in industry wanting to understand the need for biocomposites in the development of green, biodegradable and sustainable products for different applications.

Structural Modeling and Experimental Techniques presents a current treatment of structural modeling for applications in design, research, education, and product development. Providing numerous case studies throughout, the book emphasizes modeling the behavior of reinforced and prestressed concrete and masonry structures. Structural Modeling and Experimental Techniques: Concentrates on the modeling of the true inelastic behavior of structures Provides case

histories detailing applications of the modeling techniques to real structures Discusses the historical background of model analysis and similitude principles governing the design, testing, and interpretation of models Evaluates the limitations and benefits of elastic models Analyzes materials for reinforced concrete masonry and steel models Assesses the critical nature of scale effects of model testing Describes selected laboratory techniques and loading methods Contains material on errors as well as the accuracy and reliability of physical modeling Examines dynamic similitude and modeling techniques for studying dynamic loading of structures Covers actual applications of structural modeling This book serves students in model analysis and experimental methods, professionals manufacturing and testing structural models, as well as professionals testing large or full-scale structures - since the instrumentation techniques and overall approaches for testing large structures are very similar to those used in small-scale modeling work.

Fiber-reinforced composites are exceptionally versatile materials whose properties can be tuned to exhibit a variety of favorable properties such as high tensile strength and resistance against wear or chemical and thermal influences. Consequently, these materials are widely used in various industrial fields such as the aircraft, marine, and automobile industry. After an overview of the general structures and properties of hybrid fiber composites, the book focuses on the manufacturing and processing of these materials and their mechanical performance, including the elucidation of failure mechanisms. A comprehensive chapter on the modeling of hybrid fiber composites from micromechanical properties to macro-scale material behavior is followed by a review of applications of these materials in structural engineering, packaging, and the automotive and aerospace industries.

This book presents selected articles from the 5th International Conference on Geotechnics, Civil Engineering Works and Structures, held in Ha Noi, focusing on the theme "Innovation for Sustainable Infrastructure", aiming to not only raise awareness of the vital importance of sustainability in infrastructure development but to also highlight the essential roles of innovation and technology in planning and building sustainable infrastructure. It provides an international platform for researchers, practitioners, policymakers and entrepreneurs to present their recent advances and to exchange knowledge and experience on various topics related to the theme of "Innovation for Sustainable Infrastructure".

Studies presented in this book cover these topics: composites, micro / nano materials and technology, steel and iron and technology, ceramic, metal alloy materials, polymer materials and technology, physics and chemistry materials and technology, building materials, energy materials and fuel technology, environmental friendly materials and waste recycling, biomaterials, chemical materials and processes, thin films, earthquake resistant structures, materials and design, surface engineering/coatings, modeling, analysis and simulation, materials forming and processes, materials machining, welding & joining, mechanical behavior & fracture , tooling testing and evaluation of materials.

Recent advances in polymer research has led to the generation of high quality materials for various applications in day to day life. The synthesis of new functional monomers has shown strong potential in generating novel polymer materials, with improved properties. Advanced Polymeric Materials includes fundamentals and numerous examples of polymer blend preparation and characterizations. Developments in blends, polymer nanocomposites and its various characterization techniques are highlighted in the book.

Although the use of composites has increased in many industrial, commercial, medical, and defense applications, there is a lack of technical literature that examines composites in conjunction with concrete construction. Fulfilling the need for a comprehensive, explicit guide, Reinforced Concrete Design with FRP Composites presents specific informat

The range of fibre-reinforced polymer (FRP) applications in new construction, and in the retrofitting of existing civil engineering infrastructure, is continuing to grow worldwide. Furthermore, this progress is being matched by advancing research into all aspects of analysis and design. The Second International Conference on FRP Composites in

Highlights the recent developments in the fundamental understanding of composites; important information for researchers and composite scientists.

