Cyber Physical Systems Challenge Of The 21st Century

Cyber-physical systems (CPSs) have quickly become one of the hottest computer applications today. With their tight integration of cyber and physical objects, it is believed CPSs will transform how we interact with the physical world, just like the Internet transformed how we interact with one another. A CPS could be a system at multiple scales, from large smart bridges with fluctuation detection and responding functions, to autonomous cars and tiny implanted medical devices. Cyber-Physical Systems: Integrated Computing and Engineering Design supplies comprehensive coverage of the principles and design of CPSs. It addresses the many challenges that must be overcome and outlines a roadmap of how to get there. Emphasizes the integration of cyber computing and physical objects control Covers important CPS theory foundations and models Includes interesting case studies of several important civilian and health care applications that illustrate the CPS design process Addresses the collaboration of the sensing and controlling of a physical system with robust software architecture Explains how to account for random failure events that can occur in a real CPS environment Presented in a systematic manner, the book begins by discussing the basic concept underlying CPSs and examining some challenging design issues. It then covers the most important design theories and modeling methods for a practical CPS. Next, it moves on to sensor-based CPSs, which use embedded sensors and actuators to interact with the physical world. The text presents concrete CPS designs for popular civilian applications, including building and energy management. Reflecting the importance of human health care in society, it includes CPS examples of rehabilitation applications such as virtual reality-based disability recovery platforms.

Security, privacy, and trust in the Internet of Things (IoT) and CPS (Cyber-Physical Systems) are different from conventional security as concerns revolve around the collection and aggregation of data or transmission of data over the network. Analysis of cyber-attack vectors and the provision of appropriate mitigation techniques are essential research areas for these systems. Adoption of best practices and maintaining a balance between ease of use and security are, again, crucial for the effective performance of these systems. Recent Advances in Security, Privacy and Trust for Internet of Things (IoT) and Cyber-Physical Systems (CPS) discusses and presents techniques and methodologies, as well as a wide range of examples and illustrations, to effectively show the principles, algorithms, challenges, and applications of security, privacy, and trust for IoT and CPS. Book features: Introduces new directions for research, development, and engineering security, privacy, and trust of IoT and CPS Includes a wealth of examples and illustrations to effectively demonstrate the principles, algorithms, challenges, and applications Covers most of the important security aspects and current trends not present in other reference books This book will also serve as an excellent reference in security, privacy, and trust of IoT and CPS for professionals in this fast-evolving and critical field. The chapters present high-quality contributions from researchers, academics, and practitioners from various national and international organizations and universities.

Are cyber-physical systems a challenge for automation technology? Have you evaluated the appropriate communication responses to your key stakeholders? What are the interfaces between Cyber-Physical Systems and Big Data Applications? How do you leverage advances in Cyber-physical systems and machine learning? Are you satisfied the information is being held securely, whether its on paper or on computer? This breakthrough Cyber Physical System self-assessment will make you the dependable Cyber Physical System domain standout by revealing just what you need to know to be fluent and ready for any Cyber Physical System challenge. How do I reduce the effort in the Cyber Physical System work to be done to get problems solved? How can I ensure that plans of action include every Cyber Physical System task and that every Cyber Physical System outcome is in place? How will I save time investigating strategic and tactical options and ensuring Cyber Physical System costs are low? How can I deliver tailored Cyber Physical System advice instantly with structured going-forward plans? There's no better guide through these mind-expanding questions than acclaimed best-selling author Gerard Blokdyk. Blokdyk ensures all Cyber Physical System essentials are covered, from every angle: the Cyber Physical System self-assessment shows succinctly and clearly that what needs to be clarified to organize the required activities and processes so that Cyber Physical System outcomes are achieved. Contains extensive criteria grounded in past and current successful projects and activities by experienced Cyber Physical System practitioners. Their mastery, combined with the easy elegance of the self-assessment, provides its superior value to you in knowing how to ensure the outcome of any efforts in Cyber Physical System are maximized with professional results. Your purchase includes access details to the Cyber Physical System self-assessment dashboard download which gives you your dynamically prioritized projects-ready tool and shows you exactly what to do next. Your exclusive instant access details can be found in your book. You will receive the following contents with New and Updated specific criteria: - The latest quick edition of the book in PDF - The latest complete edition of the book in PDF, which criteria correspond to the criteria in... - The Self-Assessment Excel Dashboard - Example pre-filled Self-Assessment Excel Dashboard to get familiar with results generation - In-depth and specific Cyber Physical System Checklists - Project management checklists and templates to assist with implementation INCLUDES LIFETIME SELF ASSESSMENT UPDATES Every self assessment comes with Lifetime Updates and Lifetime Free Updated Books. Lifetime Updates is an industry-first feature which allows you to receive verified self assessment updates, ensuring you always have the most accurate information at your fingertips.

This book presents the state-of-the-art and breakthrough innovations in design automation for cyber-physical systems.The authors discuss various aspects of cyber-physical systems design, including modeling, co-design, optimization, tools, formal methods, validation, verification, and case studies. Coverage includes a survey of the various existing cyber-physical systems functional design methodologies and related tools will provide the reader unique insights into the conceptual design of cyber-physical systems.

