A typical engineering task during the development of any system is, among others, to improve its performance in terms of cost and response. Improvements can be achieved either by simply using design rules based on the experience or in an automated way by using optimization methods that lead to optimum designs. Design Optimization of Active and Passive Structural Control Systems includes Earthquake Engineering and Tuned Mass Damper research topics into a volume taking advantage of the connecting link between them, which is optimization. This is a publication addressing the design optimization of active and passive control systems. This title is perfect for engineers,
professionals, professors, and students alike, providing cutting edge research and applications. (Cont.) However, the electromagnetic damper provides flexibility not available previously to building designers as it can be used as a semi-active damper, as an actuator or as an energy regenerator without physical modifications to the device. Finally, we developed a design methodology for the electromagnetic damper to achieve a specified damping performance and introduced two techniques for the dynamic response analysis of buildings with electromagnetic dampers: One based on frequency domain approximations and one based on state-space models. This book is a printed edition of the Special Issue "Energy Dissipation and Vibration Control: Modeling, Algorithm and Devices" that was published in Applied Sciences. This volume comprises papers presented at the China-US Millennium Symposium on Earthquake Engineering, held in Beijing, China, on November 8-11, 2000. This conference provides a forum for advancing the field of earthquake engineering through multi-lateral cooperation. This book presents a comprehensive introduction to the field of structural vibration reduction control, but may also be used as a reference source for more advanced topics. The content is divided into four main parts: the basic principles of structural vibration reduction control, structural vibration reduction devices, structural vibration reduction design methods, and structural vibration reduction engineering practices. As the book strikes a balance between theoretical and practical aspects, it will appeal to researchers and practicing engineers alike, as well as graduate students. This volume contains a selection of papers presented at the 7th Nirma University International Conference on Engineering 'NUiCONE 2019'. This conference followed the successful organization of four national conferences and six international conferences in previous years. The main theme of the conference was “Technologies for Sustainable Development”, which is in line with the “SUSTAINABLE DEVELOPMENT GOAL” established by the United Nations. The conference was organized with many inter-disciplinary technical themes encompassing a broad range of disciplines and enabling researchers, academicians and practitioners to choose between ideas and themes. Besides, NUiCONE-2019 has also presented an exciting new set of events to engage practicing engineers, technologists and technopreneurs from industry through special knowledge sharing sessions involving applied technical papers based on case-study applications, white-papers, panel discussions, innovations and technology products. This proceedings will definitely provide a platform to proliferate new findings among researchers. Advances in Transportation Engineering Emerging Trends in Water Resources and Environmental Engineering Construction Technology and Management Concrete and Structural Engineering Futuristic Power System Control of Power Electronics Converters, Drives and E-mobility Advanced Electrical Machines and Smart Apparatus Chemical Process Development and Design Technologies and Green Environment Sustainable Manufacturing Processes Design and Analysis of Machine and Mechanism Energy Conservation and Management Advances in Networking Technologies Machine Intelligence / Computational Intelligence Autonomic Computing Control and Automation Electronic Communications Electronics Circuits and System Design Signal Processing This book presents the proceedings of the 14th International Probabilistic Workshop that was held in Ghent, Belgium in December 2016. Probabilistic methods are currently of crucial importance for research and developments in the field of engineering, which face challenges presented by new materials and technologies and rapidly
changing societal needs and values. Contemporary needs related to, for example, performance-based design, service-life design, life-cycle analysis, product optimization, assessment of existing structures and structural robustness give rise to new developments as well as accurate and practically applicable probabilistic and statistical engineering methods to support these developments. These proceedings are a valuable resource for anyone interested in contemporary developments in the field of probabilistic engineering applications.

