

Civil Structural Engineering Smart Brains

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Fuzzy Controllers CRC Press

Computational intelligence is a general term for a class of algorithms designed by nature's wisdom and human intelligence. Computer scientists have proposed many computational intelligence algorithms with heuristic features. These algorithms either mimic the evolutionary processes of the biological world, mimic the physiological structure and bodily functions of the organism, imitate the behavior of the animal's group, mimic the characteristics of human thought, language, and memory processes, or mimic the physical phenomena of nature, hoping to simulate the wisdom of nature and humanity enables an optimal solution to the problem and solves an acceptable solution in an acceptable time. Computational intelligent algorithms have received extensive attention at home and abroad, and have become an important research direction of artificial intelligence and computer science. This book will introduce the application of intelligent optimization algorithms in detail from the aspects of computational intelligence, job shop scheduling problems, multi-objective optimization problems, and machine learning

Structural Health Monitoring Technologies and Next-Generation Smart Composite Structures Woodhead Publishing

"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. This book 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, and 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"--

Structural Engineer's Professional Training Manual CRC Press

The development of new and effective analytical and numerical models is essential to understanding the performance of a variety of structures. As computational methods continue to advance, so too do their applications in structural performance modeling and analysis. Modeling and Simulation Techniques in Structural Engineering presents emerging research on computational techniques and applications within the field of structural engineering. This timely publication features practical applications as well as new research insights and is ideally designed for use by engineers, IT professionals, researchers, and graduate-level students.

Adaptronics and Smart Structures IGI Global

This book provides a comprehensive introduction to the embryonic field of smart materials and structures, and also presents a state-of-the-art review of the sub-disciplines of the field. It informs readers of the technical challenges to the commercialisation of products incorporating these material technologies.

Smart Structures Springer Nature

The study of 'intelligent (smart) structures and systems' is emerging as a new research area that is multi-disciplinary in nature, requiring technical expertise from mechanical engineering, structural engineering, electrical engineering, applied mechanics, engineering mathematics, material science, computer science, biological science, etc. This technology is quite likely to contribute significantly to advances in the design of high-performance structures, adaptive structures, high-precision systems, microsystems, etc. This volume contains specially invited contributions to state-of-the-art research in the evolution of intelligent (smart) structures and systems. Topics include: current intelligent (smart) structures research activities, piezoelectric structures, shape memory alloy reinforced composites, applications of electrorheological fluids, intelligent sensor systems, adaptive precision trusses, damage detection, model reinforcement, control of axial moving continua, distributed transducers, etc.

Fundamentals of Structural Engineering CRC Press

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Advances in Informatics and Computing in Civil and Construction Engineering John Wiley & Sons

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.

Smart Civil Structures Springer Science & Business Media

This book provides knowledge into Cognitive Digital Twins for smart lifecycle management of built environment and infrastructure focusing on challenges and opportunities. It focuses on the challenges and opportunities of data-driven cognitive systems by integrating the heterogeneous data from multiple resources that can easily be used in a machine learning model and adjust the algorithms. It comprises Digital Twins incorporating cognitive features that will enable sensing complex and unpredicted behavior and reason about dynamic strategies for process optimization to support decision-making in lifecycle management of the built environment and infrastructure. The book introduces the Knowledge Graph (KG)-centric framework for Cognitive Digital Twins involving process modeling and simulation, ontology-based Knowledge Graph, analytics for process optimizations, and interfaces for data operability. It offers contributions of Cognitive Digital Twins for the integration of IoT, Big data, AI, smart sensors, machine learning and communication technologies, all connected to a novel paradigm of self-learning hybrid models with proactive cognitive capabilities. The book presents the topologies of models described for autonomous real time interpretation and decision-making support of complex system development based on Cognitive Digital Twins with applications in critical domains such as maintenance of complex engineering assets in built environment and infrastructure. It offers the essential material to enlighten pertinent research communities of the state-of-the-art research and the latest development in the area of Cognitive Digital Twins, as well as a valuable reference for planners, designers, developers, and ICT experts who are working towards the development and implementation of autonomous Cognitive IoT based on big data analytics and context-aware computing.

