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Control and Operation of Grid-Connected Wind Energy Systems - Ali M. Eltamaly 2021-03-04 This edited book analyses and discusses the current issues of integration of wind energy systems in the power systems. It collects recent studies in the area, focusing on numerous issues including unbalanced grid voltages, low-voltage ride-through and voltage stability of the grid. It also explores the impact of the emerging technologies of wind turbines and power converters in the integration of wind power systems in power systems. This book utilizes the editors' expertise in the energy sector to provide a comprehensive text that will be of interest to

researchers, graduate students and industry professionals.

Power System Modeling, Computation, and Control - Joe H. Chow 2020-01-21
Provides students with an understanding of the modeling and practice in power system stability analysis and control design, as well as the computational tools used by commercial vendors Bringing together wind, FACTS, HVDC, and several other modern elements, this book gives readers everything they need to know about power systems. It makes learning complex power system concepts, models, and dynamics simpler and more efficient while providing modern viewpoints of power system analysis. Power System Modeling, Computation, and Control provides students with a new and detailed analysis of voltage stability; a simple example illustrating the BCU method of transient stability analysis; and one of only a few derivations of the transient synchronous machine model. It offers a discussion on reactive power consumption of induction motors during start-up to illustrate the low-voltage phenomenon observed in urban load centers. Damping controller designs using power system stabilizer, HVDC systems, static var compensator, and thyristor-controlled series compensation are also examined. In addition, there are chapters covering flexible AC transmission Systems (FACTS)—including both thyristor and voltage-sourced converter technology—and wind turbine generation and modeling. Simplifies the learning of complex power system concepts, models, and dynamics Provides chapters on power flow solution, voltage stability, simulation methods, transient stability, small signal stability, synchronous machine models (steady-state and dynamic models), excitation systems, and power system stabilizer design Includes advanced analysis of voltage stability, voltage recovery during motor starts, FACTS and their operation, damping control design using various control equipment,

wind turbine models, and control Contains numerous examples, tables, figures of block diagrams, MATLAB plots, and problems involving real systems Written by experienced educators whose previous books and papers are used extensively by the international scientific community Power System Modeling, Computation, and Control is an ideal textbook for graduate students of the subject, as well as for power system engineers and control design professionals.

Airborne Wind Energy - Uwe Ahrens 2013-10-01 This reference offers an overview of the field of airborne wind energy. As the first book of its kind, it provides a consistent compilation of the fundamental theories, a compendium of current research and development activities as well as economic and regulatory aspects. In five parts, the book demonstrates the relevance of Airborne Wind Energy and the role that this emerging field of technology can play for the transition towards a renewable energy economy. Part I on "Fundamentals" contains seven general chapters explaining the principles of airborne wind energy and its different variants, of meteorology, the history of kites and financing strategies. Part II on "System Modeling, Optimization and Control" contains eight contributions that develop and use detailed dynamic models for simulation, optimization, and control of airborne wind energy systems, while Part III on "Analysis of Flexible Kite Dynamics" collects four chapters that focus on the particularly challenging simulation problems related to flexible kites. Part IV "Implemented Concepts" contains eleven contributions each of which presents developed prototypes together with real-world experimental results obtained with the different concepts. Finally, in Part V on "Component Design", five papers are collected that address in detail the technical challenges for some of the components of airborne wind energy. Airborne Wind Energy presents all basics in a single source to someone starting to explore wind

power in the upper atmosphere and serves as a valuable reference for researchers, scientists, professionals and students active in the innovative field of Airborne Wind Energy.

Renewable Energy Systems - Ahmad Taher Azar 2021-09-09

Renewable Energy Systems: Modelling, Optimization and Control aims to cross-pollinate recent advances in the study of renewable energy control systems by bringing together diverse scientific breakthroughs on the modeling, control and optimization of renewable energy systems by leading researchers. The book brings together the most comprehensive collection of modeling, control theorems and optimization techniques to help solve many scientific issues for researchers in renewable energy and control engineering. Many multidisciplinary applications are discussed, including new fundamentals, modeling, analysis, design, realization and experimental results. The book also covers new circuits and systems to help researchers solve many nonlinear problems. This book fills the gaps between different interdisciplinary applications, ranging from mathematical concepts, modeling, and analysis, up to the realization and experimental work. Covers modeling, control theorems and optimization techniques which will solve many scientific issues for researchers in renewable energy Discusses many multidisciplinary applications with new fundamentals, modeling, analysis, design, realization and experimental results Includes new circuits and systems, helping researchers solve many nonlinear problems

Dynamics and Control of Electric Transmission and Microgrids - K. R. Padiyar 2018-12-31

A guide to the latest developments in grid dynamics and control and highlights the role of transmission and distribution grids Dynamics and Control of Electric Transmission and Microgrids offers a concise and comprehensive

review of the most recent developments and research in grid dynamics and control. In addition, the authors present a new style of presentation that highlights the role of transmission and distribution grids that ensure the reliability and quality of electric power supply. The authors — noted experts in the field — offer an introduction to the topic and explore the basic characteristics and operations of the grid. The text also reviews a wealth of vital topics such as FACTS and HVDC Converter controllers, the stability and security issues of the bulk power system, loads which can be viewed as negative generation, the power limits and energy availability when distributed storage is used and much more. This important resource: Puts the focus on the role of transmission and distribution grids that ensure the reliability and quality of electric power supply Includes modeling and control of wind and solar energy generation for secure energy transfer Presents timely coverage of on-line detection of loss of synchronism, wide area measurements and applications, wide-area feedback control systems for power swing damping and microgrids-operation and control Written for students of power system dynamics and control/electrical power industry professionals, Dynamics and Control of Electric Transmission and Microgrids is a comprehensive guide to the recent developments in grid dynamics and control and highlights the role of transmission and distribution grids that ensure the reliability and quality of electric power supply.