Damping Technologies for Tall Buildings provides practical advice on the selection, design, installation and testing of damping systems. Richly illustrated with images and schematics, this book presents expert commentary on different damping systems, giving readers a way to accurately compare between different device categories and gain and understand the advantages and disadvantages of each. In addition, the book covers their economical and sustainability implications. Case studies are included to provide a direct understanding on the possible applications of each device category. Provides an expert guide on the selection and deployment of the various types of damping technologies.

Drawn from extensive contributions from international experts and research projects that represent the current state-of-the-art and design in damping technologies, includes 25+ real case studies collected with very detailed information on damping design, installation, testing and other building implications.

This eBook is the fourth in a series of books on the critical earthquake response of elastic or elastic-plastic structures under near-fault or long-duration ground motions, and includes six original research papers which were published in the specialty section Earthquake Engineering in 'Frontiers in Built Environment'. Several extensions of the first eBook, the second eBook and the third eBook are included here. The first article is on the comparison of earthquake resilience of various building structures including innovative base-isolation systems and control systems. Pulse-type ground motions and resonant harmonic ground motions are used for investigating the earthquake resilience of those innovative building structures. The second article is concerned with the performance of an innovative seismic response controlled system with shear walls and concentrated dampers in lower stories. The resonant one-cycle sine waves and resonant harmonic waves are used as the input ground motions. The third article is related to the robustness evaluation of a base-isolation building-connection hybrid controlled building structure under the critical long-period and long-duration ground motion. The multi impulse is used as a substitute for a long-period and long-duration ground motion and the model reduction to a single-degree-of-freedom (SDOF) system is conducted to propose a simple response evaluation method. The fourth article is an extension of the previously proposed energy balance approach to a damped bilinear hysteretic SDOF system under a double impulse as a substitute for a near-fault ground motion. The energy absorption through viscous damping is incorporated appropriately in the energy balance and the application of the proposed method to actual recorded ground motions is presented. The fifth article is on the robustness evaluation of base-isolation building-connection hybrid controlled building structures considering uncertainties in deep ground. The earthquake ground motion amplitude at the earthquake bedrock is evaluated by the Boore’s stochastic method in 1983 including the fault rupture and the wave propagation into the earthquake bedrock. Then the phase angle property at the earthquake bedrock is investigated by introducing the concept of phase difference which is defined for each earthquake type. A wave at the ground surface nearly resonant
to the base-isolation building-connection hybrid controlled building structure is produced by considering uncertainties in deep ground. The sixth article is concerned with the critical response of nonlinear base-isolated buildings considering soil-structure interaction under a double impulse as a substitute for a near-fault ground motion. The complicated model of a nonlinear base-isolated building on ground is modeled into an SDOF system after a few model reduction processes. The approach presented in this eBook, together with the previous eBooks, is an epoch-making accomplishment to open the door for simpler and deeper understanding of structural reliability and resilience of built environments in the elastic-plastic and nonlinear range. There are many regions worldwide which are susceptible to extreme loads such as earthquakes. These can cause loss of life and adverse impacts on civil infrastructures, the environment, and communities. A series of methods and measures have been used to mitigate the effects of these extreme loads. The adopted approaches and methods must enable civil structures to be resilient and sustainable. Therefore, to reduce damage and downtime in addition to protecting life and promoting safety, new resilient structure technologies must be proposed and developed. This special issue book focuses on methods of enhancing the sustainability and resilience of civil infrastructures in the event of extreme loads (e.g., earthquakes). This book contributes proposals of and theoretical, numerical, and experimental research on new and resilient civil structures and their structural performance under extreme loading events. These works will certainly play a significant role in promoting the application of new recoverable structures. Moreover, this book also introduces some case studies discussing the implementation of low-damage structural systems in buildings as well as articles on the development of design philosophies and performance criteria for resilient buildings and new sustainable communities. This concise work provides a general introduction to the design of buildings which must be resistant to the effect of earthquakes. A major part of this design involves the building structure which has a primary role in preventing serious damage or structural collapse. Much of the material presented in this book examines building structures. Due to the recent discovery of vertical components, it examines not only the resistance to lateral forces but also analyses the disastrous influence of vertical components. The work is written for Practicing Civil, Structural, and Mechanical Engineers, Seismologists and Geoscientists. It serves as a knowledge source for graduate students and their instructors. A smart civil structure integrates smart materials, sensors, actuators, signal processors, communication networks, power sources, diagonal strategies, control strategies, repair strategies, and life-cycle management strategies. It should function optimally and safely in its environment and maintain structural integrity during strong winds, severe earthquakes, and other extreme events. This book extends from the fundamentals to the state-of-the-art. It covers the elements of smart civil structures, their integration, and their functions. The elements consist of smart materials, sensors, control devices, signal processors, and communication networks. Integration refers to multi-scale modelling and model updating, multi-type sensor placement, control theory, and collective placement of control devices and sensors. And the functions include structural health monitoring, structural vibration control, structural self-repairing, and structural energy harvesting, with emphasis on their synthesis to form truly smart civil structures. It suits civil engineering students, professionals, and researchers with its blend of principles and practice.