From Risk Modelling to Threat Counteraction

Organic Computing — A Paradigm Shift for Complex Systems

Big Data Analytics for Cyber-Physical Systems

Proceedings of the Third International Conference on Complex Systems Design & Management CSD&M 2012

Embedded, Cyber-Physical, and IoT Systems

Cyber-Physical Systems: Industry 4.0 Challenges

Cyber-Physical Systems

The cognitive approach to the IoT provides connectivity to everyone and everything since IoT connected devices are known to increase rapidly. When the IoT is integrated with cognitive technology, performance is improved, and smart intelligence is obtained. Discussed in this book are different types of datasets with structured content based on cognitive systems. The IoT gathers the information from the real time datasets through the internet, where the IoT network connects with multiple devices. This book mainly concentrates on providing the best solutions to existing real-time issues in the cognitive domain. Healthcare-based, cloud-based and smart transportation-based applications in the cognitive domain are addressed. The data integrity and security aspects of the cognitive computing main are also thoroughly discussed along with validated results.

This book is a relevant reference for any readers interested in the security aspects of Cyber-Physical Systems and particularly useful for those looking to keep informed on the latest advances in this dynamic area. Cyber-Physical Systems (CPSs) are characterized by the intrinsic combination of software and physical components. Inherent elements often include wired or wireless data communication, sensor devices, real-time operation and automated control of physical elements. Typical examples of associated application areas include industrial control systems, smart grids, autonomous vehicles and avionics, medial monitoring and robotics. The incarnation of the CPSs can therefore range from considering individual Internet-of-Things devices through to large-scale infrastructures. Presented across ten chapters authored by international researchers in the field from both academia and industry, this book offers a series of high-quality contributions that collectively address and analyze the state of the art in the security of Cyber-Physical Systems and related technologies. The chapters themselves include an effective mix of theory and applied content, supporting an understanding of the underlying security issues in the CPSs domain, alongside related coverage of the technological advances and solutions proposed to address them. The chapters comprising the later portion of the book are specifically focused upon a series of case examples, evidencing how the protection concepts can translate into practical application.

Challenges, Opportunities, and Dimensions of Cyber-Physical SystemsIGI Global

With the help of artificial intelligence, machine learning, and big data analytics, the internet of things (IoT) is creating partnerships within industry where machines, processes, and humans communicate with one another. As this radically changes traditional industrial operations, this results in the rapid design, cheap manufacture, and effective customization of products. Answering the growing demand of customers and their preferences has become a challenge for such partnerships. Industrial Internet of Things and Cyber-Physical Systems: Transforming the Conventional to Digital is a collection of innovative research that discusses development, implementation, and business impacts of IoT technologies on sustainable societal development and improved life quality. Highlighting a wide range of topics such as green technologies, wireless networks, and IoT policy, this book is ideally designed for technology developers, entrepreneurs, industrialists, programmers, engineers, technicians, researchers, academicians, and students.

Design Automation of Cyber-Physical Systems

Foundations and Applications

Optimal Observation for Cyber-physical Systems

Blockchain for Cyberphysical Systems: Challenges, Opportunities, and Applications

Foundations – A Conceptual Model and Some Derivations: The AMADEOS Legacy

Cyber-Physical Systems for Next-Generation Networks

Cyber-Physical Systems of Systems

Cyber Physical Systems: Architectures, Protocols and Applications helps you understand the basic principles and key supporting standards of CPS. It analyzes different CPS applications from the bottom up, extracting the common characters that form a vertical structure. It presents mobile sensing platforms and their applications toward interrelated paradigms, highlighting and briefly discussing different types of mobile sensing platforms and the functionalities they offer. It then looks at the naming, addressing, and profile services of CPS and proposes a middleware component to meet the requirements of dynamic applications and sensors/actuators deployment/configurations across different platforms. The middle chapters of the book present a context-aware sensor search, selection, and ranking model which addresses the challenge of efficiently selecting a subset of relevant sensors out of a large set of sensors with similar functionality and capabilities. The authors consider various topics in the energy management of CPS and propose a novel energy-efficient framework. They also present the fundamental networking technologies of CPS and focus on machine-to-machine communications for CPS, specifically the open technologies such as IPv6-based solutions that can be integrated into IoT and enable wireless sensor communications. In the book's final chapters, the authors bring you up to date on mobile cloud computing (MCC) research activities that enhance the capabilities of resource-constrained smart devices in CPS sensory environments. They also present a few representative CPS applications, including connected healthcare, gaming in public transport crowds, and a series of MCC-enabled emerging CPS applications. You will find that these application fields fully demonstrate the great potential of applying CPS in public life.

Smart Cyber Physical Systems: Advances, Challenges and Opportunities ISBN: 9780367337889 Cyber Physical Systems (CPS) are the new generation of collaborative computational entities, with a prime focus on integration of the physical world and cyber space. Through a feedback mechanism, the system adapts itself to new conditions in real time. The scope of this book includes research experience by experts in CPS infrastructure systems, incorporating sustainability by embedding computing and communication in day-to-day applications. CPS, integrated with Blockchain, Artificial Intelligence, Internet of Things, Big Data, Cloud Computing and Communication, lay a foundation for the fourth industrial revolution, Industry 4.0. This book will be of immense use to practitioners in industries with a focus on autonomous and adaptive configuration, and on optimization, leading to increased agility, elasticity and cost effectiveness. The contributors of this book include renowned academics, industry practitioners and researchers. It offers a rigorous introduction to the theoretical foundations, techniques and practical solutions, through case studies. Building CPS with effective communication, control, intelligence and security is discussed in terms of societal and research perspectives. The objective of this book is to provide a forum for researchers and practitioners to exchange ideas and to achieve progress in CPS by highlighting applications, advances and research challenges. It is highly recommended to be used as a reference book for graduate and post-graduate level programmes in universities, with a focus on research in computer science-related courses.