The low velocity impact response of plain autoclaved aerated concrete (AAC) and FRP/AAC sandwich panels has been investigated. The structural sandwich panels composed of a FRP/AAC combination have shown excellent characteristics in terms of high strength and high stiffness-to-weight ratios. In addition to having adequate flexural and shear properties, the behavior of FRP/AAC sandwich panels needs to be investigated when subjected to impact loading. During service, the structural members in the building structures are subjected to impact loading that varies from object-caused impact, blast due to explosions, to high velocity impact of debris during tornados, hurricanes, or storms. Low velocity impact (LVI) testing serves as a means to quantify the allowable impact energy that the structure is able to withstand and to assess the typical failure modes encountered during this type of loading. The objectives of this chapter are: to study the response of plain AAC and CFRP/AAC sandwich structures to low velocity impact and to assess the damage performance of the panels; to study the effect of FRP laminates on the impact response of CFRP/AAC panels; to study the effect of the processing method (hand layup versus VARTM) and panel stiffness on the impact response of the hybrid panels. Impact testing was conducted using an Instron drop-tower testing machine. Experimental results showed a significant influence of CFRPs laminates on the energy absorbed and peak load of the CFRP/AAC panels. Further, a theoretical analysis was conducted to predict the energy absorbed by the CFRP/AAC sandwich panel using the energy balance model, and the results found were in good accordance with the experimental ones.

This proceedings volume for the 4th international conference CIGOS 2017 (Congrès International de Géotechnique - Ouvrages - Structures) presents novel technologies, solutions and research advances, making it an excellent guide in civil engineering for researchers, students, and professional engineers alike. Since 2010, CIGOS has become a vital forum for international scientific exchange on civil engineering. It aims to promote beneficial economic partnerships and technology exchanges between enterprises, worldwide institutions and universities. Following the success of the last three CIGOS conferences (2010, 2013 and 2015), the 4th conference was held at Ho Chi Minh City University of Technology, Ho Chi Minh City (Saigon), Vietnam on 26 to 27 October 2017. The main scientific themes of CIGOS 2017 were focused on 'New Challenges in Civil Engineering'.

Natural fibers and their composites have a long and important place in the history of human creativity and industry. Increasing consumer interest in "green" products made with sustainable materials, along with the rising cost of petroleum - the basic

ingredient of synthetic fibers - have once again brought natural fibers and their composites to the fore. The renewed interest in natural fibers is only a few decades old. Thus, the pioneering work of current researchers in this new era of natural fiber composites will help to illuminate the path for future researchers as they explore new potentialities for natural fibers. Sabu Thomas and Laly Pothen, themselves leaders in the field, bring together cutting edge research by eminent scientists in Natural Fiber Reinforced Composites. Covering the latest research trends such as nano technology, the book will be a valuable resource for the natural fiber composite researcher.

This book summarizes recent developments in epoxy blends. It emphasizes new challenges for the synthesis, characterization, and properties of biofibers and biopolymers. It provides updates on all the important areas of biofibers and biopolymers in a comprehensive fashion, including synthesis, processing, characterisation and application. It provides a one-stop reference for researchers and those working in industry and government. The book correlates macro, micro and nanostructure properties. Moreover, it provides cutting edge research from experts around the globe. The current status, trends, future directions and opportunities are discussed in detail, making the book also accessible for beginners to the subject and young researchers.

Flexural Behavior of Built-up I-beams Made from Hybrid-fiber SIFCON Plates

"Advances in FRP Composites in Civil Engineering" contains the papers presented at the 5th International Conference on Fiber Reinforced Polymer (FRP) Composites in Civil Engineering in 2010, which is an official conference of the International Institute for FRP in Construction (IIFC). The book includes 7 keynote papers which are presented by top professors and engineers in the world and 203 papers covering a wide spectrum of topics. These important papers not only demonstrate the recent advances in the application of FRP composites in civil engineering, but also point to future research endeavors in this exciting area. Researchers and professionals in the field of civil engineering will find this book is exceedingly valuable. Prof. Lieping Ye and Dr. Peng Feng both work at the Department of Civil Engineering, Tsinghua University, China. Qingrui Yue is a Professor at China Metallurgical Group Corporation.

