

# Communication Networks For Smart Grids Making Smart Grid Real Computer Communications And Networks

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## ZACHARY JOSHUA

Familientätigkeit als Baustein zur Weiterqualifikation in Beruf und Gesellschaft CRC Press

As industries are rapidly being digitalized and information is being more heavily stored and transmitted online, the security of information has become a top priority in securing the use of online networks as a safe and effective platform. With the vast and diverse potential of artificial intelligence (AI) applications, it has become easier than ever to identify cyber vulnerabilities, potential threats, and the identification of solutions to these unique problems. The latest tools and technologies for AI applications have untapped potential that conventional systems and human security systems cannot meet, leading AI to be a frontrunner in the fight against malware, cyber-attacks, and various security issues. However, even with the tremendous progress AI has made within the sphere of security, it's important to understand the impacts, implications, and critical issues and challenges of AI applications along with the many benefits and emerging trends in this essential field of security-based research. Research Anthology on Artificial Intelligence Applications in Security seeks to address the fundamental advancements and technologies being used in AI applications for the security of digital data and information. The included chapters cover a wide range of topics related to AI in security stemming from the development and design of these applications, the latest tools and technologies, as well as the utilization of AI and what challenges and impacts have been discovered along the way. This resource work is a critical exploration of the latest research on security and an overview of how AI has impacted the field and will continue to advance as an essential tool for security, safety, and privacy online. This book is ideally intended for cyber security analysts, computer engineers, IT specialists, practitioners, stakeholders, researchers, academicians, and students interested in AI applications in the realm of security research.

**Power Line Communication Systems for Smart Grids** Springer

Backscattering and RF Sensing for Future Wireless Communication Discover what lies ahead in wireless communication networks with this insightful and forward-thinking book written by experts in the field Backscattering and RF Sensing for Future Wireless Communication delivers a concise and insightful picture of emerging and future trends in increasing the efficiency and performance of wireless communication networks. The book shows how the immense challenge of frequency saturation could be met via the deployment of intelligent planar electromagnetic structures. It provides an in-depth coverage of the fundamental physics behind these structures and assesses the enhancement of the performance of a communication network in challenging environments, like densely populated urban centers. The distinguished editors have included resources from a variety of leading voices in the field who discuss topics such as the engineering of metasurfaces at a large scale, the electromagnetic analysis of planar metasurfaces, and low-cost and reliable backscatter communication. All of the included works focus on the facilitation of the development of intelligent systems designed to enhance communication network performance. Readers will also benefit from the inclusion of: A thorough introduction to the evolution of wireless communication networks over the last thirty years, including the imminent saturation of the frequency spectrum An exploration of state-of-the-art techniques that next-generation wireless networks will likely incorporate, including software-controlled frameworks involving artificial intelligence An examination of the scattering of electromagnetic waves by metasurfaces, including how wave propagation differs from traditional bulk materials A treatment of the evolution of artificial intelligence in wireless communications Perfect for researchers in wireless communications, electromagnetics, and urban planning, Backscattering and RF Sensing for Future Wireless Communication will also earn a place in the libraries of government policy makers, technologists, and telecom industry stakeholders who wish to get a head start on understanding the technologies that will enable tomorrow's wireless communications.

**Wireless Communications Networks for the Smart Grid** John Wiley & Sons

Smart Grid: Networking, Data Management, and Business Models delivers a comprehensive overview of smart grid communications, discussing the latest advances in the technology, the related cyber security issues, and the best ways to manage user demand and pricing. Comprised of 16 chapters authored by world-renowned experts, this book: Considers the use of cognitive radio and software-defined networking in the smart grid Explores the space of attacks in the energy management process, the need for a smart grid simulator, and the management issues that arise around smart cities Describes a real-time pricing scheme that aims to reduce the peak-to-average load ratio Explains how to realize low-carbon economies and the green smart grid through the pervasive management of demand Presents cutting-edge research on microgrids, electric vehicles, and energy trading in the smart grid Thus, Smart Grid: Networking, Data Management, and Business Models provides a valuable reference for utility operators, telecom operators, communications engineers, power engineers, electric vehicle original equipment manufacturers (OEMs), electric vehicle service providers, university professors, researchers, and students.