This unique introduction to the foundational concepts of cyber-physical systems (CPS) describes key design principles and emerging research trends in detail. Several interdisciplinary applications are covered, with a focus on the wide-area management of infrastructures including electric power systems, air transportation networks, and health care systems. Design, control and optimization of cyber-physical infrastructures are discussed, addressing security and privacy issues of networked CPS, presenting graph-theoretic and numerical approaches to CPS evaluation and monitoring, and providing readers with the knowledge needed to operate CPS in a reliable, efficient, and secure manner. Exercises are included. This is an ideal resource for researchers and graduate students in electrical engineering and computer science, as well as for practitioners using cyber-physical systems in aerospace and automotive engineering, medical technology, and large-scale infrastructure operations.

Cyber-physical systems (CPS) and the Internet of Things (IoT) are rapidly developing technologies that are transforming our society. The disruptive transformation of the economy and society is expected due to the data collected by these systems, rather than the technological aspects of such as networks, embedded systems, and cloud technology. However, to create value out of the data, it must be transformed into information and therefore, expertise in data analytics and machine learning is the key component of future smart systems in cities and other applications. Big Data Analytics in Cyber-Physical Systems examines sensor signal processing, IoT gateways, optimization and decision making, intelligent mobility, and implementation of machine learning algorithms in embedded systems. This book focuses on the interaction between IoT technology and the mathematical tools used to evaluate the extracted data of those systems. Each chapter provides different tools and applications in order to present a broad list of data analytics and machine learning tools in multiple IoT applications. Additionally, this volume addresses the education transfer needed to incorporate these technologies into our society by examining new platforms for IoT in schools, new courses and concepts for universities and adult education on IoT and data science. Fills the gap between IoT, CPS, and mathematical modeling Numerous use cases that discuss how concepts are applied in different domains and applications Provides "best practices," "real developments", and "winning stories" to complement technical information Uniquely covers contents within the context of mathematical foundations of signal processing and machine learning in CPS and IoT

Complexity Challenges in Cyber Physical Systems

Essays Dedicated to Marilyn Wolf on the Occasion of Her 60th Birthday

Foundations, Principles and Applications

Modeling, Reliability Analysis and Applications

4th International Conference, DUXU 2015, Held as Part of HCI International 2015, Los Angeles, CA, USA, August 2-7, 2015, Proceedings, Part I

Complex Systems Design & Management

Using Modeling and Simulation (M&S) to Support Intelligence, Adaptation and Autonomy

The use of cyber-physical systems in recent computing, communication, and control methods to design and operate intelligent and autonomous systems using cutting-edge technologies has led to many advances. By studying emerging trends in these systems, programming techniques can be optimized and strengthened to create a higher level of effectiveness. Cyber-Physical Systems for Next-Generation Networks provides emerging research on using cyber-physical systems (CPS) as a method to control design and operation of intelligent systems through next-generation networks. While highlighting issues such as increasing CPS complexity due to components within physical and industrial systems, this publication explores information on real-time sensing, reasoning, and adaptation for cyber-physical systems while gaining an understanding of evolutionary computing for it. This book is a valuable resource for engineers, academicians, researchers, and graduate-level students seeking current research on CPS in cutting-edge technologies.

Cyber-Physical Systems: Foundations, Principles and Applications explores the core system science perspective needed to design and build complex cyber-physical systems. Using Systems Science's underlying theories, such as probability theory, decision theory, game theory, organizational sociology, behavioral economics, and cognitive psychology, the book addresses foundational issues central across CPS applications, including System Design -- How to design CPS to be safe, secure, and resilient in rapidly evolving environments, System Verification -- How to develop effective metrics and methods to verify and certify large and complex CPS, Real-Time Control and Adaptation -- How to achieve real-time dynamic control and behavior adaptation in a diverse environments, such as clouds and in network-challenged spaces, Manufacturing -- How to harness communication, computation, and control for developing new products, reducing product concepts to realizable designs, and producing integrated software-hardware systems at a pace far exceeding today's timeline. The book is part of the Intelligent Data-Centric Systems: Sensor-Collected Intelligence series edited by Fatos Xhafa, Technical University of Catalonia. Indexing: The books of this series are submitted to EI-Compendex and SCOPUS Includes in-depth coverage of the latest models and theories that unify perspectives, expressing the interacting dynamics of the computational and physical components of a system in a dynamic environment Focuses on new design, analysis, and verification tools that embody the scientific principles of CPS and incorporate measurement, dynamics, and control Covers applications in numerous sectors, including agriculture, energy, transportation, building design and automation, healthcare, and manufacturing

The three-volume set LNCS 9186, 9187, and 9188 constitutes the proceedings of the 4th International Conference on Design, User Experience, and Usability, DUXU 2015, held as part of the 17th International Conference on Human-Computer Interaction, HCII 2015, in Los Angeles, CA, USA, in August 2015, jointly with 13 other thematically similar conferences. The total of 1462 papers and 246 posters presented at the HCII 2015 conferences were carefully reviewed and selected from 4843 submissions. These papers address the latest research and development efforts and highlight the human aspects of design and use of computing systems. The papers accepted for presentation thoroughly cover the entire field of Human-Computer Interaction, addressing major advances in knowledge and effective use of computers in a variety of application areas. The total of 132 contributions included in the DUXU proceedings were carefully reviewed and selected for inclusion in this three-volume set. The 61 papers included in this volume are organized in topical sections on design thinking, user experience design and usability methods and tools, DUXU management and practice, emotional and persuasion design, and storytelling, narrative and fiction in DUXU.