Smart Structures IOS Press

Due to the increased use of composite materials in aerospace, energy, automobile, and civil infrastructure applications, concern over composite material failures has grown, creating a need for smart composite structures that are able to self-diagnose and self-heal. Structural Health Monitoring Technologies and Next-Generation Smart Composite Structures provides valuable insight into cutting-edge advances in SHM, smart materials, and smart structures. Comprised of chapters authored by leading researchers in their respective fields, this edited book showcases exciting developments in general embedded sensor technologies, general sensor technologies, sensor response interrogation and data communication, damage matrix formulation, damage mechanics and analysis, smart materials and structures, and SHM in aerospace applications. Each chapter makes a significant contribution to the prevention of structural failures by describing methods that increase safety and reduce maintenance costs in a variety of SHM applications.

Smart Civil Structures Springer

This book presents comparative design as an approach to the conceptual design of structures. Primarily focusing on reasonable structural performance, sustainable development and architectural aesthetics, it features detailed studies of structural performance through the composition and de-composition of these elements for a variety of structures, such as high-rise buildings, long-span crossings and spatial structures. The latter part of the book addresses the theoretical basis and practical implementation of knowledge engineering in structural design, and a case-based fuzzy reasoning method is introduced to illustrate the concept and method of intelligent design. The book is intended for civil engineers, structural designers and architects, as well as senior undergraduate and graduate students in civil engineering and architecture. Lin Shaopei and Huang Zhen are both Professors at the Department of Civil Engineering, Shanghai Jiao Tong University, China.

Evolutionary Computation Springer Science & Business Media

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.

Intelligent Structural Systems Springer Science & Business Media

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.

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This book delves into the transformative potential of neuromorphic computing within the realm of civil engineering,

emphasizing its role in advancing smart infrastructure systems. Neuromorphic computing, inspired by the neural structures of the human brain, offers unparalleled efficiencies in processing complex, dynamic data sets, thereby facilitating real time decision-making and predictive analytics in infrastructure management. Through a comprehensive exploration of emerging circuits, memory technologies, intelligent learning algorithms, and application-driven systems, it illustrates how neuromorphic computing can significantly enhance the resilience, efficiency, and sustainability of urban infrastructure. The book further addresses the challenges, ethical considerations, and future directions associated with the integration of these advanced technologies into civil engineering projects. Through detailed case studies, it provides insights into successful implementation strategies, risk management, and contingency planning, underscoring the importance of ethical design and development. This book serves as a valuable resource for practitioners, researchers, and policymakers involved in the evolution of civil engineering toward smarter, more responsive, and sustainable urban environments.

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Fuzzy control theory is an emerging area of research. At the core of many engineering problems is the problem of control of different systems. These systems range all the way from classical inverted pendulum to auto-focusing system of a digital camera. Fuzzy control systems have demonstrated their enhanced performance in all these areas. Progress in this domain is very fast and there was critical need of a book that captures all the recent advances both in theory and in applications. Serving this purpose, this book is conceived. This book will provide you a very clear picture of current status of fuzzy control research. This book is intended for researchers, engineers, and postgraduate students specializing in fuzzy systems, control engineering, and robotics. **Structural Engineering** Springer Science & Business Media This book collects invited lectures presented and discussed on the AMAS & ECCOMAS Workshop/Thematic Conference SMART'o3. The SMART'o3 Conference on Smart Materials and Structures was held in a 19th century palace in Jadwisin near Warsaw, 2-5 September 2003, Poland. It was organized by the Advanced Materials and Structures (AMAS) Centre of Excellence at the Institute of Fundamental Technological Research (IFTR) in Warsaw, ECCOMAS - European Community on Computational Methods in Applied Sciences and SMART-TECH Centre at IFTR. The idea of the workshop was to bring together and consolidate the community of Smart Materials and Structures in Europe. The workshop was attended by 66 participants from n European countries (Austria, Belgium, Finland, France, Germany, Italy, Poland, Portugal, Spain, U.K., Ukraine), 1 participant from Israel and 1 participant from the USA. The workshop program was grouped into the following major topics: 4 sessions on Structural Control (18 presentations), 3 sessions on Vibration Control and Dynamics (14 presentations), 2 sessions on Damage Identification (10 presentations), 2 sessions on Smart Materials (9 presentations). Each session was composed of an invited lecture and some contributed papers. Every paper scheduled in the program was presented, so altogether 51 presentations were given. No sessions were run in parallel. The workshop was attended not only by researchers but also by people closely related to the industry. There were interesting discussions on scientific merits of the presented papers as well as on future development of the field and its possible industrial applications.