Control and Operation of Grid-Connected Wind Farms - John N. Jiang 2016-05-31 From the point of view of grid integration and operation, this monograph advances the subject of wind energy control from the individual-unit to the wind-farm level. The basic objectives and requirements for successful integration of wind energy with existing power grids are discussed, followed by an overview of the state of the art, proposed solutions and challenges yet to be

resolved. At the individual-turbine level, a nonlinear controller based on feedback linearization, uncertainty estimation and gradient-based optimization is shown robustly to control both active and reactive power outputs of variable-speed turbines with doubly-fed induction generators. Heuristic coordination of the output of a wind farm, represented by a single equivalent turbine with energy storage to optimize and smooth the active power output is presented. A generic approximate model of wind turbine control developed using system identification techniques is proposed to advance research and facilitate the treatment of control issues at the wind-farm level. A supervisory wind-farm controller is then introduced with a view to maximizing and regulating active power output under normal operating conditions and unusual contingencies. This helps to make the individual turbines cooperate in such as way that the overall output of the farm accurately tracks a reference and/or is statistically as smooth as possible to improve grid reliability. The text concludes with an overall discussion of the promise of advanced wind-farm control techniques in making wind an economic energy source and beneficial influence on grid performance. The challenges that warrant further research are succinctly enumerated. Control and Operation of Grid-Connected Wind Farms is primarily intended for researchers from a systems and control background wishing to apply their expertise to the area of wind-energy generation. At the same time, coverage of contemporary solutions to fundamental operational problems will benefit power/energy engineers endeavoring to promote wind as a reliable and clean source of electrical power.

Robust Power System Frequency Control - Hassan Bevrani 2014-06-18
This updated edition of the industry standard reference on power system frequency control provides practical, systematic and flexible algorithms for regulating load frequency,

offering new solutions to the technical challenges introduced by the escalating role of distributed generation and renewable energy sources in smart electric grids. The author emphasizes the physical constraints and practical engineering issues related to frequency in a deregulated environment, while fostering a conceptual understanding of frequency regulation and robust control techniques. The resulting control strategies bridge the gap between advantageous robust controls and traditional power system design, and are supplemented by real-time simulations. The impacts of low inertia and damping effect on system frequency in the presence of increased distributed and renewable penetration are given particular consideration, as the bulk synchronous machines of conventional frequency control are rendered ineffective in emerging grid environments where distributed/variable units with little or no rotating mass become dominant. Frequency stability and control issues relevant

to the exciting new field of microgrids are also undertaken in this new edition. As frequency control becomes increasingly significant in the design of ever-more complex power systems, this expert guide ensures engineers are prepared to deploy smart grids with optimal functionality.

Wind Turbine Control and Monitoring - Ningsu Luo 2014-08-30
Maximizing reader insights into the latest technical developments and trends involving wind turbine control and monitoring, fault diagnosis, and wind power systems, 'Wind Turbine Control and Monitoring' presents an accessible and straightforward introduction to wind turbines, but also includes an in-depth analysis incorporating illustrations, tables and examples on how to use wind turbine modeling and simulation software. Featuring analysis from leading experts and researchers in the field, the book provides new understanding, methodologies and algorithms of control and monitoring, computer tools for modeling and

simulation, and advances the current state-of-the-art on wind turbine monitoring and fault diagnosis; power converter systems; and cooperative & fault-tolerant control systems for maximizing the wind power generation and reducing the maintenance cost. This book is primarily intended for researchers in the field of wind turbines, control, mechatronics and energy; postgraduates in the field of mechanical and electrical engineering; and graduate and senior undergraduate students in engineering wishing to expand their knowledge of wind energy systems. The book will also interest practicing engineers dealing with wind technology who will benefit from the comprehensive coverage of the theoretic control topics, the simplicity of the models and the use of commonly available control algorithms and monitoring techniques.

Advanced Control and Optimization Paradigms for Wind Energy Systems - Radu-Emil Precup 2019-02-07

This book presents advanced studies on the conversion efficiency, mechanical reliability, and the quality of power related to wind energy systems. The main concern regarding such systems is reconciling the highly intermittent nature of the primary source (wind speed) with the demand for high-quality electrical energy and system stability. This means that wind energy conversion within the standard parameters imposed by the energy market and power industry is unachievable without optimization and control. The book discusses the rapid growth of control and optimization paradigms and applies them to wind energy systems: new controllers, new computational approaches, new applications, new algorithms, and new obstacles.

Wind Turbine Control Systems - Fernando D. Bianchi 2006-09-07

This book emphasizes the application of Linear Parameter Varying (LPV) gain scheduling techniques to the control of wind energy

conversion systems. This reformulation of the classical problem of gain scheduling allows straightforward design procedure and simple controller implementation. From an overview of basic wind energy conversion, to analysis of common control strategies, to design details for LPV gain-scheduled controllers for both fixed- and variable-pitch, this is a thorough and informative monograph.

Optimal Control of Wind Energy Systems - Iulian Munteanu 2008-02-05
Covering all aspects of this important topic, this work presents a review of the main control issues in wind power generation, offering a unified picture of the issues surrounding its optimal control. Discussion is focused on a global dynamic optimization approach to wind power systems using a set of optimization criteria which comply with a comprehensive group of requirements including: energy conversion efficiency; mechanical reliability; and quality of the energy provided.