The CIRP Encyclopedia covers the state-of-art of advanced technologies, methods and models for production, production engineering and logistics. While the technological and operational aspects are in the focus, economical aspects are addressed too. The entries for a wide variety of terms were reviewed by the CIRP-Community, representing the highest standards in research. Thus, the content is not only evaluated internationally on a high scientific level but also reflects very recent developments.

Foundations, Principles, and Applications

Principles of Cyber-Physical Systems

Machine Learning for the Internet of Things

Security of Cyber-Physical Systems

Resilience of Cyber-Physical Systems
Security in Cyber-Physical Systems
An Interdisciplinary Approach

Organic Computing has emerged as a challenging vision for future information processing systems. Its basis is the insight that we will increasingly be surrounded by and depend on large collections of autonomous systems, which are equipped with sensors and actuators, aware of their environment, communicating freely, and organising themselves in order to perform actions and services required by the users. These networks of intelligent systems surrounding us open fascinating ap-plication areas and at the same time bear the problem of their controllability. Hence, we have to construct such systems as robust, safe, flexible, and trustworthy as possible. In particular, a strong orientation towards human needs as opposed to a pure implementation of the tech-nologically possible seems absolutely central. The technical systems, which can achieve these goals will have to exhibit life-like or "organic" properties. "Organic Computing Systems" adapt dynamically to their current environmental conditions. In order to cope with unexpected or undesired events they are self-organising, self-configuring, self-optimising, self-healing, self-protecting, self-explaining, and context-aware, while offering complementary interfaces for higher-level directives with respect to the desired behaviour. First steps towards adaptive and self-organising computer systems are being undertaken. Adaptivity, reconfigurability, emergence of new properties, and self-organisation are hot top-ics in a variety of research groups worldwide. This book summarises the results of a 6-year priority research program (SPP) of the German Research Foundation (DFG) addressing these fundamental challenges in the design of Organic Computing systems. It presents and discusses the theoretical foundations of Organic Computing, basic methods and tools, learning techniques used in this context, architectural patterns and many applications. The final outlook shows that in the mean-time Organic Computing ideas have spawned a variety of promising new projects.

This book is open access under a CC BY 4.0 license. Technical Systems-of-Systems (SoS) – in the form of networked, independent constituent computing systems temporarily collaborating to achieve a well-defined objective – form the backbone of most of today's infrastructure. The energy grid, most transportation systems, the global banking industry, the water-supply system, the military equipment, many embedded systems, and a great number more, strongly depend on systems-of-systems. The correct operation and continuous availability of these underlying systems-of-systems are fundamental for the functioning of our modern society. The 8 papers presented in this book document the main insights on Cyber-Physical System of Systems (CPSoSs) that were gained during the work in the FP7-610535 European Research Project AMADEOS (acronym for Architecture for Multi-criticality Agile Dependable Evolutionary Open System-of-Systems). It is the objective of this book to present, in a single consistent body, the foundational concepts and their relationships. These form a conceptual basis for the description and understanding of SoSs and go deeper in what we consider the characterizing and distinguishing elements of SoSs: time, emergence, evolution and dynamicity.

This Festschrift is in honor of Marilyn Wolf, on the occasion of her 60th birthday. Prof. Wolf is a renowned researcher and educator in Electrical and Computer Engineering, who has made pioneering contributions in all of the major areas in Embedded, Cyber-Physical, and Internet of Things (IoT) Systems. This book provides a timely collection of contributions that cover important topics related to Smart Cameras, Hardware/Software Co-Design, and Multimedia applications. Embedded systems are everywhere: cyber-physical systems enable monitoring and control of complex physical processes with computers; and IoT technology is of increasing relevance in major application areas, including factory automation, and smart cities. Smart cameras and multimedia technologies introduce novel opportunities and challenges in embedded, cyber-physical and IoT applications. Advanced hardware/software co-design methodologies provide valuable concepts and tools for addressing these challenges. The diverse topics of the chapters in this Festschrift help to reflect the great breadth and depth of Marilyn Wolf's contributions in research and education. The chapters have been written by some of Marilyn's closest collaborators and colleagues.

Overview of security and privacy in cyber-physical systems -- Network security and privacy for cyber-physical systems -- Tutorial on information theoretic metrics quantifying privacy in cyber-physical systems -- Cyber-physical systems and national security concerns -- Legal considerations of cyber-physical systems and the Internet of Things -- Key management -- Secure registration and remote attestation of IoT devices joining the cloud : the Stack4Things case of study -- Context awareness for adaptive access control management in IoT environments -- Data privacy issues in distributed security monitoring system -- Privacy protection for cloud-based robotic networks -- Network coding technique : security challenges and applications -- Lightweight crypto and security -- Cyber-physical vulnerabilities of wireless sensor networks in smart cities -- Towards detecting data integrity attacks in smart grid -- Survey on data security and privacy in wireless sensor systems for health -- Security of smart buildings -- The internet of postal things : making the postal infrastructure smarter -- Security and privacy issues in the internet of cows -- Admission control based load protection in the smart grid