**Smart Grids and Their Communication Systems** Springer Nature Discover the foundations and main applications of telecommunications to smart grids In Smart Grid Telecommunications, renowned researchers and authors Drs. Alberto Sendin, Javier Matanza, and Ramon Ferrús deliver a focused treatment of the fundamentals and main applications of telecommunication technologies in smart grids. Aimed at engineers and professionals who work with power systems, the book explains what smart grids are and where telecommunications are needed to solve their various challenges. Power engineers will benefit from explanations of the main concepts of telecommunications and how they are applied to the different domains of a smart grid. Telecommunication engineers will gain an understanding of smart grid applications and services, and will learn from the explanations of how telecommunications need to be adapted to work with them. The authors aim to offer a simplified vision of smart grids with rigorous coverage of the latest advances in the field, while avoiding some of the technical complexities that can hinder understanding in this area. The book offers: Discussions of why telecommunications are necessary in smart grids and the various telecommunication services and systems relevant for them An exploration of foundational telecommunication concepts ranging from system-level aspects, such as network topologies, multi-layer architectures and protocol stacks, to communications channel transmission- and reception-level aspects covering modulations, bandwidth, multiple access, signal to noise ratio, interference, transmission media impairments, and more Examinations of telecommunication-related smart grids services and systems, including SCADA, protection and teleprotection, smart metering, substation and distribution automation, synchrophasors, Distributed Energy Resources, electric vehicles, microgrids, etc. A treatment of wireline and wireless telecommunication technologies, like DWDM, Ethernet, IP, MPLS, PONS, PLC, BPL, 3GPP cellular 4G and 5G technologies, Zigbee, Wi-SUN, LoRaWAN, Sigfox, etc., addressing their architectures, characteristics, and limitations Ideal for engineers working in power systems or telecommunications as network architects, operations managers, planners, or in regulation-related activities, Smart Grid Telecommunications is also an invaluable resource for telecommunication network and Smart Grid architects.

**Research Anthology on Artificial Intelligence Applications in Security** Academic Press

Presenting the work of prominent researchers working on smart grids and related fields around the world, Security and Privacy in Smart Grids identifies state-of-the-art approaches and novel technologies for smart grid communication and security. It investigates the fundamental aspects and applications of smart grid security and privacy and reports on the latest advances in the range of related areas—making it an ideal reference for students, researchers, and engineers in these fields. The book explains grid security development and deployment and introduces novel approaches for securing today's smart grids. Supplying an overview of recommendations for a technical smart grid infrastructure, the book describes how to minimize power consumption and utility expenditure in data centers. It also: Details the challenges of cybersecurity for smart grid communication infrastructures Covers the regulations and standards relevant to smart grid security Explains how to conduct

vulnerability assessments for substation automation systems Considers smart grid automation, SCADA system security, and smart grid security in the last mile The book's chapters work together to provide you with a framework for implementing effective security through this growing system. Numerous figures, illustrations, graphs, and charts are included to aid in comprehension. With coverage that includes direct attacks, smart meters, and attacks via networks, this versatile reference presents actionable suggestions you can put to use immediately to prevent such attacks.

**Research Anthology on Blockchain Technology in Business, Healthcare, Education, and Government** CRC Press

Smart Power Distribution Systems: Control, Communication, and Optimization explains how diverse technologies work to build and maintain smart grids around the globe. Yang, Yang and Li present the most recent advances in the control, communication and optimization of smart grids and provide unique insight into power system control, sensing and communication, and optimization technologies. The book covers control challenges for renewable energy and smart grids, communication in smart power systems, and optimization challenges in smart power system operations. Each area discussed focuses on the scientific innovations relating to the approaches, methods and algorithmic solutions presented. Readers will develop sound knowledge and gain insights into the integration of renewable energy generation in smart power distribution systems. Presents the latest technological advances in electric power distribution networks, with a particular focus on methodologies, approaches and algorithms Provides insights into the most recent research and developments from expert contributors from across the world Presents a clear and methodical structure that guides the reader through discussion and analysis, providing unique insights and sound knowledge along the way