Control of Large Wind Energy Systems - Adrian Gambier 2022-01-12
Wind energy systems are central contributors to renewable energy generation, and their technology is continuously improved and updated. Without losing sight of theory, Control of Large Wind Energy Systems demonstrates how to implement concrete control systems for modern wind turbines, explaining the reasons behind choices and decisions. This book provides an extended treatment of different control topics divided into three thematic parts including modelling, control and implementation. Solutions for real-life difficulties such as multi-parameter tuning of several controllers, curve fitting of nonlinear power curves, and filter design for concrete signals are also undertaken. Examples and a case study are included to illustrate the parametrization of models, the control systems design with problems and possible solutions. Advice for the selection of control laws, calculation of specific parameters,

which are necessary for the control laws, as the sensitivity functions, is given, as well as an evaluation of control performance based on indices and load calculation. Control of Large Wind Energy Systems covers methodologies which are not usually found in literature on this topic, including fractional order PID and nonlinear PID for pitch control, peak shaving control and extremum seeking control for the generator control, yaw control and shutdown control. This makes it an ideal book for postgraduate students, researchers and industrial engineers in the field of wind turbine control. Advances in Industrial Control reports and encourages the transfer of technology in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control.

Doubly Fed Induction Machine - Gonzalo

Abad 2011-11-01
This book will be focused on the modeling and control of the DFIM based wind turbines. In the first part of the book, the mathematical description of different basic dynamic models of the DFIM will be carried out. It will be accompanied by a detailed steady-state analysis of the machine. After that, a more sophisticated model of the machine that considers grid disturbances, such as voltage dips and unbalances will be also studied. The second part of the book surveys the most relevant control strategies used for the DFIM when it operates at the wind energy generation application. The control techniques studied, range from standard solutions used by wind turbine manufacturers, to the last developments oriented to improve the behavior of high power wind turbines, as well as control and hardware based solutions to address different faulty scenarios of the grid. In addition, the standalone DFIM generation system will be also analyzed.

Model Predictive Control of Wind Energy Conversion Systems - Venkata Yaramasu
2016-12-19

Model Predictive Control of Wind Energy Conversion Systems addresses the predicative control strategy that has emerged as a promising digital control tool within the field of power electronics, variable-speed motor drives, and energy conversion systems. The authors provide a comprehensive analysis on the model predictive control of power converters employed in a wide variety of variable-speed wind energy conversion systems (WECS). The contents of this book includes an overview of wind energy system configurations, power converters for variable-speed WECS, digital control techniques, MPC, modeling of power converters and wind generators for MPC design. Other topics include the mapping of continuous-time models to discrete-time models by various exact, approximate, and quasi-exact discretization methods, modeling and control of wind turbine grid-side two-level and multilevel voltage source converters. The authors also focus on the MPC of several power converter configurations for full variable-speed permanent magnet synchronous generator based WECS, squirrel-cage induction generator based WECS, and semi-variable-speed doubly fed induction generator based WECS. Furthermore, this book: Analyzes a wide variety of practical WECS, illustrating important concepts with case studies, simulations, and experimental results Provides a step-by-step design procedure for the development of predictive control schemes for various WECS configurations Describes continuous- and discrete-time modeling of wind generators and power converters, weighting factor selection, discretization methods, and extrapolation techniques Presents useful material for other power electronic applications such as variable-speed motor drives, power quality conditioners, electric vehicles, photovoltaic energy systems, distributed generation, and high-voltage direct

current transmission. Explores S-Function Builder programming in MATLAB environment to implement various MPC strategies through the companion website Reflecting the latest technologies in the field, Model Predictive Control of Wind Energy Conversion Systems is a valuable reference for academic researchers, practicing engineers, and other professionals. It can also be used as a textbook for graduate-level and advanced undergraduate courses.

2020 International Symposium on Computer, Consumer and Control (IS3C) - IEEE Staff 2020-11-13
The scope of this conference includes renewable energy, power electronics, power systems, advanced multimedia, computer, telecommunication, sensors and semiconductor, consumer electronics, systems and control, and digital signal processing

Wind Power in Power Systems - Thomas Ackermann 2012-04-23
The second edition of the highly acclaimed Wind Power in Power Systems has been thoroughly revised and expanded to reflect the latest challenges associated with increasing wind power penetration levels. Since its first release, practical experiences with high wind power penetration levels have significantly increased. This book presents an overview of the lessons learned in integrating wind power into power systems and provides an outlook of the relevant issues and solutions to allow even higher wind power penetration levels. This includes the development of standard wind turbine simulation models. This extensive update has 23 brand new chapters in cutting-edge areas including offshore wind farms and storage options, performance validation and certification for grid codes, and the provision of reactive power and voltage control from wind power plants. Key features: Offers an international perspective on integrating a high penetration of wind power into the power system, from basic network interconnection to industry

deregulation; Outlines the methodology and results of European and North American large-scale grid integration studies; Extensive practical experience from wind power and power system experts and transmission systems operators in Germany, Denmark, Spain, UK, Ireland, USA, China and New Zealand; Presents various wind turbine designs from the electrical perspective and models for their simulation, and discusses industry standards and world-wide grid codes, along with power quality issues; Considers concepts to increase penetration of wind power in power systems, from wind turbine, power plant and power system redesign to smart grid and storage solutions. Carefully edited for a highly coherent structure, this work remains an essential reference for power system engineers, transmission and distribution network operator and planner, wind turbine designers, wind project developers and wind energy consultants dealing with the integration of wind power into the distribution or transmission network. Up-to-date and comprehensive, it is also useful for graduate students, researchers, regulation authorities, and policy makers who work in the area of wind power and need to understand the relevant power system integration issues.