This is the proceedings of the 4th International Conference on Strain-Hardening Cement-Based Composites (SHCC4), that was held at the Technische Universität Dresden, Germany from 18 to 20 September 2017. The conference focused on advanced fiber-reinforced concrete materials such as strain-hardening cement-based composites (SHCC), textile-reinforced concrete (TRC) and high-performance fiber-reinforced cement-based composites (HPFRCC). All these new materials exhibit pseudo-ductile behavior resulting from the formation of multiple, fine cracks when subject to tensile loading. The use of such types of fiber-reinforced concrete could revolutionize the planning, development, dimensioning, structural and architectural design, construction of new and strengthening and repair of existing buildings and structures in many areas of application. The SHCC4 Conference was the follow-up of three previous successful international events in Stellenbosch, South Africa in 2009, Rio de Janeiro, Brazil in 2011, and Dordrecht, The Netherlands in 2014.

These peer-reviewed papers reflect the valuable experience of the authors in the fields of innovation in structural systems and disaster prevention in engineering structures, architectural innovation, sustainable development of buildings, energy and the environment and innovation in, and applications of, building materials. Hot topics and cutting-edge views related to sustainable development in civil engineering are presented.

Geotechnical engineering has become an important discipline of civil engineering due to its rapid advancements and environmental challenges. Special emphasis is placed on innovative materials in the fields of geotechnical engineering, pavement engineering, health monitoring of structures and sustainability. Keywords: Green Building Materials, Cement Based Materials, Concrete Applications, Photocatalytic Effect on Paver Blocks, Stabilization of Black Cotton Soil, Concrete Filled Steel Tube Columns, Cenosphere, Fly Ash Brick, Stone Columns, Reinforced Concrete Beams, Interlocking Masonry Units, Lightweight Filler Materials, Soil Stabilization Using Fibres, Friction Stir Welding of Aluminum and Magnesium.

This book describes the latest advances, innovations and applications in the field of waste management and environmental geomechanics as presented by leading researchers, engineers and practitioners at the International Conference on Sustainable Waste Management through Design (IC_SWMD), held in Ludhiana (Punjab), India on November 2-3, 2018. Providing a unique overview of new directions, and opportunities for sustainable and resilient design approaches to protect infrastructure and the environment, it discusses diverse topics related to civil engineering and construction aspects of the resource management cycle, from the minimization of waste, through the eco-friendly re-use and processing of waste materials, the management and disposal of residual wastes, to water treatments and technologies. It also encompasses strategies for reducing construction waste through better design, improved recovery, re-use, more efficient resource management and the performance of materials recovered from wastes. The contributions were selected by means of a rigorous peer-review process and highlight many exciting ideas that will spur novel research directions and foster multidisciplinary collaboration among different waste management specialists.

"The demand for strengthening of aging reinforced concrete (RC) structures are continuously rising. Carbon fiber reinforced polymers (CFRP) are the most widely used externally bonded-reinforcing (EBR) materials for strengthening and retrofitting of RC structural members. The use of high strength galvanized steel mesh (GSM) strengthening material has recently gained some acceptance. However, Both CFRP and GSM have high strength but have low ductility. Recently developed aluminum alloys (AA) have high ductility and some desirable characteristics that may overcome some of the shortcomings of CFRP and GSM. Combining AA with CFRP and GSM will result in a hybrid material with balanced strength and ductility. Therefore, the major aim of this research is to develop a hybrid ductile and strong retrofitting system by combining AA plates with GSM and CFRP laminates to strengthen RC beams in flexure. A comprehensive experimental program was carried out to determine the tensile strength and the bond strength of the hybrid system. Fifteen-coupon specimens were tested for tensile strength, six specimens of concrete prisms for bond strength and 25 T-beam specimens for flexural strength under a four-point loading. Results showed an increase in the flexural capacity of the strengthened specimen ranging from 10% to 77% compared to the control beam and a decline in ductility of 13% to 59% compared to the un-strengthened specimen. Furthermore, analytical models based on ACI 440.2R-08 guidelines were employed to capture the flexural behavior of the tested specimens. Experimental results correlated well with the analytical predictions in a range of 30% of the experimental values. The study concluded that the newly proposed hybrid systems are promising systems for the improvement of the flexural behavior (strength and ductility) of RC beams."--Abstract.