Revolutionizing Civil Engineering with Neuromorphic Computing World Scientific Publishing Company

Artificial Intelligence Applications for Sustainable Construction presents the latest developments in AI and ML technologies applied to real-world civil engineering concerns. With an increasing amount of attention on the environmental impact of every industry, more construction projects are going to require sustainable construction practices. This volume offers research evidence, simulation results, and case studies to support this change. Sustainable construction, in fact, not only uses renewable and recyclable materials when building new structures or repairing deteriorating ones, but also adopts all possible methods to reduce energy consumption and waste. The concisely written but comprehensive, practical knowledge put forward by this

international group of highly specialized editors and contributors will prove to be beneficial to engineering students and professionals alike. Presents convincing "success stories that encourage application of AI-powered tools to civil engineering Provides a wealth of valuable technical information to address and resolve many challenging construction problems Illustrates the most recent shifts in thinking and practice for sustainable construction

Innovation in Smart and Sustainable Infrastructure, Volume 2 CRC Press

Have you ever stared in wonder at huge suspension bridge or a towering sky scraper? Then structural engineering might just be the career path for you! Learn the basics from a real-life expert and get some hands-on experience. The world of electrical engineering is at your fingertips.

Sustainability and Health in Intelligent Buildings Springer

The book presents the select proceedings of National Conference on Recent Advances in Structural Engineering (NCRASE 2020). Various topics covered in this book include advanced structural materials, computational methods of structures, earthquake resistant analysis and design, analysis and design of structures against wind loads, pre-stressed concrete structures, bridge engineering, experimental methods and techniques of structures, offshore structures, composite structures, smart materials and structures, port and harbor structures, structural dynamics, high rise structures, sustainable materials in the construction technology, advanced structural analysis, extreme loads on structures, innovative structures, and special structures. The book will be useful for researchers and professional working in the field of structural engineering.

Cognitive Digital Twins for Smart Lifecycle Management of Built Environment and Infrastructure Springer Nature

Sustainability and Health in Intelligent Buildings presents a comprehensive roadmap for designing and constructing high-performance clean energy-efficient buildings, including intelligence capabilities underpinned by smart power, 5G and Internet-of-Things technologies, environmental sensors, intelligent control strategies and cyber-physical security. This book includes a special emphasis on health pandemic resiliency that discusses strong engineering control strategies to respond and recover from infectious diseases like COVID-19. Sections cover the foundational aspects of healthy buildings, with a special emphasis on assessing indoor environmental qualities. In addition, it introduces the necessary principles that assist engineers and researchers in understanding and designing buildings that meet health and sustainability goals. Describes the basic elements of building a digital ecosystem, along with informatics-driven performance architecture Features various models used in the design of controllers for major systems such as HVAC and lighting Explores the notion of building bioelectromagnetics to ensure health and safety from human exposure to EM fields

Potential Applications of Intelligent Materials to Civil Engineering Structures IGI Global

This book expounds on the related technologies of intelligent transportation infrastructure construction. Based on the essential characteristics of intelligent construction, "perception, analysis, decision-making, and execution," the basic structure of intelligent construction technology (ICT) is established. With the integration of engineering construction technologies, the analyses of the essence of intelligent algorithms and the feasibility of Artificial Intelligence (AI) are provided. The book introduces the essential characteristics of Big Data and the Internet of Things and their relationship with engineering construction. On this basis, the feasibility and implementation plan of intelligent technology applications in design, construction, and maintenance are analyzed and demonstrated with engineering examples. The book also combines ICT with intelligent construction talent training, the professional knowledge required for intelligent construction, and the theoretical basis to provide the methods for mastering new technologies. This book can be used by technical personnel in related fields such as highways, railways, airports, and urban road construction to understand and master innovative, intelligent construction technologies. It can also be a reference book for ICT-related college courses.