Intelligent Computing - Kohei Arai 2022-08-07 The book, "Intelligent Computing - Proceedings of the 2022 Computing Conference", is a comprehensive collection of chapters focusing on the core areas of computing and their further applications in the real world. Each chapter is a paper presented at the Computing Conference 2022 held on July 14–15, 2022. Computing 2022 attracted a total of 498 submissions which underwent a double-blind peer-review process. Of those 498 submissions, 179 submissions have been selected to be included in this book. The goal of this conference is to give a platform to researchers with fundamental contributions and to be a premier venue for academic and industry practitioners to share new ideas and

development experiences. We hope that readers find this book interesting and valuable as it provides the state-of-the-art intelligent methods and techniques for solving real-world problems. We also expect that the conference and its publications will be a trigger for further related research and technology improvements in this important subject.

Handbook of Wind Power Systems - Panos M. Pardalos 2014-01-15
Wind power is currently considered as the fastest growing energy resource in the world. Technological advances and government subsidies have contributed in the rapid rise of Wind power systems. The Handbook on Wind Power Systems provides an overview on several aspects of wind power systems and is divided into four sections: optimization problems in wind power generation, grid integration of wind power systems, modeling, control and maintenance of wind facilities and innovative wind energy generation. The chapters are contributed by experts working on different aspects of wind energy generation and conversion.

Blade-Pitch Control for Wind Turbine Load Reductions - Wai Hou (Alan) Lio 2018-03-01
This thesis investigates the use of blade-pitch control and real-time wind measurements to reduce the structural loads on the rotors and blades of wind turbines. The first part of the thesis studies the main similarities between the various classes of current blade-pitch control strategies, which have to date remained overlooked by mainstream literature. It also investigates the feasibility of an estimator design that extracts the turbine tower motion signal from the blade load measurements. In turn, the second part of the thesis proposes a novel model predictive control layer in the control architecture that enables an existing controller to incorporate the upcoming wind information and constraint-handling features. This thesis provides essential clarifications of and

systematic design guidelines for these topics, which can benefit the design of wind turbines and, it is hoped, inspire the development of more innovative mechanical load-reduction solutions in the field of wind energy.

Modeling and Modern Control of Wind Power - Qiuwei Wu 2018-02-05

An essential reference to the modeling techniques of wind turbine systems for the application of advanced control methods This book covers the modeling of wind power and application of modern control methods to the wind power control—specifically the models of type 3 and type 4 wind turbines. The modeling aspects will help readers to streamline the wind turbine and wind power plant modeling, and reduce the burden of power system simulations to investigate the impact of wind power on power systems. The use of modern control methods will help technology development, especially from the perspective of manufactures. Chapter coverage includes: status of wind power development, grid code requirements for wind power integration; modeling and control of doubly fed induction generator (DFIG) wind turbine generator (WTG); optimal control strategy for load reduction of full scale converter (FSC) WTG; clustering based WTG model linearization; adaptive control of wind turbines for maximum power point tracking (MPPT); distributed model predictive active power control of wind power plants and energy storage systems; model predictive voltage control of wind power plants; control of wind power plant clusters; and fault ride-through capability enhancement of VSC HVDC connected offshore wind power plants. Modeling and Modern Control of Wind Power also features tables, illustrations, case studies, and an appendix showing a selection of typical test systems and the code of adaptive and distributed model predictive control. Analyzes the developments in control methods for wind turbines (focusing on type 3 and type 4 wind turbines) Provides an

overview of the latest changes in grid code requirements for wind power integration Reviews the operation characteristics of the FSC and DFIG WTG Presents production efficiency improvement of WTG under uncertainties and disturbances with adaptive control Deals with model predictive active and reactive power control of wind power plants Describes enhanced control of VSC HVDC connected offshore wind power plants Modeling and Modern Control of Wind Power is ideal for PhD students and researchers studying the field, but is also highly beneficial to engineers and transmission system operators (TSOs), wind turbine manufacturers, and consulting companies.

Encyclopedia of Systems and Control - John Baillieul 2015-07-29
The Encyclopedia of Systems and Control collects a broad range of short expository articles that describe the current state of the art in the central topics of control and systems engineering as well as in many of the related fields in which control is an enabling technology. The editors have assembled the most comprehensive reference possible, and this has been greatly facilitated by the publisher's commitment continuously to publish updates to the articles as they become available in the future. Although control engineering is now a mature discipline, it remains an area in which there is a great deal of research activity, and as new developments in both theory and applications become available, they will be included in the online version of the encyclopedia. A carefully chosen team of leading authorities in the field has written the well over 250 articles that comprise the work. The topics range from basic principles of feedback in servomechanisms to advanced topics such as the control of Boolean networks and evolutionary game theory. Because the content has been selected to reflect both foundational importance as well as subjects that are of current interest to

the research and practitioner communities, a broad readership that includes students, application engineers, and research scientists will find material that is of interest.

Wind Power Systems - Lingfeng Wang 2010-09-15

Renewable energy sources such as wind power have attracted much attention because they are environmentally friendly, do not produce carbon dioxide and other emitants, and can enhance a nation's energy security. For example, recently more significant amounts of wind power are being integrated into conventional power grids. Therefore, it is necessary to address various important and challenging issues related to wind power systems, which are significantly different from the traditional generation systems. This book is a resource for engineers, practitioners, and decision-makers interested in studying or using the power of computational intelligence based algorithms in handling various important problems in wind power systems at the levels of power generation, transmission, and distribution. Researchers have been developing biologically-inspired algorithms in a wide variety of complex large-scale engineering domains. Distinguished from the traditional analytical methods, the new methods usually accomplish the task through their computationally efficient mechanisms. Computational intelligence methods such as evolutionary computation, neural networks, and fuzzy systems have attracted much attention in electric power systems. Meanwhile, modern electric power systems are becoming more and more complex in order to meet the growing electricity market. In particular, the grid complexity is continuously enhanced by the integration of intermittent wind power as well as the current restructuring efforts in electricity industry. Quite often, the traditional analytical methods become less efficient or even unable to handle this increased complexity. As a result, it is natural to apply computational intelligence as a powerful tool to

deal with various important and pressing problems in the current wind power systems. This book presents the state-of-the-art development in the field of computational intelligence applied to wind power systems by reviewing the most up-to-date work and representative practical problems collecting contributions from leading experts in electrical engineering, system engineering, and other disciplines.

