Parallel Computing Opensees

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The sciences and engineering. B CRC Press
Topics in Dynamics of Civil Structures, Volume 4: Proceedings of the 31st IMAC, A Conference and Exposition on Structural Dynamics, 2013, the fourth volume of seven from the Conference, brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics, including papers on: Modal Parameter Identification for Civil Structures Vibration Control of Civil Structures Cable Dynamics Damage Detection Models for Civil Structures Data-Driven Health Monitoring of Structures & Infrastructure Experimental Techniques for Civil Structures Human-induced Vibrations of Civil Structures Structural Modeling for Civil Structures
Proceedings of the 34th IMAC, A Conference and Exposition on Structural Dynamics 2016 Prentice Hall Professional
This Proceedings contains the papers of the fib Symposium “CONCRETE Innovations in Materials, Design and Structures”, which was held in May 2019 in Kraków, Poland. This annual symposium was co-organised by the Cracow University of Technology. The topics covered include Analysis and Design, Sustainability, Durability, Structures, Materials, and Prefabrication. The fib, Fédération internationale du béton, is a not-for-profit association formed by 45 national member groups and approximately 1000 corporate and individual members. The fib’s mission is to develop at an international level the study of scientific and practical matters capable of advancing the technical, economic, aesthetic and environmental performance of concrete construction. The fib, was formed in 1998 by the merger of the Euro-International Committee for Concrete (the CEB) and the International Federation for Prestressing (the FIP). These predecessor organizations existed independently since 1953 and 1952, respectively.
Practical Programming in Tcl/Tk Springer Nature
This thesis focuses on the seismic response of piles in liquefiable ground. It describes the design of a three-dimensional, unified plasticity model for large post-liquefaction shear deformation of sand, formulated and implemented for parallel computing. It also presents a three-dimensional, dynamic finite element analysis method for piles in liquefiable ground, developed on the basis of this model,. Employing a combination of case analysis, centrifuge shaking table experiments and numerical simulations using the proposed methods, it demonstrates the seismic response patterns of single piles in liquefiable ground. These include basic force-resistance mode, kinematic and inertial interaction coupling mechanism and major influence factors. It also discusses a beam on the nonlinear Winkler foundation (BNWF) solution and a modified neutral plane solution developed and validated using centrifuge experiments for piles in consolidating and reconsolidating ground. Lastly, it studies axial pile force and settlement during post-earthquake reconsolidation, showing pile axial force to be irrelevant in the reconsolidation process, while settlement is process dependent.
Seismic Response and Numerical Analysis Methods Springer
Model Validation and Uncertainty Quantifi cation, Volume 3. Proceedings of the 34th IMAC, A Conference and Exposition on Dynamics of Multiphysical Systems: From Active Materials to Vibroacoustics, 2016, the third volume of ten from the Conference brings together contributions to this important area of research and engineering. Th e collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics, including papers on: • Uncertainty Quantifi cation & Model Validation • Uncertainty Propagation in Structural Dynamics • Bayesian & Markov Chain Monte Carlo Methods • Practical Applications of MVUQ • Advances in MVUQ & Model Updating • Robustness in Design & Validation • Verifi cation & Validation Methods
Model Validation and Uncertainty Quantification, Volume 3 John Wiley & Sons
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.