Cyber Physical Systems
Guide to Computing Fundamentals in Cyber-Physical Systems
Artificial Intelligence Paradigms for Smart Cyber-Physical Systems
Cyber-Physical Systems in the Built Environment
Cognitive Engineering for Next Generation Computing
Packets with Deadlines
Integrated Computing and Engineering Design

Offers a one-stop reference on the application of advanced modeling and simulation (M&S) in cyber physical systems (CPS) engineering This book provides the state-of-the-art in methods and technologies that aim to elaborate on the modeling and simulation support to cyber physical systems (CPS) engineering across many sectors such as healthcare, smart grid, or smart home. It presents a compilation of simulation-based methods, technologies, and approaches that encourage the reader to incorporate simulation technologies in their CPS engineering endeavors, supporting management of complexity challenges in such endeavors. Complexity Challenges in Cyber Physical Systems: Using Modeling and Simulation (M&S) to Support Intelligence, Adaptation and Autonomy is laid out in four sections. The first section provides an overview of complexities associated with the application of M&S to CPS Engineering. It discusses M&S in the context of autonomous systems involvement within the North Atlantic Treaty Organization (NATO). The second section provides a more detailed description of the challenges in applying modeling to the operation, risk and design of holistic CPS. The third section delves in details of simulation support to CPS engineering followed by the engineering practices to incorporate the cyber element to build resilient CPS sociotechnical systems. Finally, the fourth section presents a research agenda for handling complexity in application of M&S for CPS engineering. In addition, this text: Introduces a unifying framework for hierarchical co-simulations of cyber physical systems (CPS) Provides understanding of the cycle of macro-level behavior dynamically arising from spaciotemporal interactions between parts at the micro-level Describes a simulation platform for characterizing resilience of CPS Complexity Challenges in Cyber Physical Systems has been written for researchers, practitioners, lecturers, and graduate students in computer engineering who want to learn all about M&S support to addressing complexity in CPS and its applications in today's and tomorrow's world.

Cyber-physical systems (CPS) have emerged as a unifying name for systems where cyber parts (i.e., the computing and communication parts) and physical parts are tightly integrated, both in design and during operation. Such systems use computations and communication deeply embedded in and interacting with human physical processes as well as augmenting existing and adding new capabilities. As such, CPS is an integration of computation, networking, and physical processes. Embedded computers and networks monitor and control the physical processes, with feedback loops where physical processes affect computations and vice versa. The economic and societal potential of such systems is vastly greater than what has been realized, and major investments are being made worldwide to develop the technology.

Artificial Intelligence Paradigms for Smart Cyber-Physical Systems focuses on the recent advances in Artificial intelligence-based approaches towards affecting secure cyber-physical systems. This book presents investigations on state-of-the-art research issues, applications, and achievements in the field of computational intelligence paradigms for CPS. Covering topics that include autonomous systems, access control, machine learning, and intrusion detection and prevention systems, this book is ideally designed for engineers, industry professionals, practitioners, scientists, managers, students, academicians, and researchers seeking current research on artificial intelligence and cyber-physical systems.

Until the late 1980s, information processing was associated with large mainframe computers and huge tape drives. During the 1990s, this trend shifted toward information processing with personal computers, or PCs. The trend toward miniaturization continues and in the future the majority of information processing systems will be small mobile computers, many of which will be embedded into larger products and interfaced to the physical environment. Hence, these kinds of systems are called embedded systems. Embedded systems together with their physical environment are called cyber-physical systems. Examples include systems such as transportation and fabrication equipment. It is expected that the total market volume of embedded systems will be significantly larger than that of traditional information processing systems such as PCs and mainframes. Embedded systems share a number of common characteristics. For example, they must be dependable, efficient, meet real-time constraints and require customized user interfaces (instead of generic keyboard and mouse interfaces). Therefore, it makes sense to consider common principles of embedded system design. Embedded System Design starts with an introduction into the area and a survey of specification models and languages for embedded and cyber-physical systems. It provides a brief overview of hardware devices used for such systems and presents the essentials of system software for embedded systems, like real-time operating systems. The book also discusses evaluation and validation techniques for embedded systems. Furthermore, the book presents an overview of techniques for mapping applications to execution platforms. Due to the importance of resource efficiency, the book also contains a selected set of optimization techniques for embedded systems, including special compilation techniques. The book closes with a brief survey on testing. Embedded System Design can be used as a text book for courses on embedded systems and as a source which provides pointers to relevant material in the area for PhD students and teachers. It assumes a basic knowledge of information processing hardware and software. Courseware related to this book is available at http://ls12-www.cs.tu-dortmund.de/~marwedel.

This book presents a comprehensive overview of security issues in Cyber Physical Systems (CPSs), by analyzing the issues and vulnerabilities in CPSs and examining state of the art security measures. Furthermore, this book proposes various defense strategies including intelligent attack and anomaly detection algorithms. Today's technology is continually evolving towards interconnectivity among devices. This interconnectivity phenomenon is often referred to as Internet of Things (IoT). IoT technology is used to enhance the performance of systems in many applications. This integration of physical and cyber components within a system is associated with many benefits; these systems are often referred to as Cyber Physical Systems (CPSs). The CPSs and IoT technologies are used in many industries critical to our daily lives. CPSs have the potential to reduce costs, enhance mobility and independence of patients, and reach the body using minimally invasive techniques. Although this interconnectivity of devices can pave the road for immense advancement in technology and automation, the integration of network components into any system increases its vulnerability to cyber threats. Using internet networks to connect devices together creates access points for adversaries. Considering the critical applications of some of these devices, adversaries have the potential of exploiting sensitive data and interrupting the functionality of critical infrastructure. Practitioners working in system security, cyber security & security and privacy will find this book valuable as a reference. Researchers and scientists concentrating on computer systems, large-scale complex systems, and artificial intelligence will also find this book useful as a reference.

