Lifetime-Oriented Structural Design Concepts

Lifetime Oriented Structural Design Concepts

Tao Wei

Lifetime Oriented Structural Design Concepts:

Lifetime-Oriented Structural Design Concepts Friedhelm Stangenberg,2009-11-26 Safety and reliability are important for the whole expected service duration of an engineering structure Therefore prognostical solutions for different building types are needed and uncertainties have to be handled Life cycle strategies to control future structural degradations by concepts of appropriate design have to be developed in case including means of inspection maintenance and repair Aspects of costs and sustainability also matter The Cooperative Research Center for Lifetime Oriented Design Concepts SFB 398 at Ruhr University in Bochum combines the wide range of scientific topics between structural engineering structural and soil mechanics and material sciences regarding structural lifetime management in this present extraordinary monolithic format The characterization and modeling of lifetime related external actions of multiple origin are presented in this book as well as the physical description the modeling and the validation of material degradation Adaptive numerical methods and simulation techniques are provided for the lifetime oriented design concepts to forecast material and structural degradation Stochastic aspects mathematical optimization methods and interactions between various influences are included Thus a solid basis is provided for future practical use and also for standardization of structural design with respect to lifetime prediction

Structural Health Monitoring 2011 Fu-Kuo Chang,2011 This 2 volume set of books comprising over 2 700 total pages presents 325 fully original presentations on recent advances in structural health monitoring as applied to commercial and military aircraft manned and unmanned high rise buildings wind turbines civil infrastructure power plants and ships One general theme of the books is how SHM can be used for condition based maintenance with the goal of developing prediction based systems designed to save money over the life of vehicles and structures A second theme centers on technologies for developing systems comprising sensors diagnostic data and decision making with a focus on intelligent materials able to respond to damage and in some cases repair it Finally the books discuss the relation among data data interpretation and decision making in managing a wide variety of complex structures and vehicles More recent technologies discussed in the books include SHM and environmental effects energy harvesting non contact sensing and intelligent networks Material in these books was first presented in September 2011 at a conference held at Stanford University and sponsored by the Air Force Office of Scientific Research the Army Research Office the Office of Naval Research and the National Science Foundation Some of the highlights of the books include SHM technologies for condition based maintenance CBM and predictive maintenance Verification validation qualification data mining prognostics systems for decision making Structural health sensing and materials in closed loop intelligent networks Military and aerospace bioinspired sensors wind turbines monitoring with MEMS damage sensing hot spot monitoring SHM and ships high rise structures Includes a fully searchable CD ROM displaying many figures and charts in full color **Structures and Infrastructure Systems** Dan M. Frangopol,2019-12-18 Our knowledge to model design analyse maintain manage and predict the life cycle performance of

infrastructure systems is continually growing However the complexity of these systems continues to increase and an integrated approach is necessary to understand the effect of technological environmental economic social and political interactions on the life cycle performance of engineering infrastructure In order to accomplish this methods have to be developed to systematically analyse structure and infrastructure systems and models have to be formulated for evaluating and comparing the risks and benefits associated with various alternatives Civil engineers must maximize the life cycle benefits of these systems to serve the needs of our society by selecting the best balance of the safety economy resilience and sustainability requirements despite imperfect information and knowledge Within the context of this book the necessary concepts are introduced and illustrated with applications to civil and marine structures This book is intended for an audience of researchers and practitioners world wide with a background in civil and marine engineering as well as people working in infrastructure maintenance management cost and optimization analysis The chapters originally published as articles in Structure and Infrastructure Engineering **Maintenance, Monitoring, Safety, Risk and Resilience of Bridges and Bridge Networks** Tulio Nogueira Bittencourt,Dan Frangopol,Andre Beck,2016-11-17 Maintenance Monitoring Safety Risk and Resilience of Bridges and Bridge Networks contains the lectures and papers presented at the Eighth International Conference on Bridge Maintenance Safety and Management IABMAS 2016 held in Foz do Igua u Paran Brazil 26 30 June 2016 This volume consists of a book of extended abstracts and a DVD containing the full papers of 369 contributions presented at IABMAS 2016 including the T Y Lin Lecture eight Keynote Lectures and 360 technical papers from 38 countries The contributions deal with the state of the art as well as emerging concepts and innovative applications related to all main aspects of bridge maintenance safety management resilience and sustainability Major topics covered include advanced materials ageing of bridges assessment and evaluation bridge codes bridge diagnostics bridge management systems composites damage identification design for durability deterioration modeling earthquake and accidental loadings emerging technologies fatigue field testing financial planning health monitoring high performance materials inspection life cycle performance and cost load models maintenance strategies non destructive testing optimization strategies prediction of future traffic demands rehabilitation reliability and risk management repair replacement residual service life resilience robustness safety and serviceability service life prediction strengthening structural integrity and sustainability This volume provides both an up to date overview of the field of bridge engineering as well as significant contributions to the process of making more rational decisions concerning bridge maintenance safety serviceability resilience sustainability monitoring risk based management and life cycle performance using traditional and emerging technologies for the purpose of enhancing the welfare of society It will serve as a valuable reference to all involved with bridge structure and infrastructure systems including students researchers and engineers from all areas of bridge engineering Production Factor Mathematics Martin Grötschel,Klaus Lucas,Volker Mehrmann,2010-08-05 Mathematics as a production factor or driving force for