isolation, passive energy dissipation and active control represent three innovative technologies for protection of structures under environmental loads. Increasingly, they are being applied to the design of new structures or to the retrofit of existing structures against wind, earthquakes and other external loads. This book, with contributions from leading researchers from Japan, Europe, and the United States, presents a balanced view of current research and world-wide development in this exciting and fast expanding field. Basic principles as well as practical design and implementational issues associated with the application of base isolation systems and passive and active control devices to civil engineering structures are carefully addressed. Examples of structural applications are presented and extensively discussed. This book will be a valuable step toward the common goal of an “adaptive” scientific community: improving everyone’s quality of life in a sustainable and safe way. Based on the proceedings of the Seventh International Conference on Earthquake Resistant Engineering Structures (ERES), this book presents basic and applied research in the main fields of engineering relevant to earthquake resistant analysis and design of structural systems. This book is an outgrowth of several years of teaching and research of the two authors in the field of structural dynamics and control. The content of the book is based on structural dynamics, classical and modern control theory and involves also recent developments that took place with respect to the control of systems with distributed masses. It is hoped that the book will serve the researcher and the practicing engineer in the areas of civil, mechanical and aeronautical engineering. It may also be of interest to applied mathematicians and to physicists. There is no question that the book can be used as a reference book for advanced courses in the above mentioned areas. The numerous examples will provide students with the necessary material for exercising themselves and for self studying. Thanks are due to Mrs. Cynthia Jones for preparing patiently and competently the typescript of the book. The services of Mrs. Linda Strouth, Solid Mechanics Division, University of Waterloo, rendered in producing the camera-ready copy of the book with great skill and devotion, are gratefully acknowledged. Special thanks go to Mr. Ir. Ad. C. Plaizier, at Martinus Nijhoff/Dr. W. Junk, who with much understanding and enthusiasm supervised the production of the book as Publisher. May the readers of it enjoy it, and may they have the feeling of having gained something in turning to it and using it. Throughout the past few years, there has been extensive research done on structural design in terms of optimization methods or problem formulation. But, much of this attention has been on the linear elastic structural behavior, under static loading condition. Such a focus has left researchers scratching their heads as it has led to vulnerable structural configurations. What researchers have left out of the equation is the element of seismic loading. It is essential for researchers to take this into account in order to develop earthquake resistant real-world structures. Structural Seismic Design Optimization and Earthquake Engineering: Formulations and Applications focuses on the research around earthquake engineering, in particular, the field of implementation of optimization algorithms in earthquake engineering problems. Topics discussed within this book include, but are not limited to, simulation issues for the accurate prediction of the seismic response of structures, design optimization procedures, soft computing applications, and other important advancements in seismic analysis and design where optimization algorithms can be implemented. Readers will discover that this book provides relevant theoretical frameworks in
order to enhance their learning on earthquake engineering as it deals with the latest research findings and their practical implementations, as well as new formulations and solutions. Insights and Innovations in Structural Engineering, Mechanics and Computation comprises 360 papers that were presented at the Sixth International Conference on Structural Engineering, Mechanics and Computation (SEMC 2016, Cape Town, South Africa, 5-7 September 2016). The papers reflect the broad scope of the SEMC conferences, and cover a wide range of engineering structures (buildings, bridges, towers, roofs, foundations, offshore structures, tunnels, dams, vessels, vehicles and machinery) and engineering