**Clouds, Communications, Open Source, and Automation** CRC Press

Nowadays, Smart Grid has become an established synonym for modern electric power systems. Electric networks are fed less and less by large, centrally planned fossil and nuclear power plants but more and more by millions of smaller, renewable and mostly weather-dependent generation units. A secure energy supply in such a sustainable and ecological system requires a completely different approach for planning, equipping and operating the electric power systems of the future, especially by using flexibility provisions of the network users according to the Smart Grid concept. The book brings together common themes beginning with Smart Grids and the characteristics of power plants based on renewable energy with highly efficient generation principles and storage capabilities. It covers the advanced technologies applied today in the transmission and distribution networks and innovative solutions for maintaining today's high power quality under the challenging conditions of large-scale shares of volatile renewable energy sources in the annual energy balance. Besides considering the new primary and secondary technology solutions and control facilities for the transmission and distribution networks, prospective market conditions allowing network operators and the network users to gain benefits are also discussed. The growing role of information and communication technologies is investigated. The importance of new standards is underlined and the current international efforts in developing a consistent set of standards are updated in the second edition and described in detail. The updated presentation of international experiences to apply novel Smart Grid solutions to the practice of network operation concludes this book.

**Network, Control and Security** John Wiley & Sons

Appropriate for researchers, practitioners, and students alike, Communication and Networking in Smart Grids presents state-of-the-art approaches and novel technologies for communication networks in smart grids. It explains how contemporary grid networks are developed and deployed and presents a collection of cutting-edge advances to help improve current practice. Prominent researchers working on smart grids and in related fields around the world explain the fundamental aspects and applications of smart grids. Describing the role that communication and networking will play in future smart grids, they examine power delivery and the complete range of features and services available through smart grids. The book is divided into two parts: Smart Grids in General and Communications and Networks in Smart Grids. Its comprehensive coverage includes: Management of locally generated powers in micro grids Multi-

perspective service management in virtual power plants  
 Distributed algorithms for demand management and grid stability in smart grids  
 Electric distribution grid optimizations for plug-in electric vehicles  
 Communication technologies, networks, and strategies for practical smart grid deployments—from substations to meters  
 Ontology-based resource description and discovery framework for low Carbon grid networks  
 QoS in networking for smart grids  
 Outlining an optimum method for the design of distributed electric power supply and communication networks, the book reports on key ICT system engineering trends for regional energy marketplaces supporting electric mobility. It considers the spectrum of related topics in communication, IT, and security to provide you with the understanding needed to participate in the development, design, and implementation of future smart grid communications and networks.

**Communication-Enabled Intelligence for the Electric Power Grid** Academic Press

Efficient transmission and distribution of electricity is a fundamental requirement for sustainable development and prosperity. The world is facing great challenges regarding the reliable grid integration of renewable energy sources in the 21st century. The electric power systems of the future require fundamental innovations and enhancements to meet these challenges. The European Union's "Smart Grid" vision provides a first overview of the appropriate deep-paradigm changes in the transmission, distribution and supply of electricity. The book brings together common themes beginning with Smart Grids and the characteristics of new power plants based on renewable energy and/or highly efficient generation principles. It covers the advanced technologies applied today in the transmission and distribution networks and innovative solutions for maintaining today's high power quality under the challenging conditions of large-scale shares of volatile renewable energy sources in the annual energy balance. Besides considering the new primary and secondary technology solutions and control facilities for the transmission and distribution networks, prospective market conditions allowing network operators and the network users to gain benefits are also discussed. The growing role of information and communication technologies is investigated. The importance of new standards is underlined and the current international efforts in developing a consistent set of standards are described in detail. The presentation of international experiences to apply novel Smart Grid solutions to the practice of network operation concludes this book. The authors of the book worked for many years to develop Smart Grid solutions within national and international projects and to introduce them in the practice of network operations.

**Enabling Secure and Privacy Preserving Communications in Smart Grids** Springer Science & Business Media

This second edition of Power Line Communications will show some adjustments in content including new material on PLC for home and industry, PLC for multimedia, PLC for smart grid and PLC for vehicles. Additional chapters include coverage of Channel Characterization, Electromagnetic Compatibility, Coupling, and Digital Transmission Techniques. This book will provide the reader with a wide coverage of the major developments within the field. With contributions from some of the most active researchers on PLC, the book brings together a wealth of international experts on specific PLC topics.