Power System Fundamentals - Pedro Ponce 2017-12-04
Smart grids are linked with smart homes and smart meters. These smart grids are the new topology for generating, distributing, and consuming energy. If these smart devices are not connected in a smart grid, then they cannot work properly; hence, the conventional power systems are swiftly changing in order to improve the quality of electrical energy. This book covers the fundamentals of power systems—which are the pillars for smart grids —with a focus on defining the smart grid with theoretical and experimental electrical concepts. Power System Fundamentals begins by discussing electric circuits, the basic systems in smart grids, and finishes with a complete smart grid concept. The book allows the reader to build a foundation of understanding with basic and advanced exercises that run on simulation before moving to experimental results. It is intended for readers who want to comprehensively cover both the basic and advanced concepts of smart grids.

Power Conversion and Control of Wind Energy Systems - Bin Wu 2011-08-09
The book presents the latest power conversion and control technology in modern wind energy systems. It has nine chapters, covering technology overview and market survey, electric generators and modeling, power converters and modulation techniques, wind turbine characteristics and configurations, and control schemes for fixed- and variable-speed wind energy systems. The book also provides in-depth

steady-state and dynamic analysis of squirrel cage induction generator, doubly fed induction generator, and synchronous generator based wind energy systems. To illustrate the key concepts and help the reader tackle real-world issues, the book contains more than 30 case studies and 100 solved problems in addition to simulations and experiments. The book serves as a comprehensive reference for academic researchers and practicing engineers. It can also be used as a textbook for graduate students and final year undergraduate students.

Networked and Distributed Predictive Control - Panagiotis D. Christofides 2011-04-07 Networked and Distributed Predictive Control presents rigorous, yet practical, methods for the design of networked and distributed predictive control systems – the first book to do so. The design of model predictive control systems using Lyapunov-based techniques accounting for the influence of asynchronous and delayed measurements is followed by a treatment of networked control architecture development. This shows how networked control can augment dedicated control systems in a natural way and takes advantage of additional, potentially asynchronous and delayed measurements to maintain closed loop stability and significantly to improve closed-loop performance. The text then shifts focus to the design of distributed predictive control systems that cooperate efficiently in computing optimal manipulated input trajectories that achieve desired stability, performance and robustness specifications but spend a fraction of the time required by centralized control systems. Key features of this book include: • new techniques for networked and distributed control system design; • insight into issues associated with networked and distributed predictive control and their solution; • detailed appraisal of industrial relevance using computer simulation of nonlinear chemical process networks and wind- and solar-energy-generation systems; and • integrated exposition

of novel research topics and rich resource of references to significant recent work. A full understanding of Networked and Distributed Predictive Control requires a basic knowledge of differential equations, linear and nonlinear control theory and optimization methods and the book is intended for academic researchers and graduate students studying control and for process control engineers. The constant attention to practical matters associated with implementation of the theory discussed will help each of these groups understand the application of the book's methods in greater depth.

2020 International Conference on Electrical and Information Technologies (ICEIT) - IEEE Staff 2020-03-04
The 4th edition of The International Conference on Electrical and Information Technologies, ICEIT 20, will be held in the Moroccan capital, Rabat Sale, from 4th to 7th March 2020 This event is co sponsored by IEEE and IEEE Morocco section ICEIT 20 main objective is to address, explore and exchange information on the state of the art in all types of Electrical and Information Technologies Will include oral and poster technical sessions for papers describing original and previously unpublished work, plenary sessions with invited speakers, tutorials, and exhibits

Fundamental and Advanced Topics in Wind Power - Rupp Carriveau 2011-07-05
As the fastest growing source of energy in the world, wind has a very important role to play in the global energy mix. This text covers a spectrum of leading edge topics critical to the rapidly evolving wind power industry. The reader is introduced to the fundamentals of wind energy aerodynamics; then essential structural, mechanical, and electrical subjects are discussed. The book is composed of three sections that include the Aerodynamics and Environmental Loading of Wind Turbines, Structural and Electromechanical Elements of Wind Power Conversion, and Wind Turbine

Control and System Integration. In addition to the fundamental rudiments illustrated, the reader will be exposed to specialized applied and advanced topics including magnetic suspension bearing systems, structural health monitoring, and the optimized integration of wind power into micro and smart grids.

Control of Large Wind Energy Systems - Adrian Gambier 2021-11-06
Wind energy systems are central contributors to renewable energy generation, and their technology is continuously improved and updated. Without losing sight of theory, Control of Large Wind Energy Systems demonstrates how to implement concrete control systems for modern wind turbines, explaining the reasons behind choices and decisions. This book provides an extended treatment of different control topics divided into three thematic parts including modelling, control and implementation. Solutions for real-life difficulties such as multi-parameter tuning of several controllers, curve fitting of nonlinear power curves, and filter design for concrete signals are also undertaken. Examples and a case study are included to illustrate the parametrization of models, the control systems design with problems and possible solutions. Advice for the selection of control laws, calculation of specific parameters, which are necessary for the control laws, as the sensitivity functions, is given, as well as an evaluation of control performance based on indices and load calculation. Control of Large Wind Energy Systems covers methodologies which are not usually found in literature on this topic, including fractional order PID and nonlinear PID for pitch control, peak shaving control and extremum seeking control for the generator control, yaw control and shutdown control. This makes it an ideal book for postgraduate students, researchers and industrial engineers in the field of wind turbine control. Advances in Industrial Control reports and encourages the transfer of technology in

control engineering. The rapid development of control technology has an impact on all areas of the control discipline. The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control.