materials (steel, aluminium, concrete, masonry, timber, glass, polymers, composites, laminates, smart materials). Introducing important concepts in the study of earthquakes related to retrofitting of structures to be made earthquake resistant. The book investigates the pounding effects on base-isolated buildings, the soil-structure-interaction effects on adjacent buildings due to the impact, the seismic protection of adjacent buildings and the mitigation of earthquake-induced vibrations of two adjacent structures. These concepts call for a new understanding of controlled systems with passive-active dampers and semi-active dampers. The passive control strategy of coupled buildings is investigated for seismic protection in comparison to active and semi-active control strategies. Beginning with an overview of the benefits of the modern building control system, the authors go on to describe the different controls and their applications and include advice on their set-up and tuning for stable operation. This book provides an insight on advanced methods and concepts for the design and analysis of structures against earthquake loading. This second volume is a collection of 28 chapters written by leading experts in the field of structural analysis and earthquake engineering. Emphasis is given on current state-of-the-art methods and concepts in computing methods and their application in engineering practice. The book content is suitable for both practicing engineers and academics, covering a wide variety of topics in an effort to assist the timely dissemination of research findings for the mitigation of seismic risk. Due to the devastating socioeconomic consequences of seismic events, the topic is of great scientific interest and is expected to be of valuable help to scientists and engineers. The chapters of this volume are extended versions of selected papers presented at the COMPDYN 2011 conference, held in the island of Corfu, Greece, under the auspices of the European Community on Computational Methods in Applied Sciences (ECCOMAS). Abstract: Eight different sets of equations proposed for tuning the parameters of tuned mass dampers (TMDs) are compared using a 5-story building with plan and elevation irregularity, and a 15-story and a 20-story building with plan irregularity subjected to seismic loading. Next, the performance of bidirectional tuned mass damper (BTMD) is compared with that of the pendulum tuned mass damper (PTMD) using three different structures with plan and vertical irregularities ranging in height from 5 to 20 stories and dominant fundamental periods ranging from 0.55 sec to 4.25 sec subjected to Loma Prieta earthquake. It is concluded that BTMD performs consistently better than PTMD for reduction of maximum displacement, acceleration and base shear. BTMD is advantageous over PTMD because it can be tuned for two modes of vibrations and therefore can be used as an alternative to using two TMDs. Then, the effectiveness of BTMD is investigated using a 20-story building structure with plan irregularity subjected to six seismic accelerograms. Finally, the optimal placement of the BTMD is investigated using five different multi-story building structures with
plan and elevation irregularities ranging in height from 5 to 20 stories and fundamental periods ranging from 0.55 sec to 4.25 sec subjected to Loma Prieta earthquake. Engineers are always interested in the worst-case scenario. One of the most important and challenging missions of structural engineers may be to narrow the range of unexpected incidents in building structural design. Redundancy, robustness and resilience play an important role in such circumstances. Improving the Earthquake Resilience of Buildings: The worst case approach discusses the importance of worst-scenario approach for improved earthquake resilience of buildings and nuclear reactor facilities. Improving the Earthquake Resilience of Buildings: The worst case approach consists of two parts. The first part deals with the characterization and modeling of worst or critical ground motions on inelastic structures and the related worst-case scenario in the structural design of ordinary simple building structures. The second part of the book focuses on investigating the worst-case scenario for passively controlled and base-isolated buildings. This allows for detailed consideration of a range of topics including: A consideration of damage of building structures in the critical excitation method for improved building-earthquake resilience, A consideration of uncertainties of structural parameters in