**Communication Networks and Services** Academic Press

Smart grids can be described as a new generation of smart power networks that integrate actions coming from all connected end-users. This infrastructure provides bidirectional communications between end-users and the grid operator, and therefore extends the attack surface against the power system. However, one point that has been constantly overlooked and has not received the attention it deserves concerns the interdependencies and communications between all the assets that make up the new power grids. These interdependencies in communications are a fundamental pillar, as they represent the means by which all devices communicate within the smart grid network. Information transmitted through these intercommunications contains not only customer and consumption data; but also status checks, instructions to execute, orders for devices to redirect power flow, etc. Therefore, their protection is essential to protect the privacy of the customers and prevent attacks which could cause blackouts, power overloads, device malfunctions, data tampering, or even catastrophic cascading effects that could bring down the power grid itself in more than one country. For this purpose, this study focuses on the evaluation of these interdependencies, and their architectures and connections in order to determine their importance, threats, risks, mitigation factors and possible security measures to implement. To obtain this information, experts in the

fields and areas related directly with smart grids were contacted to gather their know-how and expertise.

**Technology and Applications** Springer

This brief presents a comprehensive review of the network architecture and communication technologies of the smart grid communication network (SGCN). It then studies the strengths, weaknesses and applications of two promising wireless mesh routing protocols that could be used to implement the SGCN. Packet transmission reliability, latency and robustness of these two protocols are evaluated and compared by simulations in various practical SGCN scenarios. Finally, technical challenges and open research opportunities of the SGCN are addressed. Wireless Communications Networks for Smart Grid provides communication network architects and engineers with valuable proven suggestions to successfully implement the SGCN. Advanced-level students studying computer science or electrical engineering will also find the content helpful.

**Control, Communication, and Optimization** John Wiley & Sons

Electric power systems worldwide face radical transformation with the need to decarbonise electricity supply, replace ageing assets and harness new information and communication technologies (ICT). The Smart Grid uses advanced ICT to control next generation power systems reliably and efficiently. This authoritative guide demonstrates the importance of the Smart Grid and shows how ICT will extend beyond transmission voltages to distribution networks and customer-level operation through Smart Meters and Smart Homes. Smart Grid Technology and Applications: Clearly unravels the evolving Smart Grid concept with extensive illustrations and practical examples. Describes the spectrum of key enabling technologies required for the realisation of the Smart Grid with worked examples to illustrate the applications. Enables readers to engage with the immediate development of the power system and take part in the debate over the future Smart Grid. Introduces the constituent topics from first principles, assuming only a basic knowledge of mathematics, circuits and power systems. Brings together the expertise of a highly experienced and international author team from the UK, Sri Lanka, China and Japan. Electrical, electronics and computer engineering researchers, practitioners and consultants working in inter-disciplinary Smart Grid RD&D will significantly enhance their knowledge through this reference. The tutorial style will greatly benefit final year undergraduate and master's students as the curriculum increasingly focuses on the breadth of technologies that contribute to Smart Grid realisation.

**Communication and Networking in Smart Grids** Wiley

The Smart Grid is a modern electricity grid allowing for distributed, renewable intermittent generation, partly owned by consumers. This requires advanced control and communication technologies in order to provide high quality power supply and secure generation, transmission and distribution. This book outlines these emerging technologies. This essential reading focuses specifically on security and control aspects of the smart grid. It covers various related topics including smart grid architecture; communications and networking features; measuring and sensing devices; and smart transmission and distribution. Particular emphasis is placed on security, reliability, and stability features. Different control aspects of smart grid are also covered. Each chapter includes examples, case studies, simulations and experimental results, making this a practical and essential resource for professional researchers and advanced students alike. Topics covered include: \* An introduction to smart grid architecture \* Smart grid communications and standards \* Measurement and sensing devices for smart grids \* Smart transmission and wide area monitoring system \* Bad data detection in smart grids \* Optimal energy management in smart grids \* Communication and control for the smart grid \* Smart consumer systems \* Importance of energy storage systems in smart grids \* Control and optimisation for integration of plug-in vehicles in smart grids \* Multi-agent based control of smart grids \* Compressive sensing for smart grid security and reliability \* Optimum placement of FACTS devices in smart grids \* Security analysis of smart grid \* Smart grid security policies and regulations