This volume contains selected papers presented during the International Conference on Environmental Geotechnology, Recycled Waste Material and Sustainable Engineering (EGRWSE-2018). The papers focus on finding innovative ways of recycling and reusing waste materials, reducing demand for natural resources and processing industrial and chemical wastes such that disposal reduces their environmental burden. This volume will be of interest to researchers, policy makers and practitioners working in the field of waste management.

This book contains the proceedings of the international workshop "Designing and Building with Ultra-High Performance Fibre-Reinforced Concrete (UHPFRC): State of the Art and Development", organized by AFGC, the French Association for Civil Engineering and French branch of fib, in Marseille (France), November 17-18, 2009. This workshop was focused on the experience of a lot of recent UHPFRC realizations. Through more than 50 papers, this book details the experience of many countries in UHPFRC construction and design, including projects from Japan, Germany, Australia, Austria, USA, Denmark, the Netherlands, Canada... and France. The projects are categorized as novel

architectural solutions, new frontiers for bridges, new equipments and structural components, and extending the service life of structures. The last part presents major research results, durability and sustainability aspects, and the updated AFGC Recommendations on UHPFRC. Over the last decades, natural fibers have received growing attention as alternatives to synthetic materials for the reinforcement of polymeric composites. Their specific properties, low price, health advantages, renewability and recyclability make natural fibers particularly attractive for these purposes. Furthermore, natural fibers have a CO₂-neutral life cycle, in contrast to their synthetic counterparts. However, natural fibers are also widely known to possess several drawbacks, such as a hydrophilic nature, low and variable mechanical properties, poor adhesion to polymeric matrices, high susceptibility to moisture absorption and low aging resistance. Therefore, extensive research has been conducted on natural fiber-reinforced composites in the last 20 years. In this context, this book presents several interesting papers concerning the use of natural fibers for the reinforcement of polymer-based composites, with a focus on the evaluation of their mechanical performances, ballistic properties, rheological behavior, thermal insulation response and aging resistance in humid or aggressive environments.

This volume highlights the latest advances, innovations, and applications in the field of fibre reinforced concrete (FRC) and discusses a diverse range of topics concerning FRC: rheology and early-age properties, mechanical properties, codes and standards, long-term properties, durability, analytical and numerical models, quality control, structural and Industrial applications, smart FRC's, nanotechnologies related to FRC, textile reinforced concrete, structural design and UHPFRC. The contributions present improved traditional and new ideas that will open novel research directions and foster multidisciplinary collaboration between different specialists. Although the symposium was postponed, the book gathers peer-reviewed papers selected in 2020 for the RILEM-fib International Symposium on Fibre Reinforced Concrete (BEFIB).

This book contains the proceedings of the fib Symposium "High Tech Concrete: Where Technology and Engineering Meet", that was held in Maastricht, The Netherlands, in June 2017. This annual symposium was organised by the Dutch Concrete Association and the Belgian Concrete Association. Topics addressed include: materials technology, modelling, testing and design, special loadings, safety, reliability and codes, existing concrete structures, durability and life time, sustainability, innovative building concepts, challenging projects and historic concrete, amongst others. The fib (International Federation for Structural Concrete) is a not-for-profit association committed to advancing the technical, economic, aesthetic and environmental performance of concrete structures worldwide.

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