A Cyber-Physical Systems Approach
Challenges, Opportunities, and Dimensions of Cyber-Physical Systems
Design, User Experience, and Usability: Design Discourse
A Framework for Real-Time Wireless Networks
Architectures, Protocols and Applications
Cyber-Physical Distributed Systems
Embedded Systems Foundations of Cyber-Physical Systems

CYBER-PHYSICAL DISTRIBUTED SYSTEMS Gather detailed knowledge and insights into cyber-physical systems behaviors from a cutting-edge reference written by leading voices in the field In Cyber-Physical Distributed Systems: Modeling, Reliability Analysis and Applications, distinguished researchers and authors Drs. Huadong Mo, Giovanni Sansavini, and Min Xie deliver a detailed exploration of the modeling and reliability analysis of cyber physical systems through applications in infrastructure and energy and power systems. The book focuses on the integrated modeling of systems that bring together physical and cyber elements and analyzing their stochastic behaviors and reliability with a view to controlling and managing them. The book offers a comprehensive treatment on the aging process and corresponding online maintenance, network degradation, and cyber-attacks occurring in cyber-physical systems. The authors include many illustrative examples and case studies based on real-world systems and offer readers a rich set of references for further research and study. Cyber-Physical Distributed Systems covers recent advances in combinatorial models and algorithms for cyber-physical systems modeling and analysis. The book also includes: A general introduction to traditional physical/cyber systems, and the challenges, research trends, and opportunities for real cyber-physical systems applications that general readers will find interesting and useful Discussions of general modeling, assessment, verification, and optimization of industrial cyber-physical systems Explorations of stability analysis and enhancement of cyber-physical systems, including the integration of physical systems and open communication networks A detailed treatment of a system-of-systems framework for the reliability analysis and optimal maintenance of distributed systems with aging components Perfect for undergraduate and graduate students in computer science, electrical engineering, cyber security, industrial and system engineering departments, Cyber-Physical Distributed Systems will also earn a place on the bookshelves of students taking courses related to reliability, risk and control engineering from a system perspective. Reliability, safety and industrial control professionals will also benefit greatly from this book.

Cyber-physical systems play a crucial role in connecting aspects of online life to physical life. By studying emerging trends in these systems, programming techniques can be optimized and strengthened to create a higher level of effectiveness. Solutions for Cyber-Physical Systems Ubiquity is a critical reference source that discusses the issues and challenges facing the implementation, usage, and challenges of cyber-physical systems. Highlighting relevant topics such as the Internet of Things, smart-card security, multi-core environments, and wireless sensor nodes, this scholarly publication is ideal for engineers, academicians, computer science students, and researchers that would like to stay abreast of current methodologies and trends involving cyber-physical system progression.

This book presents an in-depth review of the state of the art of cyber-physical systems (CPS) and their applications. Relevant case studies are also provided, to help the reader to master the interdisciplinary material. Features: includes self-test exercises in each chapter, together with a glossary; offers a variety of teaching support materials at an associated website, including a comprehensive set of slides and lecture videos; presents a brief overview of the study of systems, and embedded computing systems, before defining CPS; introduces the concepts of the Internet of Things, and ubiquitous (or pervasive) computing; reviews the design challenges of CPS, and their impact on systems and software engineering; describes the ideas behind Industry 4.0 and the revolutions in digital manufacturing, including smart and agile manufacturing, as well as cybersecurity in manufacturing; considers the social impact of the changes in skills required by the globalized, digital work environment of the future.

"Optimal Observation for Cyber-physical Systems" addresses the challenge, fundamental to the design of wireless sensor networks (WSNs), presented by the obligatory trade-off between precise estimates and system constraints. A unified theoretical framework, based on the well-established theory of optimal experimental design and providing consistent solutions to problems hitherto requiring a variety of approaches, is put forward to solve a large class of optimal observation problems. The Fisher information matrix plays a key role in this framework and makes it feasible to provide analytical solutions to some complex and important questions which could not be answered in the past. Readers with an applied background in WSN implementation will find all the understanding of the key theory of optimal experimental design they need within this book. The use of multiple examples to illustrate the theoretical parts of the book brings the subject into sharper focus than would an abstract theoretical disquisition.
Concepts, Design Methods, and Applications
A Practical Introduction to Human-in-the-Loop Cyber-Physical Systems

Industrial Internet of Things and Cyber-Physical Systems: Transforming the Conventional to Digital
Advances, Challenges and Opportunities
Principles of Modeling
Solutions for Cyber-Physical Systems Ubiquity

This book addresses the latest approaches to holistic Cyber-Physical System (CPS) resilience in real-world industrial applications. Ensuring the resilience of CPSs requires cross-discipline analysis and involves many challenges and open issues, including how to address evolving cyber-security threats. The book describes emerging paradigms and techniques from two main viewpoints: CPSs' exposure to new threats, and CPSs' potential to counteract them. Further, the chapters address topics ranging from risk modeling to threat management and mitigation. The book offers a clearly structured, highly accessible resource for a diverse readership, including graduate students, researchers and industry practitioners who are interested in evaluating and ensuring the resilience of CPSs in both the development and assessment stages.