Advanced Control of Doubly Fed Induction Generator for Wind Power Systems - Dehong Xu 2018-08-14
Covers the fundamental concepts and advanced modelling techniques of Doubly Fed Induction Generators accompanied by analyses and simulation results Filled with illustrations, problems, models, analyses, case studies, selected simulation and experimental results, Advanced Control of Doubly Fed Induction Generator for Wind Power Systems provides the basic concepts for modelling and controlling of Doubly Fed Induction Generator (DFIG) wind power systems and their power converters. It explores both the challenges and concerns of DFIG under a non-ideal grid and introduces the control strategies and effective operations performance options of DFIG under a non-ideal grid. Other topics of this book include thermal analysis of DFIG wind power converters under grid faults; implications of the DFIG test bench; advanced control of DFIG under harmonic distorted grid voltage, including multiple-loop and resonant control; modeling of DFIG and GSC under unbalanced grid voltage; the LFRT of DFIG, including the recurring faults ride through of DFIG; and more. In addition, this resource: Explores the challenges and concerns of Doubly Fed Induction Generators (DFIG) under non-ideal grid Discusses basic concepts of DFIG wind power system and vector control schemes of DFIG Introduces control strategies under a non-ideal grid Includes case studies and simulation and experimental results Advanced Control of Doubly Fed Induction Generator for Wind Power Systems is an ideal book for graduate students studying renewable energy and power electronics as well as for research and

development engineers working with wind power converters.

Offshore Wind Energy Generation - Olimpo Anaya-Lara 2014-03-26
The offshore wind sector's trend towards larger turbines, bigger wind farm projects and greater distance to shore has a critical impact on grid connection requirements for offshore wind power plants. This important reference sets out the fundamentals and latest innovations in electrical systems and control strategies deployed in offshore electricity grids for wind power integration. Includes: All current and emerging technologies for offshore wind integration and trends in energy storage systems, fault limiters, superconducting cables and gas-insulated transformers Protection of offshore wind farms illustrating numerous system integration and protection challenges through case studies Modelling of doubly-fed induction generators (DFIG) and full-converter wind turbines structures together with an explanation of the smart grid concept in the context of wind farms Comprehensive material on power electronic equipment employed in wind turbines with emphasis on enabling technologies (HVDC, STATCOM) to facilitate the connection and compensation of large-scale onshore and offshore wind farms Worked examples and case studies to help understand the dynamic interaction between HVDC links and offshore wind generation Concise description of the voltage source converter topologies, control and operation for offshore wind farm applications Companion website containing simulation models of the cases discussed throughout Equipping electrical engineers for the engineering challenges in utility-scale offshore wind farms, this is an essential resource for power system and connection code designers and pratitioners dealing with integation of wind generation and the modelling and control of wind turbines. It will also provide high-level support to academic

researchers and advanced students in power and renewable energy as well as technical and research staff in transmission and distribution system operators and in wind turbine and electrical equipment manufacturers.

Fault Diagnosis and Sustainable Control of Wind Turbines - Silvio Simani 2018-01-02 Fault Diagnosis and Sustainable Control of Wind Turbines: Robust Data-Driven and Model-Based Strategies discusses the development of reliable and robust fault diagnosis and fault-tolerant ('sustainable') control schemes by means of data-driven and model-based approaches. These strategies are able to cope with unknown nonlinear systems and noisy measurements. The book also discusses simpler solutions relying on data-driven and model-based methodologies, which are key when on-line implementations are considered for the proposed schemes. The book targets both professional engineers working in industry and researchers in academic and scientific institutions. In order to improve the

safety, reliability and efficiency of wind turbine systems, thus avoiding expensive unplanned maintenance, the accommodation of faults in their early occurrence is fundamental. To highlight the potential of the proposed methods in real applications, hardware–in–the–loop test facilities (representing realistic wind turbine systems) are considered to analyze the digital implementation of the designed solutions. The achieved results show that the developed schemes are able to maintain the desired performances, thus validating their reliability and viability in real-time implementations. Different groups of readers—ranging from industrial engineers wishing to gain insight into the applications' potential of new fault diagnosis and sustainable control methods, to the academic control community looking for new problems to tackle—will find much to learn from this work. Provides wind turbine models with varying complexity, as well as the solutions proposed and developed by the authors

Addresses in detail the design, development and realistic implementation of fault diagnosis and fault tolerant control strategies for wind turbine systems Addresses the development of sustainable control solutions that, in general, do not require the introduction of further or redundant measurements Proposes active fault tolerant ('sustainable') solutions that are able to maintain the wind turbine working conditions with gracefully degraded performance before required maintenance can occur Presents full coverage of the diagnosis and fault tolerant control problem, starting from the modeling and identification and finishing with diagnosis and fault tolerant control approaches Provides MATLAB and Simulink codes for the solutions proposed

Advances of Science and Technology - Mulatu Liyew Berihun 2022
This two-volume set of LNICST 411 and 412 constitutes the refereed post-conference proceedings of the 9th International Conference on Advancement of Science and Technology, ICAST 2021, which took place in August 2021. Due to COVID-19 pandemic the conference was held virtually. The 80 revised full papers were carefully reviewed and selected from 202 submissions. The papers present economic and technologic developments in modern societies in 7 tracks: Chemical, Food and Bioprocess Engineering; Electrical and Electronics Engineering; ICT, Software and Hardware Engineering; Civil, Water Resources, and Environmental Engineering ICT; Mechanical and Industrial Engineering; Material Science and Engineering; Energy Science, Engineering and Policy.