innovation Those who want to know and understand why mathematics is deeply involved in the design of products the layout of production processes and supply chains will find this book an indispensable and rich source Describing the interplay between mathematical and engineering sciences the book focusses on questions like How can mathematics improve to the improvement of technological processes and products What is happening already Where are the deficits What can we expect for the future 19 articles written by mixed teams of authors of engineering industry and mathematics offer a fascinating insight of the interaction between mathematics and engineering *Safety and performance concept. Reliability assessment of concrete structures* fib Fédération internationale du béton,2018-08-01 Concrete structures have been built for more than 100 years At first reinforced concrete was used for buildings and bridges even for those with large spans Lack of methods for structural analysis led to conservative and reliable design Application of prestressed concrete started in the 40s and strongly developed in the 60s The spans of bridges and other structures like halls industrial structures stands etc grew significantly larger At that time the knowledge of material behaviour durability and overall structural performance was substantially less developed than it is today In many countries statically determined systems with a fragile behavior were designed for cast in situ as well as precast structures Lack of redundancy resulted in a low level of robustness in structural systems In addition the technical level of individual technologies e g grouting of prestressed cables was lower than it is today The number of concrete structures including prestressed ones is extremely high Over time and with increased loading the necessity of maintaining safety and performance parameters is impossible without careful maintenance smaller interventions strengthening and even larger reconstructions Although some claim that unsatisfactory structures should be replaced by new ones it is often impossible as authorities in general have only limited resources Most structures have to remain in service probably even longer than initially expected In order to keep the existing concrete structures in an acceptable condition the development of methods for monitoring inspection and assessment structural identification nonlinear analysis life cycle evaluation and safety and prediction of the future behaviour etc is necessary The scatter of individual input parameters must be considered as a whole This requires probabilistic approaches to individual partial problems and to the overall analysis The members of the fib Task Group 2 8 Safety and performance concepts wrote on the basis of the actual knowledge and experience a comprehensive document that provides crucial knowledge for existing structures which is also applicable to new structures This guide to good practice is divided into 10 basic chapters dealing with individual issues that are critical for activities associated with preferably existing concrete structures Bulletin 86 starts with the specification of the performance based requirements during the entire lifecycle The risk issues are described in chapter two An extensive part is devoted to structural reliability including practical engineering approaches and reliability assessment of existing structures Safety concepts for design consider the lifetime of structures and summarise safety formats from simple partial safety factors to develop approaches suitable for application in sophisticated probabilistic non linear analyses Testing for design and the

determination of design values from the tests is an extremely important issue This is especially true for the evaluation of existing structures Inspection and monitoring of existing structures are essential for maintenance for the prediction of remaining service life and for the planning of interventions Chapter nine presents probabilistically based models for material degradation processes Finally case studies are presented in chapter ten The results of the concrete structures monitoring as well as their application for assessment and prediction of their future behaviour are shown The risk analysis of highway bridges was based on extensive monitoring and numerical evaluation programs Case studies perfectly illustrate the application of the methods presented in the Bulletin The information provided in this guide is very useful for practitioners and scientists It provides the reader with general procedures from the specification of requirements monitoring assessment to the prediction of the structures lifecycles However one must have a sufficiently large amount of experimental and other data e g construction experience in order to use these methods correctly This data finally allows for a statistical evaluation As it is shown in case studies extensive monitoring programs are necessary The publication of this guide and other documents developed within the fib will hopefully help convince the authorities responsible for safe and fluent traffic on bridges and other structures that the costs spent in monitoring are first rather small and second they will repay in the form of a serious assessment providing necessary information for decision about maintenance and future of important structures