Fundamentals of Finite Element Analysis I. K. International Pvt Ltd
Effort is geared towards development of large-scale nonlinear ground-structure seismic response simulations. Mechanisms to allow for modeling of transmitting boundaries are incorporated, mainly relying on the Domain Reduction Method (DRM) approach. Parallel computing is employed to permit the execution of these large-scale simulations. A range of geometric configurations are addressed in order to explore various aspects of the involved seismic response characteristics. The OpenSees computational platform is employed throughout. To accommodate nonlinear response and soil/structure element stiffness considerations, an implicit time integration scheme is adopted. This scheme poses severe limitations on the number of parallel computing processors that can be used with reasonable efficiency (due to the required taxing communications between the different processors). Within the available constraints on time and computing resources, and the necessary additional OpenSees parallel-implementation machine-specific adaptions, the conducted DRM investigations mostly employed a soil domain 3D 8-node brick element of a 20 m side length (with about 150,000 such elements in the mesh). Consequently, severe limitations are imposed on the frequency content of the propagated seismic waves and the resulting system response. Future extensions in this direction of research can build solidly on the developments in this report and provide more accurate higher frequency system response. Significant attention is given to the simulation of a large-scale highway interchange system under seismic loading. A three-dimensional (3D) Finite Element model of an existing bridge interchange at the intersection of Interstates 10 and 215 (San Bernardino, CA) is developed. This interchange consists of three connectors at different bridge superstructure elevations. Initial focus is placed on modeling the three bridges, evaluation of vibration properties, and validation of one of the bridge models (North-West connector, NW) based on available earlier recorded earthquake response. A strategy to incorporate the above bridge structural models into a bridge-foundation-ground system (BFGS) is implemented based on the Domain Reduction Method (DRM) as developed by Bielak and his co-workers. A numerical implementation of this DRM by Petropolous and Fenves is employed and adapted as the soil domain. In this implementation, seismic waves are propagated from a realistic fault rupture scenario in southern California. As such, the BFGS can include the three-bridge interchange subjected to a 3D seismic excitation scenario. Within this numerical analysis framework, the effect of foundation soils of different stiffness and strength are investigated. The results are compared to the more conventional bridge model response under uniform as well as multi-support base excitation. In addition to this DRM-based implementation, a nonlinear ground-bridge model based on the actual local soil conditions at the interchange is investigated (with the NW only as the super-structure). Efforts include implementation and validation of a classical transmitting boundary at the base of the soil domain. Using this formulation, the BFGS response is compared and validated with earthquake recorded response at the bridge and local site. Under a potential site specific strong ground motion, computed force demands from the employed linear column models are compared to the strength

as defined by a representative nonlinear column formulation. Finally, the seismic response of a large rigid structure with different embedment depths is assessed. Dynamic interaction between the structure and the surrounding soil is studied based on changes in soil elastic properties, depth of embedment, and characteristics of input excitation.
Earthquake Disaster Simulation of Civil Infrastructures DEStech Publications, Inc
Design of Integrally-Attached Timber Plate Structures outlines a new design methodology for digitally fabricated spatial timber plate structures, presented with examples from recent construction projects. It proposes an innovative and sustainable design methodology, algorithmic geometry processing, structural optimization, and digital fabrication; technology transfer and construction are formulated and widely discussed. The methodology relies on integral mechanical attachment whereby the connection between timber plates is established solely through geometric manipulation, without additional connectors, such as nails, screws, dowels, adhesives, or welding. The transdisciplinary design framework for spatial timber plate structures brings together digital architecture, computer science, and structural engineering, covering parametric modeling and architectural computational design, geometry exploration, the digital fabrication assembly of engineered timber panels, numerical simulations, mechanical characterization, design optimization, and performance improvement. The method is demonstrated through different prototypes, physical models, and three build examples, focusing specifically on the design of the timber-plate roof structure of 23 large span arches called the Annen Headquarters in Luxembourg. This is useful for the architecture, engineering, and construction (AEC) sector and shows how new structural optimization processes can be reinvented through geometrical adaptions to control global and local geometries of complex structures. This text is ideal for structural engineering professionals and architects in both industry and academia, and construction companies.
Hybrid Simulation CRC Press
Reinforced concrete columns play a very important role in structural performance. As such, it is essential to apply a suitable analytical tool to estimate their structural behaviour considering all failure mechanisms such as axial, shear, and flexural failures. This book highlights the development of a fiber beam-column element accounting for shear effects and the effect of tension stiffening through reinforcement-to-concrete bond, along with the employment of suitable constitutive material laws.
Structural Cross Sections Springer Nature
A comprehensive guide to modern-day methods for earthquake engineering of concrete dams Earthquake analysis and design of concrete dams has progressed from static force methods based on seismic coefficients to modern procedures that are based on the dynamics of dam–water–foundation systems. Earthquake Engineering for Concrete Dams offers a comprehensive, integrated view of this progress over the last fifty years. The book offers an understanding of the limitations of the various methods of dynamic analysis used in practice and develops modern methods that overcome these limitations. This important book: Develops procedures for dynamic analysis of two-dimensional and three-dimensional models of concrete dams Identifies system parameters that influence their response Demonstrates the effects of dam–water–foundation interaction on earthquake response Identifies factors that must be included in earthquake analysis of concrete dams Examines design earthquakes as defined by various regulatory bodies and organizations Presents modern methods for establishing design spectra and selecting ground motions Illustrates application of dynamic analysis procedures to the design of new dams and safety evaluation of existing dams. Written for graduate students, researchers, and professional engineers, Earthquake Engineering for Concrete Dams offers a comprehensive view of the current procedures and methods for seismic analysis, design, and safety evaluation of concrete dams.
Design of Integrally-Attached Timber Plate Structures Routledge
This book consists of selected and peer-reviewed papers presented at the 13th International Conference on Vibration Problems (ICOVP 2017). The topics covered in this book include different structural vibration problems such as dynamics and stability under normal and seismic loading, and wave propagation. The book also discusses different materials such as composite, piezoelectric, and functionally graded materials for improving the stiffness and damping properties of structures. The contents of this book can be useful for beginners, researchers and professionals interested in structural vibration and other allied fields.