Renewable Integrated Power System Stability and Control - Hêmin Golpîra 2021-03-17
Discover new challenges and hot topics in the field of penetrated power grids in this brand-new interdisciplinary resource Renewable Integrated Power System Stability and Control delivers a comprehensive exploration of penetrated grid

dynamic analysis and new trends in power system modeling and dynamic equivalencing. The book summarizes long-term academic research outcomes and contributions and exploits the authors' extensive practical experiences in power system dynamics and stability to offer readers an insightful analysis of modern power grid infrastructure. In addition to the basic principles of penetrated power system modeling, model reduction, and model derivation, the book discusses inertia challenge requirements and control levels, as well as recent advances in visualization of virtual synchronous generators and their associated effects on system performance. The physical constraints and engineering considerations of advanced control schemes are deliberated at length. Renewable Integrated Power System Stability and Control also considers robust and adaptive control strategies using real-time simulations and experimental studies. Readers will benefit from the inclusion of: A thorough introduction to power systems, including time horizon studies, structure, power generation options, energy storage systems, and microgrids An exploration of renewable integrated power grid modeling, including basic principles, host grid modeling, and grid-connected MG equivalent models A study of virtual inertia, including grid stability enhancement, simulations, and experimental results A discussion of renewable integrated power grid stability and control, including small signal stability assessment and the frequency point of view Perfect for engineers and operators in power grids, as well as academics studying the technology, Renewable Integrated Power System Stability and Control will also earn a place in the libraries of students in Electrical Engineering programs at the undergraduate and postgraduate levels who wish to improve their understanding of power system operation and control.

Technological Innovation for Cyber-Physical

Systems - Luis M. Camarinha-Matos 2016-03-24 This book constitutes the refereed proceedings of the 7th IFIP WG 5.5/SOCOLNET Advanced Doctoral Conference on Computing, Electrical and Industrial Systems, DoCEIS 2016, held in Costa de Caparica, Portugal, in April 2016. The 53 revised full papers were carefully reviewed and selected from 112 submissions. The papers present selected results produced in engineering doctoral programs and focus on research, development, and application of cyber-physical systems. Research results and ongoing work are presented, illustrated and discussed in the following areas: enterprise collaborative networks; ontologies; Petri nets; manufacturing systems; biomedical applications; intelligent environments; control and fault tolerance; optimization and decision support; wireless technologies; energy: smart grids, renewables, management, and optimization; bio-energy; and electronics.

Control of Power Inverters in Renewable

Energy and Smart Grid Integration - Qing-Chang Zhong 2012-11-16 Integrating renewable energy and other distributed energysources into smart grids, often via power inverters, is arguablythe largest "new frontier" for smart grid advancements.Inverters should be controlled properly so that their integrationdoes not jeopardize the stability and performance of power systemsand a solid technical backbone is formed to facilitate otherfunctions and services of smart grids. This unique reference offers systematic treatment of importantcontrol problems in power inverters, and different generalconverter theories. Starting at a basic level, it presentsconventional power conversion methodologies and then'non-conventional' methods, with a highly accessiblesummary of the latest developments in power inverters as well asinsight into the grid connection of renewable power. Consisting of four parts – Power Quality Control, NeutralLine Provision, Power Flow Control, and

Synchronisation –this book fully demonstrates the integration of control and powerelectronics. Key features include: the fundamentals of power processing and hardware design innovative control strategies to systematically treat thecontrol of power inverters extensive experimental results for most of the controlstrategies presented the pioneering work on "synchronverters" which hasgained IET Highly Commended Innovation Award Engineers working on inverter design and those at power systemutilities can learn how advanced control strategies could improvesystem performance and work in practice. The book is a usefulreference for researchers who are interested in the area of controlengineering, power electronics, renewable energy and distributedgeneration, smart grids, flexible AC transmission systems, andpower systems for more-electric aircraft and all-electric ships.This is also a handy text for graduate students and universityprofessors in the areas of electrical power engineering, advancedcontrol engineering, power electronics, renewable energy and smartgrid integration.

Grid Converters for Photovoltaic and Wind Power Systems - Remus Teodorescu 2011-07-28 Grid converters are the key player in renewable energy integration. The high penetration of renewable energy systems is calling for new more stringent grid requirements. As a consequence, the grid converters should be able to exhibit advanced functions like: dynamic control of active and reactive power, operation within a wide range of voltage and frequency, voltage ride-through capability, reactive current injection during faults, grid services support. This book explains the topologies, modulation and control of grid converters for both photovoltaic and wind power applications. In addition to power electronics, this book focuses on the specific applications in photovoltaic wind power systems where grid condition is an essential factor. With a review of the most

recent grid requirements for photovoltaic and wind power systems, the book discusses these other relevant issues: modern grid inverter topologies for photovoltaic and wind turbines islanding detection methods for photovoltaic systems synchronization techniques based on second order generalized integrators (SOGI) advanced synchronization techniques with robust operation under grid unbalance condition grid filter design and active damping techniques power control under grid fault conditions, considering both positive and negative sequences Grid Converters for Photovoltaic and Wind Power Systems is intended as a coursebook for graduated students with a background in electrical engineering and also for professionals in the evolving renewable energy industry. For people from academia interested in adopting the course, a set of slides is available for download from the website. www.wiley.com/go/grid_converters