Structural Dynamics with Applications in Earthquake and Wind Engineering Konstantin Meskouris,Christoph Butenweg,Klaus-G. Hinzen,Rüdiger Höffer,2019-04-27 This book offers a comprehensive introduction to the theory of structural dynamics highlighting practical issues and illustrating applications with a large number of worked out examples In the spirit of learning by doing it encourages readers to apply immediately these methods by means of the software provided allowing them to become familiar with the broad field of structural dynamics in the process The book is primarily focused on practical applications Earthquake resistant design is presented in a holistic manner discussing both the underlying geophysical concepts and the latest engineering design methods and illustrated by fully worked out examples based on the newest structural codes The spectral characteristics of turbulent wind processes and the main analysis methods in the field of structural oscillations due to wind gusts and vortex shedding are also discussed and applications illustrated by realistic examples of slender chimney structures The user friendly software employed is downloadable and can be readily used by readers to tackle their own problems **Bridge Maintenance, Safety, Management and Life-Cycle Optimization** Dan Frangopol,Richard Sause,Chad Kusko,2010-07-07 Bridge Maintenance Safety Management and Life Cycle Optimization contains the lectures and papers presented at IABMAS 2010 the Fifth International Conference of the International Association for Bridge Maintenance and Safety IABMAS held in Philadelphia Pennsylvania USA from July 11 through 15 2010 All major aspects of bridge maintenance s *Bridge Maintenance, Safety Management, Health Monitoring and Informatics - IABMAS '08* Hyun-Moo Koh,Dan Frangopol,2008-06-26 Collection of 550 revised state of the art contributions on most recent

advances in bridge maintenance safety management and life cycle performance from leading experts in this area

Predictive and Optimised Life Cycle Management Asko Sarja,2006-09-07 The system and methodologies are valid for different applications Provides tools for protecting the value of property in an optimal way Includes a description of an IT prototype program Recent Developments of Soil Mechanics and Geotechnics in Theory and Practice Theodoros Triantafyllidis,2019-08-20 This book provides essential insights into recent developments in fundamental geotechnical engineering research Special emphasis is given to a new family of constitutive soil description methods which take into account the recent loading history and the dilatancy effects Particular attention is also paid to the numerical implementation of multi phase material under dynamic loads and to geotechnical installation processes In turn the book addresses implementation problems concerning large deformations in soils during piling operations or densification processes and discusses the limitations of the respective methods Numerical simulations of dynamic consolidation processes are presented in slope stability analysis under seismic excitation Lastly achieving the energy transition from conventional to renewable sources will call for geotechnical expertise Consequently the book explores and analyzes a selection of interesting problems involving the stability and serviceability of supporting structures and provides new solutions approaches for practitioners and scientists in geotechnical engineering The content reflects the outcomes of the Colloquium on Geotechnical Engineering 2019 Geotechnik Kolloquium held in Karlsruhe Germany in September 2019 *Aspects of Structural Reliability* Michael H. Faber,2007 Consistent Higher Order Accurate Time Discretization Methods for Inelastic Material Models Schröder, Bettina Anna Barbara,2020-01-20 The present thesis investigates the usage of higher order accurate time integrators together with appropriate error estimators for small and finite dynamic visco plasticity Therefore a general visco plastic problem is defined which serves as a basis to create closed form solution strategies A classical access towards small and finite visco plasticity is integrated into this concept This approach is based on the idea that the balance of linear momentum is formulated in a weak sense and the material laws are included indirectly Thus separate time discretizations are implemented and an appropriate coupling between them is necessary Limitations for the usage of time integrators are the consequence In contrast an alternative multifield formulation is derived adapting the principle of Jourdain The idea is to assume that the balance of energy taking into account a pseudopotential representing dissipative effects resembles a rate type functional whose stationarity condition leads to the equations describing small or finite dynamic visco plasticity Accordingly the material laws and the balance of linear momentum can be solved on the same level and only one single time discretization has to be performed A greater freedom in the choice of time integrators is obtained and the application of higher order accurate schemes such as Newmark s method fully implicit as well as diagonally implicit Runge Kutta schemes and continuous as well as discontinuous Galerkin methods is facilitated An analysis and a comparison of the classical and the multifield formulation is accomplished by means of distinct examples In this context a dynamic benchmark problem is