In this concise yet comprehensive Open Access textbook, future inventors are introduced to the key concepts of Cyber-Physical Systems (CPS). Using modeling as a way to develop deeper understanding of the computational and physical components of these systems, one can express new designs in a way that facilitates their simulation, visualization, and analysis. Concepts are introduced in a cross-disciplinary way. Leveraging hybrid (continuous/discrete) systems as a unifying framework and Acumen as a modeling environment, the book bridges the conceptual gap in modeling skills needed for physical systems on the one hand and computational systems on the other. In doing so, the book gives the reader the modeling and design skills they need to build smart, IT-enabled products. Starting with a look at various examples and characteristics of Cyber-Physical Systems, the book progresses to explain how the area brings together several previously distinct ones such as Embedded Systems, Control Theory, and Mechatronics. Featuring a simulation-based project that focuses on a robotics problem (how to design a robot that can play ping-pong) as a useful example of a CPS domain, Cyber-Physical Systems: A Model-Based Approach demonstrates the intimate coupling between cyber and physical components, and how designing robots reveals several non-trivial control problems, significant embedded and real-time computation requirements, and a need to consider issues of communication and preconceptions.

This Festschrift is published in honor of Edward A. Lee, Robert S. Pepper Distinguished Professor Emeritus and Professor in the Graduate School in the Department of Electrical Engineering and Computer Sciences at the University of California, Berkeley, USA, on the occasion of his 60th birthday. The title of this Festschrift is "Principles of Modeling" because Edward A. Lee has long been devoted to research that centers on the role of models in science and engineering. He has been examining the use and limitations of models, their formal properties, their role in cognition and interplay with creativity, and their ability to represent reality and physics. The Festschrift contains 29 papers that feature the broad range of Edward A. Lee's research topics: such as embedded systems; real-time computing; computer architecture; modeling and simulation; and systems design.

The first book focusing on one of the hottest new topics in Internet of Things systems research and development Studies estimate that by 2020 we will have a vast Internet of Things (IoT) network comprising 26 billion connected devices, including everything from light bulbs to refrigerators, coffee makers to cars. From the beginning, the concept of cyber-physical systems (CPS), or the sensing and control of physical phenomena through networks of devices that work together to achieve common goals, has been implicit in the IoT enterprise. This book focuses on the increasingly hot topic of Human-in-the-loop Cyber-Physical Systems (HiTLCPS)—CPSs that incorporate human responses in IoT equation. Why have we not yet integrated the human component into CPSs? What are the major challenges to achieving HiTLCPS? How can we take advantage of ubiquitous sensing platforms, such as smartphones and personal devices to achieve that goal? While mature HiTLCPS designs have yet to be achieved, or a general consensus reached on underlying HiTLCPS requirements, principles, and theory, researchers and developers worldwide are on the cusp of realizing them. With contributions from researchers at the cutting edge of HiTLCPS R&D, this book addresses many of these questions from the theoretical and practical points of view. An essential primer on a rapidly emerging Internet-of-Things concept, focusing on human-centric applications Discusses new topics which, until now, have only been available in research papers scattered throughout the world literature Addressed fundamental concepts in depth while providing practical insights into the development of complete HiTLCPS systems Includes a companion website containing full source-code for all of the applications described This book is an indispensable resource for researchers and app developers eager to explore HiTL concepts and include them into their designs. It is also an excellent primer for advanced undergraduates and graduate students studying IoT, CPS, and HiTLCPS.

Smart Cyber Physical Systems
Embedded System Design
A Practical Analytical Approach
Security and Privacy in Cyber-Physical Systems
Transforming the Conventional to Digital
CIRP Encyclopedia of Production Engineering
Big Data and Internet of Things: A Roadmap for Smart Environments

Industry 4.0 refers to fourth generation of industrial activity characterized by smart systems and internet-based solutions. This book describes the fourth revolution based on instrumented, interconnected and intelligent assets. The different book chapters provide a perspective on technologies and methodologies developed and deployed leading to this concept. With an aim to increase performance, productivity and flexibility, major application area of maintenance through smart system has been discussed in detail. Applicability of 4.0 in transportation, energy and infrastructure is explored, with effects on technology, organisation and operations from a systems perspective.

This book introduces researchers and practitioners to Cyber-Physical Systems (CPS) and its applications in the built environment. It begins with a fundamental introduction to CPS technology and associated concepts.It then presents numerous examples of applications from managing construction projects to smart transportation systems and smart cities. It concludes with a discussion of future directions for CPS deployment in the construction, operation and maintenance of constructed facilities. Featuring internationally recognized experts as contributors, Cyber-Physical Systems in the Built Environment, is an ideal resource for engineers, construction managers, architects, facilities managers, and planners working on a range of building and civil infrastructure projects.

Recent advances in science and engineering have led to the proliferation of cyber-physical systems. Now viewed as a pivotal area of research, the application of CPS has expanded into several new and innovative areas. Challenges, Opportunities, and Dimensions of Cyber-Physical Systems explores current trends and enhancements of CPS, highlighting the critical need for further research and advancement in this field. Focusing on architectural fundamentals, interdisciplinary functions, and futuristic implications, this book is an imperative reference source for scholars, engineers, and students in the scientific community interested in the current and future advances in CPS.