Wind Energy Systems - Mario Garcia-Sanz 2012-02-02

Presenting the latest developments in the field, Wind Energy Systems: Control Engineering Design offers a novel take on advanced control engineering design techniques for wind turbine applications. The book introduces concurrent quantitative engineering techniques for the design of highly efficient and reliable controllers, which can be used to solve the most critical problems of multi-megawatt wind energy systems. This book is based on the authors' experience during the last two decades designing commercial multi-megawatt wind turbines and control systems for industry leaders, including NASA and the European Space Agency. This work is their response to the urgent need for a truly reliable concurrent engineering methodology for the design of advanced control systems. Outlining a roadmap for such a coordinated architecture, the authors consider the links between all aspects of a multi-megawatt wind energy project, in which the

wind turbine and the control system must be cooperatively designed to achieve an optimized, reliable, and successful system. Look inside for links to a free download of QFTCT—a new interactive CAD tool for QFT controller design with MATLAB® that the authors developed with the European Space Agency. The textbook's big-picture insights can help students and practicing engineers control and optimize a wind energy system, in which large, flexible, aerodynamic structures are connected to a demanding variable electrical grid and work automatically under very turbulent and unpredictable environmental conditions. The book covers topics including robust QFT control, aerodynamics, mechanical and electrical dynamic modeling, economics, reliability, and efficiency. It also addresses standards, certification, implementation, grid integration, and power quality, as well as environmental and maintenance issues. To reinforce understanding, the authors present real examples of experimentation with commercial multi-megawatt direct-drive wind turbines, as well as on-shore, offshore, floating, and airborne wind turbine applications. They also offer a unique in-depth exploration of the quantitative feedback theory (QFT)—a proven, successful robust control technique for real-world applications—as well as advanced switching control techniques that help engineers exceed classical linear limitations.

Airborne Wind Energy - Roland Schmehl 2018-03-31
This book provides in-depth coverage of the latest research and development activities concerning innovative wind energy technologies intended to replace fossil fuels on an economical basis. A characteristic feature of the various conversion concepts discussed is the use of tethered flying devices to substantially reduce the material consumption per installed unit and to access wind energy at higher altitudes, where the wind is more consistent. The introductory

chapter describes the emergence and economic dimension of airborne wind energy. Focusing on "Fundamentals, Modeling & Simulation", Part I includes six contributions that describe quasi-steady as well as dynamic models and simulations of airborne wind energy systems or individual components. Shifting the spotlight to "Control, Optimization & Flight State Measurement", Part II combines one chapter on measurement techniques with five chapters on control of kite and ground stations, and two chapters on optimization. Part III on "Concept Design & Analysis" includes three chapters that present and analyze novel harvesting concepts as well as two chapters on system component design. Part IV, which centers on "Implemented Concepts", presents five chapters on established system concepts and one chapter about a subsystem for automatic launching and landing of kites. In closing, Part V focuses with four chapters on "Technology Deployment" related to market and financing strategies, as well as on regulation and the environment. The book builds on the success of the first volume "Airborne Wind Energy" (Springer, 2013), and offers a self-contained reference guide for researchers, scientists, professionals and students. The respective chapters were contributed by a broad variety of authors: academics, practicing engineers and inventors, all of whom are experts in their respective fields.

Model Predictive Control of Wind Energy Conversion Systems - Venkata Yaramasu 2016-12-14
Model Predictive Control of Wind Energy Conversion Systems addresses the predicative control strategy that has emerged as a promising digital control tool within the field of power electronics, variable-speed motor drives, and energy conversion systems. The authors provide a comprehensive analysis on the model predictive control of power converters employed in a wide variety of variable-speed wind energy conversion systems (WECS). The contents of this

book includes an overview of wind energy system configurations, power converters for variable-speed WECS, digital control techniques, MPC, modeling of power converters and wind generators for MPC design. Other topics include the mapping of continuous-time models to discrete-time models by various exact, approximate, and quasi-exact discretization methods, modeling and control of wind turbine grid-side two-level and multilevel voltage source converters. The authors also focus on the MPC of several power converter configurations for full variable-speed permanent magnet synchronous generator based WECS, squirrel-cage induction generator based WECS, and semi-variable-speed doubly fed induction generator based WECS. Furthermore, this book: Analyzes a wide variety of practical WECS, illustrating important concepts with case studies, simulations, and experimental results Provides a step-by-step design procedure for the development of predictive control schemes for various WECS configurations Describes continuous- and discrete-time modeling of wind generators and power converters, weighting factor selection, discretization methods, and extrapolation techniques Presents useful material for other power electronic applications such as variable-speed motor drives, power quality conditioners, electric vehicles, photovoltaic energy systems, distributed generation, and high-voltage direct current transmission. Explores S-Function Builder programming in MATLAB environment to implement various MPC strategies through the companion website Reflecting the latest technologies in the field, Model Predictive Control of Wind Energy Conversion Systems is a valuable reference for academic researchers, practicing engineers, and other professionals. It can also be used as a textbook for graduate-level and advanced undergraduate courses.

Stability Control and Reliable Performance of Wind Turbines - Kenneth Eloghene Okedu 2018-10-10

This book is intended for academics and engineers working in universities, research institutes, and industry sectors wishing to acquire new information and enhance their knowledge of the current trends in wind turbine technology. Readers will gain new ideas and special experience with in-depth information about modeling, stability control, assessment, reliability, and future prospects of wind turbines. This book contains a number of problems and solutions that can be integrated into larger research findings and projects. The book enhances studies concerning the state of the art of wind turbines, modeling and intelligent control of wind turbines, power quality of wind turbines, robust controllers for wind turbines in cold weather, etc. The book also looks at recent developments in wind turbine supporting structures, noise reduction estimation methods, reliability and prospects of wind turbines, etc. As I enjoyed preparing this book, I am sure that it will be valuable for a large sector of readers.