structural control and base-isolation for improved building-earthquake resilience, and New insights in structural design of super high-rise buildings under long-period ground motions. Improving the Earthquake Resilience of Buildings: The worst case approach is a valuable resource for researchers and engineers interested in learning and applying the worst-case scenario approach in the seismic-resistant design for more resilient structures. This book presents a unique collection of contributions from some of the foremost scholars in the field of risk and reliability analysis. Combining the most advanced analysis techniques with practical applications, it is one of the most comprehensive and up-to-date books available on risk-based engineering. All the fundamental concepts needed to conduct risk and reliability assessments are covered in detail, providing readers with a sound understanding of the field and making the book a powerful tool for students and researchers alike. This book was prepared in honor of Professor Armen Der Kiureghian, one of the fathers of modern risk and reliability analysis. The most popular and trusted guide to the building regulations, Building Regulations in Brief is updated regularly to reflect constant changes. Now in its seventh edition, it has sold over 28,000 copies since its first publication in 2003. This new edition includes the latest on all the significant amendments to Building Regulations, Planning Permission and the Approved Documents that occurred in October 2010 and includes changes to Parts F and L, as well as Approved Documents A, C, and J. There are also changes reflecting the consolidation of the building regulations included. The no-nonsense approach has made it a firm favourite with all involved in the building industry including designers, building surveyors and inspectors, students and architects. A ready reference giving practical information, it enables compliance in the simplest and most cost-effective manner possible. Building Regulations in Brief cuts through the confusion to explain the meaning of the regulations, their history, current status, requirements, associated documentation and how local authorities view their importance, as well as emphasizing the benefits and requirements of each regulation. It’s an essential purchase for anyone needing to comply with the building regulations. This state of the art report from an international task group (TG44) of CIB, the International Council of Building Research Organizations, presents a highly
authoritative guide to the application of innovative technologies on response control and seismic isolation of buildings to practice worldwide. Many countries and cities are located in earthquake-prone areas making effective seismic design a major issue in structural engineering. Reassuringly, structural response control and seismic isolation have advanced remarkably in recent years following numerous studies internationally. Several major conferences have been held and reports have been written but little has been issued on the application of the technologies to good structural engineering practice. Plugging that gap, Response Control and Seismic Isolation of Buildings presents researchers in structural engineering (dynamics) and construction management with up-to-date applications of the latest technologies. Damping Technologies for Tall Buildings provides practical advice on the selection, design, installation and testing of damping systems. Richly illustrated with images and schematics, this book presents expert commentary on different damping systems, giving readers a way to accurately compare between different device categories and gain and understand the advantages and disadvantages of each. In addition, the book covers their economical and sustainability implications. Case studies are included to provide a direct understanding on the possible applications of each device category. Provides an expert guide on the selection and deployment of the various types of damping technologies. Drawn from extensive contributions from international experts and research projects that represent the current state-of-the-art and design in damping technologies. Includes 25+ real case studies collected with very detailed information on damping design, installation, testing and other building implications. No presente trabalho estuda-se a aplicação do controle estrutural na proteção de estruturas submetidas a carregamentos dinâmicos contra níveis de vibração indesejáveis que possam causar desconforto e, até mesmo, comprometer a segurança e integridade