An introduction to the engineering principles of embedded systems, with a focus on modeling, design, and analysis of cyber-physical systems. The most visible use of computers and software is processing information for human consumption. The vast majority of computers in use, however, are much less visible. They run the engine, brakes, seatbelts, airbag, and audio system in your car. They digitally encode your voice and construct a radio signal to send it from your cell phone to a base station. They command robots on a factory floor, power generation in a power plant, processes in a chemical plant, and traffic lights in a city. These less visible computers are called embedded systems, and the software they run is called embedded software. The principal challenges in designing and analyzing embedded systems stem from their interaction with physical processes. This book takes a cyber-physical approach to embedded systems, introducing the engineering concepts underlying embedded systems as a technology and as a subject of study. The focus is on modeling, design, and analysis of cyber-physical systems, which integrate computation, networking, and physical processes. The second edition offers two new chapters, several new exercises, and other improvements. The book can be used as a textbook at the advanced undergraduate or introductory graduate level and as a professional reference for practicing engineers and computer scientists. Readers should have some familiarity with machine structures, computer programming, basic discrete mathematics and algorithms, and signals and systems.

Introduction to Embedded Systems
Recent Advances in Security, Privacy, and Trust for Internet of Things (IoT) and Cyber-Physical Systems (CPS)
Essays Dedicated to Edward A. Lee on the Occasion of His 60th Birthday
Cyber-Physical Systems: A Model-Based Approach
A Fisher-information-matrix-based Approach
Handbook of Industry 4.0 and SMART Systems
Vulnerability and Impact

With the explosive increase in the number of mobile devices and applications, it is anticipated that wireless traffic will increase exponentially in the coming years. Moreover, future wireless networks all carry a wide variety of flows, such as video streaming, online gaming, and VoIP, which have various quality of service (QoS) requirements. Therefore, a new mechanism that can provide satisfactory performance to the complete variety of all kinds of flows, in a coherent and unified framework, is needed. In this book, we introduce a framework for real-time wireless networks. This consists of a model that jointly addresses several practical concerns for real-time wireless networks, including per-packet delay bounds, throughput requirements, and heterogeneity of wireless channels. We detail how this framework can be employed to address a wide range of problems, including admission control, packet scheduling, and utility maximization. Table of Contents: Preface / Introduction / A Study of the Base Case / Admission Control / Scheduling Policies / Utility Maximization without Rate Adaptation / Utility Maximization with Rate Adaptation / Systems with Both Real-Time Flows and Non-Real-Time Flows / Broadcasting and Network Coding / Bibliography / Authors' Biographies

This book contains all refereed papers that were accepted to the third edition of the « Complex Systems Design & Management » (CSD&M 2012) international conference that took place in Paris (France) from December 12-14, 2012. (Website: http://www.csdm2012.csdm.fr) These proceedings cover the most recent trends in the emerging field of complex systems sciences & practices from an industrial and academic perspective, including the main industrial domains (transport, defense & security, electronics, energy & environment, e-services), scientific & technical topics (systems fundamentals, systems architecture& engineering, systems metrics & quality, systemic tools) and system types (transportation systems, embedded systems, software & information systems, systems of systems, artificial ecosystems). The CSD&M 2012 conference is organized under the guidance of the CESAMES non-profit organization (http://www.cesames.net).

This book presents current progress on challenges related to Big Data management by focusing on the particular challenges associated with context-aware data-intensive applications and services. The book is a state-of-the-art reference discussing progress made, as well as prompting future directions on the theories, practices, standards and strategies that are related to the emerging computational technologies and their association with supporting the Internet of Things advanced functioning for organizational settings including both business and e-science. Apart from inter-operable and inter-cooperative aspects, the book deals with a notable opportunity namely, the current trend in which a collectively shared and generated content is emerged from Internet end-users. Specifically, the book presents advances on managing and exploiting the vast size of data generated from within the smart environment (i.e. smart cities) towards an integrated, collective intelligence approach. The book also presents methods and practices to improve large storage infrastructures in response to increasing demands of the data intensive applications. The book contains 19 self-contained chapters that were very carefully selected based on peer review by at least two expert and independent reviewers and is organized into the three sections reflecting the general themes of interest to the IoT and Big Data communities: Section I: Foundations and Principles Section II: Advanced Models and Architectures Section III: Advanced Applications and Future Trends The book is intended for researchers interested in joining interdisciplinary and transdisciplinary works in the areas of Smart Environments, Internet of Things and various computational technologies for the purpose of an integrated collective computational intelligence approach into the Big Data era.

This book presents new findings in industrial cyber-physical system design and control for various domains, as well as their social and economic impacts on society. Industry 4.0 requires new approaches in the context of secure connections, control, and maintenance of cyber-physical systems as well as enhancing their interaction with humans. The book focuses on open issues of cyber-physical system control and its usage, discussing implemented breakthrough systems, models, programs, and methods that could be used in industrial processes for the control, condition assessment, diagnostics, prognostication, and proactive maintenance of cyber-physical systems. Further, it addresses the topic of ensuring the cybersecurity of industrial cyber-physical systems and proposes new, reliable solutions. The authors also examine the impact of university courses on the performance of industrial complexes, and the organization of education for the development of cyber-physical systems. The book is intended for practitioners, enterprise representatives, scientists, students, and Ph.D. and master's students conducting research in the area of cyber-physical system development and implementation in various domains.

Cyber Physical System A Complete Guide - 2020 Edition