Proceedings of the Sixth International IABMAS Conference, Stresa, Lake Maggiore, Italy, 8-12 July 2012 Cambridge Scholars Publishing
This book constitutes the refereed proceedings of the Second Workshop on Software Challenges to Exascale Computing, SCEC 2018, held in Delhi, India, in December 2018. The 10 papers presented in this volume were carefully reviewed and selected from 24 submissions and focus on scientific applications, performance analysis and optimization, science gateways and high-productivity tools and frameworks.
From Engineering Seismology to Performance-Based Engineering CRC Press
Earthquake Geotechnical Engineering for Protection and Development of Environment and Constructions contains invited, keynote and theme lectures and regular papers presented at the 7th International Conference on Earthquake Geotechnical Engineering (Rome, Italy, 17-20 June 2019. The contributions deal with recent developments and advancements as well as case histories, field monitoring, experimental characterization, physical and analytical modelling, and applications related to the variety of environmental phenomena induced by earthquakes in soils and their effects on engineered systems interacting with them. The book is divided in the sections below: Invited papers Keynote papers Theme lectures Special Session on Large Scale Testing Special Session on Liquefact Projects Special Session on Lessons learned from recent earthquakes Special Session on the Central Italy earthquake Regular papers Earthquake Geotechnical Engineering for Protection and Development of Environment and Constructions provides a significant up-to-date collection of recent experiences and developments, and aims at engineers, geologists and seismologists, consultants, public and private contractors, local national and international authorities, and to all those involved in research and practice related to Earthquake Geotechnical Engineering.
Model Tests and Numerical Simulations of Liquefaction and Lateral Spreading Springer
Soil-Foundation-Structure Interaction contains selected papers presented at the International Workshop on Soil-Foundation-Structure Interaction held in Auckland, New Zealand from 26-27 November 2009. The workshop was the venue for an international exchange of ideas, disseminating information about experiments, numerical models and practical en
Earthquake Hazards and Mitigation CRC Press
discusses the new developments in the field of earthquake engineering and allied areas, * gives information about present state-of-the-art and current practices adopted globally in prediction and mitigation of earthquake hazards, * explores novel and innovative methods for prediction and mitigation of hazards considering the future earthquakes for building sustainable/ safe infrastructures and ensuring safety of community.
Three-dimensional Nonlinear Seismic Response of Large-scale Ground-structure Systems Springer Nature
The first edition of this monograph, presenting accurate and efficient simulations of seismic damage to buildings and cities, has received significant attention from the research community. To keep abreast of the rapid development in recent years, our latest breakthrough achievements have been added to this new edition, including novel resilient structural components, secondary disaster simulations, emergency responses and resilient recovery of communities after earthquake. This edition comprehensively covers a range of numerical modeling approaches, higher performance computation methods, and high fidelity visualization techniques for earthquake disaster simulation of tall buildings and urban areas. It also demonstrates successful engineering applications of the proposed methodologies to typical landmark projects (e.g., Shanghai Tower and CITIC Tower, two of the world's tallest buildings; Beijing CBD and San Francisco Bay Area). Reported in this edition are a collection of about 60 high impact journal publications which have already received high citations.
Seismic Assessment and Retrofit of Reinforced Concrete Columns CRC Press
"Evaluation of the capacity of a bridge to carry self-weight and traffic loads after an earthquake is essential for a safe and timely re-opening of the bridge. In California, modern highway bridges designed using the Caltrans Seismic Design Criteria are expected to maintain at minimum a gravity load carrying capacity during both frequent and extreme seismic events. However, no validated, quantitative guidelines for estimating the remaining load carrying capacity of such bridges after an earthquake event exist today. In this study, experimental and analytical methods were combined to evaluate the postearthquake traffic load carrying capacity of a modern California highway overpass bridge. An experimental study on models of circular reinforced concrete bridge columns was performed to investigate the relationship between earthquake-induced damage in bridge columns and the capacity of the columns to carry axial load in a damaged condition. The test results were then used to calibrate a finite element model of a bridge column. This bridge column model was incorporated into a hybrid model of a typical California overpass bridge and tested using the hybrid simulation technique. The finite element model of the typical California overpass bridge was validated using the data from hybrid simulations. The validated model of the typical bridge was used to evaluate its post-earthquake truck load capacity in an extensive parametric study that examined the effects of different ground motions and bridge modeling parameters such as the boundary conditions imposed by the bridge abutments, the location of the truck on the bridge, and the amount of bridge column residual drift. The principal outcomes of this study are the following findings. A typical modern California highway bridge is safe for traffic use after an earthquake if no columns failed and the abutments are still capable of restraining torsion of the bridge deck about the longitudinal axis. If any of the columns failed, i.e., if broken column reinforcing bars are discovered in an inspection, the bridge should be closed for regular traffic. Emergency traffic with weight, lane, and speed restrictions may be allowed on a bridge whose columns failed if the abutments can restrain torsion of the bridge deck. These findings pertain to the bridge configuration investigated in this study. Additional research on the post-earthquake traffic load capacity of different bridge configurations is strongly recommended"--Tech report doc. page.