da edificação. Os três tipos de controle estrutural, passivo, ativo e híbrido, são analisados de forma a evidenciar as vantagens do uso do controle híbrido. O mecanismo de controle utilizado é o denominado amortecedor de massa sintonizado (AMS), devido à sua vasta aplicação na Engenharia Civil, tendo uma grande quantidade sido instalada em edifícios, pontes e chaminés industriais para controle de vibrações causadas pelo vento. Verifica-se a influência da não-linearidade da rigidez do AMS no comportamento do sistema principal. A utilização de amortecedores de massa sintonizados múltiplos é também estudada como uma forma de vencer certas limitações quanto à robustez deste tipo de sistema e melhorar sua performance. Analisa-se por fim o comportamento e eficiência do amortecedor de massa híbrido (AMH), em relação ao AMS passivo. Para cálculo da força de controle são utilizados os seguintes algoritmos: controle ótimo linear clássico, controle ótimo instantâneo e controle ótimo não-linear. Uma estratégia para definição das matrizes de ponderação, utilizadas no algoritmo de controle ótimo instantâneo, que minimizem a amplitude da resposta harmônica permanente é apresentada. Exemplos numéricos são apresentados ao longo de todo o trabalho. Verifica-se que a utilização do controle híbrido é mais eficiente que os controles passivo e ativo isolados, requerendo forças de magnitude inferiores, o que reduz bastante o custo deste tipo de sistema. O sistema de controle híbrido se mostrou eficiente na redução de vibrações causadas por carregamentos cujas frequências eram diversas das consideradas no projeto do sistema de controle passivo. Verificou-se, ainda que o mesmo se comportou de forma satisfatória no caso de discrepância na frequência natural da estrutura. This set of proceedings
Building Control With Passive Dampers
Optimal Performance Based Design For Earthquakes 1st Edition By Takewaki Izuru 2009

is based on the International Conference on Advances in Building Technology in Hong Kong on 4-6 December 2002. The two volumes of proceedings contain 9 invited keynote papers, 72 papers delivered by 11 teams, and 133 contributed papers from over 20 countries around the world. The papers cover a wide spectrum of topics across the three technology sub-themes of structures and construction, environment, and information technology. The variety within these categories spans a width of topics, and these proceedings provide readers with a good general overview of recent advances in building research.

This book is an up-to-date source for computation applications of optimization, prediction via artificial intelligence methods, and evaluation of metaheuristic algorithm with different structural applications. As the current interest of researcher, metaheuristic algorithms are a high interest topic area since advance and non-optimized problems via mathematical methods are challenged by the development of advance and modified algorithms. The artificial intelligence (AI) area is also important in predicting optimum results by skipping long iterative optimization processes. The machine learning used in generation of AI models also needs optimum results of metaheuristic-based approaches. This book is a great source to researcher, graduate students, and bachelor students who gain project about structural optimization. Differently from the academic use, the chapter that emphasizes different scopes and methods can take the interest and help engineer working in design and production of structural engineering projects.

‘Building Control Systems’ provides the building services engineer with a comprehensive understanding of modern control systems and relevant information technology. This will ensure that the best form of control systems for the building is specified and that proper provision is made for its installation, commissioning, operation and maintenance. Beginning with an overview of the benefits of the modern building control system, the authors describe the different controls and their applications, and include advice on their set-up and tuning for stable operation. There are chapters on the practical design of control systems, how to work from the hardware components and their inclusion in networks, through to control strategies in Heating, Ventilation and Air Conditioning (HVAC) systems and whole buildings. The relationship between Building, Management Systems (BMS) and information technology systems is discussed, and the building procurement process and the importance of considering control requirements at an early stage in the design process.