developed which allows to focus on the effect of different time integrators For this investigation a variety of time discretization error estimators are formulated evaluated and compared **Life-Cycle and Sustainability of Civil Infrastructure Systems** Alfred Strauss,Dan Frangopol,Konrad Bergmeister,2012-09-18 Life Cycle and Sustainability of Civil Infrastructure Systems contains the lectures and papers presented at the Third International Symposium on Life Cycle Civil Engineering IALCCE 2012 held in one of Vienna s most famous venues the Hofburg Palace October 3rd 6th 2012 This volume consists of a book of extended abstracts 516 pp and a DVD ROM **Life-Cycle Civil Engineering** Fabio Biondini,Dan Frangopol,2008-05-28 Life Cycle Civil Engineering contains the papers presented at the First International Symposium on Life Cycle Civil Engineering IALCCE 08 held in Villa Monastero Varenna Lake Como Italy 10 14 June 2008 It consists of a book and a CD ROM containing 150 papers including eight keynote papers and 142 technical contributions from 28 countries

Life-Cycle Cost and Performance of Civil Infrastructure Systems Hyo-Nam Cho,Dan M. Frangopol,Alfredo H-S Ang,2007-07-18 This bookcontains papers covering a wide range of studies on life cycle performance analysis design maintenance monitoring management and cost of civil infrastructure systems Topics include reliability and optimization as design basis tools monitoring systems life cycle cost analysis and management bridge management systems and quality control acceptance criteria The book also discusses seismic reliability analysis of deteriorating structures bridge inspection strategies life cycle cost analysis of structures on a network level optimal risk based design of infrastructures updating bridge reliability using load monitoring data and statistics of extremes rehabilitation of bridges and lifetime analysis and structural repair of civil infrastructure systems **Beton-Kalender 2015 Schwerpunkte** Ernst & Sohn,2015-01-20 Das Bauen im Bestand bildet einen wesentlichen Anteil der planerischen T tigkeit f r alle Bereiche der gebauten Umwelt Die Tragwerksbewertung und planung im Bestand Schadensanalyse und Ert chtigungsma nahmen f r Betonkonstruktionen des Allgemeinen Hochbaus sowie im Besonderen f r Parkh user und Verkehrswasserbauwerke werden deshalb in diesem Jahrgang schwerpunktm ig behandelt Dabei werden auch die Instandsetzungsmaterialien und die Lebensdauerbetrachtung f r instandgesetzte Stahlbetonbauteile unter Chlorideinwirkung untersucht Dem Monitoring und seinen innovativen M glichkeiten kommt eine besondere Bedeutung zu Unter dem Schwerpunkt Br cken behandelt der Beton Kalender die Einwirkungen nach Eurocode 1 auf Br cken sowie den Entwurf die Bemessung und Konstruktion von Massivbr cken nach Eurocode 2 welche gemeinsam mit ihren Nationalen Anh ngen 2013 verbindlich eingef hrt und gegen ber den DIN Fachberichten vom M rz 2009 erneuert wurden Ausf hrliche Erl uterungen aus erster Hand und eine kommentierte Kurzfassung des DIN Handbuches Br ckenbau geben Sicherheit f r die Praxis Angesichts der Verkehrsprognose f r den Bundesverkehrswegeplan ist die berwachung und Erhaltung des Br ckenbestandes zuk nftig ein wesentliches Aufgabengebiet Insbesondere die Stra enbr cken der 1960er bis 1980er Jahre bed rfen der Untersuchung ob sie dem wachsenden Verkehrsaufkommen und steigenden Achslasten standhalten und wie sie ert chtigt werden k nnen Daher werden hier die