Development of geotechnical capabilities into OpenSees platform CRC Press
Bridge Maintenance, Safety, Management, Resilience and Sustainability contains the lectures and papers presented at The Sixth International Conference on Bridge Maintenance, Safety and Management (IABMAS 2012), held in Stresa, Lake Maggiore, Italy, 8-12 July, 2012. This volume consists of a book of extended abstracts (800 pp) and a DVD (4057 pp) co
Second Workshop, SCEC 2018, Delhi, India, December 13-14, 2018, Proceedings Earthquake Hazards and Mitigation
This book focuses on the seismic design of building structures and their foundations to Eurocode 8. It covers the principles of seismic design in a clear but brief manner and then links these concepts to the provisions of Eurocode 8. It addresses the fundamental concepts related to seismic hazard, ground motion models, basic dynamics, seismic analysis, siting considerations, structural layout, and design philosophies, then leads to the specifics of Eurocode 8. Code procedures are applied with the aid of walk-through design examples which, where possible, deal with a common case study in most chapters. As well as an update throughout, this second edition incorporates three new and topical chapters dedicated to specific seismic design aspects of timber buildings and masonry structures, as well as base-isolation and supplemental damping. There is renewed interest in the use of sustainable timber buildings, and masonry structures still represent a popular choice in many areas. Moreover, seismic isolation and supplemental damping can offer low-damage solutions which are being increasingly considered in practice. The book stems primarily from practical short courses on seismic design which have been run over a number of years and through the development Eurocode 8. The contributors to this book are either specialist academics with significant consulting experience in seismic design, or leading practitioners who are actively engaged in large projects in seismic areas. This experience has provided significant insight into important areas in which guidance is required.
Theory, Implementation and Applications FIB - Féd. Int. du Béton
Increasing demand on improving the resiliency of modern structures and infrastructure requires ever more critical and complex designs. Therefore, the need for accurate and efficient approaches to assess uncertainties in loads, geometry, material properties, manufacturing processes, and operational environments has increased significantly. Reliability-based techniques help develop more accurate initial guidance for robust design and help to identify the sources of significant uncertainty in structural systems. Reliability-Based Analysis and Design of Structures and Infrastructure presents an overview of the methods of classical reliability analysis and design most associated with structural reliability. It also introduces more modern methods and advancements, and emphasizes the most useful methods and techniques used in reliability and risk studies, while elaborating their practical applications and limitations rather than detailed derivations. Features: Provides a practical and comprehensive overview of reliability and risk analysis and design techniques. Introduces resilient and smart structures/infrastructure that will lead to more reliable and sustainable societies. Considers loss elimination, risk management and life-cycle asset management as related to infrastructure projects. Introduces probability theory, statistical methods, and reliability analysis methods. Reliability-Based Analysis and Design of Structures and Infrastructure is suitable for researchers and practicing engineers, as well as upper-level students taking related courses in structural reliability analysis and design.
Software Frameworks for the Computational Simulation of Structural Systems Springer Nature
This open access book presents work collected through the Liquefaction Experiments and Analysis Projects (LEAP) in 2017. It addresses the repeatability, variability, and sensitivity of lateral spreading observed in twenty-four centrifuge model tests on mildly sloping liquefiable sand. The centrifuge tests were conducted at nine different centrifuge facilities around the world. For the first time, a sufficient number of experiments were conducted to enable assessment of variability of centrifuge test results. The experimental data provided a unique basis for assessing the capabilities of twelve different simulation platforms for numerical simulation of soil liquefaction. The results of the experiments and the numerical simulations are presented and discussed in papers submitted by the project participants. The work presented in this book was followed by LEAP-Asia that

included assessment of a generalized scaling law and culminated in a workshop in Osaka, Japan in March 2019. LEAP-2020, ongoing at the time of printing, is addressing the validation of soil-structure interaction analyses of retaining walls involving a liquefiable soil. A workshop is planned at RPI, USA in 2020. .

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