**Implementing Security Controls into the Modern Power Infrastructure** IET

**Communication Networks for Smart Grids** Making Smart Grid Real Springer Science & Business Media

**Smart Grid Communication Infrastructures** John Wiley & Sons  
 This brief focuses on the current research on security and privacy preservation in smart grids. Along with a review of the existing works, this brief includes fundamental system models, possible frameworks, useful performance, and future research directions. It explores privacy preservation demand response with adaptive key evolution, secure and efficient Merkle tree based

authentication, and fine-grained keywords comparison in the smart grid auction market. By examining the current and potential security and privacy threats, the author equips readers to understand the developing issues in smart grids. The brief is designed for researchers and professionals working with computer communication networks and smart grids. Graduate students interested in networks and communication engineering will also find the brief an essential resource.

**Principles, Standards and Applications from Multimedia to Smart Grid** IGI Global

Many people think of the Smart Grid as a power distribution group built on advanced smart metering—but that's just one aspect of a much larger and more complex system. The "Smart Grid" requires new technologies throughout energy generation, transmission and distribution, and even the homes and businesses being served by the grid. This also represents new information paths between these new systems and services, all of which represents risk, requiring a more thorough approach to where and how cyber security controls are implemented. This insight provides a detailed architecture of the entire Smart Grid, with recommended cyber security measures for everything from the supply chain to the consumer. Discover the potential of the Smart Grid Learn in depth about its systems See its vulnerabilities and how best to protect it

**Smart Grid** John Wiley & Sons

A comprehensive resource that covers all the key areas of smart grid communication infrastructures Smart grid is a transformational upgrade to the traditional power grid that adds communication capabilities, intelligence and modern control. Smart Grid Communication Infrastructures is a comprehensive guide that addresses communication infrastructures, related applications and other issues related to the smart grid. The text shows how smart grid departs from the traditional power grid technology. Fundamentally, smart grid has advanced communication infrastructures to achieve two-way information exchange between service providers and customers. Grid operations in smart grid have proven to be more efficient and more secure because of the communication infrastructures and modern control. Smart Grid Communication Infrastructures examines and summarizes the recent advances in smart grid communications, big data analytics and network security. The authors - noted experts in the field - review the technologies, applications and issues in smart grid communication infrastructure. This important resource: Offers a comprehensive review of all areas of smart grid communication infrastructures Includes an ICT framework for smart grid Contains a review of self-sustaining wireless neighborhood that are network designed Presents design and analysis of a wireless monitoring network for transmission lines in smart grid Written for graduate students, professors, researchers, scientists, practitioners and engineers, Smart Grid Communication Infrastructures is the comprehensive resource that explores all aspects of the topic.

**Power Line Communications** Newnes

Electrical energy usage is increasing every year due to population growth and new forms of consumption. As such, it is increasingly imperative to research methods of energy control and safe use. Security Solutions and Applied Cryptography in Smart Grid Communications is a pivotal reference source for the latest research on the development of smart grid technology and best practices of utilization. Featuring extensive coverage across a range of relevant perspectives and topics, such as threat detection, authentication, and intrusion detection, this book is ideally designed for academicians, researchers, engineers and students seeking current research on ways in which to implement smart grid platforms all over the globe.

Springer Science & Business Media

From Smart Grid to Internet of Energy covers novel and emerging metering and monitoring technologies, communication systems, and technologies in smart grid areas to present a valuable reference for readers from various engineering backgrounds. Considering relevant topics on the essentials of smart grids and emerging wireless communication systems, such as IEEE 802.15.4 based novel technologies, cognitive radio networks and Internet of Energy, this book offers a discussion on the emerging trends and research direction for communication technologies. The book includes research concepts and visualization of smart grids and related communication technologies, making it a useful book for practicing network engineers. Includes global case studies and examples of communications systems integrated with smart grids Presents literature surveys for a wide variety of smart grids, wired and wireless communication technologies, big data, privacy and security Covers all aspects of IoE systems and discusses the differences between IoE and Smart Grids