Erfahrungen bei der Anwendung der Nachrechnungsrichtlinie Br cken ausgewertet und ihre Erg nzung dargestellt Der bekannte Beitrag ber konstruktive Grunds tze und Bauarten der Bauweise Feste Fahrbahn wird in diesem Jahr auf dem aktuellen Stand der Technik neu bearbeitet Als besonderes Thema werden die Baudynamik mit ihren Grundlagen und praktischen Anwendungen und die Berechnung und Bemessung von Maschinenfundamenten behandelt Der Beton Kalender 2015 ist eine besondere Fundgrube f r Praktiker und Wissenschaftler **Beton-Kalender 2013** Konrad Bergmeister,Frank Fingerloos,Johann-Dietrich Wörner,2014-08-11 Die Tragwerkplanung dient gew hnlich der Planung und Bemessung von standsicheren und gebrauchstauglichen Tragwerken nach den g ltigen Normen und Regelwerken wobei die Verpflichtung gem HOAI die Wirtschaftlichkeit f r die geplante Nutzungszeit mit einschlie t Die Standsicherheit von Betontragwerken auch gegen zeitabh ngige Komponenten von Beanspruchungen wird bislang in Form des gleichen Performance Konzeptes also mit abgesicherten Stoffgesetzen einerseits und quantifizierten Beanspruchungen andererseits und auf probabilistischer Grundlage als Dauerhaftigkeit nachgewiesen Dabei bleiben manche verwendete Kenngr en wie z B der Wasserzementwert oder die Betondeckung deskriptiv und sind f r Planer nicht transparent Unter dem Schwerpunktthema Lebensdauer und Instandsetzung wird daher im neuen Beton Kalender der Lebensdauerorientierte Entwurf vorgestellt der neben der Tragf higkeit die ver nderten Einwirkungen sowie zeitabh ngigen Materialeigenschaften und fortschreitenden Sch digungen genauso ber cksichtigt wie die Differenzierung nach der geplanten Nutzungsdauer also z B Verwertbarkeit anstelle von Langzeitbest ndigkeit Ziel ist die Begrenzung oder Vermeidung von bautechnischen Folgekosten Die Anwendung solcher Entwurfsmethoden ist auch f r die Bestimmung der Restlebensdauer von Bestandsbauwerken sinnvoll weshalb die Planung und die Ma nahmen der Instandsetzung und Ert chtigung von Stahlbetontragwerken in weiteren Kapiteln dargestellt werden Die Hei bemessung f r den Brandfall kann am einfachsten durch die Klassifizierung der Feuerwiderstandsklassen nach Konstruktionsregeln aus Tabellen Stufe 1 Verfahren durchgef hrt werden Vor diesem Hintergrund wird eine zusammenfassende Darstellung der wichtigsten bzw gebr uchlichsten Bemessungstabellen aus DIN EN 1992 1 2 mit NA und aus DIN 4102 4 DIN 4102 22 mit Beispielen gegeben Im Eurocode 2 sind Tabellen zur Klassifizierung der Feuerwiderstandsklassen f r einige tragende Stahlbeton und Spannbetonbauteile angegeben F r viele bew hrte Regelungen f r weitere Bauteile und Bekleidungen sind die Tabellen aus DIN 4102 4 weiterhin geeignet Diese sind auf den Eurocode 2 angepasst hier integriert Hierzu soll in Deutschland eine entsprechende Restnorm DIN 4102 4 erscheinen die alle Tabellen und Regelungen enth lt die im Eurocode 2 fehlen **Computational Modeling of Masonry Structures Using the Discrete Element Method** Sarhosis, Vasilis,Bagi, Katalin,Lemos, José V.,Milani, Gabriele,2016-06-09 The Discrete Element Method DEM has emerged as a solution to predicting load capacities of masonry structures As one of many numerical methods and computational solutions being applied to evaluate masonry structures further research on DEM tools and methodologies is essential for further advancement Computational Modeling of Masonry Structures Using the Discrete

Element Method explores the latest digital solutions for the analysis and modeling of brick stone concrete granite limestone and glass block structures Focusing on critical research on mathematical and computational methods for masonry analysis this publication is a pivotal reference source for scholars engineers consultants and graduate level engineering students

Generic Approaches to Risk Based Inspection Planning for Steel Structures Daniel Straub,2004

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