The recent introduction of active and passive structural control methods has given structural designers powerful tools for performance-based design. However, structural engineers often lack the tools for the optimal selection and placement of such systems. In Building Control with Passive Dampers, Takewaki brings together most the reliable, state-of-the-art methods in practice around the world, arming readers with a real sense of how to address optimal selection and placement of passive control systems. The first book on optimal design, sizing, and location selection of passive dampers combines theory and practical applications. Describes step-by-step how to obtain optimal damper size and placement. Covers the state-of-the-art in optimal design of passive control integrates the most reliable techniques in the top literature and used in practice worldwide. Written by a recognized expert in the area MATLAB code examples available from the book’s Companion Website. This book is essential for post-graduate students, researchers, and design consultants involved in building control. Professional engineers and advanced undergraduates interested in seismic design, as well as mechanical
engineers looking for vibration damping techniques, will also find this book a helpful reference. Code examples available at www.wiley.com/go/takewaki

Comprehensive coverage of the background and design requirements for plastic and seismic design of steel structures

Thoroughly revised throughout, Ductile Design of Steel Structures, Second Edition, reflects the latest plastic and seismic design provisions and standards from the American Institute of Steel Construction (AISC) and the Canadian Standard Association (CSA). The book covers steel material, cross-section, component, and system response for applications in plastic and seismic design, and provides practical guidance on how to incorporate these principles into structural design. Three new chapters address buckling-restrained braced frame design, steel plate shear wall design, and hysteretic energy dissipating systems and design strategies. Eight other chapters have been extensively revised and expanded, including a chapter presenting the basic seismic design philosophy to determine seismic loads. Self-study problems at the end of each chapter help reinforce the concepts presented. Written by experts in earthquake-resistant design who are active in the development of seismic guidelines, this is an invaluable resource for students and professionals involved in earthquake engineering or other areas related to the analysis and design of steel structures. COVERAGE INCLUDES: Structural steel properties Plastic behavior at the cross-section level Concepts, methods, and applications of plastic analysis Building code seismic design philosophy Design of moment-resisting frames Design of concentrically braced frames Design of eccentrically braced frames Design of steel energy dissipating systems Stability and rotation capacity of steel beams The structural optimization procedure presented in this book makes it possible to achieve seismic protection through integrated structural/control system design. In particular, it is explained how slender structural systems with a high seismic performance can be achieved through inclusion of viscous and viscoelastic dampers as an integral part of the system. Readers are provided with essential introductory information on passive structural control and passive energy dissipation systems. Dynamic analyses of both single and multiple degree of freedom systems are performed in order to verify the achievement of pre-assigned performance targets, and it is explained how the optimal integrated design methodology, also relevant to retrofitting of existing buildings, should be applied. The book illustrates how structural control research is opening up new possibilities in structural forms and configurations without compromising structural performance. This eBook is the third in a series of books on the critical earthquake response of elastic or elastic-plastic structures under near-fault or long-duration ground motions, and includes four original research papers which were published in the specialty section Earthquake Engineering in ‘Frontiers in Built Environment’. Several extensions of the first eBook and the second eBook are included here. The first article is on the earthquake resilience of residential houses after repeated ground motions with high intensity. The 2016 Kumamoto earthquake brought a significant impact on the earthquake resilience of residential houses under repeated ground motions with high intensity in a few days. The necessary strength upgrade withstanding two repeated high-intensity ground motions was found to be 1.5. The second article is concerned with the smart enhancement of earthquake resilience of building structures under both near-fault and long-duration ground motions. A hybrid system of base-isolation and building connection control was proposed and its earthquake resilience to near-fault and...
long-duration ground motions was evaluated by a double impulse and a multiple impulse. It was demonstrated that the base-isolation is effective for near-fault ground motions and the building connection system using passive dampers is effective for long-duration ground motions. The third article is related to the robustness evaluation of elastic-plastic base-isolated high-rise buildings under resonant near-fault ground motions. The robustness function was introduced to evaluate quantitatively the robustness of elastic-plastic base-isolated high-rise buildings. The fourth article is an extension of the previously proposed energy balance approach to a bilinear elastic-plastic single-degree-of-freedom system under a long-duration sinusoidal ground motion. A historical difficulty in nonlinear vibration posed by Caughey (1960) and Iwan (1961) has been overcome in a smart manner after half a century. The approach presented in this eBook, together with the previous eBooks, is an epoch-making accomplishment to open the door for simpler and deeper understanding of structural reliability and resilience of built environments in the elastic-plastic and nonlinear range.

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